Procedure to Participate in Tender

Tender Enquiry No.	Work Description	EMD (Rs.)	Tender Fee (Rs.)	Last Date and Time for payment of Tender Fee
TPNODL/OT/2021-22/30	SITC of SCADA/ADMS System at TPNODL	10,00,000/-	5000	21.07.2021, 17:00 Hrs

Please note that corresponding details mentioned in this document will supersede any other details mentioned anywhere else in the Tender Document.

Procedure to Participate in Tender.

Following steps to be done before "Last date and time for Payment of Tender Fee" as mentioned above:

1. Eligible and Interested Bidders to submit duly signed and stamped letter on Bidder's letter head indicating

   a. Tender Enquiry number
   b. Name of authorized person
   c. Contact number
   d. E-mail id
   e. Details of submission of Tender Fee
   f. GST Registration No

2. Non-Refundable Tender Fee, as indicated in table above, to be submitted in the form of Direct Deposit in the following bank account and submit the receipt along with a covering letter clearly indicating the Tender Reference/ Enquiry Number –

Beneficiary Name:	TP Northern Odisha Distribution Limited
Bank Name:	Union Bank of India
Branch Name:	Balasore Branch
Account No.:	500601010280332
IFSC Code:	UBIN0550060

E-mail with necessary attachment to be sent to Imran.ahmd@tpnodl.com before last date and time for payment of Tender Fee.

Interested bidders to submit Tender Fee and Authorization letter before Last date and time as indicated above, after which link from TPNODL E-Tender system (Ariba) will be shared for further communication and bid submission.

Please note all future correspondence regarding the tender, bid submission, bid submission date extension, Pre-bid query etc. will happen only through TPNODL E-Tender system (Ariba). User manual to guide the bidders to submit the bid through E-Tender system (Ariba) is also enclosed.

No e-mail or verbal correspondence will be responded. All communication will be done strictly with the bidders who have done the above step to participate in the Tender.

Also, it may be strictly noted that once date of "Last date and time for Payment of Tender Participation Fee" is lapsed no Bidder will be sent link from TPNODL E-Tender System (Ariba). Without this link BA will not be able to participate in the tender. Any last moment request to participate in tender will not be entertained.

Any payment of Tender Fee / EMD by Bidder who have not done the prerequisite will not be refunded.

Also all future corrigendum to the said tender will be informed on Tender section on website www.tpnodl.com

Open Tender Notification

For

SITC of SCADA/ADMS at TPNODL

Tender Enquiry No.: TPNODL/OT/2021-22/030

Due Date for Bid Submission: 04.08.2021 [17:00 Hrs.]

TATA POWER NORTHERN ODISHA DISTRIBUTION LIMITED
(A Tata Power and Odisha Government Joint Venture)
Contracts & Material Management Department
Corporate office: Januganj, Balasore, Odisha-756019

CONTENTS OF THE ENQUIRY

1.0 Event Information

Geographical Spared of TPNODL

Network Details of TPNODL:

Circle	No. of GSS	33 KV				11 KV		No. of DTR	LT (only for urban and semi urban divisions)	
		Total S/S	Total PTRs	No. of 33kV Feeders	33kV Ckt. Line (in kms)	No. of 11kV Feeders	11kV Ckt. Line (in kms)		LT Line with Bare Conductor (in kms)	LT Line with AB Cable (in kms)
BALASORE	6	58	125	26	630.73	189	8841.52	19982	7545.98	7685.55
BHADRAK	3	33	71	7	361.09	110	4997.47	11790	1961.2027	5742.93
J. ROAD	4	34	77	18	394.09	100	5156.09	13164	5070.40	5100.86
KEONJHAR	6	40	89	22	607.28	138	7141.04	11310	3458.38	6558.06
BARIPADA	6	50	122	18	795.25	183	10729.27	13368	4179.36	18959.75
Total	25	215	484	91	2788.44	720	36865.39	69614	22215.3243	44047.16

Consumer Details of TPNODL

Circle/ Division Name	Area (sq. km.)	LT Dom	LT (Com)	LT Industrial	HT Dom (Bulk)	HT General Purpose (Com)	HT Industrial	EHT Consumer	Others (Irrigation, Agriculture, Public)	Total
BED Balasore	302.42	49230	10281	198	6	11	35	0	597	60358
CED, Balasore	1024.39	104890	5159	397	0	7	43	3	3546	114045
JED Jaleswar	874.55	107983	5217	301	0	2	2	0	5541	119046
BED Basta	457.86	75610	3447	225	0	0	1	0	4382	83665
SED Soro	1146.78	136688	6041	417	0	3	32	0	3821	147002
BALASORE Circle	**3806**	**474401**	**30145**	**1538**	**6**	**23**	**113**	**3**	**17887**	**524116**
BNED Bhadrak	1786	168635	9926	653	0	11	34	2	2151	181412
BSED Bhadrak	719	106742	3449	316	0	2	5	1	2075	112590
BHADRAK Circle	**2505**	**275377**	**13375**	**969**	**0**	**13**	**39**	**3**	**4226**	**294002**
JRED, Jajpur Road	1092	89767	4627	297	6	22	24	11	2218	96972
JTED J Town	876	94446	3000	269	0	0	0	0	1541	99256
KED Kuakhia	920	109819	4101	368	1	2	26	1	2082	116400
J. ROAD Circle	**2888**	**294032**	**11728**	**934**	**7**	**24**	**50**	**12**	**5841**	**312628**
KED Keonjhar	3816	95122	4472	181	1	12	16	1	2316	102121
JED Joda	1752	75873	4707	197	12	11	34	9	1897	82740
AED Anandpur	2672	121573	3654	270	1	3	10	0	2066	127577
KEONJHAR Circle	**8240**	**292568**	**12833**	**648**	**14**	**26**	**60**	**10**	**6279**	**312438**
BED Baripada	3904	211667	10027	608	0	14	19	0	5164	227499
UED Udala	1828	100232	2928	267	0	0	2	0	2263	105692
RED Rairangpur	4686	184934	5557	381	0	2	17	0	4747	195638
BARIPADA Circle	**10418**	**496833**	**18512**	**1256**	**0**	**16**	**38**	**0**	**12174**	**528829**
Total	**27857**	**1833211**	**86593**	**5345**	**27**	**102**	**300**	**28**	**46407**	**1972013**

1.1 Broad scope of work

Open Tenders are invited in e-tender bidding process from interested bidders for SITC of SCADA System at TPNODL.

S. No.	Description	EMD Amount (Rs.)	Tender Fee (Rs.)
1	SITC of SCADA at TPNODL	10,00,000/-	5000/-

The scope includes supply, installation, configuration, customization, integration, testing, commissioning and training of Supervisory Control And Data Acquisition System (herein called SCADA) along with all necessary hardware, operating system, software and infrastructure. Detailed scope of work is described under subsequent section and the subsections. It is recommended for interested bidders to carry out pre-bid site-visit to have a detailed understanding of the existing system and requirements, subject to meeting qualification criteria as laid out in the document.

1.2 Availability of Tender Documents

Please refer "Procedure to participate in the e-tender".

1.3 Calendar of Events

(a)	Last Date of receipt of Tender Fee	21.07.2021 ; 17:00 Hrs
(b)	Date & Time of Pre-Bid Meeting (If any)	Not applicable due to COVID- 19. Queries to be answered through e-mail / TPNODL Tender Website.
(c)	Last Date of receipt of pre-bid queries, if any	28.07.2021 up to 18:00 Hrs
(d)	Last Date of Posting Consolidated replies to all the pre-bid queries as received	31.07.2021 up to 18:00 Hrs
(e)	Last date and time of receipt of Bids	04.08.2021 up to 17:00 Hrs
(f)	Date & Time of opening technical bids & EMD	04.08.2021 up to 17:30 Hrs
(g)	Date & Time of opening of Price of qualified	Will be notified to the successful bidders through website / e-mail.

Note: - In the event of last date specified for submission of bids and date of opening of bids is declared as a closed holiday for TPNODL, the last date of submission of bids and date of opening of bids will be the following working day at appointed times.

Pre bid meeting shall be scheduled at TPNODL Corporate Office or Online. Same shall be communicated to the interested bidders post receipt of their Tender Fee.

1.4 Mandatory documents required along with the Bid

1.4.1 EMD of requisite value and validity
1.4.2 Tender Fee in case the tender is downloaded from website
1.4.3 Duly signed copy of TENDER as an acceptance to all terms and conditions as mentioned in this TENDER.
1.4.4 Requisite Documents for compliance to Qualification Criteria mentioned in Clause 1.7.
1.4.5 Drawing, Type Test details along with a sample of each item as specified at Annexure I (as applicable)
1.4.6 Duly signed and stamped 'Schedule of Deviations' as per Annexure XIII on bidder's letter head.

1.4.7 Duly signed and stamped 'Schedule of Commercial Specifications' as per Annexure XIV on bidder's letter head.
1.4.8 Proper authorization letter / Power of Attorney to sign the tender on the behalf of bidder.
1.4.9 Copy of PAN, GST, PF, ESI Registration and valid Labour License (In case any of these documents is not available with the bidder, same to be explicitly mentioned in the 'Schedule of Deviations')

Please note that in absence of any of the above documents, the bid submitted by a bidder shall be liable for rejection.

1.5 Deviation from Tender

Bidder shall necessarily submit a signed and stamped copy of this TENDER (in original) as a token of acceptance of all the terms and conditions of this TENDER. Replication of this TENDER on bidders' document shall not be acceptable. Normally, the deviations to tender terms are not admissible and the bids with deviation are liable for rejection. Hence, the bidders are advised to refrain from taking any deviations on this Tender. Still in case of any deviations, all such deviations shall be set out by the Bidders, clause by clause in the 'Annexure III - Schedule of Deviations' and same shall be submitted as a part of the Technical Bid.

1.6 Right of Acceptance/Rejection

Bids are liable for rejection in absence of following documents: -

1.6.1 EMD of requisite value and validity
1.6.2 Tender fee of requisite value
1.6.3 Price Bid as per the Price Schedule mentioned in Annexure-I
1.6.4 Necessary documents against compliance to Qualification Requirements mentioned at Clause 1.7 of this Tender Document.
1.6.5 Complete technical details are not enclosed
1.6.6 Filled in Schedule of Deviations as per Annexure XIII
1.6.7 Filled in Schedule of Commercial Specifications as per Annexure XIV
1.6.8 Receipt of Bid within the due date and time

TPNODL reserves the right to accept/reject any or all the bids without assigning any reason thereof.

1.7 Qualification Criteria

1.7.1 The Bidder must have a presence in India for last 8 years. Copy of Certificate of Incorporation prior to 01.04.2013 to be enclosed in this regard. Alternatively, Bidder must have supplied SCADA/EMS/DMS solution in India prior to 01.04.2013 as a sole bidder or Consortium. Copy of LOI/ Purchase Order/ Work Order prior to 01.04.2013 to be enclosed in this regard.

1.7.2 The bidder should have a cumulative turnover of at least Rs. 150 Crores in the last three financial years (2017-18, 2018-19 and 2019-20). Copy of Audited Balance Sheet and P&L Account to be submitted in this regard.

1.7.3 The Bidder shall provide evidence of previous experience in the design, engineering, supply, installation, testing and commissioning of SCADA & ADMS (Supervisory Control and Data Acquisition System & Advance Distribution Management System) in multiple Projects (Maximum 3 nos.) for Power Distribution Systems (11KV or above) in the last eight (8) years. The above project(s) should have interface of at least 20 RTUs/ Data Concentrator (DC)/ Bay controller Unit (BCU). At least the following functionalities should have been commissioned by the Bidder in the above 3 projects:

a. SCADA Software supporting alarm, tagging, trending, SOE, real time data acquisition & calculations

b. DMS software supporting at least two functions out of load flow, loss minimization via feeder reconfiguration, FMSR (Fault Management and System Restoration), Volt-VAr control

c. OMS software supporting at least two functions out of Outage Management, Outage Analysis & Prediction, Crew Management, Switch Management and field Scheduling & Dispatching

d. Software functional redundancy for SCADA and ADMS functions

1.7.4 Out of the above projects, one of the project should be in successful operation for at least one year as on 01.04.2021. Experience Certificate clearly establishing – the start and end date of the project (the start date should not be prior to 01.04.2013), scope of work and worth of project, on client letterhead to be submitted in this regard. The supporting proof document must be labelled as original/true copy/translation, as the case may be, and the same shall necessarily be signed and authenticated by the Authorized Signatory of Bidder. The owner/client contact details shall be provided against each project experience proof being submitted. TPNODL reserves the right to contact the client for cross-checking the Bidder's credentials. The proof documents available in any language other than English shall be translated to English and authenticated by Authorized Signatory of bidder for submission. In such cases, the original language copies shall also be submitted along with the translated proof documents.

1.7.5 The Bidder should have at least 20 personnel on its rolls with a minimum experience of 5 years on SCADA/EMS/DMS system. Signed resume of employees authenticated & signed by the bidder needs to be submitted. Scanned signatures of the employees shall be accepted.

The bidder may avail credentials of its parent company for fulfillment of eligibility criteria as mention in points c, d & e above.

1.8 Marketing Integrity

We have a fair and competitive marketplace. The rules for bidders are outlined in the General Condition of Contracts. Bidders must agree to these rules prior to participating. In addition to other remedies available, TPNODL reserves the right to exclude a bidder from participating in future markets due to the bidder's violation of any of the rules or obligations contained in the General Condition of Contracts. A bidder who violates the market place rules or engages in behaviour that disrupts the fair execution of the marketplace, may result in restriction of a bidder from further participation in the marketplace for a length of time, depending upon the seriousness of the violation. Examples of violations include, but are not limited to:

- Failure to honour prices submitted to the marketplace
- Breach of terms as published in TENDER / NIT

1.9 Supplier Confidentiality

All information contained in this tender is confidential and shall not be disclosed, published or advertised in any manner without written authorization from TPNODL. This includes all bidding information submitted to TPNODL. All tender documents remain the property of TPNODL and all suppliers are required to return these documents to TPNODL upon request. Suppliers who do not honour these confidentiality provisions will be excluded from participating in future bidding events.

2.0 Evaluation Criteria

- The bids will be evaluated technically on the compliance to tender terms and conditions as detailed in Annexure II – Volume I Clause 4.6.
- Bidder has to mandatorily quote against each item of Schedule of Items *[Annexure I].* Failing to do so TPNODL may reject the bids.
- Bidder must comply with Qualification requirement and compliance sheet.
- Bidder must submit the list of sites and contact details in which similar solution have been developed and successfully running its operation. TPNODL team reserves the right to visit those sites and bidder shall facilitate such visit. The travelling, loading and boarding charges shall be borne by TPNODL.

NOTE: In case of a new bidder, not registered with TPNODL, facility inspection and evaluation shall be carried out to ascertain bidder's manufacturing capability and quality procedures. However TPNODL reserves the right to carry out facility inspection and evaluation for any bidder prior to technical qualification. In case a bidder is found as disqualified in the sites visit evaluation, their bid shall not be evaluated any further and shall be summarily rejected. The decision of TPNODL shall be final and binding on the bidder in this regard.

2.1 Price Variation Clause: The prices shall remain firm during the entire contract period.

3.0 Submission of Bid Documents

3.1 Bid Submission

Bidders are requested to submit their offer in line with this Tender document. TPNODL shall respond to the clarification raised by various bidders and the replies will be sent to all participating bidders through e-mail.

Bids shall be submitted in 3 (Three) parts:

FIRST PART: "EMD" of Rs. **10,00,000**/- (Rupees Ten Lacs Only) shall be submitted. The EMD shall be valid for 180 days from the due date of bid submission in the form of BG/Bankers Pay Order favouring 'TP Northern Odisha Distribution Limited", payable at Balasore only. The EMD has to be strictly in the format as mentioned in General Condition of Contract, failing which it shall not be accepted and the bid as submitted shall be liable for rejection. A separate non-refundable tender fee of stipulated amount also needs to be transferred online through NEFT/ RTGS in case the tender document is downloaded from our website.

TPNODL Bank Details for transferring Tender Fee and EMD is as below:

Beneficiary Name:	TP Northern Odisha Distribution Limited
Bank Name:	Union Bank of India
Branch Name:	Balasore Branch
Account No.:	500601010280332
IFSC Code:	UBIN0550060

SECOND PART: "TECHNICAL BID" shall contain the following documents:

a) Documentary evidence in support of qualifying criteria
b) Technical literature/GTP/Type test report etc. *(if applicable)*
c) Qualified manpower available

d) Testing facilities *(if applicable)*
e) Original tender document duly stamped & signed on each page as token of acceptance
f) No Deviation Certificate as per the Annexure III – Schedule of Deviations
g) Acceptance to Commercial Terms and Conditions viz. Delivery schedule/period, payment terms etc. as per the Annexure IV – Schedule of Commercial Specifications.
h) Quality Assurance Plan/Inspection Test Plan for supply items *(if applicable)*
i) A complete, detailed and clear description of the proposed System to meet all functional requirements of the Specification. A list which cross-references the Specification sections and the relevant sections of the Bidder's Proposal shall also be provided
j) Performance Analysis for the processors, LANs, and memory
k) Baseline System Overview Document
l) OEM data sheets for hardware and third party software
m) Availability Analysis.
n) All other documents required as per RFP.
o) Product brochures, white papers, case studies etc.

The technical bid shall be properly indexed and is to be submitted through TPNODL E-tender platform (Ariba) only. Hard copy of Technical Bids need not be submitted.

THIRD PART: "PRICE BID" shall contain only the price details and strictly in format as mentioned in Annexure I along with explicit break up of basic prices, Taxes & duties, Freight etc. In case any discrepancy is observed between the item description stated in Schedule of Items mentioned in the tender and the price bid submitted by the bidder, the item description as mentioned in the tender document (to the extent modified through Corrigendum issued if any) shall prevail. Price Bid is to be submitted in soft copy through TPNODL E-Tendering system (Ariba) only. Hard copy of Price Bid not be submitted.

SIGNING OF BID DOCUMENTS:

The bid must contain the name, residence and place of business of the person or persons making the bid and must be signed and sealed by the Bidder with his usual signature. The names of all persons signing should also be typed or printed below the signature.

The Bid being submitted must be signed by a person holding a Power of Attorney authorizing him to do so, certified copies of which shall be enclosed.

The Bid submitted on behalf of companies registered with the Indian Companies Act, for the time being in force, shall be signed by persons duly authorized to submit the Bid on behalf of the Company and shall be accompanied by certified true copies of the resolutions, extracts of Articles of Association, special or general Power of Attorney etc. to show clearly the title, authority and designation of persons signing the Bid on behalf of the Company. Satisfactory evidence of authority of the person signing on behalf of the Bidder shall be furnished with the bid.

A bid by a person who affixes to his signature the word 'President', 'Managing Director', 'Secretary', 'Agent' or other designation without disclosing his principal will be rejected.

The Bidder's name stated on the Proposal shall be the exact legal name of the firm.

3.2 Contact Information

All the bidders are requested to send their pre-bid queries (if any) against this tender through e-mail within the stipulated timelines. The consolidated reply to all the queries received shall be posted on TPNODL website by the stipulated timelines as detailed in calendar of events.

Communication Details:

Name: Mr. Imran Ahmad
Contact No: 9910891222
E-Mail ID: Imran.ahamd@tpnodl.com

HOD (Contracts):

Name: Mr. Vipin Chauhan
Contact No.: 9717393121
E-Mail ID: vipin.chauhan@tpnodl.com

Bidders are strictly advised to communicate with Package Owner through e-mail/TPNODL E-tender System (Ariba) only. They need to pay Tender Participation Fee to receive the Ariba log-in.

3.3 Bid Prices

Bidders shall quote for the entire Scope of Supply/Work with a break up of prices for individual items and Taxes & duties. The total bid price shall also cover all the supplier's mentioned in or obligations mentioned in or reasonably to be inferred from the bidding documents in respect of Design, Supply, Transportation to site, all in accordance with the requirement of bidding documents. The bidder shall complete the appropriate Price Schedules included herein, stating the Unit Price for each item & total price with taxes, duties & freight up to destination at various sites of TPNODL. The all-inclusive prices offered shall be inclusive of all costs as well as Duties, Taxes and Levies paid or payable during the execution of the supply work, breakup of price constituents.

The quantity break up shown else-where other than Price Schedule is tentative. The bidder shall ascertain himself regarding material required for completeness of the entire work. Any items not indicated in the price schedule but which are required to complete the job as per the Technical Specifications/ Scope of Work / SLA mentioned in the tender, shall be deemed to be included in prices quoted.

Applicable GST to be specified clearly.

The quantity break up shown else-where other than Price Schedule is tentative. The bidder shall ascertain himself regarding material required for completeness of the entire work. Any items not indicated in the price schedule but which are required to complete the job as per the Technical Specifications / Scope of Work / SLA mentioned in the tender, shall be deemed to be included in prices quoted.

3.4 Bid Currencies

Prices shall be quoted in Indian Rupees Only.

3.5 Period of Validity of Bids

Bids shall remain valid for 180 days from the due date of submission of the bid.

Notwithstanding clause above, the TPNODL may solicit the Bidder's consent to an extension of the Period of Bid Validity. The request and responses thereto shall be made in writing.

3.6 Alternative Bids

Bidders shall submit Bids, which comply with the Bidding documents. Alternative bids will not be considered. The attention of Bidders is drawn to the provisions regarding the rejection of Bids in the terms and conditions, which are not substantially responsive to the requirements of the bidding documents.

3.7 Modifications and Withdrawal of Bids

The bidder is not allowed to modify or withdraw its bid after the Bid's submission. The EMD as submitted along with the bid shall be liable for forfeiture in such event

3.8 Earnest Money Deposit (EMD)

The bidder shall furnish, as part of its bid, an EMD amounting as specified in the tender. The EMD is required to protect the TPNODL against the risk of bidder's conduct which would warrant forfeiture.
The EMD shall be denominate in any of the following form:

- Banker's Cheque / Demand Draft / Pay order drawn in favour of "TP Northern Odisha Distribution Limited", payable at Balasore only.
- Online transfer of requisite amount through NEFT / RTGS.
- Bank Guarantee valid for 210 days after due date of submission.

The EMD shall be forfeited in case of:

a) The bidder withdraws its bid during the period of specified bid validity.

Or

b) The case of a successful bidder, if the Bidder does not
   i) accept the purchase order, or
   ii) furnish the required performance security BG

3.9 Type Tests (if applicable)

The type tests specified in TPNODL specifications should have been carried out within five years prior to the date of opening of technical bids and test reports are to be submitted along with the bids. If type tests carried out are not within the five years prior to the date of bidding, the bidder will arrange to carry out type tests specified, at his cost. The decision to accept/ reject such bids rests with TPNODL.

4.0 Bid Opening & Evaluation process

4.1 Process to be confidential

Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process. Any effort by a Bidder to influence the TPNODL's processing of Bids or award decisions may result in the rejection of the Bidder's Bid.

4.2 Technical Bid Opening

Bids shall be opened as per the schedule mentioned in Calendar of Events. In case of limited tenders, the bids shall be opened internally by TPNODL. Owing to COVID Scenario, in case of Open Tenders also, the bids shall be opened internally by TPNODL. Technical bid must not contain any cost information whatsoever.

First the "EMD" will be checked. Bids without EMD/ cost of tender (if applicable) of required amount/ validity in prescribed format, shall be rejected.

Next, the technical bid of the bidders who have furnished the requisite EMD will be opened, one by one. The salient particulars of the techno commercial bid will be read out at the sole discretion of TPNODL.

4.3 Preliminary Examination of Bids/ Responsiveness

TPNODL will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the Bids are generally in order. TPNODL may ask for submission of original documents in order to verify the documents submitted in support of qualification criteria.

Arithmetical errors will be rectified on the following basis: If there is a discrepancy between the unit price and the total price per item that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price per item will be corrected. If there is a discrepancy between the Total Amount and the sum of the total price per item, the sum of the total price per item shall prevail and the Total Amount will be corrected.

Prior to the detailed evaluation, TPNODL will determine the substantial responsiveness of each Bid to the Bidding Documents including production capability and acceptable quality of the Goods offered. A substantially responsive Bid is one, which conforms to all the terms and conditions of the Bidding Documents without material deviation.

Bid determined as not substantially responsive will be rejected by the TPNODL and/or the TPNODL and may not subsequently be made responsive by the Bidder by correction of the non-conformity.

4.4 Techno Commercial Clarifications

Bidders need to ensure that the bids submitted by them are complete in all respects. To assist in the examination, evaluation and comparison of Bids, TPNODL may, at its discretion, ask the Bidder for a clarification on its Bid for any deviations with respect to the TPNODL specifications and attempt will be made to bring all bids on a common footing. All responses to requests for clarification shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted owing to any clarifications sought by TPNODL. After all techno commercial issues are clarified, the date of price bid opening will be intimated to the technically accepted bidders and same shall also be notified at TPNODL website.

4.5 Clarification of Bids

To assist in the examination, evaluation and comparison of Bids, the TPNODL may, at its discretion, ask the Bidder for a clarification of its Bid. All responses to requests for clarification shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted.

4.6 Price Bid Opening

Price bids will be opened at the stipulated date and time. The EMD of the bidder withdrawing or substantially altering his offer at any stage after the technical bid opening will be forfeited at the sole discretion of TPNODL without any further correspondence in this regard.

4.7 Reverse Auctions

TPNODL reserves the right to conduct the reverse auction (instead of public opening of price bids) for the products/ services being asked for in the tender. The terms and conditions for such reverse auction events shall be as per the Acceptance Form attached as Annexure VI of this document. The bidders along with the tender document shall mandatorily submit a duly signed copy of the Acceptance Form attached as Annexure VI as a token of acceptance for the same.

5.0 Award Decision

TPNODL will award the contract to the successful bidder whose bid has been determined to be the lowest-evaluated responsive bid as per the Evaluation Criterion mentioned in Annexure-II. The Cost for the said calculation shall be taken as the all-inclusive cost quoted by bidder in Annexure I (Schedule of Items) subject to any corrections required in line with Clause 4.3 above. The decision to place purchase order/LOI solely depends on TPNODL on the cost competitiveness across multiple lots, quality, delivery and bidder's capacity, in addition to other factors that TPNODL may deem relevant.

TPNODL reserves all the rights to award the contract to one or more bidders so as to meet the delivery requirement or nullify the award decision without assigning any reason thereof.

In case any supplier is found unsatisfactory during the delivery process, the award will be cancelled and TPNODL reserves the right to award other suppliers who are found fit.

6.0 Order of Preference/Contradiction:

In case of contradiction in any part of various documents in tender, following shall prevail in order of preference:

1. Schedule of Items (Annexure I)
2. Post Award Contract Administration (Clause 7.0)
3. Submission of Bid Documents (Clause 3.0)
4. Scope of Work and Technical Specifications (Annexure II)
5. Acceptance Form for Participation in Reverse Auction (Annexure VI)
6. General Conditions of Contract (Annexure VII)

7.0 Post Award Contract Administration

7.1 Special Conditions of Contract

- Contractor Safety Management System along with its amendments as issued time to time by TPNODL shall be applicable in this contract. All new amendments shall be effective from the date of their issue or from its date of intimation to the vendor by TPNODL whichever is later.
- TPNODL reserves the right to make changes to the scope of work with a view to optimize on the overall cost to TPNODL. The vendor shall fully cooperate with TPNODL in making such changes with an aim for overall cost optimization. The revised charges for AMC shall be jointly agreed upon between TPNODL and the vendor in such case.
- In case, a mutual consensus on the rates and other terms and conditions is not reached at between TPNODL and the vendor, TPNODL reserves the right to terminate the contract by giving suitable notice period and allocating the same to any other vendor as deemed fit by TPNODL to maintain uninterrupted operations at site.
- Performance Bank Guarantee amounting to 3 % of order value shall be submitted by the BA as per GCC for a period equivalent to contract validity period
- Unless communicated by TPNODL in writing, the contract shall automatically stand terminated after the expiry of its validity period without serving any notice thereof.
- TPNODL appreciates and welcomes the engagement/employment of persons from SC/ST community or any other deprived section of society by their BAs.
- Any change in statutory taxes, duties and levies during the contract period shall be borne by TPNODL.
- All the terms and conditions of TPNODL GCC shall be applicable.

7.2 Drawing Submission & Approval

Not Applicable.

7.3 Delivery Terms

The Bidder shall provide a detailed Implementation Schedule indicating major Supplier and TPNODL activities, major completion milestone events, and interdependencies between events. Required TPNODL activities and associated dates must be clearly shown and include interdependencies to the Supplier's scheduled activities. The schedule shall be in terms of months after Receipt of Order (ARO), not absolute dates.

The Supplier shall perform all scheduling activities with Microsoft Project, such that all schedules as periodically transmitted to TPNODL include both hard copy and electronic versions.

Following is the expected delivery schedule. Bidders may propose separate delivery schedule; however the total time for project completion shall not exceed 800 days from the date of placement of firm purchase order by TPNODL.

S. No.	Milestone	Days following PO Placement
1	Notice to Proceed	0
2	As is & submission of project execution plan	30
3	Submittal of Functional Specifications and Design Specifications	90
4	Submittal of Acceptance Test Plans and Test Procedures	120
5	Start of Factory Acceptance Tests	150
6	System shipped from Factory	180
7	Start of Site Acceptance Tests	240
8	Start of Availability Tests	270
9	Project area roll out	300
10	Project Completion Part-A SCADA as per RFP	360
11	Project Start Part-B DMS & OMS (tentative)	480
12	Submittal of Functional Specifications and Design Specifications for DMS & OMS and integration with existing systems(CRM,ERP,AMI , Mobile app and SAP-BI/BO)	540
13	Submittal of Acceptance Test Plans & Pilot for DMS & OMS	720
14	Complete of site Acceptance Tests	810
15	Pilot area roll out	830
16	Roll out of Part-B DMS & OMS at all circle	1000
17	Project completion as per RFP	1090

7.4 Warranty Period

The complete solution including hardware/ software shall be under comprehensive on-site warranty for a period of 60 months from the date of project completion as mentioned in Scope of Work in Annexure II.

7.5 Payment Terms

Payment shall be released within 45 days from the date of submission of certified bills / invoices after deduction applicable amounts as per the following milestones. Payment milestone of Part A and Part B is defined separately.

MS Number	Milestone Description	% of Total Contract Price**
	Part-A Delivery- SCADA	
MS-1(a)	Mobilization Advance – Against submission of the following: a) PO Acceptance b) Submission of Contract Performance Bank Guarantee for 10% of Contract Value c) Submission of Advance Bank Guarantee (ABG) by the Bidder for 10%% of Total Contract Value	10
MS-1(b)	Submission and approval of: ▪ List of Deliverables ▪ Detailed Project Schedule ▪ System & Configuration Drawings ▪ Database Design Documentation ▪ Design Documentation for Hardware & Software System ▪ Application Overview Document ▪ Software requirements specifications for custom designs ▪ Functional Design Specifications ▪ Any Other Documentation related to Design Engineering	5
MS-2	System hardware staging completed in the Factory. Complete installation of all the Supplier standard baseline system and application software ▪ Software Test Review & Signoff ▪ Software Test Execution ▪ Software Test Planning to test SCADA Functions ▪ Review and Signoff Requirements ▪ Successful completion of FAT and resolution of all variances to TPNODL's satisfaction	25
MS-3	▪ Shipment of the entire system, its complete installation at TPNODL's site, and successful completion of system start-up activities. ▪ Installation and commissioning of entire scope of work of SCADA	40
MS-4	Final Payment after Operational Acceptance (on successful completion of system availability tests), delivery of spares, maintenance & testing equipment's etc. and post support period of 6 months	20
	Part-B Delivery- DMS & OMS (ADMS)	
MS-1(a)	Mobilization Advance – Against submission of the following: d) PO Acceptance e) Submission of Contract Performance Bank Guarantee for 10% of Contract Value	10

MS Number	Milestone Description	% of Total Contract Price**
	Submission of Advance Bank Guarantee (ABG) by the Bidder for 10%% of Total Contract Value	
MS-1(b)	Submission and approval of: ▪ List of Deliverables ▪ Detailed Project Schedule ▪ System & Configuration Drawings ▪ Database Design Documentation ▪ Design Documentation for Hardware & Software System ▪ Application Overview Document ▪ Software requirements specifications for custom designs ▪ Functional Design Specifications Any Other Documentation related to Design Engineering	5
MS-2	▪ Shipment of the System, its complete installation at TPNODL's site ▪ Data Model & Network creation ▪ Pre-FAT test acceptance ▪ GIS & ADMS based interface development in one of circle or pilot area Interface development with other system like ,CIS,PM,BO-module)	20
MS-3	▪ Installation & commissioning of one circle system meeting the entire scope of work of ADMS system ▪ Pre-SAT test acceptance and Site Preparation Plan ▪ Witness demonstrations of all custom features ▪ Field Update Period completed ▪ Approval of Operator's User's Manual ▪ Rectification of Bugs/ Issues if any reported after Pre-SAT ▪ Interface development with other system like ,CIS,SAP-(PM,BO-module), Pre-SAT test acceptance	25
MS-4	Approval of site acceptance test (SAT) after completion of all test plans and procedures. This includes: Site Preparation Plan ▪ Remaining circle system meeting the entire scope of work of ADMS system ▪ Witness demonstrations of all custom features ▪ Field Update Period completed ▪ Approval of Operator's User's Manual ▪ Rectification of Bugs/ Issues if any reported after Pre-SAT. ▪ Training on O&M of System ▪ Modification if any to the Operator's User's manual ▪ Delivery of all final documents ▪ Availability of Complete functionality pan TPNODL	30
MS-5	Final Payment after Operational Acceptance (on successful completion of system availability tests), delivery of spares, maintenance & testing equipment's etc. and post support period of 6 months	10

Payment towards annual maintenance and support charges post expiry of warranty shall be made on quarterly basis in arrears.

Bills / invoices would be verified by TPNODL authorized person for payment and also for deduction / withheld against non- compliance as listed in Performance Measurement criteria.

7.3 Climate Change

Significant quantities of waste are generated during the execution of project and an integrated approach for effective handling, storage, transportation and disposal of the same shall be adopted. This would ensure the minimization of environmental and social impact in order to combat the climate change.

7.4 Ethics

- TPNODL is an ethical organization and as a policy TPNODL lays emphasis on ethical practices across its entire domain. Bidder should ensure that they should abide by all the ethical norms and in no form either directly or indirectly be involved in unethical practice.
- TPNODL work practices are governed by the Tata Code of Conduct which emphasizes on the following:

- We shall select our suppliers and service providers fairly and transparently.
- We seek to work with suppliers and service providers who can demonstrate that they share similar values. We expect them to adopt ethical standards comparable to our own.
- Our suppliers and service providers shall represent our company only with duly authorized written permission from our company. They are expected to abide by the Code in their interactions with, and on behalf of us, including respecting the confidentiality of information shared with them.
- We shall ensure that any gifts or hospitality received from, or given to, our suppliers or service providers comply with our company's gifts and hospitality policy.
- We respect our obligations on the use of third party intellectual property and data.

Bidder is advised to refer GCC attached at Annexure VII for more information.

Any ethical concerns with respect to this tender can be reported to the following e-mail ID: imran.ahmad@tpnodl.com

8.0 Specification and standards

As per Annexure-II

9.0 General Condition of Contract

Any condition not mentioned above shall be applicable as per GCC for Service attached along with this tender at Annexure VII.

10.0 Safety

Safety related requirements as mentioned in our safety Manual put in the Company's website which can be accessed at www.tpnodl.com

All Associates shall strictly abide by the guidelines provided in the safety manual at all relevant stages during the contract period.

All jobs are this tender have to be executed strictly in compliance to the Safety terms and Conditions of TP Northern Odisha Distribution Limited. Please refer attached Safety terms and conditions, Annexure-VIII, for details. Violation of Safety norms will result in Penalty as mentioned in the above document.

11.0 Technical Proposal

11.1 General Guideline

The Purchaser will select a Supplier (also referred as the 'bidder') in accordance with the eligibility criteria indicated in Section 1.7 of this document

The bidders are invited to submit a Technical Proposal and a Price Proposal for goods and related services required for the project as defined in RFP. This proposal will be the basis for contract negotiations and finalization of the contract with the successful bidder.

The bidders must familiarize themselves with local conditions and take these into account while preparing their proposals. To facilitate the bidders in making the Proposal, the Purchaser shall have a 'Pre-Bid conference' at the address and date as given in Section 4.4

Please note that:

Costs involved in preparation of the proposal and of negotiating the contract, including a visit to the Purchaser, are not reimbursable.

The final evaluation will be based on both technical and commercial factors as per the evaluation methodology mentioned in the Section 4.4.

11.2 Bidder Company Statistics

Please provide the general and financial details of bidders:

Details	Supplier Response
Bidder's Name	
Address	
Contact (s), Title (s), Telephone (s), E-mail id (s)	
Name of the Chairman/ MD/ CEO/ Partners	
Nature of Ownership	
Date of Incorporation of Company/Entity	
Headquarter Location	
Other Office Locations, Functions and Personnel Strength	
1) Number of Employees by Function **2) Implementation** **3) Sales** **4) Support** **5) Quality Assurance** **6) Administrative** **7) Management**	
Size of Team for the Proposed Solution	
Location of Support Centers for Proposed Solution	
Other Businesses	

Table: Bidder Company Statistics

11.3 Hardware Technical Specifications (Including network equipment's, LAN/WAN, Kiosk etc.)

The bidder shall provide compliance to the Hardware requirements.

Please mention the detailed specification of hardware equipment and system software (operating system, database etc.) including manufacturer, technical details etc. The bidders should provide details of required system software like operating system , database for solution and utilities in following format :-

Product details	No. of installations	Version and year of release

Table: Details of Hardware Offered

11.4 Approach and Methodology

The following table elaborates various requirements within A&M:

(i) Understanding of Purchaser and its requirement with clear mention of the deliverables
(ii) Details of proposed methodology
(iii) Project Team Structure
(iv) Resource planning and estimation
(v) Risk planning
(vi) Detailed work plan with timelines

11.4.1 Understanding of TPNODL and its requirement

Bidder should depict complete understanding of the as-is system of the Utility based on the information provided in the Bid Document. It should also require to list down all the deliverables that has been planned as a part of the overall project with timelines. Also provide details of prior interaction with TPNODL & if any.

11.4.2 Details of proposed methodology

Please provide details of methodology followed by your organization in successfully implementing similar projects. Also highlight the special steps that your organization intends to take in order to ensure that the change from current system to proposed one will be smooth and effective.

11.4.3 Project Team Structure

In this section please provide detail of the team that would be deployed by your organization to execute the project. Please provide details of the team structure in the following format:

Name of Staff	Position Assigned	International or Domestic	Firm	Employment status with the firm (Full time/ Associate)	Education (Degree, Year, Institution)	Area of Expertise and no. of years of relevant experience	Task Assigned
A. Professional Staff							
B. Support Staff							

Table: Proposed Project Team Structure

11.4.5 Resource Planning and Estimation

Bidder shall provide detailed staffing schedule of the professional and support staff in the following format. For Professional Staff the input should be indicated individually; for Support Staff it should be indicated by category (e.g.: IT administrator, etc.). Months are counted from the start of the assignment. For each staff indicate separately staff input for off-site and on-site work.

S. No.	Name of Staff	Position	Staff Input							
			In Weeks	W1	W2	W3	W4	W5	.....	Total
	A. Professional Staff									
	B. Support Staff									

Table: Proposed Resource Planning and Estimation

11.4.6 Risk & Mitigation Planning

Bidder shall assess underlying risks in implementation of the Project and detail out the methodology to mitigate them. It may include development of a risk assessment matrix indicating severity of the risk, chance of its occurrence and its mitigation approach.

11.4.7 Detailed work plan with timelines

Bidder shall provide project execution plan

11.5 Project Experience

Bidder shall provide details of projects with application modules and other requirements Eligibility Criteria (Section 1.7 of this document) which have been successfully completed during the last 5 financial years. Please do not supply the names of clients who are no longer using your product/system. Bidders need to submit the details as per the format in the table provided.

Table: The details of the same should be included in the following format and necessary supporting documents should be attached with RFP:

S. No.	Name of the Project	Client Name	Whether the Project was successfully commissioned	Date and Year of Commissioning	Value of the Project	Indicate the SCADA/ADMS modules implemented in the project	Indicate the integration with IT system, if any viz GIS, ERP, Customer Care etc.	Indicate whether interface were included in the project? If Yes, please provide the detail	Indicate the protocol implemented viz IEC60870-5-101/104, IEC61850, Modbus, ICCP, IEC62056

Table: Details of Project Experience

Note: Kindly provide Client Performance Certificates for the completed projects provided for establishing/confirming the requisite details for project experience as mentioned above Or Copy of LoA/ Work Order along with proof of release of final payment.

11.6 Team details (CVs)

Use the following format for key personnel who would be involved in the project. Please include details of team members proposed to implement the project, install or manage hardware, install and manage LAN/WAN and provided GIS solution, ESB interface developed etc., please ensure that the CV has a maximum length of 3 pages.

Format of Curriculum Vitae

1.	**Proposed Position:**			
2.	**Name of Firm and Role**			
3.	**Name of Staff:**			
4.	**Date of Birth:**		Nationality:	
5.	**Education:**			

Year	Degree/Examination	Institute/Board

6.	**Membership of Professional Associations:**	
7.	**Other Training:**	
8.	**Countries of Work Experience:**	
9.	**Languages:**	

Language	Speaking	Reading	Writing

10.	**Employment Record:**	

From	To	Employer	Positions Held

11.	**Detailed Tasks Assigned:**	12.	**Work Undertaken that best illustrates capability to handle the tasks assigned:**
13.	**Certification:**		
	I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.		
	Signature of authorized representative of the staff	Date:	
	Full name of authorized representative:		

11.7 Project Management Practices

Please provide high-level details of the project management practices that will be followed to manage the project. The project management practices would include (but not be limited to) details of:-

- Bidder must provide details of how they envisage the contract being managed and control mechanisms; regular and active review meetings; Project management of individual work streams and overall program management of the entire service; Performance reporting
- Bidder should outline their proposed governance structure and designate a Service Manager to co-ordinate their activities and provide a focal point of contact to which TPNODL can refer on any matter concerning the service.
- Reporting lines and decision-making powers within the bidder's organization must be explained
- Reporting formats and templates that would be followed by the bidders
- Outline the proposed escalation procedures in the event that issues arise.

11.8 Quality Assurance

Quality of service - Suppliers must provide details of their proposed approach to quality assurance to ensure the quality of services in accordance with RFP Document. This should include:

- Responsibility of quality of service;
- How the supplier will ensure quality service is provided;`
- How quality will be measured

Does your company have any quality certification / Assessment? If so, please provide your responses for the following:

Details of Certification

Description	Bidder's Response
Certification / Assessment Name	
Who issued the certification/assessment?	
When was the certification/assessment obtained?	
Does this certification/assessment process involve periodic reviews and observations/ remarks after such review? If so, please provide details and specify when your company is due for its next quality review?	

Please specify your company's process for product development and enhancements.

11.9 Documentation

Please provide a list of all user documents that will be provided along with the software package. This must include the following minimum documents:

- System and administration manuals
- Technical support handbook
- User Manuals;
- Error Messages and their Meanings;
- Training Manuals;
- Analysis & Design Manuals with the relevant data flow diagrams, entity relationship diagrams, schemas etc.;
- Additions/ changes to the documents after upgrades; and
- Operations Manuals

Annexure – I

Schedule of Items

Pricing Forms

References are to sections or tables in the Specification.

1.1 SCADA/ADMS Price Summary

1)	Total SCADA/ADMS Hardware Price (all prices from 1.2)	Rs. _____
2)	Total SCADA/ADMS Software Price (all prices from 1.3)	Rs. _____
3)	Total Project Implementation Price (all prices from 1.4)	Rs. _____
4)	Total Recommended Spare Parts (all prices from 1.5) (See Volume I, Availability of Parts & Services)	Rs. _____
5)	Total Recommended Test Equipment (all prices from 1.6) (See Volume I, Availability of Parts & Services)	Rs. _____
6)	Total Training Budget (all prices from 1.7) (See Volume II, Training Budget)	Rs. _____
7)	Any Other	Rs. _____
Total SCADA/ADMS Price		Rs. _____

1.2 Hardware Prices

1.2.1 Part A - SCADA Control Subsystem Hardware

S. No.	Description	QTY	UOM	Unit Cost	Unit Tax	Total Cost
1	Processing Units, Main and Bulk Memory, Terminals, Readers, etc. for SCADA (as Per Vol. II/ Appendix – D)	1	LOT	Rs.____	Rs.____	Rs.____
2	Processing Units, Main and Bulk Memory, Terminals, Readers, etc. for DMS & OMS (Per Vol. II/ Appendix – D)	1	LOT	Rs.____	Rs.____	Rs.____
3	Archival Storage for SCADA (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
4	Archival Storage for DMS & OMS (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
5	Other Company Computer Systems Interfaces (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
6	FEP Communications Network Equipment (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
7	Time & Frequency Subsystem (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
8	2-Monitor Consoles at MCC (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
9	2-Monitor Consoles at other location (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
10	Video Projection System (MCC) (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
11	Expendable Supplies (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
12	Miscellaneous Hardware Cost (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
	Total SCADA/ADMS Subsystem Hardware Price				Rs._____	

1.2.2 Information Storage and Retrieval Subsystem Hardware

S. No.	Description	QTY	UOM	Unit Cost	Unit Tax	Total Cost
1	Processing Units, Main and Bulk Memory, Terminals, CDROM, Readers (As Per Vol. II)	1	Lot	Rs.____	Rs.____	Rs.____
2	Tape with Media Changer (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
3	Any Other	1	Lot	Rs.____	Rs.____	Rs.____
	Total IS&R Hardware Price				**Rs.**_____	

1.2.3 Dispatcher Training Simulator Hardware

S. No.	Description	QTY	UOM	Unit Cost	Unit Tax	Total Cost
1	Processing Units, Main and Bulk Memory, Terminals, CDROM, Readers (As per Vol. II, Figure 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
2	2-Monitor Consoles (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
3	Any Other (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
	Total DTS Hardware Price				**Rs.**_____	

1.2.4 Development System

S. No.	Description	QTY	UOM	Unit Cost	Unit Tax	Total Cost
1	Processing Units, Main and Bulk Memory, Terminals, CDROM, Readers (As per Vol. II)	1	Lot	Rs.____	Rs.____	Rs.____
2	2-Monitor Consoles (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
	Total Development Hardware Price				**Rs.**____	

1.2.5 Backup Control System

S. No.	Description	QTY	UOM	Unit Cost	Unit Tax	Total Cost
1	Processing Units, Main and Bulk Memory, Terminals, CDROM, Reader for SCADA (As per Vol. II)	1	Lot	Rs.____	Rs.____	Rs.____
2	Processing Units, Main and Bulk Memory, Terminals, CDROM, Reader for DMS & OMS (As Per Vol. II)	1	Lot	Rs.____	Rs.____	Rs.____
3	Other Company Computer System Interfaces (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
4	FEP/ICCP Communications Network Equipment (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
5	Time and Frequency System (As required)	1	Lot	Rs.____	Rs.____	Rs.____
6	2-Monitor Consoles (As per Vol. II, Table 2-2)	1	Lot	Rs.____	Rs.____	Rs.____
	Total BCS Hardware Price				**Rs.**_____	

1.3 SCADA/ADMS Software Prices

S. No.	Description	Quantity	UOM	Unit Cost	Unit Tax	Total Cost
1	Base SCADA All software costs (Operating Systems, SCADA/ User Interface, etc.) (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
2	DMS & OMS Software Cost - All software costs (Operating Systems, SCADA/ User Interface, etc.) excluding the items defined below.	1	Lot	Rs.____	Rs.____	Rs.____
2	LAN Management Software (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
3	Other Systems Interface (GIS, SAP,), list prices individually. (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
4	Web UI (As Required)	1	Lot	Rs.____	Rs.____	Rs.____

5	Video Projection System Interface (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
6	IS&R (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
8	Load shedding (List Application Prices individually) (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
9	Advance Distribution Management System Applications (List Application Prices individually) (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
10	Dispatcher Training Simulator (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
11	Third Party Software Licenses (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
12	RDBMS Licenses (Specify manufacturer) (As Required)	1	Lot	Rs.____	Rs.____	Rs.____
	Total SCADA/ADMS Software Price					**Rs.____**

1.4 SCADA/ADMS Project Implementation Cost

Part-A: SCADA

S. No.	Description	Quantity	UOM	Unit Cost	Unit Tax	Total Cost
1	Project Management (As required)	1	Lot	Rs.____	Rs.____	Rs.____
2	Testing (As required)	1	Lot	Rs.____	Rs.____	Rs.____
3	Documentation (As required)	1	Lot	Rs.____	Rs.____	Rs.____
4	Shipping (As required)	1	Lot	Rs.____	Rs.____	Rs.____
5	Insurance (As required)	1	Lot	Rs.____	Rs.____	Rs.____
6	Warranty/Guarantee (As required)	1	Lot	Rs.____	Rs.____	Rs.____
7	Installation of SCADA/ADMS system including interface (As required)	1	Lot	Rs.____	Rs.____	Rs.____

S. No.	Description	Quantity	UOM	Unit Cost	Unit Tax	Total Cost
		Project Implementation Price			Rs.____	

Part-B: DMS &OMS

S. No.	Description	Quantity	UOM	Unit Cost	Unit Tax	Total Cost
1	Project Management (As required)	1	Lot	Rs.____	Rs.____	Rs.____
2	Testing (As required)	1	Lot	Rs.____	Rs.____	Rs.____
3	Documentation (As required)	1	Lot	Rs.____	Rs.____	Rs.____
4	Shipping (As required)	1	Lot	Rs.____	Rs.____	Rs.____
5	Insurance (As required)	1	Lot	Rs.____	Rs.____	Rs.____
6	Warranty/Guarantee (As required)	1	Lot	Rs.____	Rs.____	Rs.____
7	Installation of SCADA/ADMS system including interface (As required)	1	Lot	Rs.____	Rs.____	Rs.____
		Project Implementation Price			Rs.____	

1.5 Recommended Training Courses

Course Name	Price for On-Site Course	Price for Course at Bidder's Site
	Rs._____	Rs._____
	Rs._____	Rs._____
Training Budget Total		**Rs.**_____

Each of the above quotes shall be independent and shall include all associated documentation, testing, and delivery costs necessary to implement the associated function. If there are economies by selecting certain options together, the Contractor shall identify the groupings and the corresponding group costs in addition to the individual costs.

Note: - Before pilot area roll out one demo/training to be provided to the users for basic understanding of the system.

1.6 Optional Support Services

1	Software Post Warranty Maintenance a. Year 1 b. Year 2 c. Year 3 d. Year 4 e. Year 5	Rs._____ Rs._____ Rs._____ Rs._____ Rs._____
2	Software End of Warranty Upgrade	Rs._____

- ***Detailed Price Breakup of the Support Cost quoted above also needs to be submitted. TPNODL reserves the right to place orders for support services for all/ few items as desired on a year to year basis post expiry of warranty period. The prices as quoted above however shall remain valid for all the 5 years.***
- ***PBG for 3% of Contract Value shall be submitted valid for Contract Validity Period plus three month.***

NOTE:

- **Details of taxes such as GST any other shall be submitted separately along with price proposal.**
- **All the prices quoted above include 60 months warranty on all software from the date of project completion. However, all hardware warranty shall be with 84 months warranty 24*7*365 days basis.**
- **All line items of price bid format are mutually exclusive. TPNODL reserves the right to remove any line item price at the time of placement of order.**
- **The quantities as mentioned above are for evaluation purposes only. Payment shall be made as per actuals.**
- **The bidder shall quote prices strictly in the above format. Failing to do so, bids are liable to be rejected.**
- The bidder must fill each and every column of the above format. ***Mentioning "extra/inclusive" in any of the column may lead for rejection of the price bid.***
- No cutting/ overwriting in the prices is permissible.
- The unit price to be indicated in col. No. 6 should be exclusive of taxes & duties which are to be indicated in separate columns meant for the purpose.
- The prices shall be for TPNODL Locations.

ANNEXURE II

SCOPE OF WORK

VOLUME - 1

1. Introduction

1.1 Introduction of TPNODL

1.2 Procurement Intent

It is TPNODL intent to procure SCADA with Master Control Center (MCC) & Back-up Control Center facility. The SCADA will facilitate TPNODL operations along with new generation technology. The main & backup control center shall works as hot redundant control center. The SCADA shall collect field data on IEC 60870-5-104 from Data Concentrator Units (DCU)/ Remote Terminal Units (RTUs) and shall interface with Load Dispatch Center of TPCODL, TPNODL & SLDC of Odisha over ICCP ICCP/TASE.2. The SCADA shall have the provision to interface with impending Systems like GIS, ERP, and other technologies like AMI, WFM, Asset Condition & Management System. Access to the TPNODL Corporate WAN will be through a firewall. The SCADA systems at the CC shall be accessible by authorized personnel either directly via the SCADA LAN or through the Corporate WAN.

The SCADA shall be fully redundant so that the availability requirements specified in this specification are satisfied. The SCADA shall provide automatic failover features to survive all single hardware device failures, major and minor communication outages, and site power and environmental problems. The SCADA will also include a Backup Control Center (BCC) that will be used in the event the primary control center is unavailable.

This specification describes the commercial and technical requirements of the systems to be procured.

1.4 Organization of the Specification

This Specification is divided into two sections and is organized as follows:

Volume I – Commercial Terms (This Document)

Section 1: Introduction – High-level description of this procurement and a summary of the specification contents.

Section 2: General Conditions – Defines the general conditions and the agreement for execution of and payment for the work.

Section 3: Maintenance and Upgrade Program – Specifies the requirements for hardware and software maintenance of the System.

Section 4: Instructions to Bidders – Defines the required Request for Proposal documentation.

Volume II – Technical Requirements

Section 1, Introduction – High-level description of this procurement and a summary of the Specification contents

Section 2, SCADA Architecture – Description of the architecture, sizing, performance, availability, and standards

Section 3, Capacity and Performance – Includes the hardware and software capacity and performance requirements

Section 4, User Interface – Functional description of the requirements for alarm and event processing, user interface design standards and general features, trending, hardcopy, and displays

Section 5, Hardware Requirements – Provides a description the major hardware that will be included in the SCADA

Section 6, Data Acquisition and Processing – Functional description of the requirements for data acquisition, data exchange, supervisory control, and data processing

Section 7, Information Storage and Retrieval – Functional description of the requirements for the short-term and long-term archival data requirements

Section 8, Power System Network Analysis– Functional description of the requirements for the power system model, real time and study network analysis functions

Section 9, Operator Training Simulator – Functional description of the requirements for an Operator Training Simulator (OTS) used as a training facility

Section 10, Advance Distribution Management Requirements – Functional description of the requirements for the distribution system model and required applications.

Section 11, Documentation – Provides a description of the standard and custom documentation requirements

Section 12, Quality Assurance and Testing – Provides the requirement for quality assurance and factory and site testing

Section 13, Training – Provides the training requirements

Section 14, Project Implementation – Provides the project implementation responsibilities, project organization, project documents, and responsibilities for testing, shipping, and commissioning the SCADA.

2. General Conditions

As attached in Annexure VII

3. Maintenance and Upgrade Program

This Section specifies the requirements for hardware and software maintenance for the System. Responsibility for the maintenance of the System hardware and software will vary over the term of this Contract. This section also includes options for hardware and software maintenance after the warranty period.

3.1 Pricing for Maintenance Options

The Supplier shall provide pricing for each maintenance option using the pricing forms indicated in Annexure I.

3.2 Definitions

The responsibility for maintenance of hardware and software will vary depending on the time during the Contract. So that the times for changes in responsibility can be determined, the following definitions shall be used:

Delivery: Delivery of any item shall be interpreted as receipt of the item at TPNODL's facility.

Commissioning: Commissioning of any item shall be interpreted as receipt of the item at TPNODL's facility, installation on-site, successful completion of the site tests, and correction of all variances from the tests.

3.3 Phased Deliveries

Deliverables of each phase are described in. The requirements of this maintenance program shall be applied to each phase and shall undergo factory, site and availability test.

3.4 Deliverable Version

The delivered hardware shall be the latest version being delivered by the manufacturer of the hardware six months prior to its delivery to TPNODL's facility. Similarly, the delivered software shall be the latest version being delivered by the supplier six months prior to its delivery to TPNODL's facility.

All hardware and software shall be of compatible versions. That is, the Supplier shall be responsible to ensure that all delivered hardware and software versions will inter-operate successfully. If it becomes necessary to upgrade some hardware or software to meet this requirement, the cost and time shall be borne by the Supplier. If it is necessary to revert to a previous version of any hardware or software to overcome incompatibilities among the hardware or software, the Supplier shall bear the cost and time of the "downgrade" and shall present a plan to correct the problems with the newer release. Such corrections shall also be at the Supplier's sole expense.

3.5 Hardware Maintenance

The project schedule shall include an allowance for hardware maintenance prior to the availability test (refer to Volume 2, Availability Test). The Supplier will not be granted any relief for project delays caused by maintenance problems prior to the availability test. Maintenance delays during the availability test will be addressed as presented in Volume 2, Availability Test.

3.5.1 Hardware Categories

Not Applicable

3.5.2 Pre-Delivery Maintenance

The Supplier shall have the responsibility for maintenance of all hardware prior to delivery to TPNODL's site. This maintenance may be performed by a maintenance contract with Original Equipment Manufacturers (OEMs) or other parties or by the Supplier staff using spare parts from the Supplier's stores or other sources.

3.5.3 Maintenance during Commissioning

The Supplier shall have the responsibility for maintenance of all hardware after delivery and prior to commencement of the Warranty. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Supplier staff using spare parts from the Supplier's stores or other sources.

Failed equipment shall be replaced or repaired and spares inventories (if any) replenished to their delivered level throughout the period of commissioning. Any spare parts found to be defective during initial delivery inspection or during this period shall be replaced within one week after notification. There shall be no charges to TPNODL for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by TPNODL's facility.

3.5.4 Maintenance under Warranty (60 months)

Maintenance during the warranty shall be in conformance with the terms of the warranty sections of this Contract. Where the Supplier elects to contract the maintenance to a third party, the maintenance contractor shall meet the requirements as set forth in GCC.

During the warranty period,

TPNODL facility hardware maintenance responsibilities will include the following:

- Provision of trained staff, responsible for call-out when problems occur
- Providing local assistance to the Supplier during problem resolutions

The Supplier's hardware maintenance responsibilities shall include the following:

- Providing maintenance of all equipment's, including spare parts
- Providing materials and instruction for appropriate engineering changes for equipment
- Provision of technical guidance towards the resolution of all hardware problems for equipment. When needed, the Supplier shall respond to requests for technical support within Two Hours, 24 hours a day, seven days a week; either via on-site visit or remote diagnostic access via dial-up connection.

Failed equipment shall be replaced or repaired and spares inventories replenished to their delivered level throughout this period. Any spare parts found to be defective during initial delivery inspection or during the Warranty period shall be replaced within one week after notification. There shall be no charges to TPNODL for these replacement parts, including delivery charges. All spare parts replaced under maintenance shall be new parts unless otherwise accepted by TPNODL

The Supplier's technical support staff shall work with TPNODL technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, TPNODL believes that the Supplier's technical support is not effectively resolving a problem, TPNODL may request that the Supplier's staff or staff from the equipment's manufacturer be dispatched to TPNODL facility. The Supplier's technical team shall be at TPNODL facility within 24 hours of that request to provide hands-on support towards the problem resolution. TPNODL will not be responsible for any expenses connected to the technical support, including travel expenses.

The Resolution time for different complaints shall be as per the below matrix:

Category	Definition	Maximum Resolution Time
Severity 1 Urgent	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability	0-2 hrs
Severity 2 Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost Non-availability of Man-power at control centre during working hours	0-4 hrs
Severity 3 Minor	Any other system defect, failure, or unexpected operation. Request for information, technical configuration assistance, "how to" guidance, and enhancement requests.	0-24 hrs

Failure by the Supplier to comply with the above mentioned timelines, shall attract a penalty @ Rs. 5000 per hour. Penalty amounts shall be recovered from the amounts due to

Supplier or by invoking the Contract Performance Bank Guarantee submitted by Supplier against this Contract.

3.5.5 Post-Warranty Maintenance (Option)

The following post-warranty maintenance services shall be provided as options for all hardware:

- A subscription to the equipment modification notices issued for all equipment in the System. These notices, commonly called Equipment Change Orders (ECOs) or Field Change Orders (FCOs), shall advise TPNODL of any changes or modifications to the equipment that are necessary or suggested for compatibility, operational, maintenance, or safety reasons.
- Contract maintenance, eight hours per day, six days per week, two-hour response. The Supplier's technical support staff shall work with TPNODL technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, TPNODL believes that the Supplier's technical support is not effectively resolving a problem, TPNODL may request that the Supplier's staff or staff from the equipment's manufacturer be dispatched to TPNODL's facility. The Supplier's technical team shall be at TPNODL facility within 24 hours of that request to provide hands-on support towards the problem resolution. TPNODL will not be responsible for any expenses connected to the technical support, including travel expenses.
- The maintenance contracts shall cover preventative and remedial maintenance, spare parts, and installation of all engineering, equipment, and field change orders and upgrades. TPNODL agrees to notify the Supplier of their intent to install any changes or upgrades so that their compatibility with the other elements of the System may be determined.
- The SLAs for support including response time, resolution time, applicable penalties for non-compliance etc. shall remain same as per the terms and conditions prevailing during the warranty period.

3.5.6 Spare Parts, Tools, and Test Equipment

The Supplier may keep the required spare parts on-site for field-replaceable and repairable modules for equipment. The spare inventory shall be suitable adjusted by the Supplier during the project so that the delivered set is consistent with the delivered System configuration. The spare inventory shall include any special tools and test equipment that the Supplier and the OEM use and which are applicable for TPNODL maintenance.

3.5.7 Hardware Minimum Support Period

The Supplier shall guarantee the availability of spare parts and hardware maintenance support services for all System equipment for a minimum period of 10 years. Subsequent to this minimum support period, the Supplier shall provide to TPNODL a minimum of two year's advance notice of their intent to terminate such services.

3.5.8 Expendable Supplies

The Supplier shall supply all expendable supplies required for use during the project while the equipment is at the Supplier's facility. The Supplier shall also provide a list of recommended expendable supplies one month prior to any delivery of hardware to TPNODL site. Expendable supplies shall include but not be limited to optical and magnetic media.

3.6 Software Maintenance

The term “software” shall include all firmware and software delivered under this Contract, as well as the associated configuration files, installation kits, release media, documentation, and support media such as on-line help facilities and maintenance tools.

The project schedule shall include an allowance for software maintenance prior to the availability test (refer to Volume 2, Availability Test). The Supplier will not be granted any relief for project delays caused by maintenance problems prior to the availability test. Maintenance delays during the availability test will be addressed as presented in Volume 2, and Availability Test.

3.6.1 Software Categories

Software shall be divided into two categories:

Category 1 – All software, whether supplied by the Supplier or a Subcontractor, exclusive of that software defined as Category 2.

Category 2 – General-purpose software to be executed on Unix, Linux or Personal Computers. This software specifically includes:

a) Operating systems from vendors such as Microsoft Corporation's Windows operating system and derivatives of UNIX
b) Productivity software from Microsoft Corporation, such as versions of the Office productivity suite
c) World Wide Web browsers from Microsoft Corporation (Internet Explorer) and Netscape Communications Corporation (Communicator)
d) Web enabled browser for remote client.

3.6.2 Right to Change Software

TPNODL must have the right to alter, modify, edit, and add to all software provided with the System. This right shall begin with the delivery of the Development system and the Supplier's baseline software. This requirement is necessary to facilitate development of TPNODL -supplied software and the interfaces to the other TPNODL computer systems. TPNODL agrees to discuss any changes to be made to software no less than 48 hours in advance of the implementation of the change.

3.6.3 Pre-Delivery Maintenance

The Supplier shall have the responsibility for maintenance for all software prior to delivery. This maintenance may be affected by a maintenance contract with OEMs or other parties or by Supplier staff.

3.6.4 Maintenance during Commissioning

The Supplier shall have the responsibility for maintenance of all (Category 1 and 2) software after delivery and prior to commencement of the availability test. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Supplier staff.

3.6.5 Maintenance during the Availability Test

The Supplier shall have the responsibility for maintenance of all (Category 1 and 2) software after delivery and prior to commencement of the Warranty. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Supplier staff.

3.6.6 Maintenance under Warranty (60 months)

Maintenance during the warranty shall be in conformance with the terms of the warranty sections of this Contract. The Supplier shall have the responsibility for maintenance for all Category 1 software during the warranty period. This maintenance may be performed by a maintenance contract with OEMs or other parties or by Supplier staff.

The System software will likely be composed of Supplier's standard system elements, customized or specially developed elements, and several third-party products. In order to facilitate the efficient maintenance of the System software, the Supplier shall follow the general principle that software that

is specific to TPNODL shall be implemented in specific libraries that are properly identified. This principle shall ensure that changes and upgrades to the Supplier's standard system software, applications, or third-party products can be implemented without affecting or interfering with the software specific to TPNODL

During the Warranty period, TPNODL may make changes to databases, displays, and reports as necessary to meet TPNODL operational needs. TPNODL shall be under no obligation to inform the Supplier of such changes.

The Supplier's software maintenance responsibilities shall include - Provision of technical guidance towards the resolution of all software problems for equipment. When needed, the Supplier shall respond to requests for technical support within Two Hours, 24 hours a day, seven days a week; either via on-site visit or remote diagnostic access via dial-up connection.

The Supplier's technical support staff shall work with TPNODL technical staff to establish a strategy to efficiently resolve each identified problem. If at any time, TPNODL believes that the Supplier's technical support is not effectively resolving a problem, TPNODL may request that the Supplier's staff or staff from the equipment's manufacturer be dispatched to TPNODL facility. The Supplier's technical team shall be at TPNODL facility within 24 hours of that request to provide hands-on support towards the problem resolution. TPNODL will not be responsible for any expenses connected to the technical support, including travel expenses.

The Resolution time for different complaints shall be as per the below matrix:

Category	Definition	Maximum Resolution Time
Severity 1 Urgent	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability	0-2 hrs
Severity 2 Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost Non-availability of Man-power at control center during working hours	0-4 hrs
Severity 3 Minor	Any other system defect, failure, or unexpected operation. Request for information, technical configuration assistance, "how to" guidance, and enhancement requests.	0-24 hrs

Failure by the Supplier to comply with the above mentioned timelines, shall attract a penalty @ Rs. 5000 per hour. Penalty amounts shall be recovered from the amounts due to Supplier or by invoking the Contract Performance Bank Guarantee submitted by Supplier against this Contract.

3.6.7 End-of-Warranty Upgrade (Option)

An option to upgrade the System software to the latest release at the end of the warranty period shall be quoted. This option shall remain open throughout the project, up to six months into the warranty period. That is, TPNODL shall be able to elect the option at any time up to six months into the warranty period at the cost originally quoted.

If this option is purchased, the Supplier shall upgrade the software to the latest release prior to the end of the warranty period. TPNODL staff will be available to work with the Supplier to effect this upgrade. However, the Supplier shall remain responsible for the successful completion of the upgrade.

3.6.8 Post-Warranty Maintenance (Option)

The following post-warranty maintenance services shall be provided as options for all software:

A subscription to change notification services of the software suppliers. The service shall include transmission of service bulletins and notices of the availability of corrections, modifications, upgrades, revisions, patch and new releases. The service for each software supplier shall be quoted separately. These bulletins and notices shall describe:

a) The release or version of the previous software to which the upgrade may be applied
b) Prerequisites for the upgrades, including a complete list of the minimum release or version of all other software necessary to support the new software
c) Problems with the previous releases corrected by the upgrade
d) New features available with the upgrade.

As part of this service, the Supplier shall maintain and periodically publish a list of the current release of their standard products and the compatible releases of all software supplied by Subcontractors.

Subscriptions to the software upgrade services of the software suppliers. The service shall include the change notification service as described above, as well as a copy of the new software, appropriate licenses for the new software, installation instructions, and a reasonable amount of support for the installation of the upgrade. The service for each software supplier shall be quoted separately.

A contract for upgrades to be performed by the software supplier. This contract shall include the software upgrade service described above, plus on-site installation service to be provided by the software supplier.

The SLAs for support including response time, resolution time, applicable penalties for non-compliance etc. shall remain same as per the terms and conditions prevailing during the warranty period.

3.6.9 Software Minimum Support Period

The Supplier shall guarantee the availability of upgrades, technical support for all System software, and announcements of software and hardware releases applicable to the system for a period of ten years after the expiry of the warranty. Subsequent to this minimum support period, the Supplier and the System software suppliers shall provide to TPNODL a minimum of two year's advance notice of their intent to terminate such support and mitigation plan.

4. Instructions to Bidders

4.1 List of Deliverables

The Bidder shall provide a detailed list of all delivered software and hardware. List of Deliverables shall include SCADA, Development, Operator Training Simulator and the BCS (including hardware, software, licenses, recommended spare parts, test equipment, documentation, training and third party products). The List of Deliverables (LOD) shall provide sufficient detail to allow TPNODL to easily determine all hardware, software, and licenses (Supplier and 3rd party) that are included in the Supplier’s proposal.

4.2 Configuration Diagram

The Bidder shall provide a detailed configuration diagram of the proposed system (SCADA, Development, OTS and the BCS) showing all the processors, consoles, LAN, WAN and peripherals including interconnections.

4.3 List of Subcontractors and Suppliers

The identification and location of the subcontractors and major suppliers with a comprehensive description of their offering or contribution to the System. Any change after award is normally not envisaged, only in exceptional case it will be subject to TPNODL sole discretion/ consent only.

4.4 Committed Supplier Staff

TPNODL regards continuous staffing to be of critical importance to the successful implementation of this project. Therefore, the Bidder is requested within the proposal to propose a formal project organization including all nominated personnel that are assigned to TPNODL project.

The following information is requested to support staffing proposals:

1) Project Organization chart specific to TPNODL project
2) Company organization chart indicating the relationship between TPNODL project and other Bidder resources
3) Nominated Project Personnel and positions on TPNODL project
4) TPNODL project availability grid, indicating each member, his position, and percentage time commitment over the entire contract period.

4.5 Maintenance Agreement

A description, including price, of standard hardware and software maintenance agreements and services that are available for all major components proposed. The Bidder shall outline preferred arrangements that would provide TPNODL with optimal, cost effective arrangements for maintenance of its systems.

4.6 Evaluation Criteria

The Bids will be evaluated economically and technically (in terms of price, quality, technical merit, functional characteristics, schedule, after-sales service, local support in India and technical back-up). The technical merits and quality and functional characteristics of the offered equipment and work will be evaluated in terms of its ability to meet specific technical requirements included in the Contract Documents. The Bidder shall therefore be prepared to submit at the request of TPNODL adequate information or conduct system demonstration to substantiate that the offered equipment or Work meets the intent of the technical requirements. The offered equipment or Work will also be evaluated in terms of whether it is one of a kind or has been used extensively for similar applications. TPNODL shall be fully entitled to adopt whatever means it deem fit to evaluate the bids at its sole discretion, which shall not be questioned by the bidder under any circumstances whatsoever.

- The evaluation team will thoroughly review the proposals submitted by various bidders / consortiums. The broad evaluation will be based as following:-
  - Technical Proposal: 50% Weight
  - Price Proposal: 50% Weight
  - Pre-demo meetings will be conducted with all the bidders
  - Each of the bidder will be requested to demonstrate the product and services
  - **Minimum qualification mark for technical score as mentioned in the RFP shall be 40 out of 50. In case bidder fails to secure minimum marks. The bid shall not be further evaluated.**
- TPNODL, in observance of best practices, shall:
  - Maintain the bid evaluation process strictly confidential
  - Reject any attempts or pressures to distort the outcome of the evaluation, including fraud and corruption

- Strictly apply only and all of the evaluation and qualification criteria specified in the Bid document

Evaluation and Comparison of bids

The bids shall be evaluated by combining technical and commercial scores and will be awarded to the Bidder whose Bid has been determined to be have scored maximum in the composite formula as defined below:

Total Score = 50% x Technical Proposal Score + 50% x Price Proposal Score

Initially the Supplier's responses are reviewed for compliance with the Commercial terms and conditions. The Suppliers who fail to comply with any of the commercial terms and conditions mentioned may be termed as non-responsive and will not be evaluated further. For those Suppliers who have qualified the commercial terms and conditions Technical evaluation will be conducted followed by the Price-Bid evaluation. The price bids will remain sealed until the technical evaluation is complete.

Technical Evaluation

The technical bid has a weightage of 50%. Technical evaluation will happen in two stages.

Stage-1: Preliminary Evaluation

In stage-1, the following shall be confirmed: Deviations, Submission of Bank Guarantee, Acceptance of terms and conditions, Acceptance to scope of work and compliance to technical specification (as mentioned in Volume-2). In case the bid doesn't meet all the mandatory requirements, the bid shall be termed as non-responsive and will not be evaluated further

Stage-2

The distribution of weights shall be as follows:

Table: Distribution of weights for bid evaluation

No	Description	Weight	
A	Technical Proposal		50
1	Project Experience	17	
2	Presence in India	10	
3	Team Details (CV)	08	
4	Pre-Demo	15	
B	Price Proposal		50
	Total Marks		**100**

Details for each of the above parameters is as mentioned subsequently.

Technical Proposal: Following is the methodology which shall be used to evaluate the various parameters under the technical proposal.

Technical solution Evaluation

Score for Technical Evaluation

S. No	Description	Max Score
Technical Solution Score		**50**

S. No	Description	Max Score
1	**Project Experience**	**17**
a)	**Number of SCADA/ADMS project successfully completed in last 8 years. as meeting the Technical Requirements**	7
	3 marks shall be awarded for a single project meeting the functionality of SCADA/EMS/DMS/OMS as mentioned in the QR. In case multiple projects are submitted as a support for meeting the QR, 2 marks shall be awarded for each project subject to a ceiling of 4 marks. The project should have similar or up-graded software product versions offered to TPNODL	
b)	**Project experience in implementation of modules/applications of SCADA/ADMS Systems**	4
	1 mark shall be awarded for experience in implementation of modules/applications as mentioned below:- (i) Voltage VAR Control (ii) Load Shedding (iii) State estimator (iv) Fault isolation & service restoration The bidder shall be awarded 1 mark for implementation of above modules in one project or multiple projects put together. For implementation of single module, only 1 mark shall be awarded, irrespective of its implementation in number of projects.	
c)	Project Experience in integration of IT applications.	3
	The distribution of marks for experience integration of IT applications is provided as follows:- (i) GIS – 2 Marks (ii) ERP – 1 Marks	
d)	Project Experience in RTU Implementation (i) IEC 870-5-104 – 0.25 marks (ii) IEC 62056 – 0.25 marks (iii) IEC 61850 – 0.25 marks (iv) IEC 870-5-103- 0.25 marks	1
e)	Experience in implementation of interface used in SCADA/ADMS Systems	2
	The distribution of marks for experience in implementation of interface is as follows:- (i) ESB over SOA – 1 marks (ii) ICCP – 0.5 marks (iii) CIM(IEC-61968)-0.5 marks	
2	**Presence in India**	**10**
a)	The bidder with existing software design,/Engineering/Testing facility as on (date of release of NIT/RfP) shall be awarded 10 marks	10
3	**CVs** (purchase may take interview of employees whose CV has been submitted and no resource diversion will be allowed unless it is produced that employee has resigned from Organization. As the project duration is one year)	**8**
a)	Experience minimum 5 years in area of SCADA/ADMS Hardware For submission of CV, 1 mark shall be awarded per CV subject to ceiling of 4 marks that can be obtained in this category.	4
b)	Experience minimum 5 years in area of SCADA/ADMS Software For submission of CV, 1 mark shall be awarded per CV subject to ceiling of 4 marks that can be obtained in this category.	4
4	**Pre-Demo**	**15**

<table>
<tr><th>S. No</th><th>Description</th><th>Max Score</th></tr>
<tr><td></td><td>
The Bidder will set up all required equipment at TPNODL site. The Bidder is expected to demonstrate all standard software and hardware necessary for implementation of SCADA/ADMS system by simulation of the SCADA/ADMS under various scenarios. The Bidder is required to set-up their own system/server for demonstration purpose. The application functionalities demonstrated are to be with data relevant to the business of TPNODL All queries are to be addressed during the demonstration only, and no further opportunities would be presented for subsequent clarifications, if any. Kindly note that the bidders are expected to bring necessary software / hardware required to support such demonstrations. Adherence to the timings is critical and the overall demonstration should not exceed specified hours.
<table>
<tr><th colspan="4">Demonstration key function & Marks distribution</th></tr>
<tr><th>S. No.</th><th>Description of demonstration</th><th>Prospect</th><th>Marks</th></tr>
<tr><td>4.1</td><td>GIS data import & interface.
▪ Demonstrate on import of Sample Data of GIS into SCADA/ADMS system- 1 marks
▪ Demonstrate Navigation between one line and GIS displays- 0.25 Marks
▪ Demonstrate alarm status on GIS display- 0.25 Marks
▪ Demonstrate status changes on a GIS display-0.25 Marks
▪ Demonstrate analog value on a GIS display-0.25 Marks
▪ Demonstrate Supervisory control from a GIS display-0.5 Marks
▪ Demonstrate incremental import data validation tools and rule.-1.5 Marks</td><td>Availability of automatic network update and technological address alignments based on network topology</td><td>4</td></tr>
<tr><td>4.2</td><td>Interactive Navigation techniques
Demonstrate the following:
▪ Navigation between one line & GIS based displays -0.25 Marks
▪ Supervisory control techniques from One line displays – 0.25 Marks
▪ Interaction of navigation tools (mouse, function keys, toolbars, menus)- 0.5 marks
▪ Panning and zooming -0.25 Marks
▪ Navigation using an overview window- 0.25 Marks
▪ Differentiation between real time, state estimator, training and study mode data- 0.50 Marks
▪ Quick Search mechanism for finding elements, TA, alarms ,tags-2 marks</td><td>Enhance the operation efficiency of operator with interactive scenario</td><td>4</td></tr>
<tr><td>4.3.</td><td>Historical Information Subsystem & real time report generation
▪ ISR database queries and reports based on UI menu and ISR data to Excel spreadsheet & trend-2 Marks</td><td>Availability of real time reporting capability.</td><td>4</td></tr>
</table>
</td><td></td></tr>
</table>

S. No	Description				Max Score
		▪ Message log storage and retrieval- **0.25 marks** ▪ Disturbance data collection**- 0.25 marks** ▪ Quality indices-**0.5 marks** ▪ Customization flexibility through drag & drop reporting by user/reporting engine- **1 marks**			
	4.4.	**ADMS Application** ▪ DPF-**1 marks** ▪ Outage management-**1 marks** ▪ Prediction analysis-**1 marks** Note:- the purchaser may ask to demonstrate any other functionality also during demonstration		**3**	

Price-Bid Evaluation

The Price-Bid evaluation is done only for those bids which are found to be responsive. The net cost quoted will be calculated as simple addition of all the cost mentioned in the price proposal (Annexure - I). The price proposal score shall be calculated with following formula:

Price proposal score = (LP/FP)*50, where LP: Lowest Price Offer; FP: Firm's Price Offer

VOLUME – 2

1. Network Introduction of TPNODL

1.1 Description of the 33/11 KV PSS Grid

TPNODL present power system network includes a HT grid at 33 kV. This network operated mostly redial and T-OFF. The OPTCL transmission company in State provided the energy that is distributed in License area.

In addition to the interconnections with OPTCL several interconnections with TPNODL, TPNODL (the distribution company that distributes electric energy in the rest of Odisha) are in place. These interconnections are used mainly in emergencies, and are being provided with energy meters on TPNODL side to accurately measure the exchange of energy at these border points.

The typical substation configuration includes 2x8MVA transformers, which supply the 11 kV feeders. Typically, 6 to 8 feeders are implemented per station and each transformer has its own bus. Tie breakers between bus sections also exist for possible transfer of load between transformers.

1.2 Distribution Network

1.2.1 Description of the TPNODL Distribution Network

Almost the entire medium voltage distribution is performed by at TPNODL at 11 kV. No plans to increase voltage level (for distribution) as indicated by TPNODL in forthcoming time However, for areas where industrial types of loads are to be expected it may be important for losses reduction to consider a higher voltage level say 33 kV/0.4KV kind of distribution network.

The typical configuration of the 11 kV feeders are redial and length of 11 KV feeder varies from 15 to 80 Km in urban and rural area respectively. TPNODL are in planning to introduce RMU, Auto-Reclosure, Sectionalizer and FPI for improvement of reliability across License area.

1.3 Scope of work

- Study of existing deployed Micro SCADA and migration along with interfaces planned by TPNODL
- Establishment of Hardware & software along with peripheral accessories for SCADA/ADMS Control Centre & Back-up center at TPNODL
- Supply, installation, integration & commissioning of Supervisory Control and Data Acquisition (SCADA) system and Information Storage & Retrieval (ISR) Functions with following features:
  - Power system network analysis
- Advance Distribution Management Systems with following functions:
  - Network Connectivity Analysis (NCA)
  - Distribution Power Flow (DPF)
  - Load Shed Application (LSA)
  - Fault Detection Isolation and Restoration (FDIR)
  - Outage Management System
  - Prediction logic
  - Trouble Call Management
  - Switching Procedure Management
  - SCADA/ADMS Dispatcher training simulator (DTS)
- Real time data acquisition from DCU/RTU/FRTU over IEC 60870-5-104 to MCC & BCC

- Integration with various OT/IT systems like GIS, ERP (SAP), MDM, AMI, etc. on impending interfaces and provisioning of ESB interface over SOA.
- Preparation of real time reports as per TPNODL customization and capturing operational event carried out by operators.
- Providing complete System Documentation and User Manuals
- Training & Hand Holding
- Providing source code for customizations.
- Providing necessary tools & licenses for all the software & hardware
- Providing warranty & guarantee of supplied system.

1.4 Organization of the Specification

This Specification is divided into two volumes and is organized as follows:

Volume I – Commercial Terms

Section 1: Introduction – High-level description of this procurement and a summary of the specification contents.

Section 2: General Conditions – Defines the general conditions and the agreement for execution of and payment for the work.

Section 3: Maintenance and Upgrade Program – Specifies the requirements for hardware and software maintenance of the System.

Section 4: Instructions to Bidders – Defines the required Request for Proposal documentation.

Volume II – Technical Requirements (This Document)

Section 1, Introduction – High-level description of this procurement and a summary of the Specification contents

Section 2, SCADA/ADMS Architecture – Description of the architecture, sizing, performance, availability, and standards

Section 3, Capacity and Performance – Includes the hardware and software capacity and performance requirements

Section 4, User Interface – Functional description of the requirements for alarm and event processing, user interface design standards and general features, trending, hardcopy, and displays

Section 5, Hardware Requirements – Provides a description the major hardware that will be included in the SCADA/ADMS

Section 6, Data Acquisition and Processing – Functional description of the requirements for data acquisition, data exchange, supervisory control, and data processing

Section 7, Information Storage and Retrieval – Functional description of the requirements for the short-term and long-term archival data requirements

Section 8, Power System Network Analysis– Functional description of the requirements for the power system model, real time and study network analysis functions

Section 9, Operator Training Simulator – Functional description of the requirements for an Operator Training Simulator (OTS) used as a training facility

Section 10, Advance Distribution Management Requirements – Functional description of the requirements for the distribution system model and required applications.

Section 11, Documentation – Provides a description of the standard and custom documentation requirements

Section 12, Quality Assurance and Testing – Provides the requirement for quality assurance and factory and site testing

Section 13, Training – Provides the training requirements

Section 14, Project Implementation – Provides the project implementation responsibilities, project organization, project documents, and responsibilities for testing, shipping, and commissioning the SCADA/ADMS.

Appendix A, Questionnaire
Appendix B, Sample Reports
Appendix C, GSAS & DA Station Data Points
Appendix D, SCADA/ADMS BoM

2. SCADA/ADMS Architecture

The existing & proposed hardware and software architecture of the System is presented in this section.

This section describes the functions to be performed by the SCADA/ADMS applications for distribution system for the project area. Bidders are encouraged to supply standard, proven & tested products that meet or exceed the Specification requirements. Unless specified as optional functions/ features are mandatory for the project area.

Proposed Configuration:

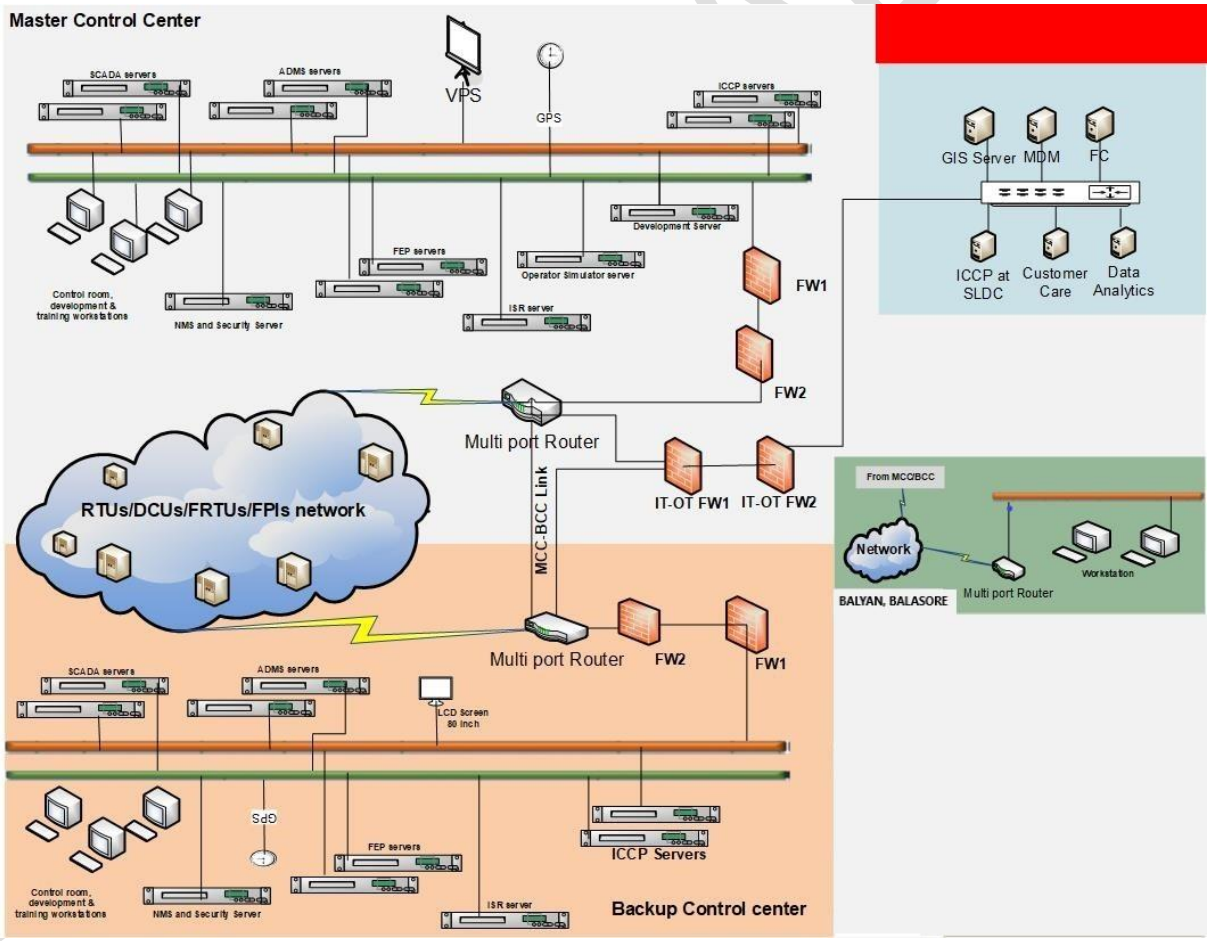

Figure 2.2: proposed conceptual SCADA/ADMS architecture

NOTE: SCADA/ADMS, ISR, COMMNUICATION, FEP, NMS, DMZ, WEB SERVERS SHALL BE DUAL REDUNDANT. SCADA /ADMS LAN SHALL BE DUAL STAR TOPOLOGY & DTS, DEVELOPMENT SYSTEM, BCC SHALL BE SINGLE SYSTEM.

For Centralize monitoring of the entire network and coordinating the network operations in real-time, there is a strong need to setup the Centralised Power System Control Centre along with Area Power System Control Centre by implementing state of the art technologies available in the market for distribution network.

The centralized monitoring and control of the entire distribution network. It is proposed with SCADA/ADMS control center to cover the entire TPNODL distribution network covering all the 5 circles i.e., BALASORE, BHADRAK, J. ROAD, KEONJHAR and BARIPADA comprising of 215 nos. of Primary Sub-Stations.

The operation philosophy will be as followed:

- The BALASORE i.e., MCC location and BCC (location shall be shared later) with full function operation
- The BADRAK, J. ROAD, KEONJHAR and BARIPADA will be de-centralized remote location for area power system control.

Apart from standard SCADA functions, the proposed System shall perform advance distribution management applications such as Load Flow computations, computation of Performance Indices (CAIFI, SAIFI, and SAIDI etc.), Network Coloring etc.

2.1.1 Proposed System

The SCADA/ADMS system shall make use of modern computers and control systems at Main & Backup Control Centres. The technical requirements for various functions of SCADA/ADMS system are described in subsequent sections.

2.1.2 Critical & Non critical functions

The functions defined in this specification shall be classified as Critical or Non-critical. Every critical function must be supported by sufficient hardware & software redundancy to ensure that no single point (hardware & software included) failure will interrupt the availability of the system.

Non-critical function may not be supported by hardware & software redundancy and can be suspended in case of non-availability of corresponding hardware.

Generally the following are to be classified as Critical functions

a) All SCADA applications
b) All ADMS applications
c) Information Storage and Retrieval (ISR)
d) Data exchange among the contractor supplied SCADA/ADMS system and other systems
e) Web server applications, Security applications
f) Network Management system (NMS)

The following are Non-Critical functions

g) Dispatcher Training Simulator (DTS)
h) Report modification and creation
i) Data exchange with Remote VDUs, if any

2.1.3 Software Architecture

All SCADA/ADMS software provided by the Contractor, including the Operating system, RDBMS and support software, shall comply with the industry-accepted software standards produced by national and international organizations, such as ANSI, ISO, IEC, IEEE, ECMA in order to facilitate maintenance and enhancement of the SCADA/DMS systems being supplied. In areas where these organizations have no standards, the software shall comply with those widely accepted de- facto standards put forth by industry consortiums, such as OSF and X-window/Open software standards. The Contractor shall commit to meet the "open systems" objective promoted by industry standards groups by using software products that are based on open standards. The software shall be able to work on platforms based on a minimum of 64 bit computing architectures.

2.1.4 Design and Coding Standards for SCADA/ADMS applications

All SCADA/ADMS applications shall be maintainable by TPNODL using the supplied software utilities and documentation. The SCADA/ADMS software design and coding standards shall also address the following:

a) **Expansion/ scalability**: software shall be dimensioned to accommodate the ultimate size of SCADA/ADMS system envisaged.

b) **Modularity**: software shall be modular to minimize the time and complexity involved in making any change to supplied system.

c) **User-Directed Termination:** Functions taking long execution times shall recognize and process user requests to abort the processing.

d) **Programming languages:** The software shall be written using ISO or ANSI or ECMA standard programming languages like .NET, JAVA, C, C++and SQL and for Unix based systems the APIs shall

be POSIX-conforming.

e) **SOA architecture**: Software shall conform to SOA (Service Oriented Architecture).

f) **Enterprise Service Bus (ESB):** ESB based architecture is essential to enable interaction of applications from different product manufacturer, platforms etc.

g) **Portability & Interoperability**: The software shall be designed for hardware independence and operation in a network environment that includes dissimilar hardware platforms to the extent possible. The use of system services software shall be built on Open standards

2.1.5 Open Systems Interfaces

The SCADA/ADMS System shall exchange data with ISR System & ISR System shall be the nodal interface with all other IT System. The Data exchange with ERP, & other IT systems, shall exchange with ISR System, using Open Standards like CIM/XML & IEC 61968 Series Standards for Power System, OPC, ODBC. The GIS System shall exchange data with SCADA System over IEC 61968.

SOA based ESB using CIM/XML Models for Power System using GIS Engine / Adapters supporting the standard
Direct SQL/ODBC interfaces should continue to be supported for report generation and ad-hoc queries.
CIM compliance means that the interface definitions comply with the CIM in terms of:
Semantics (i.e., naming and meaning of data)
Syntax (data type)
Relationships (i.e., to other CIM components, to permit proper navigation within the model)

2.1.6 System Services

A system service provides facilities to the application systems that run in the computing network.

2.1.7 Global Naming Service

Objects of interest in the computing network shall be assigned names in a global directory. Examples of such objects are servers, peripheral devices, and users. The global naming service shall allow users to reference computing network objects in the directory both by name and by type of service.

2.1.8 Network File Service

Services shall be provided to give users of the System access to files from anywhere in the network. The file system shall provide a reliable, consistent interface that offers the same performance and ease of access for both network and locally resident files.

The network file service shall use the global naming service. The network file service shall allow transparent information access to applications and utilities and shall support functions such as remote copy, backup, and restore across network nodes. It shall be possible to allocate or de-allocate devices to the network file system as well as allocate or de-allocate logical files and their backups to physical devices via a convenient maintenance procedure. The network file service shall be easily extensible as the System is expanded.

2.1.9 Scheduling Services

Scheduling services shall include a facility for scheduling application activity based on time-of-day, period, and other events. The following shall be provided as a minimum:

1) Triggers shall be definable based on absolute or relative time based on either system or application time

2) Triggers shall also be definable based on conditions or events raised by any other applications (that is, based on calls to the scheduling service from applications setting a condition or event)

3) When initiated by this facility, an application shall be provided with a notice that states the reasons for activation (that is, a trigger)

Scheduling services shall include facilities such that direct co-ordination between applications in the system is unnecessary and such that applications may be moved from one system environment to another without requiring source code changes to the applications. Thus, the system-unique aspects shall be modularized as part of the system definition and shall not be mixed into the application definition.

Scheduling services shall also monitor the correct initiation and completion of periodic applications. These applications shall be monitored for execution at the proper time. The elapsed time shall be governed by a database parameter that is assigned to each application individually. If an application has not completed its execution prior to its next scheduled initiation, the scheduling services shall notify the users through appropriate messages. A logging facility shall record statistics on the cycle time and run time of cyclic real time applications. A simple manual entry shall be provided to turn off the scheduling of each application.

2.1.10 Time Services

The System shall maintain a common system time across all servers and devices. The time and frequency standard shall be used as the source of time (when available). System time shall be periodically synchronized to the time standard, and large deviations between system time and the time standard shall be annunciated. Upon failure of the time standard, the System shall revert to an internal time standard.

Application time shall be distinct from system time. Application time shall be shared by a group of applications within a system. Application time shall maintain time and date as understood by the users (that is, account for holidays, daylight savings time changeovers, etc.). Application time may be driven either by system time (the default) or by an application (as in the case of a historical data reconstruction program).

As a minimum, application time services shall support the following features:

1) A uniform internal representation to facilitate normal date and time, relative date and time, arithmetic date and time operations, etc.
2) A date maintenance facility (day in week, date, week number, week in month, day in year, day in month)
3) Support for leap years, unlimited holidays per year, and change of century through the year 2100
4) Support for multiple jurisdictions with differing holidays in each
5) Ability to define arbitrary time period types by jurisdictions (for example on-peak and off-peak) for use by applications

2.1.11 Print Services

Hard copy output resources in the computing network, including those outside the SCADA/ADMS LAN such as those on the Enterprise LAN, shall be assigned as network (rather than local) resources and shall be available for use from any node in the network. Users shall be kept informed of the status of their print jobs (for example, spooled/printed/completed).

2.1.12 Distributed Backup and Archiving

The SCADA/ADMS shall include services to backup, archive, and restore all SCADA/ADMS software and data independently of its location on the SCADA/ADMS networks. Once initiated, the distributed backup and archiving services shall automatically back up all information needed to recover from failures or data corruption without manual intervention by users, except for replenishment of

removable media. Although the devices being backed up may be physically separate, the backup system shall be managed centrally.

2.1.13 Application and System Development

An application, as used in this section, shall mean a module of functionality such as data acquisition. An application shall consist of various components such as executable application images, user interface definitions (displays and display interactions), data sets, messages, and reports, all working together to deliver a particular functionality.

2.1.14 Software Configuration Management

An integrated source code development subsystem supporting C, python, SAS, .NET, Java, and C++ and all other programming languages used in the SCADA/ADMS shall allow teams of programmers to work together effectively, including allowing concurrent activity by TPNODL and Contractor personnel. The Contractor shall provide a software configuration management system to define the elements and the associated attributes of the applications provided in the SCADA/ADMS. Source definitions for the application's elements (such as source code, display formats, etc.), the residency requirements (such as local, shared), and any access attributes shall be defined through the software configuration management system.

Source definitions for all elements of an application shall be maintained in disk files under a code management system like SVN/Subversion. As a minimum, the code management system shall:

1) Manage source code and binary images including their versions
2) Allow tracking of code changes by date, author, and purpose
3) Manage documentation modules and associate them with source code, binary images, and other documentation
4) Support multiple teams of programmers working concurrently on the same modules
5) Provide an efficient link between modules

Procedures for completely regenerating executable images and run-time files shall allow individual applications to be rebuilt and installed within one or more application system contexts. Applications shall be made part of any application system by a straightforward procedure that requires no modification to application sources.

2.1.15 Compilers

Compilers with code optimization features shall be provided for all programming languages used in the System. Compilers shall conform to the latest applicable standards (for example, ANSI and IEEE standards). Program source code shall utilize symbolic interfaces for all application system services. The compiler shall provide extensive error checking facilities, explicit error messages, and complete output listings.

2.1.16 Interactive Debugger

An interactive debugger product shall be supplied that, as a minimum, includes full or selective (interpretative) trace, memory alter and dump, snapshot with or without memory dump, and search capabilities. The interactive debugger shall utilize symbolic references to statements and variables. It shall also provide simultaneous presentation of the source code with an indication of program flow (that is, an indicator showing the currently executing statement).

2.1.17 Diagnostics

The SCADA/ADMS shall include all diagnostic software (e.g. CPU usage, disc read/write etc.) provided by the manufacturers of all hardware, including servers and peripheral devices, supplied with the

SCADA/ADMS. The SCADA/ADMS shall also support error detection and diagnostic tools sufficient to support the requirements of this section.

Diagnostics for communications data sources and computer systems external to the SCADA/ADMS shall provide at least the following capabilities:

1) Select any communications channel for test
2) Select a request message for transmission to data sources and computer systems
3) Select single or cyclic message transmissions to data sources and computer systems for test purposes
4) Monitor and display information sent to and received from data sources and computer systems
5) Monitor and display data communication device status
6) Provide communication statistics including the number of errors, retries, bytes transferred, etc.

The communications diagnostics shall include a "trace" facility for messages as they are sent and received. The trace facility shall trace a selected set of or all logical channels and shall provide explicit trace information at each level of the protocol stack. It shall be possible to trigger the trace facility manually as well as by program status flags and inter-program messages. The level of detail included in the trace shall be triggered by incoming or outgoing message contents on one or more logical channels, or by any of the methods described.

2.2 Data Architecture

2.2.1 Real time data access

The SCADA/ADMS RTDB (Real Time Data Base) shall be an active process model. i.e. it shall initiate actions or events based on the input it receives. The RTDB shall describe the state of the power system at a given point in time and the events that move the system to a new state at the next point in time. This database is required to support the data access to real time information and to allow efficient integration and update.

A library of event routines may encapsulate or interface the RTDB with other components of the system. These event routines shall be the preferred means for application programs to interact with RTDB. This way, application programs (and programmers) only need to concern themselves with callable interface (API) of these routines. Each application shall interact with the RTDB through the event library. These event routines shall serve as generic APIs for database access thereby eliminating proprietary database function calls at the application level.

The SCADA/ADMS shall include a single logical repository for all data needed to model the historical, current, and future state of the power system and SCADA/ADMS – the Source Database (SDB). All information needed to describe the models on which the SCADA/ADMS operates, shall be defined once in the SDB and made available to all SCADA/ADMS applications, real-time database, and user interface maintenance tools that need the information.

Any database update, whether due to local changes or imported network model changes, shall be able to be placed online in a controlled manner without causing undue interruption to network operations, including without losing any manually entered data. For example, a network model update to introduce a new substation shall not interrupt the ability to perform supervisory control actions or receive telemetry to view the network state. It shall be possible the changes, local or imported, to be placed online either automatically or under manual control with proper validation. It shall be possible to easily revert to an earlier database version, again without undue interruption to network operations. The capability to import & export the CIM compliant network model data including the corresponding telemetry and ICCP data reference in XML format to send it to other parties shall be provided. The capability to import the CIM compliant network model data from other parties in XML format shall also be provided.

The SCADA/ADMS shall provide a consistent interface to accept XML format data for updates from other database applications; and provide a consistent interface to import & export data in XML format through or without web services.

2.2.2 Database development tools

The Supplier shall provide all necessary software tools for the development and maintenance of the SCADA, EMS, ADMS, ICCP and ISR databases at Control Centers.

This tool shall be capable of managing the entire system database. The database development software tool delivered with the SCADA/ADMS system shall be used to generate, integrate and test the database.

The database development tool shall facilitate IEC 61970 CIM data exchange of both Incremental and full power system model .**The bidder would submit the report of CIM certification testing with other vendor's product along with the bid. The database tool should have the facility to export and import model files as per IEC 61970 part 552-4.**

This tool shall contain database structure (format) definitions and all initialization data to support the generation of all relational and non-relational run-time databases required to implement the system's SCADA/ADMS functions. The tool shall include consistent procedures to manage and access the databases regardless of the location of the data or the residency of the database management functions within a Control Centre. All exchange, co-ordination and procedure required across a Control Centre shall be independent of each other. This tool shall allow following modes:

1) Incremental data exchange of a function.
2) Complete data exchange of a Control Centre.

The data exchange shall be possible in different time frame and shall not impact the ability of one Control Centre to make changes in online database.

This tool shall include definition of data fields, structure of application data sets using the global database, database population, correction of entry errors, checkout against telemetry definitions for SCADA functions, checkout against model definitions for power system analysis functions. Extensive reasonability, integrity, and referential integrity checks shall be made on user entries to detect errors at the time of entry. Invalid entries, such as entering an invalid data type or attempting to define contradictory characteristics for a database item, shall be detected and reported to the user in an error message. Help displays shall be available to provide additional, detailed information to the user on request.

2.2.3 Database Construction and Maintenance

Database construction refers to the definition of the initial database structure, population of the structure with its initial contents, and revision of the structure when necessary. Database maintenance refers to the subsequent addition of new database contents and the modification of existing contents. The Contractor's database construction and maintenance tools shall allow construction and maintenance of all databases within the SCADA/ADMS. The tools used by the Contractor for the development and maintenance of the Source Database (SDB) database shall be delivered with the SCADA/ADMS.

The SCADA/ADMS shall include a single logical repository for all data needed to model the historical, current, and future state of the power system and SCADA/ADMS – the Source Database (SDB). All information needed to describe the models on which the SCADA/ADMS operates, shall be defined once in the SDB database and made available to all SCADA/ADMS applications, real-time database, and user interface maintenance tools that need the information.

The SDB shall accept interactive user commands and pre-compiled SQL statements to provide at least the following functions:

1) Storage of the database data definitions, including schemas, relational tables, views, and fields.
2) An active repository component that provides the capability to organize, manage, and control information about users, applications, and programs that access the data.
3) On-line access to review the structure of the database and its data definitions.
4) Development of new databases.
5) Copying of existing database structures.
6) Modification of the database definition without unloading/loading the database.
7) Modifying existing databases, such as adding attributes ("columns" in a table-row-column structure). The addition of attributes shall not disrupt access to existing attributes.

Listing of all information on database parameters, attributes, etc.

For a given relation or table, a list of relations referencing this relation table and a list of relations referenced by this relation or table. Preferably, these relationships shall be shown graphically.

Support for command lists or catalogued procedure input.

Automatic time and date stamp on output.

Name change utilities that identify all uses of an entity name throughout the SCADA/ADMS databases and facilitate selective and global changes to an entity's name.

Processing of the SDB into the data structures used by the SCADA/ADMS for on-line applications – the "run-time" databases.

All entries to the database shall be checked for validity. Effective use shall be made of menu selections, dialog boxes, list boxes, text boxes, and selection entries. Old values shall be displayed in conjunction with the request for new values during database modifications. All modifications shall be maintained in an audit log. The log shall be displayed on a console and printed upon demand.

Modified portions of the SCADA/ADMS databases shall be buffered and shall not be utilized until commanded by a user. A copy of the pre-modification database shall be retained until a subsequent user command indicates that the new database is acceptable. At any time during the "temporary" use of the new database, the user shall be able to command the SCADA/ADMS to revert to operation using the previous unmodified database. The SCADA/ADMS shall support multiple files ("work areas") of in-progress modifications, such that several users can be preparing database modifications at any time.

On-line database editing shall not affect the SCADA/ADMS system's reaction to hardware and software failures nor shall it require that the exchange of data among servers for backup purposes be suspended. The On-line editing of database and its backup to standby machine should not result into the failover of servers.

The capability to export the CIM compliant network model data including the corresponding telemetry and ICCP data reference in XML format to send it to other parties shall be provided. The capability to import the CIM compliant network model data from other parties (such as other Security Coordinators) in XML format shall also be provided.

The SCADA/ADMS shall provide a consistent interface to accept XML format data for updates from other database applications; and provide a consistent interface to export data in XML format.

2.2.3.1 Data Retention

The database generation process shall retain and utilize data from the current SCADA/ADMS database in the newly generated database, even when a newly generated database contains structure changes.

Data to be retained across database generation cycles shall include, but not be limited to, quality codes, manual entries, tags, historical data, and tuning parameters.

During any modification of the database, all dynamic data from the current run-time databases shall automatically merge or carry over into the newly built database. Users shall not be required to re-enter any manually entered data as a result of any database or software modifications that cause the restructuring of the database (even in the event that recompiling or re-linking of the software is required).

2.2.3.2 Database Integration (on lining)

Newly generated run-time databases shall only be placed on-line by user command. After an error-free database generation, the new database shall be integrated into the system by assigning it to an appropriate server. The previous run-time database of the server shall be archived such that it is available to replace the new database upon demand. The archived database shall be deleted only when directed by the user. Following the assignment of a new database to a server and on user demand, the database management software shall access each SCADA/ADMS server to ensure that all databases are consistent. Inconsistencies shall be annunciated to the user.

2.2.3.3 Tracking Database Changes

The database manager utility shall maintain Audit trail files for all changes made by all users including on-line database editing. The audit trails shall identify each change including date and time stamp for each change, and identify the user making the change. An audit trail of last 10,000 edit operations shall be maintained.

2.2.3.4 Initial Database Generation

The Contractor shall be responsible for the initial database generation using data available at control centre in association with the Owner. The Contractor shall arrange the required software tool to acquire the initial data from the existing control centre at his own cost. The owner shall provide the access to these regional control centres for acquiring the required data.

2.2.3.5 Development System as a Test Bench

Development system shall be able to provide testing facility for integration of new RTU and new Control centre with Main and Backup SCADA/ADMS system before putting it online with Real-time system.

Integration of New RTU: - Development System shall be used to test the integration of new RTU on all RTU protocols as envisaged in the specification. It will facilitate in validating all the functionalities of the RTU data acquisition as explained in earlier sections.

It shall be possible for the development system to run in a 'listen' mode whereby the data exchanged between the online system and field RTUs simultaneously updates the database on the development system. This is to facilitate testing of pending database changes on the development system without interfering with existing communications on the online system

Integration of new control Centre on ICCP protocol: - Development System shall be used to test the integration of new Control Centre on ICCP with Main and Backup Control Centre. Development System shall have the capability of modeling new ICCP connections for both Main and Backup Control Centers.

In test bench mode, Development System shall be able to connect through the existing LAN/WAN to the new RTU and/or Control Centre and test the link step by step as well as continuous run mode upto 24 hours to observe the data acquisition/exchange process. During the continuous run mode the data collected shall be stored in a temporary files /tables for review to assess effectiveness and stability of integration. All relevant logs for monitoring the communication with RTU and Control Centre under test such as defined for regular SCADA/EMS system shall be stored and presented and reported on

similar displays. The Hardware required for necessary connectivity including the interface with communication links shall be included as part of Development System Hardware.

2.2.4 Save Cases and Working Areas

Save cases are databases that contain the results of selected application programs. Typically, these programs are characterized by large input and output volumes. The application may run the input data against a "model", a mathematical analog of a physical process. Also typically, these programs execute at slower-than-real-time periodicities, for example, every five minutes, hourly, or on user demand.

The following applications to be supplied under this contract shall include save case and working area features:

1) Power flow
2) Load forecast
3) Other applications as defined

The save cases generated and used by different applications may be significantly different in structure and content. However, the following characteristics shall be present in all save cases:

1) The saved information shall include all input and output data, as well as all information needed to identically reproduce the output by rerunning the application. Where necessary to meet this requirement, it must be possible to revert to previous models if the model has been changed subsequent to the original execution of the application.
2) Save cases shall be stored in a library. The quantity of save cases to be supported is presented in Table 3-6, Application Capacity. The library shall be sorted by application (or separate libraries may be supported for each application) and by date and time. Filtering by keyword in the title shall also be supported.
3) Each save case shall include the following information:
    a) The name of the application
    b) The time and date the save case was produced
    c) An 80-character user-entered title
    d) A user-entered comment field of at least 512 characters
4) Save cases may be copied and moved to archive media and restored from archive media to the save case library. The quantity of archived save cases shall be unlimited. Save cases may also be deleted from the library and archive media.
5) A locking mechanism shall preclude deletion from the library. The lock shall be set and removed by any user.
6) Where multiple users are to be supported by an application, each user shall have a dedicated working area. Before executing the application, the user shall initialize the working area with new data or with data from a save case. Initialization of a working area shall not change the save case, render it unavailable for use by other users, or lock it.

2.2.5 Adjustable Parameters

All parameters in the SCADA/ADMS shall be defined in the database and shall be adjustable by system personnel. Adjustments made to parameters shall become effective without having to recompile programs or regenerate all or portions of the database. All time periods contained in this Specification shall be considered initial values for planning purposes, but all software parameters must be adjustable by TPNODL personnel.

2.3 Configuration Control, Redundancy, and Failure Management

The ability of the SCADA/ADMS to perform its specified tasks under normal conditions and under conditions of hardware and software failure is of paramount importance to TPNODL This section presents requirements for monitoring and managing the SCADA/ADMS hardware and software.

2.3.1 SCADA/ADMS Management

The SCADA/ADMS shall include a centralized management function. Services shall be provided for the configuration, control, and monitoring of SCADA/ADMS resources, including servers, peripheral device, network devices, applications, and databases. Configuration management tools shall be accessible from any node in the SCADA/ADMS and shall be capable of managing resources anywhere in the network, subject to security constraints. Management tools shall facilitate the orderly start-up, shutdown, and tuning of any SCADA/ADMS resource without affecting the availability of the other elements of the SCADA/ADMS.

The SCADA/ADMS management function shall "discover" the servers, devices, applications, and databases automatically. The SCADA/ADMS management function shall have the capability to automatically configure policies for discovered servers and devices. The SCADA/ADMS management function shall support the performance monitoring capabilities presented in Section 3.2.5, Resource Monitoring.

It shall be possible to add resources outside the SCADA/ADMS to the SCADA/ADMS management scheme. This may require modifications to these applications, databases, servers, or devices, such as the addition of agents or other software plug-ins. Such modifications will be performed outside this contract. However, the SCADA/ADMS management function shall include documentation describing the interface with both new SCADA/ADMS and non-SCADA/ADMS resources.

All errors and other events detected by the SCADA/ADMS management function shall be recorded and reported to the user. Fatal errors (as defined below) shall be reported as alarms. Where an error causes the SCADA/ADMS management function to reconfigure the SCADA/ADMS (such as bringing a backup resource to the primary state), the reconfiguring action shall be reported as an alarm along with the error report.

2.3.2 Server and Device States

Server and device states identify the operating condition of each server and peripheral device[1] of the SCADA/ADMS and shall be used to determine the system's reaction when restart and failover operations take place. The definition of states will depend on the Contractor's SCADA/ADMS design. However, the following states, or their equivalent, shall be supported:

1) *Primary* – A primary server or device performs any or all of the SCADA/ADMS functions
2) *Backup* – A backup server or device replaces a primary server or device in the event of primary failure or upon user command
3) *Down* – A down server or device is not communicating with other elements of the SCADA/ADMS and is not capable of participating in any SCADA/ADMS activity

2.3.3 Server and Device Interconnections

A server group is defined as one or more servers performing a subset of SCADA/ADMS tasks in either a primary/backup manner or distributed manner (where the functions performed by the server group are distributed among multiple servers). The component systems of the SCADA/ADMS – the MCS,

IS&R, BCS, OTS, PDS and OMS – may each be thought of as server groups, although each component system may itself be comprised of multiple server groups.

Interconnections shall be provided among all servers within a server group, among all server groups and all consoles. This Specification assumes the use of local and wide area networks for the interconnections. The state of each server connection to a network and the network itself shall be changeable by the user. The configuration of the interconnections, redundant or non-redundant, shall be as listed in APPENDIX Section 2.

2.3.4 Backup Databases

Backup databases shall be supported as required in APPENDIX Section 2 so that SCADA/ADMS operation may continue in the event of server, device, or software failure. The backup databases shall be updated with the current contents of the primary databases such that all changes to a primary database are reflected in the backup database within the time listed in Table 2-3: Communications Channel Interface. Failure of a server shall not preclude access to current data by the server assuming the functions of the failed server. The backup databases shall be protected from corruption due to server or device failure. Backup databases shall be preserved across system input power disruptions of any duration. The information maintained in the backup databases shall include:

1) Telemetered and calculated values and their attributes, including quality codes, control inhibit state, and tag data
2) SCADA/ADMS function execution and control parameters and input and output data, including network analysis save cases
3) Data maintained by the Information Storage and Retrieval functions, including attributes
4) Alarm, event, and summary displays (such as off-normal, control inhibit, and alarm inhibit displays) or sufficient information to rebuild the displays in their entirety (including the time and date of the entry, not the time and date the display was created)

[1] This document specifically includes network devices, such as routers, switches, and firewalls, as peripheral devices. (Network interfaces may be considered as peripheral devices or as part of a server or other device.)

Changes to the quantity of information to be backed up resulting from the addition or deletion of items in an existing database shall be automatically accommodated by the backup function. The addition, deletion, or restructuring of databases in the SCADA/ADMS shall be accommodated by the backup function without requiring changes to the code.

2.3.5 Error Detection and Failure Determination

All servers, devices, and functions shall be monitored for fatal and recoverable errors. All detected errors and failures shall be recorded for maintenance purposes. These records shall include the dates and times of the failures, the reason for the failure, and of the subsequent automatic or manual return to service.

2.3.6 Server and Device Errors

All fatal and recoverable errors of all servers operating in the primary and backup states shall be detected. Each type of recoverable error shall be assigned a threshold. When the count of recoverable errors exceeds this threshold, a fatal error shall be declared. Where multiple devices share a common communication channel, such as party-lined RTUs, the quantity of failed devices that constitute failure of the communication channel shall be individually specified for each channel.

2.3.7 Software Errors

Execution errors in functions that are not resolved by program logic internal to the function shall be considered fatal software errors. Examples of errors that may be resolved by internal program logic include failure of a function to achieve a solution due to violation of an iteration limit or arithmetic errors (such as division by zero). These errors shall produce an alarm informing the user of the error but shall not be considered fatal software errors.

Fatal software errors shall result in either termination of the function (but not terminate the application) or shall be handled as a fatal server error. The action to be performed shall be defined for each function. If the function is to be terminated, future executions of the function shall also be inhibited until the function is again initiated.

2.3.8 Reasonability of Data

Despite the fact that the SCADA/ADMS is carefully specified, prudently designed, and thoroughly debugged and tested before it is commissioned, unreasonable results occasionally occur. In order to prevent this from having a harmful effect on the SCADA/ADMS, all data shall be checked for reasonability. All input data and parameters, whether collected automatically or entered by a user, shall be checked for reasonability and rejected if they are unreasonable. All intermediate and final results shall be checked to prevent unreasonable data from being propagated or displayed to the user.

When unreasonable input data or results are detected, diagnostic messages, clearly describing the problem, shall be generated. All programs and the system shall continue to operate in the presence of unreasonable data. All calculations using the unreasonable data shall be temporarily suspended or continue to use the last reasonable data.

2.3.9 Server Redundancy and Failure Management

Server groups shall be configured as redundant or as non-redundant as specified in APPENDIX Section 2. When a failure of a primary server in a redundant group is detected, the SCADA/ADMS shall invoke the appropriate failover and restart actions so that functions assigned to the failed server are preserved. When a failure of a primary server in a non-redundant group is detected, the SCADA/ADMS shall not invoke failover or restart actions. Functions assigned to a failed server in a non-redundant group may be lost until the failed server is restored to service.

Failures of servers in the backup state shall not initiate restart or failover actions. The SCADA/ADMS shall only change the server state to down.

2.3.10 Function Restart

Function restart is the assignment of a function or functions to a server and the initiation of these functions. Function restart shall be invoked during system startup, manually by a user, and automatically to recover from hardware and software failures. Function restart shall proceed to completion without user intervention. The restart logic shall determine the desired state of the restarting server and the function(s) to be initiated. The restart logic shall also preclude conflicts among servers and functions, such as assigning too few or too many servers to the primary state and the erroneous duplication of functions in multiple servers. Immediately after the initialization tasks have been completed, the restarted function(s) shall be scheduled for execution.

The restarted functions shall access data from primary database or a backup database as appropriate. If the restarted function uses a backup database, that database shall become the primary database. Databases may be updated from initialized from “empty” databases or from static, initialization databases (a “cold” restart) only when directed by the user.

Restarts shall be completed within the time listed in Table 2-3: Communications Channel Interface.

2.3.11 Server Failover

In the event of failure of any primary server in a redundant server group, the SCADA/ADMS shall initiate a failover operation, restarting the functions of the failed server in a functioning server. Where the SCADA/ADMS is configured such that functions are distributed (shared) across multiple primary servers, failover shall be implemented by reassigning the failed server's tasks to another primary server.

Immediately upon detection of a failure, the failed primary server's state shall be changed to down and all peripheral devices and interconnections shall be reconfigured as necessary to support the restarting functions. The functions of the failed server shall then be assigned to a backup or another primary server by a function restart **as described in Section 2.3.10**, Function Restart. If the functions are restarted in a backup server, the server state shall be changed to primary. If backup servers are not available or if insufficient primary servers are available to perform the required functions, the SCADA/ADMS shall attempt to restart the failed primary server.

After a failover, alarm conditions as shown on the alarm summaries and other displays shall be current as of the time of the last update of the backup databases prior to the failover. (This assumes that the restarted functions will access data from a backup database. However, the restarted functions may access data from any database, primary or backup, as long as the data is current.) All data, including telemetered, calculated, manually entered data such as overridden telemetered values, supervisory control device tags and control inhibits, function execution and control parameters, and input and output data, shall also be current as of the time of the last backup database update. Alarm conditions detected after the time of the last backup database update shall be annunciated as new alarms.

Failed servers shall be switched from down to any other state by user command only.

2.3.12 Server Start-Up

Server start-up shall be performed when commanded by a user such that the operating environment of the server is established prior to restarting its functions. Establishment of the operating environment may include execution of self-diagnostics, reloading the operating system, and connection to and verification of communications with all appropriate networks. Subsequent to server start-up, a function restart shall bring the servers to the appropriate state. Server start-up shall be completed within the time listed in Table 2-3: Communications Channel Interface.

2.3.13 System Power-On Start-Up

The SCADA/ADMS shall automatically restart itself when input power is interrupted and restored. System restart shall include server start-up, initialization of all network devices, initialization of all peripheral devices, initialization of all communications with data sources and external computer systems, resumption of all SCADA/ADMS functions, and notification to the users that startup has completed.

System power-on start-up shall be completed within the time listed in Table 2-3: Communications Channel Interface. System power-on start-up shall be tested during factory and site testing.

2.3.14 Device Redundancy and Failure Management

Devices shall be configured as redundant or non-redundant as specified in APPENDIX Section 2. When a failure of a redundant device is declared, the SCADA/ADMS shall invoke the appropriate device failover actions so that on-line functions using the failed device are preserved. Server failover shall not be necessary to recover from device failure.

When a failure of a non-redundant device is declared, the SCADA/ADMS shall not invoke server or device failover or function restart actions. On-line functions using a failed, non-redundant device may

be lost until the failed device is restored to service. Notification Alarms should be generated whenever any failure of any server occurs.

2.3.15 Device Failover

The device failover function shall direct an orderly transfer of operation in the event of any primary, redundant device failure. The failover assignment scheme shall allow for multiple levels of failover. That is, if a primary device fails and its backup device then fails or if the backup device is failed at the time of failure of the primary device, the system shall attempt to use the backup assigned to the backup device. All functions associated with both failed devices shall then be directed to use the new device. Device failover shall be completed within the time listed in Table 2-3: Communications Channel Interface.

Device failover shall accommodate the following special cases:

1) *Printers* – In lieu of an automated failover process, the user shall be able to direct output to any printer. However, the print services shall preclude the loss of information due to printer failures. This shall include information transferred to a printer but not yet printed at the time of the printer failure.
2) *Consoles* – Although consoles are configured as non-redundant devices, the failover logic shall insure that all of the areas of responsibility assigned to a failed console are assigned to at least one other console. If one or more areas are not assigned, the areas shall be assigned to a default console and an alarm shall be generated at that console.
3) *Archive storage* – In lieu of an automated failover process, the user shall be able to direct output to or read data from any archive storage device.
4) *LANs and WANs* – Recovery from failures of networks and network devices shall be managed by rerouting of communications. Failover to backup servers or devices in order to recover from network failures shall be attempted only where no network route to the primary server or device is available.
5) *Time and frequency facility* – The time and frequency facility will report loss of its input signal. If the facility is redundantly configured, loss of input shall be managed as a device failure. If the facility is non-redundant or if the redundant facility is down or also reporting a loss of signal condition, the SCADA/ADMS shall report the loss of signal as an alarm but shall continue to use the time and frequency measurements from the facility (the facility will revert to an internal time standard).

2.3.15.1 Device Reinstatement

Except for communications with data sources and other computer system connected to the SCADA/ADMS by the Enterprise WAN or the Control Center WAN, failed devices shall be reinstated by user command only. Failed communications to data sources or computer systems connected to the SCADA/ADMS by the Enterprise WAN and the Control Center WAN shall be periodically retried. When reliable communications are reestablished, the DCU/RTU, data source, or communication channel shall be automatically returned to operation.

Data sources may require the download of configuration information as part of the reinstatement process. Such configuration information may include report-by-exception deadbands.

2.3.15.2 Inter-site Switchover

While operating in the normal state (the SCADA/ADMS at the MCC is controlling the power system), all data, displays, and reports available at the MCC shall be available at the BCC. In the event of failure of the SCADA/ADMS at the MCC, the BCS shall assume monitoring and control of the entire power system. (This action is termed "inter-site switchover" to differentiate it from intra-site failover actions.)

To support this requirement, the BCS shall be maintained in a state where it can assume full control within the time specified in Table 2-3: Communications Channel Interface.

The users shall be notified of the SCADA/ADMS failure, but the inter-site switchover process shall be initiated only by user command. Once initiated, the process shall proceed without intervention. A procedure and process shall also be provided to allow the automated process to be manually completed through analyst control.

After intra-site failover at the MCC, the databases of BCS shall be current to within the time specified in Table 2-3: Communications Channel Interface, and all data and all displays available on the SCADA/ADMS shall be available on the BCS.

2.4 System Availability

Selected SCADA/ADMS component systems are essential to maintaining control of the power system. These component systems include:

1) Energy Control System
2) Information Storage and Retrieval

These systems are collectively referred to as the Core SCADA/ADMS for the purpose of defining the availability requirements, Availability requirements applied to the Core SCADA/ADMS shall be applied to the Core SCADA/ADMS as a whole, not individually to each component system comprising the Core SCADA/ADMS.

The availability applied to the other SCADA/ADMS component systems shall be separately applied to each component system. These other systems include:

3) Backup Control System
4) Operator Training Simulator
5) Program Development System

2.4.1 Availability Requirements – Core SCADA/ADMS

The Core SCADA/ADMS shall exhibit a measured availability of 99.95% during the availability test. That is, the ratio of total time minus downtime to total time shall be equal to or greater than 0.9995. (Section 12.11.2, Availability Test Definitions. Define downtime and other availability measurement terms.) The Core SCADA/ADMS software shall be considered available when all of the functions described in this Specification, except as noted in **Section 2.4.1.1, Functional Availability** are operating as specified, at their scheduled periodicity, and within the execution time parameters, at the same time all hardware is available as specified in Section 2.4.1.2, Hardware Availability.

The Core SCADA/ADMS shall have no single point of failure. That is, there shall be no hardware or software element that, as a result of its failure, renders the Core SCADA/ADMS unavailable. This requirement shall specifically include all hardware, the interconnections among hardware, power supplies, and enclosures provided by the Contractor.

Individual Core SCADA/ADMS devices, including servers, shall each exhibit availability no less than 99%.

2.4.1.1 Functional Availability

The Core SCADA/ADMS software shall be considered available when all of the functions described in this Specification are operating as specified, at their scheduled periodicity, and within the execution time parameters, with the exception of the following functions:

1) Database generation and modification
2) Display generation and modification

3) Report creation and modification
4) Software development support

2.4.1.2 Hardware Availability

The Core SCADA/ADMS hardware shall be considered available when sufficient servers, peripheral devices, and interfaces to data sources and computer systems external to the SCADA/ADMS are operating, and the Core SCADA/ADMS is satisfying its performance requirements. The term sufficient, as used in this paragraph, shall be interpreted as requiring the following minimum hardware complement to be operating:

1) At least one server of each server group
2) Auxiliary memory sufficient to support the operating servers. For RAID memory, no more than one storage unit of each enclosure shall be down.
3) At least Two operating consoles
4) At least two maintenance consoles
5) At least one monochrome printer
6) At least one archive device
7) At least one time and frequency facility
8) Sufficient DCU/RTU interfaces, FEPs, and other devices such that communications with all DCU/RTUs are supported
9) Connections to the CC WAN and CNPs sufficient to support communications with all nodes on that network
10) Connections to the Enterprise WAN sufficient to support communications with all nodes on that network

2.4.2 Availability Requirements – Other SCADA/ADMS Component Systems

Each component system of the SCADA/ADMS that is not included in the Core SCADA/ADMS shall individually satisfy the following availability requirements:

1) The system shall exhibit a measured availability of 99% over any one-year period (8760 consecutive hours). That is, the ratio of total time minus downtime to total time shall be equal to or greater than 0.99. The system shall be considered available when the all functions and all hardware are operating. This requirement shall also be verified during the availability test.

2) Individual devices, including servers, shall each exhibit availability no less than 99%.

2.5 Standards

The design, construction, and performance of all equipment and software supplied by the Contractor shall conform to the latest applicable standards listed below:

1) International Electrotechnical Commission (IEC)
2) International Organization for Standardization (ISO)
3) International Telegraph and Telephone Consultative Committee (ITU)
4) American National Standards Institute (ANSI)
5) Institute of Electrical and Electronic Engineers (IEEE)
6) Electronic Industries Association (EIA)
7) National Electrical Manufacturers Association (NEMA)
8) North American Energy Reliability Council (NERC)
9) National Critical Information Infrastructure Protection Centre (NCIIPC)

In addition, the recommendations of the Electric Power Research Institute (EPRI) regarding preferred suites of standards for electric utility use (e.g., CIM, CCAPI) shall be used throughout the SCADA/ADMS.

2.6 Cyber Security

2.6.1 Overview

The SCADA/ADMS system needs to be secure. The measures taken to meet this obligation cover a wide range from background checks on employees through restricting and digitally recording access to facility. It includes employee training, restricting access to in-house customer systems, documents and data, safeguarding any remote access capability, and protecting information about security vulnerabilities.

In the following the minimum requirements on the SCADA/ADMS product related to cyber security are listed.

2.6.2 Access Control

Role-Based Access Control (RBAC): The Contractor shall implement Role-Based Access Control (RBAC) in compliance with IEC 62351-8, NERC CIPS (1-9), NIST SP 800-53 (Access Control), NIST SP 800-82 (security standard for power grid control systems) and Smart Grid Cyber Security Requirements (Access Control – AC). Users (human, software applications, device) shall have individual user accounts, while roles shall be assigned to functional accounts with established rights and constraints. Software applications and devices that are used to interact with the SCADA/ADMS shall also be considered as RBAC "users". The authorization and privileges of each role shall be defined (reference IEC 62351-8):

1. Each user, shall be assigned to one or more of the roles - Authorization and privileges assigned to roles may include read data, write data, modify data, delete data, run invoke applications, issue commands
2. Some roles should be mutually exclusive if required (e.g. enforce the separation of duties, to eliminate conflicts of interest, and to ensure independence in the responsibilities)
3. Users may be assigned to multiple roles so long as they are not mutually exclusive.
4. Default roles/functional accounts shall be provided for basic operational and engineering activities including security management, with default privileges assigned down to the individual device and type of data. These default roles and their privileges shall be modifiable.
5. No user shall be able to access the SCADA/ADMS without having their user account assigned to at least one role. That role shall determine what access privileges the user has.
6. The Contractor shall provide for user accounts with configurable access and permissions associated with the defined user role.
7. The Contractor shall adhere to least privilege permission schemes for all user accounts, and application-to-application communications.
8. The Contractor shall configure the system so that initiated communications shall start with the most trusted application controlling the communication. Upon failed communication, the most trusted side will restart communications.
9. The Contractor shall ensure that under no circumstances can a user escalate their privileges without logging into a security management role first.
10. The Contractor shall provide a mechanism for changing user-to-role associations.

2.6.2.1 Certificate Authority and Digital Certificates

A Certificate Authority (CA) entity shall be provided to manage digital certificates for secure data exchange within the distributed grid control system. The CA shall be only accessible to system administrators.

Digital certificates shall be used for authentication and encryption of the following services:

Inter-process communication between servers
Data exchange between remote partner systems
User interface access
Database access

2.6.2.2 Digital Keys

For secure data exchange between servers, the SCADA/ADMS setup process shall create, install, and distribute digital keys.

2.6.2.3 Authentication, Authorization, and Auditing

The system shall require a username and password to authenticate the individual user. If the login is successful, the single sign-on system shall assign a unique (encrypted) token to the console. This token shall be used during the session to access services for which the user and console have authority. The token shall expire at logout.

The administrator shall specify what applications the user is allowed to access. The SCADA/ADMS shall log security-related events. Security events that are logged shall include topics that the system monitors. Security-related events shall be logged to the SCADA/ADMS General Summary alarm list. It shall also support various reporting mechanisms.

2.6.2.4 Cryptography

In the SCADA/ADMS, encryption shall be used where confidentiality is required to protect user credentials. It shall also be used to ensure confidentiality of data exchanged with user interface consoles. The latter is important because some user interface consoles may be located remotely and communications with them traverse networks that are difficult to secure. User Interface HTTPS and TLS encryption shall use AES cryptography.

2.6.3 Security Architecture and Design

The SCADA/ADMS vendor shall provide a system blueprint and associated documentation for the SCADA/ADMS. This material shall include a diagram illustrating a recommended network layout. To provide defense in depth, the system shall be partitioned into groups of servers (zones) with internal firewalls between the partitions.

2.6.4 Interfaces (External)

The ICCP subsystem shall support data exchange with remote entities that are secure using strong authentication and encryption based on the IEC international standards organization.

Secure ICCP authentication and encryption shall be supported using digital certificates and the Transport Layer Security (TLS) protocol.

The user interface to the SCADA/ADMS shall consist of the user logging in to the console Unix based (or Windows computer). After the user has initiated the Web browser (Mozilla on Unix or Internet Explorer on Windows) the data traffic between the end-user console and the SCADA/ADMS shall be encrypted to prevent disclosing the user credentials on the network.

SCADA/ADMS system and network must compliance all the controls of ISO27001:2013

SCADA/ADMS system shall be provided with all Security provision as per IEC 62351 standards.

2.7 System Interfaces

This section describes the information integration standards and requirements for the SCADA/ADMS. TPNODL intends on implementing an Enterprise Integration Solution based on middleware products. TPNODL requires SCADA/ADMS solution to integrate with the ESB over standard like Service Oriented Architecture (SOA).

AS Existing landscape of TPNODL doesn't include ESB, however interface design of SCADA/ADMS planned to message bus and/or enterprise asset integration technology. Once this technology is in place, efforts required for integration of SCADA/ADMS with this technology have to be included in the implementation cost in price proposal as optional.

2.7.1 SCADA / ADMS Interfaces Overview

SCADA/DMS/OMS will be in a single integrated system i.e. there will be no mapping or interfaces between SCADA, Advance Distribution Management System (ADMS) and the Outage Management System (OMS) and all three functions will be on one platform solution.

The following interfaces to systems will be required for the SCADA/ADMS to be operational

2.7.1.1 External Control Centers - SCADA / ADMS

SCADA/ADMS should be interfaced with external SCADA of other utilities and SLDC through ICCP protocol or other industry standards (currently exists).

2.7.1.2 SCADA/ADMS from GIS Interface

The master network electric facility and land base data is contained in the GIS. Periodic extracts of this data will be used to update the electric network model in the SCADA/ADMS. The extracts shall contain only the changes to the GIS model since the last extract run and not a complete refresh of the data unless so selected by the administrator. Temporary or abnormal switch status identified in the SCADA/ADMS shall also be over-ridden within the SCADA/ADMS by the GIS import. Differences in key data between the SCADA/ADMS and the GIS shall be available on an exception report for analysis by System Operation.

The SCADA/ADMS solution shall have a CIM compliant interface for network model exchange as a standard integration mechanism with GIS. In case the solution is not CIM compliant, necessary adapter has to be provided. The proposed solution shall have capabilities to incrementally extract and load data into the system from GIS without any downtime or major performance issues. The solution shall have SOA based capabilities for sharing relevant information/changes in SCADA/ADMS with GIS system.

As part of this interface GIS adaptor would be required for GIS Land base data, network model using GIS engines/adaptors supporting Native Adapters , CIM/XML Model for Distribution / Power System, using Model Exchange & Data Exchange over IEC 61968 Enterprise SOA Based BUS.

In addition to this the bidder shall provide detailed methodology on Integration of GIS with the proposed SCADA/ADMS system.

2.7.1.3 SCADA/ADMS from/to CIS (SAP ISU) Interface

The following are high level flows from CIS to the new SCADA/ADMS:

- The SCADA/ADMS will need to receive trouble calls from the CIS on an interactive basis. This includes all IVR calls received by the CIS.
- The SCADA/ADMS will need to receive a subset of the customer information along with trouble call details. This subset includes at a minimum the customer's name, phone, premise address, and its priority code.

- The SCADA/ADMS will need to receive list of newly connected customers and any changes to the electrical network connectivity on a daily basis (this customer connectivity information may go to the GIS first and then to the SCADA/ADMS via daily incremental transfer).

The following are high level flows of information that need to go from the SCADA/ADMS to the CIS

- The SCADA/ADMS will need to provide the following Outage status information: confirmed outage status, crew dispatched information, cause of outage and the estimated restoration time
- The SCADA/ADMS will need to provide the number of times the customer has been part of an outage for a given date range

Vendors are required to indicate typical time (Provide reference examples of existing customers) that will be required for transferring information.

2.7.1.4 SCADA/ADMS to IVR Interface

TPNODL has planned to introduce an interactive voice response system (IVR) – . There is no direct interface from the SCADA/ADMS to the IVR, All information routed is through fluent grid -CIS. It is intended that the IVR to fluent grid CIS interface will capture necessary information to create a trouble ticket that can in-turn pass to the SCADA/ADMS. The SCADA/ADMS, in-turn, will provide outage status information on, but not be limited to, outage areas and customers affected by outages to the IVR system.

2.7.1.5 SCADA/ADMS from/to work management system (SAP PM/WMS) Interface

There will be an interface between the SCADA/ADMS and the work management system (WMS) to create work orders/switching orders for planning different types of planned shutdowns. On creating these planned shutdown for follow-up work from an outage, such as additional investigative work, clean-up, broken pole replacement, tree trimming, service and meter re-attachment, etc.

2.7.1.6 SCADA/ADMS from AMI Interface

AMI allows you to ping meters, disconnect and reconnect meters, receive unsolicited outage and event reports from meters, and read voltages and other data on demand or on schedule.

There will be interfacing available in SCADA/ADMS to connect with TPNODL' AMI/ Meter management system.

2.7.1.7 SCADA/ADMS from/to GIS Interface

SCADA/ADMS from /to GIS over CIM based interface TPNODL for 11 KV & below network.

2.7.1.8 SCADA/ADMS from/to Historian (other than ISR)

SCADA/ADMS should be equipped with in-built interface developed with 3rd party Data Historian (such as PI, E-DNA, Hadoop, SAP-HANA etc.) which will send data on real time basis to Historian. For this capability appropriate adapter or interfacing ability should be provided with the system.

APPENDIX Section 2

Server Group/Device	Redundant configuration of equipment (Yes/No)
SCADA Server	Y
ISR Server	Y
FEP server	Y
ICCP server	Y
NMS Server	Y

Server Group/Device	Redundant configuration of equipment (Yes/No)
Web server	Y
DTS Server	N
Development Server	N

Table 9-1: SCADA/ADMS Redundancy

Note: Bidder has to assess the requirement equivalent or better as envisaged by purchaser

Location/Equipment	Connection[2]	Quantity
SCADA/ADMS Control System Operations consoles 2 monitor	L	10
Video projection system (MCS)	L L	1 1
Backup Control System Operations consoles 1 monitor (BCS) optional other location (80 inch TV)	L L	10 4
Area Power Control Center at-4 Location i.e Bhadrak, J. Road, Keonjhar & Baripada Operations consoles 2 monitor	CC	15
Dispatcher Training Simulator at MCC & BCC Location Operations consoles 2 monitor	L	10
Program Development System at MCC & BCC Location Support consoles 2 monitor	L	10

[2] L = Local connection (LAN)
CC = Remote connection via the Control Center WAN
IS = Remote connection via the Enterprise WAN

Table 9-2: User Interface Equipment

From	Interface to:	Qty. of Channels	Redundant Channels (Y/N)	Data Rate Available	Data Rate Needed (supplier to fill)
MCS &BCS	DCU/RTU	5	N	Core ring 40 Mbps Sub ring 10 Mbps	
MCS	BCS	1	N	20 Mbps	
ISR	GIS/SAP servers on Enterprise N/w	1	N	50 Mbps	
ICCP	SLDC & State Discoms ICCP	1	N	2 Mbps	

Table 2-3: Communications Channel Interface

Action	Minimum Performance	Performance Proposed (supplier to fill)
Backup Database Update User entries IS&R database Other databases	 Within 10 seconds Within 30 seconds Within 30 seconds	
Detection and annunciation of server or device failure and initiation of restart/failover process	Within 10 seconds	
Function restart/server failover Restart/failover using a backup database Restart/failover using an empty or initialization database	 Within 30 seconds Within 30 seconds	
Function restart/server failover Restart/failover using a backup database Restart/failover using an empty or initialization database	 Within 30 seconds Within 30 seconds	
Recovery from communications failure LAN or WAN failure RTU communications failure	 Within 10 seconds Within 10 seconds	
Device failover	Within 10 seconds	
Complete SCADA/ADMS startup (from power-off condition)	Complete, with all functions scheduled for execution, within 10 minutes	
Server startup	Complete, with all functions scheduled for execution, within 5 minutes	

Table 9-4: Configuration Management Performance

Action	Performance	Performance Proposed (supplier to fill)
Complete database regeneration	1 hours	-
Complete system software build, including operating system, applications, and databases	6 hours	
Software build or all applications and databases	3 hours	
Software build of a single applications and databases	30 minutes	
Installation of a single, new display including distribution to all consoles	60 seconds	
Reinstallation of all displays	60 minutes	
Perform an on-line update of a database parameter and propagation of the change to the source data	60 seconds	
Time required to take daily back up for database/operational system	60 minutes	

Table 9-5: Software Maintenance

S. No.	From	To	Data	Application	Frequency	Size	Proposed Standards
1	SAP	ADMS	Planned Maintenance information	Planned Orders are created for outages to be taken 2 days later	Everyday	500/day	ESB Web/ services
2	ADMS	SAP-R3	Follow Up order Information	Orders are created in SAP for those cases in which further maintenance work is to be done.	Everyday	500/day	ESB Web/ services
3	Fluent Grid	ADMS	NCC and Street Light complaints information	Information is transferred for complaints to be categorized and shown to the zone.	Everyday	5000/min ute	ESB Web/ services
4	ADMS	Fluent Grid	Updates for NCC and street light complaint and shutdown order being created in OMS	CRM is updated on basis of data sent	Everyday	3 Lacs Update per day	ESB/ Web services
5	ADMS	SMS-Gatewa y	OMS outage updates to Zonal Staff	OMS outage escalation messages to Zonal Manager, District Heads & Circle Heads, if outage no resolved within timeframe	Everyday	1000/Min ute	ESB/ Web services
6	ADMS	SAP BW-BO	Data for Reports	reports to be built in SAP BO/BW data repository	Everyday	5Lac Update per day	ODBC
7	GIS	ADMS	Complete GIS data	GIS based Network, Equipment, Structure	Predefined schedule	Fortnightl y	IEC 61968 CIM, XML

S. No.	From	To	Data	Application	Frequency	Size	Proposed Standards
				and Consumer data is used by OMS			
8	GIS	ADMS	11KV SLD for updation of DMS	Autocad created SLD	Daily	40-50 per day	IEC 61968 CIM, XML
9	GIS	ADMS	Route identification and navigation	Network Topology	On demand	As & when Required	IEC 61968 CIM, XML
10	GIS	ADMS	Network model(bulk data and incremental	DMS model up to date with GIS	Once per day		IEC 61968 CIM, XML
11	RTU/DCU/FRTU/IED	ADMS	Telemetry , calculated data and quality flag	system monitoring	real time basis		IEC 61850,IEC 104
12	ADMS	RTU/DCU/FRTU/IED	Telemetry control	system monitoring	real time basis		IEC 61850,IEC 104
13	DPS(CYME, ETAP etc)	ADMS	group setting of protection and control devices	ensure system integraty and protection through feeder configuration changes	As needed		IEC 61968 CIM, XML
14	ADMS	MWM/ FFA	Switching plan and switching map	crew dispatch	As needed		IEC 61968 CIM, XML
15	MWM/FFA	ADMS	operation changes	DMS model up to date	On-demand		IEC 61968 CIM, XML
16	MDM	ADMS	Load profile and system load snapshot	network model valiadation and calibration	On-Demand		IEC 61968 CIM, XML
17	AMI	ADMS	Low voltage and PQ events	system monitoring	On-Demand		IEC 61968 CIM, XML
18	ADMS	Notification(SAP BCM)	network event and performance	network event/alarms, alerts and notification	On-Demand		ESB
19	ADMS	DPS(CYME,ETAP etc)	system snapshot ad saved cases	post event analysis,saved cases	As needed		IEC 61968 CIM, XML
20	Asset operation and performance data warehouse	ADMS	operation history	post event analysis	as needed		ODBC
21	ADMS	Asset operation and performance data warehouse	utility configurable telemetry and calculation points and device points/operations	datamining by planning and operation engineer			IEC 61968 CIM, XML
22	ADMS	SAP-BO,SAP-BW	all network data(bulk data)	Reporting purpose			ODBC
23	SAP	ADMS	Outage Related Information	Complaints Details for No Supply Etc	Daily		ESB/web Service

S. No.	From	To	Data	Application	Frequency	Size	Proposed Standards
24	ADMS	MDM	Outage Verification Request	Outage Verification/ Restoration Verification. A request to verify a service outage when a trouble call is not part of a known outage. MDMS will perform an on-demand ping to verify the meters are receiving energy.	Hourly	Est. Max. 10,000 per hour	IEC 61968 CIM, XML
27	MDM	ADMS	Outage Verification Response	Outage Verification/ Restoration Verification. The results of the on-demand ping.	Hourly	Est. Max. 10,000 per hour	SAP PI / IEC 61968 CIM
28	MDM	ADMS	Outage Notification.	Outage Notification (last-gasp messages). Should be filtering for momentary interruptions and known outages and known service orders. Should be throttled during large scale outages	Hourly	Est. Max. 250,000 per hour	SAP PI / IEC 61968 CIM
29	ADMS	MDM	Restoration Verification Request.	Restoration Verification. A request to query a specific meter or group of meters to verify a service restoration. MDMS will perform an on-demand ping to verify the meters are receiving energy. Should be set to low priority or turned off during large scale outages	Hourly	Max. 250,000 per hour	SAP PI / IEC 61968 CIM
30	MDM	ADMS	Restoration Verification Response.	Restoration Verification. The energized states of the select meters as a result of on-demand pings.	Hourly	Max. 250,000 per hour	SAP PI / IEC 61968 CIM
31	MDM	ADMS	Restoration Notifications.	Power restored notifications that originate from the AMI meter.	Hourly	Max. 250,000 per hour	SAP PI / IEC 61968 CIM
32	MDM	ADMS	Momentary Outage Data.	Momentary interruption counts during daily reads.	As & when		SAP PI / IEC 61968 CIM
33	MDM	ADMS	Load Profiles.	Network model validation and calibration	daily	Once per day	SAP PI, IEC 61968 CIM
34	MDM	ADMS	Meter Load.	Network model validation and calibration	Monthly	Once per month	SAP PI, IEC 61968 CIM

S. No.	From	To	Data	Application	Frequency	Size	Proposed Standards
35	Power BI	ADMS	all	Report	As & when	-	-

Table 9-6: List of System Interfaces

3. Capacity and Performance

The System shall be designed to meet the capacity and performance requirements defined in this section.

3.1 System Capacity

All capacity requirements are to be satisfied including:

1) The System equipment listed in Section 2, SCADA Architecture
2) Functional and database capacity requirements of Section 3.1.1.
3) The processor and auxiliary memory capacity requirements of Sections 3.1.2 and 3.1.3.

While meeting:

1) The performance requirements of Section 3.2,System Performance.
2) The availability requirements of Section 2.5, System Availability.

3.1.1 Function and Database Capacity

The System functions and their associated databases shall be dimensioned for the following data when delivered:

1) The data quantities listed in Table 4-2: Non-Telemetered Data
2) Table 4-4: IS&R Data
3) Table 3-1: TPNODL Network Parameters
4) Table 3-6: Application Capacity.

The System functions and associated databases shall be capable of accommodating at least a 100% increase in the delivered capacity without requiring hardware and software up-gradation, regeneration, recompilation, or any other processing.

3.1.2 Processor Memory

The main memory of each processor and console shall be expandable to twice the delivered capacity within the delivered enclosures by TPNODL using hand tools.

3.1.3 Auxiliary Memory

Fifty percent of the auxiliary memory capacity of each processor, console, or storage unit shall be unused (spare), and completely available for future use by TPNODL (A storage unit is defined as an enclosure, external to a processor, which is largely dedicated to auxiliary memory.) The auxiliary memory of each processor, console, and storage unit shall be expandable to twice the delivered capacity within the delivered enclosures by TPNODL using hand tools.

3.2 System Performance

Satisfaction of the performance requirements will be verified during both the factory test and the site test as specified in Sections 12.9 and 12.10. It is TPNODL's intent that the System exhibits consistent performance even when operating in a degraded configuration. To this end, the System shall satisfy the performance and capacity requirement of this specification under the following configurations:

1) The "normal" configuration with all System components operating

2) A degraded configuration where one processor of each redundant processor group is assigned to the backup state.

A processor assigned to the backup state shall not, by definition, execute any application other than those required to maintain itself in a state ready to assume the primary state. If the System does not support a backup state and redundant processors within a processor group share applications, then one of these processors shall be set to the "down" state. (The terms "backup", "primary,' "down", and "processor group" are defined in Section 2.4.2, server and Device States, and Section 2.4.3, server and Device Interconnections).

Supplier would be requested to provide performance metrics on the recommended hardware.

3.2.1 System Activity Scenarios

The System performance shall be tested under the following system activity scenarios:

1) The base conditions (Section 3.2.1.1) define System activities and conditions upon which the steady state and high activity scenarios are layered.
2) The steady-state scenario (Section 3.2.1.2) represents field operating conditions during a typical 60-minute period.
3) The high activity scenario (Section 3.2.1.3) represents field operating conditions during a 15-minute period such as might be experienced during a power system disturbance.

3.2.1.1 Base Conditions

The following conditions shall apply to both the steady state and high activity scenarios:

1) The System shall be configured with all hardware and functions required by this Specification operating, including hardware and functions specified as optional that have been elected by TPNODL (Note that Section 3.2, System Performance requires that some processors may be deliberately removed from service during testing.)
2) All System function execution parameters shall be as determined by TPNODL
3) System functions shall execute at the periodicities and execution times specified in Table 4-7: Function Periodicity and Execution Time.
4) The System software and databases shall be configured in accordance with the requirements of Section 3.1, System Capacity.
5) The contents of the System databases and the display and report definitions shall be as determined by TPNODL The database contents will not be greater than the delivered capacity specified in Section 3.1, System Capacity.
6) The hour change shall occur such that all data acquisition and processing associated with the hourly System functions, including report production, are executed.
7) Each monitor at all consoles (including operations, support, and management consoles) shall present all "common information" deemed by TPNODL to be part of the normal display arrangement. Such common information may include:
    a) Display title and window border
    b) Alarm zone
    c) Operator message area
    d) Time and date area
    e) Top-level menu bar
8) Operation view shall be customizable to operator for view of any operational menu based on user display.

9) Video Projection System shall show user selected displays.

3.2.1.2 Steady State Scenario

The Steady State Scenario shall consist of the Base Conditions and the following activities over a sixty-minute period:

1) Twenty-five percent of all the analog points shall change sufficiently each time they are acquired so as to require complete processing by the System.
2) Sixty alarms per minute (Thirty status alarms and Thirty analog alarms) shall be generated and processed. Each of these alarms may be acknowledged within sixty seconds at TPNODL discretion.
3) One new display shall be called into one of the viewports at each console every sixty seconds.
4) One data entry shall be executed at each operations console every sixty seconds including Modification of 5 data points in each of the 5 Substations or Modify 2 percent of geo reference data of utility network.
5) One supervisory control sequence consisting of the opening or closing of one device shall be executed at each operations console every one minutes.
6) Distribution Power Flow shall be run for at least 50% of the network every 15 minutes.
7) The study security analysis and distribution functions shall be executed every fifteen minutes, each from one console. utility will supply the input data and solution parameters.
8) Five ad hoc queries of ISR data and five report requests of ISR data from one operations console shall be made during the scenario. Each query or report shall, on average, include 500 items.
9) One query of the current conditions from the continuous data recording function data from one-half of the corporate user consoles every two minutes. The queries shall total no more than 5000 data items per minute.
10) Fail and restore 1 RTU per 5 minutes
11) Fail and restore 1 ICCP server connection every 30 minutes
12) Web servers to be accessed by 200 people simultaneously
13) Transfer and store 1 save case for each application
14) Transfer and store 2 files of selected 10 minutes duration of continuous real-time data for playback and trending

3.2.1.3 High Activity Scenario

The high activity scenario shall consist of the base conditions and the following activities over a fifteen-minute period:

1) Fifty percent of all the analog points shall change sufficiently each time they are acquired so as to require complete processing by the System.
2) A burst of 10000 alarms (5000 status alarms and 5000 analog alarms) shall be generated and processed within the first sixty seconds of the scenario. Hundred alarms per minute (Fifty status alarms and fifty analog alarms) shall be generated and processed for the remainder of the scenario. Each of these alarms may be acknowledged within sixty seconds at TPNODL discretion.
3) Five new displays shall be called up in one of the viewports at each console once every sixty seconds.

4) Five data entries shall occur at each operating console every minute including Modification of 5 data points in each of the 5 Substations or Modify 5 percent of geo reference data of utility network.
5) Five supervisory control sequence consisting of the opening or closing of devices shall be executed at each operating console every one minute.
6) The study security analysis and distribution functions shall be executed every three minutes, each from one console. utility will supply the input data and solution parameters.
7) Distribution Power Flow shall be run for at least 20% of the network every 5 minutes.
8) Five ad hoc queries of IS&R data and five report requests of IS&R data from one operations console shall be made during the scenario. Each query or report shall, on average, include 500 items.
9) One query of the current conditions from the continuous data recording function data from one-half of the corporate user consoles every two minutes. The queries shall total no more than 2000 data items per minute.
10) Fail and restore 3 RTU per one minute.
11) Fail and restore 1 ICCP server connection every 10 minutes
12) Web servers to be accessed by 200 people simultaneously
13) Transfer and store 1 save case for each application
14) Transfer and store 2 files of selected 10 minutes duration of continuous real-time data for playback and trending

3.2.2 Resource Utilization

Utilization is defined as the average utilization over the time of the test scenario and shall be calculated as the used capacity of the resource divided by the total available capacity of the resource. For example, processor average utilization may be calculated as busy time divided by total time. LAN average utilization may be calculated as the quantity of data transferred (Mbytes) divided by the LAN data rate (Mbytes/second) multiplied by total time (seconds).

3.2.2.1 Steady State Utilization

The average resource utilization of each System resource during the steady state scenario shall not exceed:

1) Utilization of the processing capacity of any processor used for executing application functions shall not exceed 30%.
2) Utilization of the transfer capacity of each auxiliary memory device shall not exceed 30%.
3) Utilization of any non-deterministic LAN (such as Ethernet) shall not exceed 5%; the loading of any deterministic LAN shall not exceed 10%.

3.2.2.2 High Activity State Utilization

The average resource utilization of each System resource during the high activity scenario shall not exceed:

4) Utilization of the processing capacity of any processor used for executing application functions shall not exceed 40%.
5) Utilization of the transfer capacity of each auxiliary memory device shall not exceed 40%.
6) Utilization of any non-deterministic LAN (e.g., Ethernet) shall not exceed 10%; the loading of any deterministic LAN shall not exceed 25%.

3.2.3 User Interface Response

The System shall provide rapid and consistent response to power system events and user inputs. Responsiveness to events and inputs shall be within the following requirements under both the steady state and high activity scenarios.

3.2.3.1 Display Request

The display response time is defined as the elapsed time from a user's request for a display (initiated by a menu selection, function key activation, or cursor target selection) until the requested display is presented complete with current data retrieved from the System databases. Display response times shall be demonstrated for the system operating in the steady state and the high activity scenarios. The display response time for each request shall conform to the display response time requirements shown in Table 4-6: User Interface Response. TPNODL may choose any or all System displays for this test. Displays selected shall be updated at the rates specified in Table 4-7: Function Periodicity and Execution Time. Subsequent to the initial presentation of a display, the data on the display shall be updated at the rates specified in Table 4-7: Function Periodicity and Execution Time and also within the display response time requirements shown in Table 4-6: User Interface Response.

3.2.3.2 Alarm and Event Annunciation

Any change of a data item that results in the generation of an alarm shall be reported by audible and visual indications within the times shown in Table 4-6: User Interface Response. The response time shall be measured from the time:

7) The System receives a message from a data source containing a changed data item that produces an alarm condition. (Received shall mean the last bit of the message cross the interface with the System, but prior to any processing)
8) A periodic System function calculates or otherwise generates a data item (and stores the item in the database) that produces an alarm condition.
9) The execution of a System function initiated by a user action or other request calculates or otherwise generates a data item (and stores the item in the database) that produces an alarm condition.

The measurement of the alarm response time will end at the time the alarm condition has been completely processed, recorded in the System database, and presented on all viewports with displays that include the value in alarm or any presentation of alarm conditions.

3.2.3.3 User Requests

The response to user requests shall be measured from the time the user completes all information necessary to define the request or any step of a sequence that makes a request, until the time the requested action is completed. Completion of the request shall include production of all results, storage of the results in the System database, and updating of all relevant displays. User request response requirements for specific tasks are presented in Table 4-6: User Interface Response. The default response time presented in Table 4-6: User Interface Response, shall be met for all other user requests not specifically included in this Specification.

For any user request that may be expected to exceed the default request time, including the processing of requests with allowed response times greater than the default time, the System shall post an unambiguous response to the requesting user indicating that the request has been accepted and is being processed. This indication shall not require further action of the user, such as acknowledging the indication.

User response time is not to be confused with the function execution times of Table 4-7: Function Periodicity and Execution Time. When a user requests execution of a function listed in Table 4-, the

actions leading up to the start of the function shall be considered as a user request that shall comply to the requirements of this section. Once started, the function execution time is subject to the requirements of Table 4-. However, the System shall indicate that the user's request for execution of the function has been accepted and the function has been started as presented in the preceding paragraph.

3.2.4 Degraded Operation

TPNODL accepts that the System will infrequently experience operating conditions beyond those embodied in the high activity scenario. The System shall continue to operate under such conditions and may exhibit degraded performance under such conditions. However, the System shall include features to minimize the degradation and the ensuing effects on power system operations. These features may include:

1) Assignment of priorities to System functions and delaying or inhibiting the execution of lower priority functions
2) Inhibiting the execution of periodic functions until the completion of the previous execution of the function or observing a minimum delay between executions
3) Reassigning functions to resources that are less utilized

The System shall be configured to give priority to the following when operating in a degraded state:

1) Detecting and annunciating exception conditions (alarms) in the power system
2) Presenting data to the users through the consoles – priority shall be given to users at operating consoles
3) Maintaining coherency of the database – specifically including data used as inputs to functions and the outputs produced by the functions
4) A point on interface inputs slowing the system

Any actions taken by the System to mitigate degraded operating conditions shall be revealed/alarmed to the users/administrators.

3.2.5 Resource Monitoring

Resource utilization shall be measured, calculated and displayed for the System processors, devices, and networks. The minimum set of parameters to be presented include:

1) Time utilization (percent processor utilization) of each function per processor
2) Time utilization (percent disk utilization) of each function per disk
3) Disk data transfers per disk
4) Performance of LANs, bridges, routers, switches, firewalls and other network devices.

Statistical sampling and accumulation techniques shall be used to collect these parameters over a user-selected time period. The user shall be able to specify the study period over which samples are collected and the sampling frequency. Typical study periods shall be ten seconds to sixty minutes, and typical sampling frequencies shall be once per two milliseconds to once per fifty milliseconds.

S. No.	Data Description	UoM	TPNODL
1	OPTCL Grid (132/33)kv	Nos.	41
2	Grid Stations(33KV/11KV)	Nos.	278
3	33KV OH Line	Kms	4723
4	Power Transformers	Nos.	592
5	Power Transformer Capacity	MVA	2976
6	11 KV feeders	Nos.	1049

7	11KV OH Line	Kms	44297
8	11KV UG Line	Kms	–
9	Distribution Transformer Capacity	MVA	2589
10	Distribution Transformers(3-phase)	Nos.	55359
11	LT feeder	Nos.	53837 Kms
12	LT OH Line	Kms	53837

Table 4-1: TPNODL Network Parameters

Note:- functions and associated databases shall be capable of accommodating at least a 100% increase in the delivered capacity (both including telemetered & non telemetered) without requiring additional hardware and software up-gradation, regeneration, recompilation, or any other processing.

Data Source	Data Type	Periodicity	Quantity (Estimated)
Manually entered	StatusAnalog	Upon change	5000 1000
Calculated	Status Analog Accumulator	every seconds Upon change 15 minutes	500 5000 5000
Redundant Point Processing	Status Analog Accumulator	every seconds 5 seconds 15 minutes	100 100 50

Table 4-2: Non-Telemetered Data (table formatting changed)

From	To	Protocol	Data Type	Periodicity
TPNODL	SLDC	ICCP		
			Status	1 seconds
			Analog	2 seconds
			Accumulator	15 minutes
			Operator message	-
SLDC	TPNODL	ICCP	Transaction schedules Operator message	
TPNODL	Other DIscom	ICCP	Status Analog Accumulator	1 seconds 2 seconds 15 minutes
Other Discom	TPNODL	ICCP	Status Analog Accumulator	1 seconds 2 seconds 15 minutes

Table 4-3: Data Exchange Format

Function/Data	Quantity	Periodicity	Retention Period
Alarms and events	300000/day	-	12 months
Continuous data recording	All data in, Table 4-2, and Table 3-3	Upon change	3 months
Sequence of Events	50000/day	On occurrence	3 months
System Peak Information			
Peak MW Coincident Mvar Date and hour of peak	4 4 4	On occurrence per month	60 months 60 months 60 months

Table 4-4: IS&R Data

Note: Additionally ISR data stored (including energy balance data) will be copied to the Enterprise Historian server. Details of this requirement will be defined during system design phase.

Application/Parameter	Quantity
Data Acquisition and Data Processing	
Number of operating limit pairs (analog values)[3]	3
Number of operating limit pairs (accumulator values)[4]	1
Number of operating limit sets	4
Number of state definitions (two-state points)	64
Number of state definitions (three-state points)	64
Number of tag types	10
Number of tags per point (maximum)	6
Load Shedding and Restoration	
Load blocks	500
Load points per block	100
User Interface	
Number of displays per console (Minimum)	2/3 per console
Alarms presented on the alarm summary	2000
Events presented on the event summary	5000
No. of simultaneous users connections	250
Power Network Analysis	
Simultaneous users	20
Contingency cases screened	100
Contingency cases evaluated (full ac solution)	25
Equipment outages per contingency case	10
Power flow study save cases	25
Contingency study save cases	5
Advance Distribution Network Analysis	
Simultaneous users	20
Switching Procedures saved	500
Power flow study save cases	100
Predictions logic analysis	500

[3] Not including reasonability limits.
[4] Not including reasonability limits.

Application/Parameter	Quantity
Outage Scheduling	
Number of Outage Schedules	500
Maximum duration of outage (hours)	168
Maximum future time (days)	365
IS&R	
Simultaneous System users	20
Simultaneous non-System users	100
Maximum user accounts	50
Development users	5
Dispatcher Training Simulator	
Scenarios	100
Events per Scenario	300
Power Flow Periodicity (seconds)	< 10
Dynamics Calculation Periodicity (seconds)	1
Duration of Longest Scenario (hours)	48

Table 4-5: Application Capacity

Action	Maximum Response Time (For Local/WAN/Serial connection)		Notes
	Steady State	High Activity	
Default response	1/2/3 second	1.5/3/5 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Display request	1/2/3 seconds	2/3/4 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Forms requests	2/4/6	4/6/8	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Display data update (subsequent to the initial presentation of data)	2/4/6 seconds	2/4/6 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Alarm and event annunciation	1/2/2 second	1.5/3/4 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Viewport creation	1/1/1 second	1.5/1.5/2 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Network panning – should be possible with keyboard arrow keys	5/5/5, 20-pixel steps per second	5/5/5, 20-pixel steps per second	No visible flicker.
Network zooming	2/2/2, 10% steps per second	2/2/2, 10% steps per second	No visible flicker.
Pop-up menu, pull down menu, dialog box, etc.	1/2/2 second	1.5/3/3 seconds	Not to exceed 150% of the maximum under any condition

Action	Maximum Response Time (For Local/WAN/Serial connection)		Notes
	Steady State	High Activity	
Display hardcopy	60/60/60 seconds	90/90/90 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum
Console user logon	10/10/10 seconds	10/10/10 seconds	98% of actions complete within the maximum time. 100% within 1.5 times the maximum

Table 4-6: User Interface Response

Note: The supplier shall indicate their proposed response times (for the above and any additional items available with the supplier) in the table in Italics.

Function	Periodicity	Maximum Execution Time		Notes
		Steady State	High Activity	
Data Acquisition (any data source)	Table 4-2: Non-Telemetered Data (table formatting changed)	1 second	1 second	Execution time is measured from the receipt of the message containing the changed data until all processing is complete, the changed data is stored in the database, and the alarm lists have been updated.
Supervisory Control	-	1	1	Execution time is measured from the time the user executes the command until the command exchange with the data source is complete.
Display Update	4 second	1	1	
Time & Frequency Update	1 second	-	-	
Real-Time Analysis Network Model Builder Analysis Distribution Power Flow Prediction logic	 With SE 2 minutes 10 minutes 10 minutes 2 minutes	- 10 seconds 20 seconds 120 seconds 10 seconds 2 seconds	- 15 seconds 30 seconds 120 seconds 20 seconds 3 seconds	Execution times assume a stable input data set.
Study Analysis Network Model Builder Dispatcher Power Flow	- - - - -	 10 seconds 20 seconds 120 seconds 30 seconds	 20 seconds 60 seconds 180 seconds 60 seconds	All studies from a “flat start”.

Function	Periodicity	Maximum Execution Time		Notes
		Steady State	High Activity	
Distribution Power Flow		10 seconds	20 seconds	For a Grid station and interconnects

Table 4-7: Function Periodicity and Execution Time

Note: The supplier shall indicate their proposed response times (for the above and any additional items available with the supplier) in the table in Italics.

Action	Performance Required	Proposed Performance
Complete database regeneration	1 hours	
Complete system software build, including operating system, applications, and databases	6 hours	
Software build or all applications and databases	3 hours	
Software build of a single applications and databases	30 minutes	
Installation of a single, new display including distribution to all consoles	60 seconds	
Reinstallation of all displays	60 minutes	
Perform an on-line update of a database parameter and propagation of the change to the source data	60 seconds	

Table 4-8: Software Maintenance

Note: The supplier shall indicate their proposed response times (for the above and any additional items available with the supplier) in the table in Italics.

4. User Interface

The principal interface between users and the SCADA/ADMS will be the consoles. Printing devices and a video projection system will also be part of the interface between the users and the SCADA/ADMS. The following definitions shall apply:

1) *Console* – A console is an operating position consisting of one or more monitors and user interaction devices.
2) *Screen* – A screen is the full physical display area of a monitor.
3) *Window* – A window is defined area of a screen where a display is presented.
4) *Display* – A display is the image selected by the user for view on a screen or within a window. A display may be part of a Geo-reference view.
5) *Geo-reference view* – A Geo-reference view is a device independent Cartesian coordinate system used for specifying graphical input and output.
6) *Functions Key* – A function key is a device, either a physical pushbutton on the keyboard or mouse, or a sensitized area on displays, which the user employs to interact with the SCADA/ADMS.

Performance requirements for the user interface are presented in Section 3.2.3, User Interface Response.

4.1 SCADA/ADMS Access Security

A mechanism for defining and controlling user access to the SCADA/ADMS shall be provided. This security scheme shall be in addition to that included with the operating system. That is, even though

a user has logged onto the SCADA/ADMS network or a processor, access to the SCADA/ADMS functionality shall be subject to additional security checks.

4.1.1 User Login

Password security shall be provided for access to the SCADA/ADMS. Users shall log in by entering a user ID and a password. Each password shall be validated against the corresponding user information in the database. A procedure shall be provided for users to log off. SCADA/ADMS passwords shall be stored in encrypted form. Passwords shall meet criteria similar to those used by the operating system. Users shall have the ability to change their own passwords. Changed password shall be propagated throughout the SCADA/ADMS as necessary and without additional user intervention.

Each log-on and log-off shall be reported as an event, and stored in an audit trail. Unsuccessful attempts to log-on shall also be reported as events. The event message for log-on, log-off, and unsuccessful attempts shall indicate the date and time the procedure was executed, the name of the console and the identification of the user. If any user console is left unattended, the user should be logged off (after a user definable time interval) by the system. The log-in status of the user shall be unaffected by any failure recovery procedure in the SCADA/ADMS.

4.1.2 Operating Jurisdictions

Once logged on, access to the SCADA/ADMS capabilities shall be managed by assigning a set of operating jurisdictions (which shall be referred to as “jurisdictions”) to each console, not to user accounts. The jurisdictions allocated to each console shall be stored in the SCADA/ADMS database. Management of jurisdictions shall be a function itself subject to validation.

The access security validation procedure shall follow a hierarchy of jurisdictions:

1) *Display Jurisdictions* – The presentation of each display shall be limited to selected consoles, even though access to the data or functions presented on the display may be allowed. Display access shall be further limited by allocating access as read-only or read/write. Read-only access shall preclude user interaction with the display other than to request another display.

2) *Function Jurisdiction* – Access to the facilities of any function shall be limited to selected consoles even though access may be permitted to a display from which such facilities could be exercised.

   The means by which displays, reports, and databases are defined and modified shall be considered functions, as well as functions that manage the software configuration of the SCADA/ADMS. These functions shall be subject to the same access security validation as other functions.

3) *Database Item Jurisdiction* – Access to manage database items shall be governed by the jurisdiction. Each database item shall be assigned to a single jurisdiction. Each console shall be granted access to all or a subset of the jurisdictions. Attempts to alter any telemetered or calculated database item shall be denied if the item’s jurisdiction does not match the console's jurisdictions. Database element alterations regulated by the operating jurisdiction scheme shall include:

   a. Enabling and disabling scanning and processing
   b. Enabling and disabling alarm processing
   c. Manually entering a value
   d. Overriding a limit
   e. Managing alarms, including alarm acknowledgement and deletion.

4) *Supervisory Control Jurisdiction* – Similar to database item access controls, attempts to initiate supervisory control actions shall be denied if the supervisory control database item’s jurisdiction does not match the console's assigned jurisdictions. Access to supervisory control facilities shall encompass not only the control, but also access to the control inhibit (tagging) feature for the

database item. Control of the SCADA/ADMS hardware configuration shall be considered a supervisory control procedure.

There shall be no restrictions on the assignment of multiple jurisdictions to a console or the assignment of a jurisdiction to multiple consoles. The access security function shall insure that each jurisdiction is at all times assigned to a least one console. If a console failure or manual reassignment of jurisdiction results in one or more jurisdictions not being assigned to at least one console, the unassigned jurisdictions shall be automatically assigned to a pre-assigned default console and suitable alarms shall be generated.

The term "user" is applied to the personnel interacting with the SCADA/ADMS system. These users shall be required to login in one or more of following user modes, which include:

a) Supervisor Personnel responsible for SCADA/ADMS system administration and management such as assigning the access area to users, creating users, monitoring system health, general maintenance of the system etc.

b) Dispatcher Personnel responsible for real-time Power system operations including real-time study.

c) Engineer: Personnel having access to certain SCADA/ADMS system functions and maintenance of database/ displays and responsible for support activities such as post fault analysis , report generation, regular backup of database

d) Programmer: Personnel responsible for continuing development and maintenance of the SCADA/ADMS system functions, databases, displays and report formats. Security system

e) Remote VDU user : Personnel having only monitoring & control access of real-time power system from SCADA/ADMS system , reports.. however system administrator can enable or disable the authorization

Modes should not be limited to above and the system administrator should be able to create other modes/roles as well as per TPNODL need, like PSD Role, Reliability Role and Power Manager Role etc.

DTS (Instructor & Trainee modes): The Consoles dedicated for DTS shall have instructor & trainee modes

4.2 Alarm and Event Processing

Alarms are conditions that require user notification when detected. Alarms may be generated by the data acquisition and processing functions described in Section 6.3, Data Processing and by other SCADA/ADMS functions, including the processor and device failure detection functions described in Section 2.4, Configuration Control, Redundancy, and Failure Management.

Events are conditions that are to be recorded by the SCADA/ADMS, but that do not require notification to the users. Events may be generated by the same functions as alarms. For the purposes of this discussion, events will be considered as a special case of alarms, where the event is intended only to record information for future reference. Users shall not be notified of events nor are they to perform management actions such as acknowledgement or deletion.

Alarms shall be subjected to a series of alarm processing actions and user interactions. Those actions to be executed shall be determined by the jurisdiction assigned to that database item (described in Section 4.1.2, Operating Jurisdictions) that is exhibiting the alarm condition and by the alarm class also assigned to the database item (Section 4.2.1, Alarm Class and Alarm Presentation).

Each database item may be associated with several alarms. For example, a telemetered analog point will include operating limit alarms, reasonability limit alarms, and telemetry failure alarms. Each alarm

of each point shall be individually assigned to a jurisdiction (Section 4.1.2, Operating Jurisdictions) and to an alarm class (Section 4.2.1, Alarm Class and Alarm Presentation).

4.2.1 Alarm Class and Alarm Presentation

The alarm class assignment shall determine how the alarm will be presented, acknowledged, deleted, and recorded. The alarm class will be categorized by TPNODL during implementation of project. The alarm class shall determine how the following alarm presentation and management characteristics are to be employed:

1) *Audible annunciation* – enable/disable, single stroke or repeating, which tone (out of multiple tones made available by the system administrator)
2) *Display annunciation* –
    a. For schematic diagrams and geo-referenced view – symbol change, color change, inversion, or no change, and flash/no flash for both unacknowledged and acknowledged alarms.
    b. For message displays (such as an alarm summary) – message color and flash/no flash.
3) Presentation on the alarm window (refer to Section 4.2.4, Alarm Window)
4) Inclusion on the alarm summary (note that all alarms and events shall be included on the event summary described in Section 4.6.12, Event Summary)
5) User interaction (none required for events):
    a. Alarm message is deleted when acknowledged and symbol or value reverts to normal.
    b. Alarm message is deleted when return-to-normal alarm occurs and symbol or value reverts to normal.
    c. Alarm message is deleted when return-to-normal alarm is acknowledged and symbol or value reverts to normal.
    d. Alarm message is deleted by other user action and symbol or value reverts to normal.

The alarm condition shall appear on all displays containing the device or value at all consoles regardless of the alarm's jurisdiction.

4.2.2 Alarm Messages

Alarm messages shall be a single line of text describing the alarm that has occurred indicating current value (if applicable) and the date and time of occurrence. (Alarms from previous days shall be readily identified.) The alarm message shall be unabbreviated English text and shall not require the use of a reference document for interpretation. The TPNODL shall be able to modify alarm message formats and define new formats. Clicking on alarms should zoom to the location of device (on schematic or geo-referenced window) generating alarm.

4.2.3 Alarm Message Recording

Alarm messages shall be stored within the Information Storage and Retrieval database (Section 7.1.2, System Message Log Storage and Retrieval).

4.2.4 Alarm Window

An alarm window shall provide a visual indication of alarm conditions in every category assigned to the console. The alarm window shall contain an indicator for each data source (for example, a substation) and SCADA/ADMS function (for example, contingency analysis, and Distribution power flow). The indicator for data sources and functions with no alarm conditions present shall not be presented. When an unacknowledged alarm is present in any data source or function, the indicator shall be displayed and flashing, color, or other highlighting shall be used to draw the user's attention

to the indicator. Acknowledgement of the alarm shall modify the attributes of the indicator to indicate the presence of only unacknowledged alarms.

If the number of indicators exceeds the capacity of the alarm window, the user shall be notified of the overflow condition. Popups or tailing or escalation of alarms required

4.2.5 Alarm Acknowledgement

The user shall be able to acknowledge an alarm within the assigned jurisdiction from anywhere the point in alarm is displayed:

1) From the alarm summary by line or by page
2) From a one-line diagram/geo-referenced view display by point or by viewed page
3) From a station tabular display by point or by viewed page.
4) The alarms can be acknowledged in bulk as all alarm on one page with warning pop-up

4.2.6 Alarm Inhibit/Enable

The user shall be provided the capability to inhibit the alarm on any measurement (telemetered or calculated), device, or application function alarm condition from display and audible alarming. Alarm inhibit and enable operations shall be reported as events. Although the alarm is inhibited, it shall be processed as usual so that its data is available for use. However, no alarm conditions shall be reported. The inhibited alarm shall not generate entries on the alarm summary and nor be treated as an event for reporting purposes. An inhibited alarm shall be indicated as such on displays and reports by an appended character. The event of alarm inhibit need to be archived with name of user ID.

4.2.7 Alarm Audible Suppression

Upon user command, the audible alarm annunciation shall be suppressed. Alarm audible suppression and enable operations shall be reported as events. The default suppression technique shall suppress the audible alarm only for existing alarms. New alarms shall again sound the audible alarm.

A separate user action shall result in the audible alarm being suppressed for existing and new alarms. This condition shall affect only the console at which the action was initiated and an indication of the suppression shall be presented on all displays at that console so that the user is clearly informed of the condition. The suppression shall be removed by a user action.

Audible Alarm suppression can be possible as per alarm class (one by one) by operator

4.2.8 Alarm Deletion

It shall be possible to delete alarms either by page or individually. Alarm deletion shall remove the alarm message from the alarm summary display and all other representations of the alarm shall be similarly removed. The remaining alarm messages shall be re-aligned to present a continuous listing of alarms on each console page. Manual alarm deletion shall be reported as an event and indicate the associated console.

4.2.9 Historical Playback of Alarms

The SCADA/ADMS shall include an historical playback of alarms feature. The operator shall be able to select a start date and time from a disturbance file or the historical alarm and event file and have the alarms shown visually on a graphical representation of the system. The operator shall be able to move forward and backward through the disturbance file or historical alarm and event file and the corresponding alarms shall be shown on the display as they occurred in time.

4.2.10 Enhanced Alarm Management

Additional features for alarm management shall be provided. Desirable features of the enhanced alarm management function include:

5) Minimization of nuisance alarm messages (for example, repetitive alarms for the same alarm condition)
6) Combining of related alarm messages
7) Prioritization of alarm messages
8) Highlighting of the most urgent messages
9) Suppression of alarms based on related alarm conditions
10) Evaluation of related alarm conditions to determine the true alarm condition.

The Supplier's proposal shall describe each of these proposed features.

4.3 User Interface Design Standards

All displays provided by the Supplier shall have a consistent layout and consistent rules of operation (also known as a consistent "look and feel"). This requirement shall apply to displays provided from the Supplier's standard offering and displays developed specifically for the TPNODL as part of this contract. Each display shall be consistent in its use of graphics, commands, menus, colors, poke procedures and data entry such that data similar in appearance shall have a consistent meaning throughout the SCADA/ADMS.

The Supplier's proposal shall describe the User Interface Design Standards document. The User Interface Design Standards document shall include information about how the Supplier provided displays will be constructed, presented, and operated. The User Interface Design Standards document shall also have sufficient information so that the TPNODL provided displays can be built to conform to the same standards as the Supplier provided displays.

4.4 User Interaction General Features

The following features shall be included in the SCADA/ADMS user interface. Alternatives may be offered but must be functionally equivalent to the features specified.

4.4.1 Common Display Features

Each display shall have the following common features:

11) Time and date shall be displayed on each console, not necessarily on each screen or display, and shall be always visible
12) Each console shall include the alarm window described in Section 4.2.4, Alarm Window
13) Each display shall include a heading at the top of the display consisting of a title showing the unabbreviated name of the display, abbreviated display call-up name, and, on multi-page displays, a page number in the form Page N of M.
14) When a display that is larger than the screen or window is presented, a navigation aid shall appear with the display. The navigation aid shall be a condensed map of the full display. It shall be located in the lower right hand corner of the screen and pertain to the display in the active window. Highlighting within the condensed display shall indicate the portion of the display that is currently presented. The user shall be able to move and resize the navigation aid.
15) A means for the user to enter and edit free-format text notes related to any display shall be provided. The notes or an indication of the presence of notes for each display shall be presented each time the display is called. If an indication is present, the notes shall be called via a single user action or short-cut key.
16) A means for presenting software-generated user guidance and help messages on a console shall be provided. User guidance and help messages shall be unabbreviated English text.

4.4.2 Windows

Each console shall support the simultaneous presentation of at least that quantity of user-defined windows specified in, Table 3-7: User Interface Response. These windows shall be in addition to those

dedicated for the common display features (refer to Section 4.4.1, Common Display Features). The presentation of any display in any window shall be allowed. Window position and dimensions shall be independently adjustable to a screen resolution of four pixels or less. The windows shall be displayed in either overlapping or tiled fashion depending on the window definition of the user. In addition to the defined windows, user definition of windows shall be supported. Efficient techniques for switching between windows on a screen and between screens shall be provided.

4.4.3 Display Selection

Rapid, convenient, and reliable selection of displays shall be provided using the following methods:

17) Selection from a menu display
18) Cursor target selection on any menu, graphic, or tabular display
19) Selection of an alarm on an alarm summary or the alarm window followed by a display request command
20) Entry of a display name in a display select field
21) Forward and reverse paging through a series of displays. Paging forward from a display's last page of a series shall present the display's first page. Paging backward from a display's first page of a series shall present the display's last page
22) Selecting a display recall command. This shall cause the display that was on view immediately prior to the current display to be recalled
23) Selecting function keys or cursor targets dedicated to displays

The user shall be provided window selection techniques to independently direct a display to any window on any screen at the console.

4.4.4 Scaling and Translation

The user shall be able to scale (zoom) the image of a Geo-reference view or other display in a smooth fashion to any scale factor in a minimum of 64 steps. The scale factors shall allow the presentation of an entire Geo-reference view or other display on the full screen or a window. Static and dynamic data shall be displayed and updated during a scaling operation, and display text shall be scalable to be consistent with the scaled image. At defined scale factors, levels of declutter shall be invoked.

The user shall be able to select an area of a world coordinate display by cursor manipulation (“rubber-banding”) and cause the display to be redrawn with the selected area centered in the display and with the selected area magnified to best fit the full window. The window dimensions shall not be changed by such an action.

The user shall be able to translate (pan) the display image in steps no larger than 16 pixels to permit the observation of other portions of a display within a selected window. Static and dynamic data shall be displayed and updated during a translation operation. The user shall also be able to translate (pan) and zoom using keyboard arrow keys and the mouse scroll button.

4.4.5 Supervisory Control Initiation

Supervisory control functions shall be performed through dialog boxes that present commands dependent on the type of element to be controlled. As the final step of the supervisory control process, the user shall be presented with a clear description of the device to be controlled and the specific command to be issued and shall be required to confirm the command (“execute”) or terminate the command (“cancel”). The SCADA/ADMS shall issue the command only after the user confirms the operation.

The supervisory control procedure shall support the control permissive check and other control interlock requirements described in Section 6.5, Supervisory Control and the interlock requirements of Section 4.4.7, Interlocks.

4.4.6 Manual Data Entry

User entry of data shall be facilitated by simple procedures to select the point or points to be entered, enter the value or values, validate the changed, and to confirm or cancel the entry. Data entry may use full screen or single point techniques as appropriate.

The full screen entry mode shall be initiated by a single user action and shall simultaneously affect all points on the display for which data entry is possible. The SCADA/ADMS shall respond by suspending the updating of and highlighting all points on the display that may be entered. The user shall then enter the new values and request entry of the values. The SCADA/ADMS shall perform any validity checks appropriate to the affected points (refer to Section 6.3, Data Processing for telemetered, calculated, and non-telemetered data entry validity checks). If there are no invalid entries, the new values shall be written to the database. If there are invalid entries, the invalid entries shall be highlighted and the user presented with the option of correcting the entries or accepting only the valid entries.

Single-point data entry shall be initiated by selecting the point to be entered and commanding the data entry mode. Only the selected point shall be placed in the data entry mode. The remainder of the entry procedure shall be as for full-screen entry.

The manual data entry procedure shall support the interlock requirements of Section 4.4.7, Interlocks.

4.4.7 Interlocks

Although the same display may appear concurrently in multiple windows at multiple consoles, data entry for that display shall be restricted so that multiple users will not produce conflicting actions on a given value. If a display is in the full-screen data entry mode in one window, an attempt to initiate the data entry function for that display in another window shall result in rejection of the second attempt to enter the data entry mode and the second user shall be informed of the conflict along information of the console creating the conflict.

Similarly, control of a power system device or management of a single point (such as manual entry of the value or removing a point from scan) shall only be allowed from one window at one console at a time. Concurrent user action on different areas of a world coordinate map or other display and concurrent supervisory control or data management of different points on the same display shall be allowed.

In addition to the above, a display of all long standing interlocks should be available to the system administrators to review, to which they might also like to remove.

4.4.8 Inactivity Timeout

The progress of all user operations shall be monitored. If the user does not complete to a step within a multi-step operation within a pre-defined time (configurable by the system admin), the process shall reset, and the user shall be informed of the reset. A partially completed action shall be reset if the user begins another non-related sequence. This functionally can be enabled or disabled by operator.

4.4.9 User Guidance

The SCADA/ADMS shall respond to all user actions indicating whether the action was accepted, was not accepted, or is pending. For multi-step procedures, the SCADA/ADMS shall provide feedback at each step. Indications such as text messages, color changes, and blinking shall provide this feedback.

4.4.10 User Help

In addition to the detailed user documentation, a general and specific context-sensitive on-line help shall be available to the SCADA/ADMS user. Access to user help shall be available by:

24) A Help command on the window menu bar

25) A Help button in a dialog box
26) Topics from a Help menu

The Help menu shall present a list of topics available for reference. The topics shall refer to the SCADA/ADMS user documents. The ability to scroll through the topic's explanatory text shall be supported.

The Help button in a dialog box shall present the text of the SCADA/ADMS user documents where use of the dialog box is explained. The user shall be able to scroll through this text. Exit from the help facility shall return the user to the same point in the sequence for which help was requested.

As a minimum, context-sensitive help facilities shall be provided for each application software package and the database fields. The capability to easily edit or add additional help facilities in the future shall be provided.

4.4.11 Screen Saver

The SCADA/ADMS shall provide a screen saver, which shall blank or show a configurable screen saver on the monitor whenever there is no activity on the monitor for a configurable period of time. The screen saver may be turned on or off by the user. If the monitor has been blanked by the screen saver function, the display selected for that monitor shall immediately reappear if any keyboard entry or pointer movement occurs. The screen saver shall not be activated during data entry procedures.

4.4.12 ISR Data display

ISR display shall be different from other displays and shall have user friendly features such as tabs or icons for events, major disturbances, outages, pending equipment's etc. for quick report generation for a defined time period. Recently and frequently used fields for report generation and configuration shall be stored as "favourite" reports. The display shall have drop down menus for:

Data Elements (MW, MVAR, Min, Average, Max, trend, etc.) and calendar view for selection of Year, Month, week, day, date and time.

On the display, Provision for selection of format shall be made available (option for word, Excel, PDF) with Export button. On the top of the display types of reports should be displayed, e.g. daily report, weekly, Monthly Report etc.

ISR Display shall provide real time customizable report generation on data available. Examples of this are reports based on operational event carried out by operator, major disturbances, outages planned/unplanned, pending electrical equipment's, reliability indices etc.

4.5 Trending

The SCADA/ADMS shall include facilities to generate graphic trend curves for real-time and historical data. Up to twelve (12) trends shall be allowed on a single display. Selecting a point and designating a trend curve shall result in the display of a dialog box where the user can enter information on how the selected point is to be displayed:

27) Value name
28) Trend direction
29) Scaling factor
30) Offset
31) Trend number and color (for multiple trends on one display)
32) Time base values of all trends being displayed using a hairline cursor
33) Trend rate
34) Trend start time (historical data)
35) Trend period (historical data).

The color of the trend shall represent the highest priority data quality code. Quality code colors shall be consistent with those used for data display and they shall be protected, that is, they shall not be selectable for normal trending. The trend color shall change as the quality code changes.

4.6 Display Hardcopy

A means shall be provided to produce printed copies of any display on any printer. The output shall be directed to any printer of the user's choice. Color displays shall be translated for black and white printers using a mapping table (or similar) that can be changed by the user. The video hardcopy function shall not inhibit the console from normal operation after a copy is requested, even when multiple users issue simultaneous video hardcopy requests.

4.6.1 Power System Overview One-Line

The power system overview will present a schematic overview of the TPNODL power system. As a minimum, the elements of the power system shall include generators, substations, transformers, reactors, capacitors, lines, line regulators, re-closers, and circuit breakers.

Telemetered and calculated data shall be presented on the overview one-line displays. Flows such as amperes, watts, and vars shall be displayed as values with direction arrows. In addition, the symbols used to represent the elements of the power system shall reflect the presence of alarms and other abnormal operating conditions. This shall include the use of highlighting to distinguish elements that have exceeded loading limits and different colors to distinguish elements that have been de-energized. The user shall be able to navigate to substation displays by selecting poke points on the overview displays. These displays will be produced and linked to the real-time database by the supplier. The Supplier shall be responsible for linking these displays to the other data sets and layers (e.g., state estimator results, power flow data, and training simulator).

4.6.2 Substation One-Line

These displays show the interconnected elements of individual substations. The elements shall include buses, incoming and outgoing lines, transformer banks, circuit breakers, capacitor banks, and disconnects. The displays shall present telemetered and calculated data, including all alarm conditions. Highlighting and colors shall be used to distinguish the operating states of the different substation elements shall be consistent with all other one-line displays. The user shall be able to interact with the substation one-line displays to perform any associated user interactions such as data entry and supervisory control.

The user shall be able to navigate to other substation displays from poke points on transmission line segments on the one-line. The user shall also be able to call-up the associated substation tabular display from a poke point on the one-line.

These displays will be produced and linked to the real-time database by the supplier. The Supplier shall be responsible for linking these displays to the other data sets and layers (e.g., state estimator results, power flow data, training simulator).

Normal operating condition of the network will be captured in this overview one line diagram

4.6.3 Other One-Line Displays

Other one-line displays may be provided to show the power system to the operator. For example, one-line displays may be provided of major transmission and distribution circuits. The characteristics of these displays shall be the same as the Power System Overview One-Line displays (Section 4.6.1) and the Substation One-Line displays (Section 4.6.2).

These displays shall be produced and linked to the real-time database by the supplier. The Supplier shall be responsible for linking these displays to other data sets and layers (e.g., state estimator results, power flow data, and training simulator).

4.6.4 Substation Tabular

These displays list the value of telemetered and calculated data associated with each substation as well as related information such as alarm limits. The user shall be able to interact with the substation tabular displays to perform any associated user interactions such as data entry and supervisory control. The user shall be able to call-up the associated substation one-line display from a poke point located on the tabular display.

These displays shall be generated automatically by the SCADA/ADMS upon call up and shall be based on the current contents of the database. The TPNODL shall have approval over the format of these displays. Points displayed shall be all non-spare database points that are associated with the substation:

1) *For status points* – The information displayed for each point shall include:
    a. Name descriptors
    b. All data attributes
    c. Current status
    d. Normal status
    e. Quality codes and tags
    f. Unique point ids.
2) *For analog points* – Information displayed for each point shall include:
    a. Name descriptors
    b. All data attributes
    c. Current value
    d. All limit values
    e. Quality codes
    f. Unique point ids.
3) *For accumulator points* – Information displayed for each point shall include:
    a. Name descriptors
    b. All data attributes
    c. Current value
    d. Quality codes
    e. Unique point ids.
4) *For calculated points* – Information displayed for each point shall include:
    a. Name descriptors
    b. All data attributes
    c. Current value
    d. All limit values, if applicable
    e. Quality codes.

The four types of points shall be displayed separately from each other and telemetered data displayed separately from calculated data. Within each type, the order of points displayed shall be determined by device or value type, not by database or data exchange list order. For example, for status points all 33 kV breakers would be first, then all 11 kV breakers, and so forth down to lower voltage breakers and switches.

As many display pages as needed to show all points at a substation shall be provided for substations with multiple DCU/RTUS/FRTUs/, the points shall be ordered according to DCU/RTUS/FRTU. It shall be possible to perform any allowed point function from the Station Tabular page if the console is assigned to the appropriate AOR designated for the point.

These displays shall provide one-line menus for substations. The substation one-lines shall be listed by Territory and alphabetically by name within each Territory. Each entry in these lists shall allow selection of the associated one-line diagram.

4.6.5 Other Tabular Displays

These displays could contain telemetered data and calculated data. They could also be associated with either Supplier-provided application programs or TPNODL-provided application programs. The user shall be able to interact with these tabular displays to perform user interactions such as data entry, application function execution, and display call-up.

4.6.6 One-Line Menu

These displays shall provide one-line menus for substations. The substation one-lines shall be listed by Territory and alphabetically by name within each Territory. Each entry in these lists shall allow selection of the associated one-line diagram.

4.6.7 Access Control Display

This display shall allow a designated authority to control user access to the SCADA/ADMS. The display shall enable the designated authority to enter, modify, and delete user IDs and passwords and to assign console jurisdiction and operating modes.

4.6.8 Menu Directory Display

This display shall list all menu displays in alphabetical order. Each entry in the list shall have a cursor target for menu selection.

4.6.9 SCADA/ADMS Directory Display

This display shall list all SCADA/ADMS displays in alphabetical order. Each entry in the list shall have a cursor target for display selection.

4.6.10 SCADA/ADMS Configuration Monitoring and Control

These displays shall allow the System Administrators to monitor and control the SCADA/ADMS configuration. The displays shall:

1) Present all equipment status and associated equipment alarms
2) Provide menus or cursor targets for performing actions such as failover, switching local and remote devices (such as consoles, servers, and DCUs/RTUs), switching communication channels, controlling the SCADA/ADMS resource monitoring function
3) Present processor and communication channel loading and error statistics.

These displays shall graphically show the interconnected elements of the SCADA/ADMS including communication paths and Supplier-provided channel interface equipment such as modems, transceivers, and multiplexors. The data sources communicating over each path shall be shown.

4.6.11 Alarm Summary

Alarm summaries shall be provided to show power system and SCADA/ADMS alarms. When called to a screen or window, the most recent alarms shall be presented. The user shall be able to acknowledge and delete messages on the display. Flashing shall identify unacknowledged alarms. (To facilitate reading unacknowledged messages, only the time field shall flash). The alarm class (Section 4.2.1, Alarm Class and Alarm Presentation) shall determine the response of the SCADA/ADMS to acknowledge or delete actions and for annunciation of return-to-normal alarms.

The TPNODL prefers an implementation where the alarm summaries expand to display any quantity of alarms. If the capacity of the alarm summary is limited, the minimum capacity of the alarm summary

is presented in Table 3-6: Application Capacity. Otherwise, when the full complement of alarm messages will not fit on a single page, multiple pages shall be provided and a message shall appear on each page of the display, indicating there are more alarm messages on other pages. If the capacity of the alarm summaries is limited and an alarm summary display becomes full, the oldest messages shall be automatically deleted and the newest messages shall be added. It shall be possible to perform any alarm interaction from the alarm summary displays.

A single user action shall be used to call an alarm summary that presents only those alarms for the jurisdictions assigned to the console from which the display is called. All alarms in all classes shall be presented. The user shall be able to filter the alarms to present selected classes.

The SCADA/ADMS shall also include facilities to call a general alarm summary that will present all alarms in all jurisdictions. The user shall be able to filter and sort the alarms based on:

1) Jurisdiction
2) Location (substation, generating plant)
3) Class.

4.6.12 Event Summary

The event summary shall be similar to the alarm summary with the exception that all alarms and events as well as records of user actions (such as supervisory control commands, tag placement, and data management actions) shall be listed. The user shall be able to filter and sort the events based on:

1) Jurisdiction
2) Location (substation, generating plant)
3) Class.

No user interaction shall be required with this display.

4.6.13 Off-Normal Summary

This display shall list devices and values that are not in their normal state. Telemetered, calculated, and manually entered status, analog, and accumulator data points shall be included. The displays shall show the off-normal data points in the following groups:

1) Status points for which the present telemetered state is different from the normal state stored in the database
2) Analog and accumulator points that present telemetered values exceeding alarm limits.

For those points with an undefined normal state, the system shall provide a convenient mechanism for redefining their normal states. The off-normal status displays shall use dynamic coloring facilities to identify the different conditions associated with the points.

4.6.14 Off-Scan Summary

This display shall list all points that have been taken off scan. When a point is taken off scan, it should be listed on this display. When the point is returned to scan, it should be removed from this display.

4.6.15 SOE Summary

This display shall list all SOE points

4.6.16 RTU Errors

This display shall list all RTU errors.

4.6.17 Alarm Inhibit and Override Summary

This display shall list devices and data values for which the user has inhibited alarm processing and for devices and data values for which the user has overridden limits. The entries for overridden limits shall show the database (non-overridden) value of the limit as well as the overriding value. Controls to enable sorting by substation and by date and time of the entry of the inhibit or override shall be included on the display.

4.6.18 Tag Summary

This display shall list and describe all active tags for all devices. The user shall be able to place or remove a tag from this summary. Information on this display shall list each device tagged and shall include: date and time of tag placement, user who placed the tag, tag level, station identifier, device identifier, and comment field.

4.6.19 Manual Replace Summary

This display shall list all points that have been replaced by manual entries. The points shall be arranged by RTU. For each point, there shall be facilities for fast access to the display containing the point, such that the user can further modify the value or return the point to automatic data acquisition.

4.6.20 Trend Control and Summary Displays

Trend shall be a display of series of values of parameters on a time axis. Both graphical trend and tabular trends shall be supported. The attributes of the trend display shall be user configurable. The trend application shall be able to show trends for any measurement type from more than one source, at least from real-time, historical and forecast sources. It shall be possible to combine this data showing data for comparison using a shared timeline simultaneously comparing for example yesterday (historic) and today (historic, actual and forecast) as two curves on the same time axis. It should be possible to trend different types of parameters (P, Q, V, I, F etc.) with associated Scales on the same display. The user shall be able to select a trend rate different than the sampling rate.

4.6.21 Application Program Displays

The Supplier shall provide all displays associated with all specified application programs and functions. Displays that allow the user to interact with SCADA/ADMS application programs shall use a common look-and-feel approach. The information provided shall help expedite the user's interactions.

4.6.22 Trend and Bar Chart Displays

Trend displays shall show the trend curves defined by the user for selected analog values. The bar chart displays shall provide an alternative approach, one in which the trend takes the form of a series of bars, with the variables displayed in a percentage or per unit value based on a user entered full scale value.

4.6.23 Notes

From the consoles, users shall be able to assign notes that contain directly entered free-form text and graphics to displays. It shall be possible to assign notes to any display and at any location within a display. A unique icon or indicator shall be provided that will visually highlight to the user that a note is assigned to the display. The note icon shall be visible at all declutter levels during a zoom operation.

4.6.24 Communication Maintenance Displays

A set of communication and communication maintenance displays shall be provided. The TPNODL will define the layout and information content of these displays. The Supplier shall create the displays. A graphical display shall show the current status of the communication channels. Communication error counts and tabulations of all types of errors within a predefined sliding period shall also be displayed.

4.6.25 Study Displays

Study displays shall utilize the same displays as those used for display of real-time data, with different layers or overlays allowing access to both real-time and study data. It shall not be necessary to provide additional study input and output displays for any display used in the real-time system.

4.6.26 Other Displays

Specific display requirements for other SCADA/ADMS functions are described throughout this Specification. The Supplier shall be responsible for the supply of all displays necessary to support the specified functions, in addition to any other SCADA/ADMS displays required to control and monitor the SCADA/ADMS itself. The Supplier's proposal shall describe these displays.

4.6.27 Report Generation

The contractor shall be required to generate the Daily, Weekly, Monthly reports formats for SCADA/ADMS system. **The report formats shall be finalized during detailed engineering stage and minimum 100 numbers of different kind of report shall be generated however to give ease to bidders sample reports has been attached with this document as appendix-B.** The user shall be able to schedule periodic generation of reports, direct report to display, print report, and archive report using report-scheduling display. The report scheduling display shall enable entry of the following parameters, with default values provided where appropriate

a) Report name
b) Report destination (printer or archiving device)
c) Time of the system should produce the report.

The user shall be able to examine and modify the contents of reports for the current period and for previous report periods using displays. Any calculation associated with the revision of data in a report shall be performed automatically after data entry has been completed.

The report review displays shall accommodate formatted report pages up to132 characters in width and 66 lines in length and shall contain headings that correspond to the printed report headings. For reports containing more columns or rows than the display, the system shall include a means to view the entire report in a graphic format. The report view and editing displays shall function with the initially supplied reports and all future reports added by employer.

Auto emailing of reports should be available after scheduling of the reports for users.

4.7 Browser-based User Interface

The SCADA/ADMS shall provide the capability to authorized users to view a pre-defined list of displays via a browser-based user interface. The Supplier's proposal shall describe how authorized users may be verified. The Supplier's proposal shall also describe how the predefined list of displays can be managed by the TPNODL

The user interface software shall be based on state-of-the-art web-based technology to present interactive, full-graphics views of system data via LAN, corporate intranet or the internet. The same displays shall be used.

It is essential that the same web-based user interface (same navigator, same tools) be available to the operator either for local use in the dispatching center or remotely by Circle/ Sub -division offices.

The web technology shall be natively supported by the SCADA/ADMS product, which means that having the displays shown in the web browser shall not bring additional work to the maintenance engineer at display building time. Nor shall it require additional third-party software products like specific plug-ins.

The web user interface shall support and enforce all security features.

Additionally, the Supplier shall describe how the proposed SCADA/ADMS meets the following design guidelines / requirements for such a browser-based user interface:

1) Pages shall load quickly (i.e., the general display response requirements of Section 3.2.3, User Interface Response, Table 3-7: User Interface Response).
2) Displays shall have a consistent look and style. Use of colors and fonts shall be applied consistently. Control buttons, navigation aids, message windows, etc. shall have consistent appearance and location.
3) Navigation aids shall be provided to enable users to easily determine which display is being viewed and to facilitate movement around the current display and to other displays
4) Users shall be provided with positive, visual feedback when they make a selection, which remains visible until the request is completed or until they make a new selection
5) Dynamic information on the displays shall refresh at a rate configurable by the user, from 2 seconds to 1 minute.
6) Decentralized Zonal offices shall be shown their allocated complaint / outage information through this web interface along with a geographical map.

The TPNODL would prefer an implementation that is not dependent on use of a specific browser.

4.8 Geographic Maps and drawings

The SCADA/ADMS shall be able to import and store spatial data, connectivity information as well as attribute information from the Geographic Information System (GIS) required for SCADA/ADMS operations. The GIS contains the information about the feeder topology, and all devices associated with the electrical network including their features, attributes and connectivity. The SCADA/ADMS system shall provide adequate disk storage capacity capable of importing the data for entire TPNODL service territory in bulk initially and incremental updates on a periodic basis. The supplier shall explain in detail how this is accomplished, including the data validation process. The frequency of incremental update shall be a user definable parameter. Geographic maps shall display real time status of devices and measured values for all the points where such data is available in the SCADA/ADMS system. **The maps shall reflect current connectivity of the network (e.g. energized, de-energized, grounded segments etc. in distinct colors) based on the status (open, close etc., derived from the real time system or manually entered) of the devices.**

4.9 AutoCAD Interface

The SCADA/ADMS shall be able to use AutoCAD drawings output in .DXF format as input to the Supplier's display editor in order to add dynamic data to the display. In addition, the capability to import AutoCAD drawings in .DXF format and directly view static drawings in a viewport on the user's console shall be provided.

4.10 Video Images

The SCADA/ADMS shall be able to display security camera real time input, CCTV input, and any static video image associated with a point on the console monitors' viewports.

4.11 User Interface Development

4.11.1 Graphics Standards

Consoles in the computing network shall adhere to the latest recognized standards such as the X Window system for windowing and OSF/Motif for presentation, Microsoft® Windows 2012

Professional (or latest) graphic standards, or HTML (hypertext mark-up language). The graphics system supplied with the SCADA/ADMS shall execute on all consoles provided by the Supplier and on Intel-based personal computers supplied by the TPNODL that meet the Supplier's minimum requirements, using commercially available GUI software products. The TPNODL shall define a display only once, after which it shall operate on any console or PC. The TPNODL shall not have to develop multiple versions of displays for each type of console or PC.

4.11.2 Display Generation and Editing

An interactive tool shall be provided for creating the operational displays and interfaces associated with each application. With this tool, the user shall draw (rather than code) the contents of application windows, define dynamic linkages to any SCADA/ADMS data, and sensitize graphical elements to respond to user input actions. (Such sensitized elements are typically referred to as cursor targets.) The ability to link to any SCADA/ADMS data, not only real-time data, shall allow interactive graphic displays to be constructed for all applications in the SCADA/ADMS via the display building tool.

A scripting tool is also required to allow displays to be easily modified to incorporate TPNODL changes on top of any Supplier product upgrades. The scripting tool can also be used to port existing TPNODL displays and third party products into the Supplier's system.

A display editor shall be used to construct new displays and modify existing displays. The display editor shall be fully compatible with the database generation and editing function. The display editor shall be fully interactive and shall provide "What You See Is What You Get" (WYSIWYG) capabilities. The display editor shall maintain a complete audit trail of edit activity as part of software configuration management.

New displays shall be constructed beginning from a blank display, from an existing display definition, or from display templates within a library. The editor shall support the creation of libraries of standard and custom symbols or components to be created, modified, and used to facilitate the editing process. The editor shall be designed such that any future display requirements may be readily added to its functional display definition capabilities.

The display editor shall support the listing, dumping, reloading, and validating of display definitions. The list function shall provide for partial and full summaries (directories) of displays cross-referenced to their use in applications. The list function shall also produce detailed documentation of the contents of any display showing all elements. The list function shall also provide tools to find on which displays a given piece of data is referenced. Dumping and reloading of displays shall be provided for individual displays, display libraries, individual applications, or an entire application system.

The display editor shall support a variety of construction options that simplify the building and modification of displays:

1) Editing features to copy, move, delete and modify selected groups of information and to undo/redo the previous actions.
2) Building a display at any zoom level.
3) Visible and invisible snap-grids at specifiable increments with snap-to-placement of objects on the grid.
4) Various font sizes, line types, and line thickness.
5) Linking of any defined graphics symbol to any database point.
6) Pop-up menus for selection of points for linkages by default. The points shall be those in a user-defined substation for which the display is being built. The user, however, shall be able to request a menu list of all available points.

7) Ability to establish different symbol or display conventions for the same database point on the same or on different displays.
8) Definition of dynamic display linkages to any SCADA/ADMS database variable on any SCADA/ADMS display.
9) Building and modification of display icons and store them in an easily accessible library.
10) Protection of any data field on any display against user entry based on log-on identifiers.
11) Activation of displays within any application system or across all application systems by a simple procedure that causes no noticeable interruption of on-line SCADA/ADMS activity.

If a display definition is stored in multiple locations (for example, a copy in each console), a validation function shall be provided to ensure that all definitions over all consoles in both systems are consistent and up-to-date. With entry of the proper authorization code, it shall be possible to edit any display at any console. Similarly, a validation function shall be provided to ensure that displays used by more than one system are propagated to the other systems.

4.11.3 Display Elements

Displays shall be composed of display elements, primitives, symbols, and macros. Macros form an arbitrarily complex hierarchy of display elements, primitives, symbols, and other macros. Graphical macros, such as gauges (for example, thermometers and circular meters), bar charts, and X-Y plots, shall be provided to display selected data elements graphically. As a minimum, displays shall consist of the following:DisD

1) Fixed text.
2) Drawing primitives (polylines, arcs, and circles).
3) Bit-mapped images.
4) Data references.
5) Formats.
6) Formatted data items.
7) Sensitized regions.
8) Conditionality.
9) Graphic attribute definitions.
10) Custom polygons.
11) Macros.

Drawing primitives, text, and formats shall refer to common graphic attribute definitions for color, line width, fill pattern, et al. Text shall also refer to fonts.

4.11.3.1 Data Presentation

The user, during the interactive display definition process, shall logically identify individual dynamic data fields and data arrays in defined displays. All linkages to the database necessary for ensuring the proper retrieval and output of the dynamic data or data arrays during actual use of the display shall be automatically established according to this identification. The linkages between the displays and the database shall be by logical identification (for example, point name or point identifier) and shall be designed such that any database modifications (even those resulting in insertions into tables/files and changes in table/file sizes) do not require redefinition of existing displays.

Data fields shall reference all supported formats. These formats shall include programming language-equivalent data-to-ASCII conversions, plus all general OSF/Motif style elements (for example, radio boxes, menus, and sliders) and a special set of formats appropriate to the SCADA/ADMS context. Formats shall be conveniently definable and modifiable.

Data items shall be defined as locally resident (that is, only for use as parameters in commands), or as RDBMS or real-time data set resident. In the latter two cases, multiple fields in a record shall be grouped as a record reference, so that the record identity need only be entered once. Data items shall be specified as being enterable. Data verification routines shall be specifiable to execute on data entry, before data is actually transacted to its source database.

It shall be possible to present any item in the database on any display. Database items shall be displayable anywhere on the screen, excluding dedicated screen areas such as the display heading. There shall be no limitation on the number of data items presented on any display, up to the physical limitations of the viewport or screen. Similarly, screen locations for cursor targets shall be unrestricted.

Database items shall be presented in the following formats as appropriate:

1) Numerical text that presents analog and accumulator values; the format definition of the text shall include the number of characters, number of decimal places, and the use of sign or flow direction arrows.
2) Symbols, including alphanumeric text strings for a single item, based upon the item's state for all defined states.
3) Symbols, including alphanumeric text strings for multi-state items, based on flag fields where each flag represents a condition or a state and where multiple states may be true at any time; for example, data quality flag fields for both telemetry failure and alarm inhibit may be simultaneously set for an item.
4) X-Y and X-t point relationships with vectors connecting the points; for example trending and Kiviat plots.
5) Filled polygons (x or y axis inside the polygon showing the percent of full scale of the variable); for example, bar charts.
6) Filled arcs; for example, pie charts or simulations of meter movements.
7) Colors, textures, and blink conditions based upon state or value changes or a change of data quality; for example, alarm limits.
8) Combinations of the actions listed above; for example, change a bar chart color when the data value exceeds the limit.

4.11.3.2 Quality Code and Tag Presentation

The quality code reflects the condition of the data on the display (Refer to Section 6.3.1, Data Quality). When more than one condition applies to the data, the highest priority condition, as determined by a TPNODL defined priority sequence shall be displayed. The TPNODL shall determine the presentation of each quality code. Color, appended symbols, and other display features may be used. It shall be possible to construct multiple representations for a data item and its quality codes such that the presentation of data may be optimized for a particular display.

A separate indicator shall be used to reflect the tag status of a database point. Tags are defined in Section 6.4, Tagging.

4.11.3.3 User Interaction

Cursor targets shall send a message to an application or issue a command when events (such as a user action) occur. Such messages and commands shall convey both fixed and contextual data. As a minimum, supported contextual information shall include:

1) Record identities linked to the cursor target.
2) Cursor position on the screen and within the display.
3) Database, application, and application system associated with the display.

4) List position (for lists).
5) Console identification and any associated parameters, such as permissions.

Conditional attribute values shall be attached to any display element, primitive, symbol, macro, or macro sub-element. Conditional attributes shall be able to make a particular display item valid or invalid depending on whether the referenced data or display context is in a specified state. Multiple cases shall be supported so that, for example, a data item may appear in one color if it is in range, another color if it is below range, and a third color if it is above range. Other examples of some of the attributes of power system entities that can be color-coded are states (in service/out of service/manually overridden, etc.) and values (real time, state estimated, unavailable, good, bad, manually overridden, etc.).

4.11.3.4 Display Layers

Geo-reference coordinate displays shall be constructed in layers. Each layer shall be a self-contained Geo-reference co-ordinate space onto which display elements, including data, shall be placed. Layers shall be displayed in a defined order, with higher-order layers overlaying lower-order layers. Where displayable elements of a multiple layers occupy the same space, the higher-order layer elements shall be displayed. Otherwise, the elements of the lower-order layers shall be visible.

The selective presentation of layers – "decluttering" – shall be controlled by the scale (zoom or magnification) level and by user selection. Each layer shall be visible over a range of scale level set defined as the display is built. As the user scales the display, layers shall be presented or removed from presentation. It shall also be possible for the user to override the automatic selection of layers and to select those layers presented at any time.

4.11.3.5 Menus

The SCADA/ADMS shall support the employment of "pop-up" and "pull-down" menus for user interaction. Those menus supplied with the SCADA/ADMS shall be extensible by the TPNODL to incorporate new features and applications developed by the TPNODL It shall be possible to add additional items to existing menus, to define entirely new menus, and to link the call-up of new menus to specific user actions. The menu items, when selected, shall pass messages to applications including fixed and contextual data as described in Section 4.11.3.3, User Interaction.

4.11.3.6 Display Macros

The user shall be able to create display macros to aid in the display construction process. Display macros shall be created with an editor designed for this purpose. It shall be convenient to switch back and forth between macro editing and display editing. The editor shall support an arbitrary number of sharable macro libraries. Changes made to macros shall automatically be reflected in all displays that use the macro once the macro is installed in a system. A display macro may be defined to reserve a region of display for a connection with custom application code.

Display macros shall be placed individually. The user shall be prompted for necessary additional information as required by the macro. For instance, if the macro references a particular field of a particular record type, the macro placement shall prompt the user to identify which record is being referenced.

For all record references, it shall be possible to supply the required reference by selecting it with the cursor from any list or from another macro placement showing the record in any window at the console. A generalized copy/paste facility for data references is preferred.

Interactive user interface Display			
S. No.	**Description**	**Frequency**	**Remark**
1	Availability of analog trend of Switching device/power trf /Distribution trf for half hourly /hourly on UI display while moving crusher on it.	As & when	user should have authority to enable or disabled this displays
2	Direct e-mail/SMS facility for operator/UI desk for tripping or any kind of information	As & when	user should have authority to enable or disabled and selective choice
3	Pending/De-energies detail can be traced through PTW no.	daily/shift-wise	
4	Query/search at user display shall have optimal search engine feature where SCADA/ADMS system shall guide for any equipment, text, TA, Alarm etc. to operator.	As & when	
5	Real time Availability of report based on the history of the equipment faults and analog value trend for any equipment, TA etc. to operator.	As & when	

Table 4-1

5. Hardware Requirements

This section describes the technical requirements of all the hardware envisaged in the BOQ for the SCADA/ADMS system. The minimum hardware specifications (RAM, Aux. Memory, interfaces etc.) for all equipment are specified in the Table A (end part of this document) and the bidder has to submit the details of the supplied hardware along with the bid as per format attached in Table A. The Bidder shall assess the adequacy of hardware specified in the BOQ & if any additional hardware or higher end hardware configurations are required to meet all the requirements of the technical specifications, the same shall be included in the offer. The Bidder's proposal shall include necessary calculations to clearly establish that the proposed hardware meets the functional and performance requirements of the technical specification.

The bidders are encouraged to optimize the requirement of hardware for servers and processors where one or more applications can be combined or distributed in any combination with adequate redundancy without impacting the performance as described in section 3. However certain applications are to be hosted on independent hardware. All hardware shall be manufactured, fabricated, assembled, finished, and documented with workmanship of the highest production quality and shall conform to all applicable quality control standards of the original manufacturer and the Supplier. All hardware components shall be new and suitable for the purposes specified.

5.1 General Requirement for Hardware

Delivered hardware shall include all engineering changes and field changes announced by the manufacturer since it was produced. The hardware shall be audited for change orders immediately prior to the factory performance test (to be supplied) and unimplemented change orders shall be installed at this time. As part of the field performance test, the Supplier shall have all hardware inspected and certified as acceptable for service under a maintenance contract by the local service offices representing the equipment manufacturers.

All hardware features described in the Proposal shall be fully supported by the SCADA/ADMS applications. The hardware shall be CE/FCC or equivalent international standard compliance.

All hardware shall include self-diagnostic features. On restoration of power after interruption they shall resume operation. All servers, workstations and network equipment's (Switches, routers, firewall etc.) shall be compatible for remote monitoring using secure SNMP Ver. 3.0. All hardware shall support both IPv6 and IPv4 simultaneously.

The configuration of the SCADA/ADMS shall comprise of distributed computing environment with open systems architecture. The system architecture should be designed in such a manner that it can adapt to hardware/software additions, whether supplied by the original supplier of the SCADA/ADMS or obtained from third party vendor. Additional hardware/software may be required for capacity expansion or for up-gradation, the changes made should not affect the existing SCADA/ADMS components or its operation.

To be recognized as a true open computer system, all internal communications among the SCADA/ADMS Servers and all external communications between the SCADA/ADMS and other computer systems shall be based on widely accepted and published international or industry standards which are appropriate and relevant to the open systems concept or should have a field proven acceptance among utilities. This applies to the operating system, database management system, and display management system, as well as to APIs providing standardized interfacing between System software and application software.

The contractor shall ensure that at the time of final approval of hardware configuration and BOQ, all the hardware is as per the current industry standard models and that the equipment manufacturer has not established a date for termination of its production. Any hardware changes, except version upgrade in same series, proposed after contract agreement shall be subject to the following:-

a) Such changes/updates shall be proposed and approval shall be obtained from TPNODL along with the approval of Drawings/documents.

b) The proposed equipment shall be equivalent or with better features than the equipment included in the Contract.

c) Complete justification along with a comparative statement showing the original and the proposed hardware features/parameters including brochures shall be submitted to the TPNODL for review and approval.

d) Changes/updates proposed will be at no additional cost to TPNODL

e) The porting of software shall be at no additional cost in case of replacement of hardware during the warranty period by bidder.

In this technical specification all hardware has been broadly classified as "Server" and "Peripheral device". The term "server" (also referred as "processor") is defined as any general-purpose computing facility used for hosting application functions as defined in the specification. The servers typically serve as the source of data, displays and reports. The term "Peripheral Device" is used for all equipment other than servers. Peripheral device includes Workstation consoles, WAN router, LAN, printer, Time & Frequency system, External tape Auto Loader, External Cartridge Magnetic tape drive, VPS, Firewalls etc.

The redundant hardware such as Servers, Firewall etc. shall work in hot standby manner. All the servers and networking equipment (Firewalls, LAN switches etc.) shall be mounted in rack panel.

5.2 Servers

The Servers shall have provision for expansion of the Processor, auxiliary memory and Main memory (RAM).Servers shall be mounted in a rack and a management console should be provided for centrally accessing all the servers implemented at that particular location. However the grouping of servers in

a rack shall be such that the primary and backup servers for a system function are located in different racks.

Proposed servers should allow hardware assisted virtualization and processor multithreading.

All servers shall have dual redundant power supplies, capable to operate on single power supply module. And there shall not be any interruptions in the operation of servers when there is a failover between the two AC Power Supply of the server.

The OEM of servers shall be complying of TPC/SPECMARK ratings and this can be broadly classified into the following categories:

A) Application server
   - SCADA
   - ADMS
   - ISR

B) Communication server
   - Front –End server (Communication Front End) FEP(CFE)
   - ICCP /Inter control center communication server
   - NMS
   - Web server

C) Training & development system server
   - DTS
   - Developmental server

The minimum hardware configuration of the servers shall be as per **Table A**

5.2.1 Application Servers

Redundant SCADA/ADMS servers shall house SCADA/ADMS application. The SCADA/ADMS shall include historical data storage configured to store historical data at the storage rates, for the required period of time, and for the Ultimate historical database sizes.

Redundant Web Server shall host Web Applications for SCADA/ADMS

Redundant NMS server shall be provided to host NMS application.

5.2.2 Communication Servers:

5.2.2.1 FEP (CFE) Server

The redundant FEP server shall be a functional unit that offloads the task of communication & preprocessing between RTUs/FRTUS/FPIs & SCADA/ADMS servers. All RTUs/FRTUs/FPIs shall be connected to CFE through IEC 60870-5-104 link. For any existing RTUs/FRTU/FPI that to be integrated, interface must be available to use existing protocols. Free slots shall be made available inside the FEP server, so as additional communication boards can be plugged-in to meet the network future expansion. Each channel shall be assigned a different protocol and the front-end shall be able to manage several protocols in parallel.

The redundancy of front-end servers shall allow handling of RTUs/FRTUs/FPIs connected either through single channel or redundant channels. In both cases, one FEP server shall be able to take control of all RTUs/FRTUs/FPIs channels. In order to meet network's expansion behind the full capacity of a pair of FE servers, it shall be possible to connect additional FE servers' pairs to the LANs. Each communication line shall be able to support its own communication protocol. The CFE shall comply VPN based security for connecting with IEC 60870-5-104 node on public networks. Further the nodes and CFE shall be self-certified by manufacturers as NERC/CIP compliant to comply with future smart grid requirements.

All FEPs shall not have open ports other than needed for protocol traffic / SCADA traffic, and shall have an audit trace of all login attempts / connection attempts. This FEP shall exchange data through secured VPN and encryption of protocol traffic whether it is a is public network or a dedicated one. The equipment should take control command from designated Master IP address only and no other IP.

The Communication Servers shall be able to process time – stamped data and can be directly connected to GPS device for time synchronization. FEP servers shall have a suitable interface for time synchronization from the GPS based time synchronizing system. This interface shall have the time synchronization accuracy of 1millisecond. The FEP server shall further synchronize the time of the RTUs on IEC 60870-5-104 protocols.

FEP server shall have feature to show the online process of raw data from the RTUs/DCUs as a protocol test analyzer.

5.2.2.2 ICCP Server /inter control center communication server

The redundant ICCP/inter control center protocol communication servers shall be installed at SCADA/ADMS control center . SCADA/ADMS control center shall also exchange data using ICCP with State Load Dispatch Centre (SLDC) of the state and other control center of different utilities .Data exchange shall also allow other information to be transferred report by exception but also configurable periodically, or on demand

5.2.2.3 Network Management System (NMS) servers

Redundant NMS servers shall be used for configuration management, fault detection & performance monitoring of servers, workstations, routers & LAN equipment etc.

Proposed devices such as Servers, network equipment etc. should support functioning of NMS application.

5.2.2.4 Web servers:

Redundant Web servers shall be provided. The third party interface will be developed from this server. Web server shall support JSON REST API, MQTT inputs for IOT

5.2.3 Training & development System Server

5.2.3.1 DTS server

A non - redundant server to host DTS applications shall be provided to impart the training.

5.2.3.2 Development server

A non- redundant server to host Developmental applications shall be provided

5.3 Archive Storage

Archive storage devices shall be used for backup of the SCADA/ADMS data and software and archival storage for the Information Storage and Retrieval functions. TPNODL prefers an archive storage solution that is an integral part of a hierarchical storage management system.

LTO (Linear Tape-Open) media storage shall be provided for general back-up purposes and short-term archiving. The LTO drive shall have sufficient capacity for a complete backup of the SCADA/ADMS data and software (including all source code) without requiring user action to replace filled recording media. A media changer that accepts industry-standard media handling commands is preferred. External 4mm DAT, 160/320 GB Cartridge magnetic tape drive shall be supplied for taking Backups and performing restores of the Hard disks of any computer. The external tape drive shall have hot-pluggable port for connection to any computer. Bidder may also provide equivalent Magneto Optical (MO) – disk in place for DAT drive (Cartridge magnetic tape drive)

A SAN (Storage Area Network) based storage shall be provided which shall be sized adequately and shall be used for online storage and all online data backup. It shall be possible to take and store image backup of all servers & workstations on it. The SAN shall facilitate TPNODL Application Data Storage also.

5.4 Local and Wide Area Networks

The Supplier is responsible for implementing the SCADA/ADMS LAN and the connections to the Enterprise WAN and the backup Control Center WAN (refer to Section 5.4.2).

5.4.1 SCADA/ADMS Network

Servers, consoles and devices are connected to each other on a local area network (LAN), which allows sharing of resources without requiring any physical disconnections & reconnections of communication cable. Dual LAN shall be formed for complete SCADA/ADMS system. LAN shall have the following characteristics:

- Shall conform to the or IEEE 802 series standards.
- Shall preclude LAN failure if a server, device, or their LAN interface fails.
- Shall allow reconfiguration of the LAN and the attached devices without disrupting operations
- Shall be either controlled LAN such as Token passing or uncontrolled LAN such as CSMA/CD
- Shall have minimum of forty eight (48) ports of 1GBPS per LAN switch for SCADA/ADMS LAN & twenty four(24)ports be considered for DTS & development system & DR system each,)

5.4.2 Control Center WAN

The Control Center WAN will be used to connect the master control center (MCC) to Backup control center (BCC) and vice versa for data replication. The TPNODL are responsible for the supply of the CC WAN. The Supplier shall be responsible for the connections from the SCADA/ADMS to the CC WAN.

5.4.3 Enterprise WAN

The SCADA/ADMS shall interface to the TPNODL Enterprise LAN at both the Master Control Center and the Backup Control Center. The Enterprise WAN supports communications at LAN data rates (10 and 100 Mbps or 1000Mbps) within the Master Control Center and Backup Control Center and T-1 data rates outside the Control Center. External communications are carried over leased Line of MPLS or TPNODL -owned channels. The SCADA/ADMS shall connect to the Enterprise WAN via a MPLS Ethernet interface.

5.5 Time and Frequency Facility

A time and frequency facility to determine Universal Coordinated Time (UTC), power system time, time deviation, power system frequency, and power system frequency deviation shall be provided. UTC shall be obtained from the Global Positioning System (GPS) satellite constellation. The time receiver shall include propagation delay compensation to provide an overall accuracy of ±1.5 ms and shall also include an offset to permit correction to local time.

Upon loss of the time signal, the time and frequency facility shall revert to an internal time base. The internal time base shall have a stability of 1 ms per hour or better. The time shall return to within ±1.5 ms of UTC within five minutes of reacquisition of signal.

The local frequency input shall be separate from the time and frequency facility's power input. The TPNODL will supply 220 Vac local frequencies input.

The time and frequency facility shall include digital displays for:

1) UTC time and date in the format DD:HH:MM:SS (the hour display shall be in 00 to 23 hour format)
2) Time deviation in the format ±xx.xx seconds

3) Power system frequency in the format xx.xxx Hz
4) Frequency deviation in the format ±x.xxx Hz.

The time and frequency facility shall include a digital display of local time suitable for mounting on the wall. The display shall be in 24-hour time, showing time in HH:MM:SS format. Each digit shall be at least 5 cm (2 inches) in height, and shall be bright enough to be read at a distance of 15 meters (50 feet) under ambient room lighting levels of 50 lumens (75 foot-candles).

5.6 User Interface

The user interface shall include all hardware necessary to facilitate optimum user communication with the SCADA/ADMS and to efficient operational control and monitoring of the power system.

5.6.1 Consoles

A console consists of the following equipment:

- Two or more LCD monitors.
- One alphanumeric keyboard.
- One audible alarm.
- One cursor control device.
- A workstation.

5.6.1.1 Monitors

Each monitor shall have the following characteristics; however, TPNODL expects to receive monitors that conform to the latest technology.

- The TFT monitor shall have flat panel color screen.

S. No.	Specification	For 24”monitor
1	Diagonal Viewable size	24”
2	Viewing angle	Sufficiently wide horizontal & vertical viewing angles
3	Dot Pitch	0.28 mm
4	Resolution	1920x1080 minimum
5	Color support	16 million
6	Refresh rate	Minimum 75Hz
7	On screen control	Yes
8	Anti-glare & anti-static	Yes
9	Tilt , Swivel	Yes
10	Aspect ratio	16:9

5.6.1.2 Workstations

The operator Workstation console shall be used as a Man Machine Interface (MMI) by despatcher for interacting with all SCADA/ADMS system. Operator Workstation consoles shall also be used as development console to take up developmental/maintenance activities such as generation/up-gradation of database, displays etc. & to impart training through DTS workstation consoles. Each workstation shall consist of two/three monitors & single keyboard and a cursor positioning device/mouse.

Workstation consoles for development system shall also be available with single TFT monitor Operator

Workstation consists of a console driving single/ dual monitors as defined in the BOQ.

The user shall be able to switch the keyboard and cursor-positioning device as a unit between both monitors of console.

5.6.1.3 Keyboard and Cursor Control

One keyboard shall be provided at each console. The keyboard shall include an alphanumeric keyboard, numeric keyboard, four-key cursor control, and twelve function keys.

The cursor control device shall be a mouse. One device shall be provided at each console. The device shall facilitate movement of the displayed cursor in any direction and at varying speeds without the use of function keyboard controls.

The keyboard and cursor control device shall be shared among all monitors at each console. The cursor control device shall move across all monitors without switching by the user. Keyboard output shall be directed to the active viewport (as determined by the user interface techniques).

5.6.1.4 Audible Alarm

Each console shall be equipped with an audible alarm tone generator that is capable of producing a minimum of four (4) different distinct sounds. Tone volume shall be adjustable by the user from inaudible (off) to full maximum output (90 dbA minimum) at one meter (36 inches) from the console.

5.7 Printers

As mention in this document

5.8 Video Projection System

The contractor shall provide a video projection system based on modular DLP (Digital Light Processing) based high resolution LED based rear projection technology. The VPS will be used to project displays of SCADA/ADMS system independently of workstation console monitors (is this dependency required?). All the operations envisaged from workstation console (dispatcher) shall be possible from the VPS also. The VPS shall also be able to display Video signals (CCTV/DTH) and other Laptop Computer Feeds.

The VPS shall enable users to display inputs from multiple sources/applications simultaneously in freely resizable and repositionable windows on entire display area to enable effective collaboration and faster decision making.

The Contractor shall supply all necessary hardware and software, including modesty panel, multi-screen drivers, adapters and memory to seamlessly integrate the video projection system with the user interface requirements described in the specification.

The video projection systems shall be rear projection systems and shall be complete with all projection modules, supporting structures, cooling system and cabling. Design & installation of the video projection systems shall be coordinated with the Employer during project implementation.

The VPS controller shall have SNTP clients for synchronizing its time with the SCADA/ADMS system. A panel shall be supplied for installation of VPS Controller as well as Time and Frequency Display System.

5.8.1 VPS Module

The requirements for each modular VPS wall are as follows:

- The VPS wall shall be a seamless rectangular array wall, formed using modules in curved arrangement upto 15 degree. The screen shall not contain any holes, or screws in the active viewing area.
- The screens shall be capable of displaying full resolution of the source.

- The configuration of the VPS wall (no. of cubes and size of each cube) is defined in the Bill of Quantity. The height of VPS above the ground level shall be decided during detailed engineering based on the layout of the control room and available clear height.
- The VPS wall should be rugged in nature and shall be designed for 24X7 operational environments. Necessary cooling arrangement for VPS shall be provided with the VPS. The air-conditioned environment in the Control room shall be provided by the Owner/Employer.
- The VPS shall be designed to prevent dust ingress.

5.8.2 VPS wall Management Software

- The VPS wall Management Software shall have the following features:
- The management software shall be able to pre configure various display layouts (arrangement of different windows) and access them at any time with a simple mouse click. The window can be of different size and could contain display from different applications/sources.
- The management software shall enable the users to see the desktop of the VPS wall remotely on any Windows based PC connected with the Display Controller over the Ethernet and change the size and position of the various windows being shown.
- The management software shall enable various operators to access the display wall from local keyboard and mouse of their Windows workstation connected with the VPS Controller over the LAN.
- The management software shall be able to push the screen content of a Windows PC / workstation to be shown on the Display wall in scalable and moveable windows in real time environment. The Windows PC/workstation shall be connected to the local Display Controller over LAN.
- The Wall Management software shall allow display of video/data windows inside other graphic windows and it should be possible to configure the video/data windows to always remain on top while the operator works on the windows below.
- The wall management software shall support open APIs to enable system integrators to integrate it with their Software. These APIs shall be provided for from the SCADA/ADMS system.

5.8.3 VPS diagnostics and maintenance

The Diagnostic software shall perform health monitoring that allows timely detection of faults and provide at least the following:

- Cube health
- LED age, expected life left
- Monitoring of critical Cooling and cooling components
- Selected inputs and presence of sources on either input

The VPS maintenance Software shall allow commands on wall level or cube level or a selection of cubes for at least the following:

- Switching the entire display wall or display cube or a selection of cubes ON or OFF.
- Provide manual adjustments to keep the wall picture uniform over time. The auto adjusting of color and brightness shall not require downtime or image loss at any time.
- Changing the active input (of the two present DVI inputs).
- Fine tune color of each cube
- The VPS must allow easy removal of the components for maintenance.

5.9 Other Peripheral Devices

The Supplier shall supply any other peripheral devices or equipment normally provided for operation, software support, and maintenance of the SCADA/ADMS.

5.10 Operating and Construction Requirements

All SCADA/ADMS equipment shall operate and be constructed in accordance with the following requirements.

5.10.1 Power Distribution and Protection

The TPNODL will provide single-phase 240 Vac power for all SCADA/ADMS equipment. Input voltage will vary ±10% and frequency will vary ±0.5% from nominal. Power will normally be supplied from an uninterruptible, conditioned source but may at times be supplied directly from the utility lines.

The TPNODL will supply a single input power circuit to each enclosure as required. Each circuit will include a circuit breaker typed and sized in accordance with the Supplier's recommendation. The TPNODL will supply all power cabling to the enclosures. Power connections between the enclosures and the input cable shall be dead-front connectors located within the enclosures. The Supplier shall supply a mating connector half for each power input.

The Supplier shall distribute power within the system enclosures, consoles, peripherals, and other components of the system. The Supplier shall supply all fusing, circuit breakers, switches, and surge protection necessary to protect the hardware, excluding only the power input circuit breakers to be provided by the TPNODL

5.10.2 Environment

Equipment located in the computer room shall operate over an ambient temperature range of 12 to 48 °C , with a maximum rate of change of 8 °C per hour. Relative humidity will range from 40% to 90% non-condensing.

Equipment located outside of the computer room shall operate over an ambient temperature range 0 to 50 °C, with a maximum rate of change of 12 °C per hour. Relative humidity will range from 30 to 95% non-condensing.

5.10.3 Equipment Noise

The noise generated by the equipment in any enclosure, including desktop equipment, located in the computer room shall not exceed 60 dbA 1 meter (3 feet) from the enclosure. The noise generated by the equipment in any enclosure, including desktop equipment, located outside the computer room shall not exceed 50 dbA 1 meter (3 feet) from the enclosure. Sound-deadening enclosures shall be provided where necessary to meet these requirements.

5.10.4 Assembly and Component Identification

Each assembly in the system, to the level of printed circuit cards, shall be clearly marked with the manufacturer's part number, serial number, and the revision level. Changes to assemblies shall be indicated by an unambiguous change to the marked revision level. All printed circuit card cages and all slots within the cages shall be clearly labeled. Printed circuit cards shall be keyed for proper insertion orientation.

5.10.5 Panels

In case the equipment’s are mounted in panel type of enclosures, then such enclosures shall be finished inside and out. All cabinet metal shall be thoroughly cleaned and sanded to obtain a clean, smooth finish. All surfaces shall be treated to resist rust and to form a bond between the metal and the paint.

Moving assemblies within the enclosure, such as swing frames or extension slides, shall be designed such that full movement of the assembly is possible without bending or distortion of the enclosure or the moving assembly. Enclosures shall not require fastening to the floor to preclude tipping of the enclosure when the moving assembly is extended. No cables shall be visible, all cables shall be properly clamped, and all entries shall be properly sealed to prevent access by rodents.

Cooling air shall be drawn from the conditioned air within the room. Ducted or directed cooling air to the enclosures will not be supplied by Employer.

All wiring shall use copper conductors. Conductors in multi core cables shall be individually colour coded.

Wiring within the enclosures shall be neatly arranged and securely fastened to the enclosure by non-conductive fasteners. Wiring between all stationary and moveable components, such as wiring across hinges or to components mounted on extension slides, shall allow for full movement of the component without binding or chafing of the wire.

All materials used in the enclosures including cable insulation or sheathing, wire troughs, terminal blocks, and enclosure trim shall be made of flame retardant material and shall not produce toxic gasses under fire conditions.

The finish colours of all enclosures/panels shall be finalized during detailed engineering.

5.10.6 Enclosure Grounding

A safety ground in accordance with the National Electrical code shall be provided within each enclosure and shall connect to the ground (green) wire of the ac power input. Enclosure grounding shall be subject to the TPNOLDL's approval.

5.10.7 Seismic Standards

All equipment must conform to the latest uniform building code earthquake design standard. The design shall be for the current zone rating or zone four (4) as a minimum. No testing is required.

5.10.8 Consumables

The Contractor shall supply, at its own expense, all consumables required for use during all phases of the project through completion of the system availability test. The consumable items shall include as minimum:

- Magnetic cartridges (DAT)/ MO disks
- Printer paper
- Printer toner, ink. Ribbons and cartridges
- Special cleaning materials
- CDs/DVDs

5.11 Table A

1. Servers

SCADA, ADMS, DTS, ISR, NMS, DTS, ICCP, CFE, Development server, Web

(Please fill for each server as per BOQ)

S. No.	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1	Processor	2 x 3.2GHz 16core processor or more (should allow SMT and Processor partition capabilities) The servers shall be enterprise level SMP RISC / Itanium / x-86 -64 based processor based systems. The offered systems should be high end Data Center class servers with redundancy / N+1 features built in at every level like disk, memory, power supplies, cooling etc.	
2	Operating System	Latest version of OEM operating system shall be provided for each server, with required number of user license on each server	
3	Specint & specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
4	L3 cache	20MB Minimum	
5	Memory	Minimum 128 GB of ECC DDR4 Memory and scalable up to 512 GB memory(Memory slots free for expansion)	
6	Hard Disk Drives	SATA 1 TB	
7	Integrated SAS/RAID Controller	Integrated hardware RAID controller and should support hardware RAID 0, 1,5, 6, 10 Offered controller should have 1GB battery backed cache.	
8	Optical Drive	Server should be configured with single DVD-RW drive/ blu-ray R/W drive	
9	Gigabit Ethernet Ports	Server should be configured with 4*1Gigabit Ethernet ports	
10	Storage Connectivity	Server should be configured with two dual port 8Gbps Fiber Channel adapter to connect to external storage.	
11	USB ports	For connecting i/o devices	
12	Additional port	Server should support 2 Number of 10G Fiber Ethernet Ports with SFP	
13	Redundant Power Supply	Server should be configured with Dual redundant power supplies with 80 PLUS Platinum certification	
14	Failure Alerting Mechanism	The server should be able to alert impending failures on server component to administrator in order to avoid any downtime on the server due to actual failure	
15	Management Console	Should support integrated management with remote presence, Server should be supplied with OEM Server Management software/hardware and required ports	
16	Warranty	Onsite Warranty 24*7 response time	
17	RAS feature	Should have RAS features such as Hot swappable disks, Hot pluggable/replaceable PCI Controllers, Power Supplies, Cooling fans etc.	

2. Workstation consoles

S. No.	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
2	RAM	8 GB minimum, expandable upto 32GB	
3	Processor speed	3.6 GHz each processor, 4Core, 8MB L3 Cache	
4	Internal Auxiliary memory	500GB minimum, expandable upto 1TB	
5	Speakers	Two internal speakers	
6	Interfaces	1 GB dual Ethernet ports	
		Min 4 USB 3.0 Ports	
		Port for cartridge magnetic tape drive	
		Graphic adapter cards(HDMI/DVI/Display Port)	
7	User interface	Three/Two(as per BOQ) 24" wide screen (16:9 aspect ratio), HD Resolution (1920x1080) LED monitors, keyboard & optical mouse	
8	Mounting	Desktop mounting	
9	Dual AC Power Supply (in Watts)		
10	Heat Load		

3. TFT Color Monitors

Monitor for Work Stations:

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Diagonal Viewable size	24"	
2	Color support	16.7 million	
3	On screen control	Required	
4	Anti-glare & anti-static	Yes	
5	Tilt , Swivel	Yes	
6	Aspect ratio	16:9	

4. Video Projection System (VPS) / Tower type Video Wall

S. No.	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
1	Manufacturer		
2	Model No.		
3	Display technology (DLP)	Laser Based Projection/LED	
4	Each VPS module size	70" Diagonal	
5	Aspect ratio	16:9 ratio	
6	Colours	16.7 million	
7	VPS projector resolution	Minimum 1920x1080	
8	Inter modular gap	< 1.0 mm	
9	Screen border	0 mm (No border)	

S. No.	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
10	Horizontal & Vertical viewing angle	+1600 (approx)	
11	Horizontal & Vertical Half gain angle	+300 with tolerance of +50	
12	Overall brightness of each module	Minimum 2400 ANSI Lumens	
13	Luminance measured at the screen	Minimum 300 candelas/sq.m	
14	Median life	Minimum 100,000 Hours	
15	Centre to corner uniform brightness	> 90%	
16	Brightness adjustable through software	Yes	
17	Contrast ratio	1800 : 1 ratio	
18	Operating temperature range	16 – 300 C	
19	Operating Relative Humidity	20-80% non-condensing	

VPS Controller Feature

S. No.	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
1	Specint &Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
2	RAM	8 GB expandable to 32GB	
3	Internal Auxiliary Memory	320GB	
4	Optical Drive	DVD+R	
5	User Interface	Keyboard & Optical Mouse with 15 meter extension cable	
6	Interface with VPS	Audio video signal input module with 2 video, 2 audio & 2 RGB inputs each.	
7	Types of video signal to be supported by VPS Controller	PAL	
		SECAM	
		NTSC	
		HDTV 720p, 1080i, 1080p (Component)	
		RGB Analog up to 1920x1200 (up to 165 MHz pixel clock)	
		DVI up to 1920x1200 (up to 165 MHz pixel clock).	
8	Time synchronization	SNTP	
9	Dual AC Power Supply (in Watts)		
10	Heat Load		

5. GPS based time facility

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the

			Contractor
1	Manufacturer		
2	Model No.		
3	Time stability of internal time base	Minimum 2ppm	
4	Propagation delay compensation	Yes	
5	Include an offset to permit correction to local time	Yes	
6	Reverting to internal time base upon loss of signal from UTC source	Yes	
7	Resynchronization Delay	Not more than 5 minutes.	
8	Accuracy of resynchronization	< 1.5 Micro Sec	
9	Interfaces	Ethernet ports - 2 IRIG-B port - 2	
10	Power Supply (in Watts)		
11	Heat Load		

6. Digital Displays for GPS Based Time facility

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Manufacturer		
2	Model No.		
3	Functions	For viewing UTC day of the year and time and frequency	
4	Day display format	XXX (MON through SUN)	
5	Time Display format	24 Hours, HH:MM:SS, where hour display will be from 00 to 23 hours format.	
6	Date format	MM: DD: YY	
7	Frequency display format	XX.XX Hz	
8	Display digit requirements	Display Digit height >7.5cm	
9	Mounting of displays	Wall/panel mounting	
10	SCADA Interfaces	Frequency	
11	Power Supply (in Watts)		
12	Heat Load		

7. LAN Switch

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Manufacturer		
2	Model No.		
3	Functions	For connecting all servers & peripheral devices on Local Area Network (LAN).	
4	Conform to standards	ISO8802 or IEEE 802 Series Standards	
5	Switching capability	Layer-3 switching & VLAN	
6	Interface ports	** Minimum 48- 1GBps Ethernet ports	

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
7	Cable standard	Cat 6 or higher bandwidth cable	
8	Mounting	Rack mountable	
9	Power Supply (in Watts)		
10	Heat Load		

***** However, the no of ports in a LAN switch shall be as per the network architecture & the no of servers/devices on that LAN.***

8. SAN (Storage Area Network) based storage

S. No.	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1	Storage Architecture	SAN Storage System with no single point of failure architecture. Storage subsystem should also be able to support Unified (SAN & NAS) as an integrated offering. Management of storage system should be through single management tool.	
2	Storage Controller	System to have minimum Two controllers, each controller to have 64 bit Quad -core or higher CPU	
3	Storage Cache / System Memory	The system should have a minimum of 64GB of system memory mirrored across dual SAN controllers. The SAN storage system must keep write cache persistent during fault conditions. Array should support cache de-stage to disk or battery backed cache in order to avoid any data loss due to abrupt power outage.	
4	Front-end Ports	Proposed should have minimum 4 FC Host ports at 16Gbps per controller and should support additional iSCSI / FCoE ports in each controller. The storage arrays shall minimum support 16Gbps FC, 1Gbps iSCSI, 10Gbps iSCSI & FCOE Protocols. Both FC and iSCSI ports shall have the capability of host connectivity and array based remote replication.	
5	Back-end Disk Ports	Storage System should have minimum 8 X 6Gbps SAS backend lanes per controller	
6	Storage Capacity & Performance Configured	System should be configured to deliver 20 TB usable capacity on SAS 15k rpm, SATA & SSD (SLC/eMLC) drives. System should be sized to deliver the performance required on RAID 5. Supplier to include the required number of drives & share the sizing calculation explaining how the designed solution is meeting the required IOPS.	
7	Storage Scalability	System should be scalable to minimum 150 Disk Drives by adding disk shelves without the need of controller addition or upgrade.	
8	Disk Support	System should support 600GB, 900GB & 1.2 TB 10k rpm 6Gbps SAS Disks & 300 / 600GB 15K rpm 6Gbps SAS Disks. System should also support 1TB, 2TB,3 & 4 TB 7200 rpm SATA II or 7200 rpm NL-SAS (Nearline SAS) Disk	

		Drives. System should also support enterprise level (SLC/eLMC) SSD drives.	
9	Protocols Support	System should be configured with 8 x 8 Gbps FC ports. All the licenses should be provided.	
10	RAID Support	Should support RAID 0, 1, 10, 5, 6	
11	Storage Array Management	Easy to use GUI based and web enabled administration interface for configuration, storage management. Storage Management software must include both GUI and CLI tools. It must be able to centrally manage and monitor multiple arrays of same class from the vendor over the network. It must support event auditing for security. Should be able to support automated email to vendor support centre for proactive maintenance. Should be able to report metrics including Inventory of all components, reports on Capacity (raw, user, compressed, oversubscribed), reports on Performance (throughput, bandwidth, queue length, service time, response time), Health (availability, SLA).	
12	Snapshots	The Storage array should support controller based functionality for pointer based snap copies. The pointer based snap copies should require minimal space for creation of snapshot. The snapshot should use industry standard, copy-on-first-write technique and should should support read/write mode. License for snapshot & restore should be included with the BOM.	
13	On-line Expansion / RAID Group creation / Pool Expansion	System support online expansion of RAID Group or addition of new RAID Group. Must be able to add additional disks on the fly to expand the RAID group capacity or create new RAID Group.	
14	Auto-tiering	Proposed system should support Automated Tiering. Tiering should happen at the block level, providing more granular movement of data within the LUN by automatically moving data. Tiering should happen between all 3 tiers i.e. Flash, SAS and NL-SAS drives. Tiering policy should be managed by the same storage management interface. License for same should be included in the BOM.	
15	Disaster Recovery / Replication Support	Storage array should be capable of replicating SAN Data to DR Location Synchronously or Asynchronously. Storage array should support storage based long distance data replication, if required through optional software license.	
16	Virtualization integration	Storage system must be able to discover and monitor virtual machines so that entire environment can be mapped from virtual machines to physical disk from a single management GUI. Storage must have virtualization API integration VMware VASA, VAAI. Storage based replication must support integration with VMware SRM in order to automate Disaster Recovery	

		failover and failback. If required necessary licenses to be quoted.	
17	Global Hot Sparing	System should have the capability to designate global hot spares that can automatically be used to replace a failed drive anywhere in the system.	
18	QoS	It should be possible to fine tune the storage performance on different parameters. License for same or equivalent should be included in the BOM.	
19	Support	24 x 7 x 365 premium support for hardware and software	

9. SAN Switch

S. No.	Description	Offered by the Contractor
1	Non-blocking architecture with minimum of 24 ports and scalable up to 48 ports in a single domain concurrently active at 16 Gbit/sec full duplex with no oversubscription.	
2	The switch should support auto-sensing 2, 4, 8 Gbps capabilities.	
3	The switch shall support different port types such as D Port, F_Port, M_Port (Mirror Port), EX Port and E_Port; self-discovery based on switch type (U_Port);	
4	The switch should be rack mountable.	
5	Non-disruptive Microcode/ firmware Upgrades and hot code activation.	
6	The switch shall provide a minimum Aggregate bandwidth of 384 Gbit/sec: 24 ports × 16 Gbit/sec (data rate) end to end.	
7	The switch should have additional power supply for redundancy	
8	The Switch should be configured with the Zoning and ISL Licenses	
9	The switch shall be able to support ISL trunk up to 128 Gbit/sec between a pair of switches for optimal bandwidth utilization and load balancing.	
10	Support for web based management and should also support CLI.	
11	The switch should support Diagnostic Ports (D_Ports)	
12	The switch should support Dynamic Fabric Provisioning	
13	The switch should support Access Gateway mode	
14	The switch should support forward error correction feature	
15	Port to port latency should be 700 ns	

10. Desktop Cartridge Magnetic Tape Unit

Desktop Cartridge Magnetic Tape

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Manufacturer		
2	Model No.		
3	Capacity	Minimum 160/320 GB	
4	Sustained transfer rate	Minimum 3MB/second	

5	Recording media	Tape	
6	Interface ports	Suitable port for interfacing with servers/workstations.	
7	Power Supply (in Watts)		
8	Heat Load		

Tape Library

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Slots	24 Minimum	
2	Sustained transfer rate	Minimum 140MB/s	
3	Drive Interface	iSCSI, SAS, or FC	
4	User Interface	Operator Control Panel/Remote Web Management	
5	Supported Tape Drive Technologies	LTO-3-060, LTO-3, LTO-4-120, LTO-5-140, LTO-6	
6	Interface ports	Suitable port for interfacing with servers/workstations.	
7	Power Supply (in Watts)		
8	Heat Load		

11 Firewall:-	Technical Specifications for Firewall at Control Center	
S.No	**Specification**	**Offered by the Contractor**
1	Equipment must have one Console port, four or more GbE Ethernet Port, support 75 Gbps or more Firewall throughput and redundant power supply	
2	Network Firewall shall support Layer 3 feature with support for advanced IP Services	
3	Equipment should facilitate to apply unified threat policy like AV/AS, IPS, Content filtering, Bandwidth policy & policy based routing decision on firewall rule for ease of use, also unified threat controls must be applied on inter zone traffic.	
4	Rack mount compatible	
5	Should support substation protocols IEC 60870-5-104/IEC 61850 data to detect and analyse anomalies against established baselines	
6	Equipment should have inbuilt support for IPsec VPNs, L2TP & PPTP VPN and it should also support threat free IPsec / L2TP / PPTP VPN. Equipment should support provide SSL-VPN solution with Web Access (Clientless), Full Tunnel and Split Tunnel control. Solution should provide per user / group SSL-VPN access	
7	Enabling proactive monitoring and detection of network anomalies covering all industrial protocols like IEC60870-5-101, IEC60870-5-104, IEC61850, DNP3 and TCP/IP	
8	Equipment should have inbuilt support for DES, 3DES, AES, Serpent encryption and Pre-shared keys & Digital certificate based authentication connection tunnel.	
9	The proposed integrated IPS should provide 11Gbps or more throughput with 4000+ signature database including the SCADA and other industrial threats. It should support creation of custom IPS signature and creation of multiple IPS policy for different zone.	
10	Firewall should support HTTP Request tempering protection, Directory traversal prevention, Form data tampering protection, SQL injection Protection, Hidden field manipulation Protection, Session Attacks Mitigation, Banner-grabbing Protection, Buffer overrun Protection, OS command injection Protection, Cross-site scripting Protection (XSS) and Cookie Protections etc.	

11	Equipment must have the real-time and historical graphical monitoring system which can log minimum 1200 or more events per second and report can be viewed in CSV/ HTML / PDF format.	
12	Equipment must have the facility of logging of Antivirus, Anti-spam, content filtering, Traffic discovery, IPS, Firewall activity	
13	Detect and analyse anomalies across network like unexpected connection requests originating from substation for a resources in another substation or Master SCADA DOS events.	
14	It should be able to protect against Denial of Service (DOS) and DDOS attacks and able to block unwanted traffic of P2P software such as Bittorrent, TOR etc along with blocking IM traffic if required	
15	Firewall should be Hardware based and operating system / firmware should be reside on hard Disk	
16	Firewall must have minimum 1 TB HDD for log storage.	
17	Firewall must have support of virtual Firewall from Day one.	
18	Firewall solution os must not have any vulnerability in OS from last 3 years (till 2018)	
19	Firewall solution must be field upgradable as per architecture for RAM and ports.	
20	Firewall solution Must allow security rules to be enforced within time intervals to be configured with an expiry date/time.	
21	Firewall solution Must provide security rule hit count statistics to the management application	
22	The Firewall solution should have detection and prevention capabilities for C&C DNS hideouts: Reverse engineer malware in order to uncover their DGA (Domain Name Generation)	
23	Firewall Solution must detect an administrator login at irregular hour.	

12 Panels

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1	Manufacturer		
2	Model No.		
3	Functions	For mounting or placement of equipment's	

S. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
4	Mounting	Floor mounted with front & rear access to hardware and wiring	
5	Cable entry	Bottom	
6	Internal lighting lamp	Yes, with door interlock	
7	230V AC, 15/5 A Internal power socket with switch	Yes	
8	All material used in the panel are flame retardant	Yes	
9	All Louvers provided with suitable wire mesh	Yes	
10	Dual AC Power Supply (in Watts)	Dual Power Supply	
11	Heat Load		

Note: SCADA/ADMS & IT system will exchange the information through firewall.

6. Data Acquisition and Processing

This section describes the functions to be performed by the SCADA/ADMS applications for distribution system for the project area. Bidders are encouraged to supply standard, proven & tested products that meet or exceed the Specification requirements. Unless specified as optional functions/ features all functions/ features mandatory for the project area.

The Supervisory Control and Data Acquisition (SCADA), data exchange, and data processing requirements of the SCADA/ADMS are presented in this section. Performance and capacity requirements for these functions are presented in Section 3.

All requirements of this Section shall apply equally to all data acquisition, supervisory control, data exchange, and processing, regardless of the data source or the communications protocol used between the SCADA/ADMS and the data source.

6.1 Data Acquisition

Telemetered/Non Telemetered data shall be collected from the following data sources:

1) DCUs/RTUs/FRTUs/FPIs /FRTUs/FPIs located at substations, plants, equipment on distribution lines, and other facilities throughout TPNODL power system. These DCUs/RTUs/FRTUs/FPIs communicate using the IEC 60870-5 profile 104 protocol. The SCADA/ADMS shall support communicating with DCUs/RTUs/FRTUs/FPIs over IP. The SCADA System shall be provided with all security provisions as per IEC 62351 Standard. The bidder shall fill and submit the protocol implementation conformance statement in line with the IEC 62351-5 Standard along with the bid documents. The Control centre shall support all features of the IEC 60870-5-104.
2) Computer systems connected to a computer network linking the SCADA/ADMS with the neighboring utilities. These systems communicate using the IEC 60870-6 TASE.2 protocol.
3) GIS land base data, network model using GIS engines/adaptors
4) for IT Systems - (in specified format (OPC / CIM-XML / ODBC Format) Model & Data Exchange over IEC 61968 Enterprise SOA Based BUS)

The protocol considerations shall be made in accordance to the system/ device to be interfaced. However, system shall have capability to interface using all necessary protocols as specified above for the devices that may be interfaced in future.

This Specification does not, in principle, differentiate between "conventional" Remote Terminal Unit data acquisition and data acquisition with sources using the IEC 870-6 TASE.2 protocol. Unless explicitly stated otherwise, the term 'DCU/RTU' shall be construed to include substation automation host processors. The SCADA/ADMS shall support all features of all specified protocols unless specifically stated otherwise. Functional requirements for capabilities not supported by the communications protocol used by a data source need not be supported by the SCADA/ADMS, but only for those sources using the protocol.

A data source may collect data from more than one location (adjacent switchyard with a single RTU or a feeder, for example) or a location may have more than one data source (multiple RTUs in a substation, for example). The SCADA/ADMS shall associate telemetered data with the location rather than the data source. The identity of all data presented to the users of the SCADA/ADMS shall include the location name rather than the source name, and, where applicable, data presentation shall be organized by location name rather than by source name. TPNODL shall determine the mapping of the location name to the data source.

In addition to telemetered data, the SCADA/ADMS shall support the following types of data:

1) Non-telemetered data entered by the user
2) Calculated data generated by the data processing function
3) Calculated data generated by applications.

All input data and parameters, whether collected automatically or entered by a user, shall be checked for reasonability and rejected if they are unreasonable. All intermediate and final results shall be checked to prevent unreasonable data from being propagated or displayed to the user. When unreasonable input data or results are detected, diagnostic messages, clearly describing the problem, shall be generated. All programs and all computer systems shall continue to operate in the presence of unreasonable data.

This data may be of any type specified in **Section 6.3**, Data Processing. Unless explicitly stated otherwise, all requirements in this and other sections pertaining to telemetered data, such as limit monitoring, state change detection, enabling and inhibiting alarms, and quality codes, shall also apply to non-telemetered and calculated data.

SCADA/ADMS system shall have feature to show the online process of raw data from the RTUs/DCUs as a protocol test analyzer.

6.1.1 Scan Groups

A "scan group", as used in this specification, is an addressable unit of data to be retrieved from a data source. A scan group may include one or more items of data, as defined by the protocol used by the data source and its configuration. Each item of data available from each source shall be assigned to one or more scan groups, in accordance with the capabilities of the source and the protocol used by the source.

Each data source may include any number of scan groups and each scan group may contain any number of points, up to the limits of the protocol. No scan group will be defined to span more than one data source. TPNODL shall be able to assign priority for each scan group, if permitted by the protocol. The SCADA/ADMS shall support all data address capabilities of each data source and shall specifically not be limited to retrieving only all data or all data of a specific type (status, analog, or accumulator) in a single scan.

6.1.2 Data Acquisition

The SCADA/ADMS shall acquire data by polling (master/slave relationship between the SCADA/ADMS and the data source) and by spontaneous reporting (peer-to-peer). Data may be transmitted by the source as a full report or by exception.

6.1.2.1 Data Acquisition via Polling

In data acquisition via polling, the SCADA/ADMS initiates the data collection by transmitting a scan request periodically to each scan group. TPNODL shall assign a scan periodicity and a start time to each scan group. The scan periodicity shall be set between 1 second and 3600 seconds to a resolution of one second. The scan start-time shall establish the time after the start of an hour that the first scan of the scan group is to occur. Start time shall be specified to a resolution of one second. The SCADA/ADMS shall support parallel (concurrent) scanning of sources on multiple communications channels and over networks where the protocol supports concurrent exchanges (over TCP/IP networks).

Prior to the transmittal of a scan request for selected scan groups, typically those containing accumulator values, the SCADA/ADMS shall issue a "freeze" command to one or more data sources at the defined time of the collection. The freeze command may be of any of the following types:

1) A 'broadcast' freeze command addressing multiple (typically all) data sources on a given communications channel. The data sources will not reply to the freeze command.
2) A 'broadcast' freeze command addressing multiple (typically all) data sources on a given communications channel. The data sources will present an indication of the successful receipt of this freeze command in the reply to the next scan request.
3) A freeze command addressed to a single data source or scan group. The data source will not reply to the freeze command.
4) A freeze command addressed to a single data source or scan group. The data source will present an indication of the successful receipt of this freeze command in the reply to the next scan request.

For those data sources that present a success indication, the scan request shall not be issued to the data source until that data source reports success of the freeze command. If a 'broadcast' freeze command has been issued to multiple data sources on a channel, all data sources reporting success shall be scanned. The failure of any data source on a channel shall not delay the scanning of data sources reporting success.

Failed freeze commands, if detectable, shall be handled as telemetry failures, including retrying the failed freeze command if defined.

6.1.2.2 Spontaneous Reporting

Unsolicited data acquisition is spontaneously initiated by data sources, typically when changes in input data (to the source) are detected or when processes within the data source determine that data should be reported (for example, periodically). The SCADA/ADMS shall accept data transmitted from the spontaneously reporting data sources at any time, and shall acknowledge the receipt of the data as required by the protocol.

6.1.2.3 Demand, Programmatic, and Integrity Scans

In addition to periodic and spontaneous data acquisition, the SCADA/ADMS shall acquire data from sources under the following conditions:

1) When requested by a user. (It shall be possible to define on any display, a cursor target that will initiate this "demand" scan.)
2) When initiated by an application. The SCADA/ADMS shall include calls to the data acquisition function such that software written by TPNODL can initiate "programmatic" scans.
3) Periodically for all scan groups where the data is acquired by report by exception (refer to Section 6.1.2.4) or by unsolicited reporting. This is referred to as an "integrity scan". The periodicity of the integrity scan shall be user-defined for each scan group.

Each initiation of a demand, programmatic, or integrity scan shall include parameters to specify the data source and scan group to be scanned.

6.1.2.4 Full Report and Report by Exception

The SCADA/ADMS shall accept data reported in full and by exception. Data reported in full is transmitted as the current value of every item in the scan group requested (polling) or transmitted (spontaneous reporting), even where the value has not changed since it was last reported.

The SCADA/ADMS shall also accept data reported by exception, both in response to polls or spontaneously reported. Data reported by exception is transmitted by the source when the value of the data has fulfilled some condition at the source, typically when it has changed. (Some data, typically analog data, is reported only when the magnitude of the change exceeds a threshold value - its "deadband".)

If supported by the protocol and for those data sources so configured by TPNODL, the SCADA/ADMS shall store a deadband value for each value reported by exception. This deadband shall be adjustable by SCADA/ADMS users and shall be downloading to the data source upon change of the deadband and whenever the data source is brought on-line.

6.1.3 Enabling and Suspending Data Acquisition

Users shall be able to suspend acquisition of ("remove from scan") any individual point, scan group, or entire data source. Suspended points scan groups, and data sources reporting spontaneously shall not be processed nor stored in the database. Suspended points acquired by polling may continue to be polled from the data source, but shall not be processed nor stored in the database. Suspended data sources acquired by polling shall not be polled. It is preferred that suspended polled scan groups shall not be polled. The SCADA/ADMS shall set an "acquisition suspended" quality code for all suspended points and shall make an entry for the points on the off-scan summary. The acquisition suspended quality code shall be distinct from the 'telemetry failure' quality code (refer to Section 6.1.4). When the user enables ("restores") the point, scan group, or data source, the SCADA/ADMS shall resume polling the data and updating the database with the data. When enabled, the acquisition suspended quality code shall be removed from the affected points, and the affected points shall be removed from the off-scan summary.

6.1.4 Telemetry Failure and Manual Substitution

"Telemetry failure" is defined as any of the following conditions:

1) The inability of the SCADA/ADMS to complete a scan group data collection within a timeout period defined for the scan group. The timeout period for each scan group shall be set between 1 and 60 seconds to a resolution of 1 second.
2) The inability of the SCADA/ADMS to complete a scan group data collection prior to the next scan request addressed to the same scan group.
3) The inability of the SCADA/ADMS to complete a scan group data collection due to errors in the communications with the data source.

Failed, polled scan groups with a scan periodicity longer than a threshold (initially 10 seconds) shall be immediately retried (without waiting for the next periodic scan time) and a "retry count" for the scan group shall be incremented. Failed, polled scan groups with scan periodicities less than the threshold shall not be retried, but the retry count shall be incremented. (The scan will be effectively "retried" at the next periodic scan time.) The SCADA/ADMS shall increment the retry count for each erroneous transmission from a spontaneously reporting scan group. The retry count shall be reset whenever a successful acquisition is completed.

When the retry count exceeds a retry limit set for each scan group, a telemetry failure shall be declared. The SCADA/ADMS shall set a "telemetry failure" quality code for all affected points and shall make an entry for the points on the off-scan summary. The SCADA/ADMS shall generate an alarm when a telemetry failure occurs. The alarm shall describe the data source or scan group failing; the individual points of the scan group or data source shall not be listed.

Scans subsequent to a telemetry failure shall occur at the normal time, as if the failed telemetry scan had been successful.

If a new transmission is received from a spontaneously reporting scan group before the previous transmission has been processed and acknowledged, the SCADA/ADMS shall attempt to process the incoming data. If a spontaneously reporting data source continues to report data at a rate faster than the SCADA/ADMS can process the data ("data overrun"), the SCADA/ADMS shall declare a telemetry failure for the source. The telemetry failure condition shall be removed by the SCADA/ADMS after a time specified for all spontaneously reporting sources (initially 30 minutes). The user shall be able to inhibit this failure restoration procedure (for all sources, not individually).

The last good value of a point in telemetry failure (that value stored in the database immediately prior to the detection of the telemetry failure) shall be retained in the database. For selected accumulator points as described in Section 6.3.4.4, Long Value Accumulator Quality Code, the SCADA/ADMS shall automatically substitute another value for accumulator points experiencing telemetry failure.

The SCADA/ADMS shall support user entry of a substitute value for any point. The SCADA/ADMS shall set a "manual substitution" quality code for a manually substituted point, but shall not suspend data acquisition for the point. When the point is next successfully (without error) acquired and processed, the value shall be overwritten and the manually substituted quality code shall be reset.

6.1.5 Sequence-of-Events Collection

Sequence-of-events (SOE) data, time-stamped reports of status changes, shall be collected from appropriately configured data sources. An SOE data source may report data as part of the normal data acquisition process or shall report data by exception.

A subset of the data sources reporting SOE data will include time stamp with each status change indication. The time stamp may be to a millisecond resolution. The status change shall be processed as any other status change, ignoring the value of the time stamp. TPNODL shall be able to select any or all of these points for further SOE processing as described below.

Other data sources will report only the availability of SOE data (report-by-exception), typically by setting a flag in the header of a reply to a scan request. When the SCADA/ADMS detects the availability of SOE data, it shall issue a scan request for the appropriate SOE scan groups.

The collection of report-by-exception SOE data shall take place at a lower priority than other data acquisition activity and supervisory control actions. However, where the data source and the communications protocol support SOE buffer 'near-full' and 'overflow' conditions, the SOE collection process shall give priority to retrieving SOE data from those sources reporting the 'near-full' or 'overflow' condition. The SOE buffer overflow condition shall be annunciated as an alarm.

6.2 TASE.2 Data Exchange

SCADA/ADMS control centre shall also exchange data using ICCP with State Load Dispatch Centre (SLDC) of the state. Data exchange shall also allow other information to be transferred report by exception but also configurable periodically, or on demand. It shall be possible to exchange at least the following data:

- real-time telemetered data of the interconnected network,
- non-telemetered data of the interconnected network,

- calculated data of the interconnected network
- SOE data of the interconnected network
- historical data of the interconnected network
- scheduling data
- Operator messages.
- Event /alarm lists

It is envisaged that the TPNODL shall get the load forecasting & drawl schedules from SLDC & versa in order to execute planning of load distribution. In addition, status /measurement of interconnected network shall be able exchanged in both directions.

In addition to the data acquisition functions described above, the SCADA/ADMS shall also support the following data exchanges:

1) The transmission of data to and from the computer systems of neighboring utilities, power system users, and electricity markets connected to the Control Center WAN
2) The exchange of information messages with the same computer systems
3) The transfer of accounts with the same computer systems.

6.2.1 Blocks 1 and 2, SCADA/ADMS Data

Conformance Blocks 1 and 2 shall be employed for the acquisition of telemetered data from selected data sources and for the transmission of telemetered data to the same computer systems. The TASE.2 client shall support the following optional client operations:

1) *Data Value object*: Get Data Value, Get Data Value Names, and Get Data Value Type
2) *Data Set object*: all Client operations. The Critical Data parameter shall be supported
3) *DS Transfer sets*: all Client operations.

The Supplier shall provide an interface to TASE.2 for storing and retrieving SCADA/ADMS data exchanged with other systems. This interface shall be integrated with the SCADA/ADMS database and with the appropriate applications. The SCADA/ADMS data received via TASE.2 shall be processed by the Data Processing function in order to apply most of the same processing that would be provided if the SCADA/ADMS data had been received direct from an RTU link, except that analogs are already in engineering units and so do not need to be converted from raw counts. TASE.2 shall also support the ability to specify both sign change and additive offsets on a point basis.

For each requested transfer, the User shall be able to set the update rates and define a “Grace Period” for Block 1 data sets. If a report is not received within the given grace period after it is expected, the corresponding points in the database shall be marked as “Not Updated”. A System Alert message shall be generated identifying, in plain English, the report that was not received. Alarms shall not be generated for each of the corresponding points marked as “Not Updated”. For Block 2 data sets, the User shall be able to define triggers, transmit (all or report by exception), and integrity (on/off and time interval).

Telemetered data transmitted to other systems shall be the current value retrieved from the SCADA/ADMS database. There shall be no restrictions on the selection of any data for transmission. TPNODL shall determine the mapping of SCADA/ADMS quality flags to the TASE.2 data object flags. The Supplier shall support all the data quality codes in the TASE.2 protocol by mapping them to the appropriate data quality codes in the SCADA/ADMS.

6.2.2 Block 4, Information Messages

The SCADA/ADMS shall support the bi-directional exchange of information messages between the SCADA/ADMS and other computer systems. Conformance Block 4 shall be provided to support the following functions:

1) *User messages* – text messages entered by users
2) *System alerts* – text messages generated by SCADA/ADMS functions.

An interface to TASE.2 shall be provided to accept information messages from the SCADA/ADMS User and applications for conversion into Block 4 messages and transmission to other computer systems. This interface shall be integrated with the SCADA/ADMS database and with appropriate applications. When a message has been successfully sent, a success response shall be provided to the originating user or application. If a message has not been successfully sent, the user or application shall be notified that it was not successfully sent. Block 4 messages received shall be buffered and any application or user registered to receive messages shall be notified when messages addressed to them are received.

A programming interface, for use by TPNODL-written applications, shall be provided to accept information messages into Block 4 messages and subsequent transmission of the messages. The programming interface shall also include features to notify recipient applications of arriving messages and to transfer the contents of the message to the applications.

The Info Reference field of the information message shall be used to distinguish between user messages and system alerts. The Local Reference field shall be used to identify the processing requirement for each message and may have different semantics based on Info Reference. Since the Info Reference and Local Reference fields must be coordinated between TASE.2 clients and servers, it shall be possible to configure the mapping of field values to the appropriate SCADA/ADMS functions.

It shall be possible to configure the Local Reference value to support user registration for user messages. Configuration of the Local Reference field for system alerts shall also be provided to direct the location where alerts are displayed and logged.

6.2.3 Access Control

The IEC 870-6-503 TASE.2 specification, Clause 5.1.2, states: “Implementers are free to use any method of implementing access control and may choose to implement only a subset of the access control [described in the TASE.2 Specification] without affecting interoperability." The specification goes on to provide a detailed description of Bilateral Tables and access control.

For this procurement, the Supplier shall provide the full access control functionality described in the TASE.2 Specification Version 1996-08.

6.2.4 Alarm and Event Monitoring

The TASE.2 function shall continuously monitor the status of connections on the TASE.2 system and generate alarms or events whenever the status of a connection changes. The alarm message shall state, in plain English, the reasons for a loss of connection. The TASE.2 function shall send all messages to the Alarm and Event Processing subsystem in the SCADA/ADMS for processing, user notification, logging, historical storage, and archival. Processing of TASE.2 alarms and events shall follow the requirements specified in the Alarm and Event Processing in Section 4.2, Alarm and Event Processing.

6.2.5 Bilateral Table

The SCADA/ADMS shall implement a Bilateral Table structure (or the functional equivalent) with the required access controls. Since access controls may be different for different clients, multiple Bilateral Tables (one per communicating partner) are required. The Bilateral Table shall be stored in the database and maintained by the database editor described in Section 2.3.2, Database Construction

and Maintenance. Each object available to each remote client shall be stored including access rights to the object. No object may be served that is not in the database.

6.2.5.1 Contents

All data objects available for exchange shall be listed in a Bilateral Table. No data object shall be served unless it appears in a Bilateral Table. Each data object named in a Bilateral Agreement shall have a corresponding entry in a Bilateral Table. The TASE.2 Specification includes models for Access Control Specification, List of Access Control Specification, and List of Permitted Access. There shall be exactly one Access Control Specification for each TASE.2 client that may have one or more associations with the server. For each client, there shall be a List of Permitted Access for every TASE.2 object in the server's Virtual Control Center (VCC); this indicates whether the object is visible to the particular client and which services the client may perform on the object.

6.2.5.2 Functionality

No data item shall be served to any client unless it appears in a Bilateral Table. It shall be possible to specify different access privileges for the same data object for different clients. For example, for a data object named dataObject1, it shall be possible to grant read access to Client A, read and write access to Client B, and no access to Client C.

6.2.6 TASE.2 User Interface Requirements

A User Interface (UI) shall be provided with operational tools to enable the user to maintain the TASE.2 database and monitor TASE.2 link performance. Displays shall also be provided to enable the Operator to view availability of TASE.2 systems and the status of each TASE.2 connection. The user shall be able to access the TASE.2 system remotely, with required access security controls, for problem determination and resolution.

6.2.6.1 Bilateral Table Creation and Editing

A user interface shall be supplied to facilitate entry and modification of the Bilateral Table data. The interface shall be designed to lead the user in a stepwise fashion to perform the desired editing or data entry function and to prevent accidental or intentional changes to the Bilateral Table data by unauthorized personnel.

It shall be possible to create or edit a Bilateral Table while the system is on-line and operating. It shall be possible to create a Bilateral Table by making a copy of existing data. The user shall be able to edit a Bilateral Table by entering data into a temporary area that is not activated until a specific command is issued. It shall be possible, by user command, to revert to a previous Bilateral Table. TPNODL will prefers that the information used to model the Bilateral Table be maintained in a RDBMS. TASE.2 database configuration (Data Engineering) shall be done using the RDBMS. Consistency checks and data type validation shall be performed. After the changes are completed and approved in the RDBMS, they may then be brought on line.

6.2.6.2 Data Set Creation and Editing

The SCADA/ADMS shall include displays facilitating the creation and editing of data sets. The interface shall be designed to lead the user in a stepwise and logical fashion to perform the desired editing or data entry function and to prevent accidental or intentional changes to data sets by unauthorized personnel. Displays shall be provided to permit creation and editing of Transfer Account objects.

Displays shall be provided wherein a TASE.2 client can view the Bilateral Table of a compliant server to determine what objects the client is permitted to access. The capability shall be provided via point–and-click to select desired data objects and create data sets for Block 1 data without having to manually enter the selected point information. Changes to the Bilateral Table shall be highlighted to

aid the client in determining what objects have changed (i.e., been added, deleted, or modified) since the last update.

Messages that automatically and dynamically define datasets shall be sent when transfers are started. This ensures that the remote systems definition of the dataset matches the local definition. TASE.2 shall also support incoming Dataset Creation and Deletion requests and shall dynamically create server datasets as necessary. It shall be possible for the client to create and delete Data Sets in the server, and to restart individual associations without restarting TASE.2.

TASE.2 shall support collection of a data item under one Object ID and sending the same data item under another Object ID.

Data set creation shall validate all model changes (data items and connection) before TASE.2 model deployment.

Data set creation shall support creating partial data sets. This feature allows TPNODL to create a partial data set when one or more items are missing or not granted access by the other end of a connection.

A display facility that can show the actual data that is available to each external entity that is data from SLDC via TASE.2 is required to check the functionality of the process. The users are periodically asked to verify information that is being supplied by the existing data links.

6.2.6.3 Connection and Association Control

The SCADA/ADMS software shall include displays that enable a user to exercise control over TASE.2 data link software and manage Associations (e.g., Associate, Conclude, and Abort). TASE.2 functionality shall include the following display features:

1) An overview display shall be provided which shows the roles and availability of primary and backup TASE.2 systems. This display shall include pages to show the roles and availability in both a tabular and graphical format. The graphical display shall use full graphics capabilities and color to visually diagram the TASE.2 connections and indicate TASE.2 system status (e.g., primary, backup) and availability (e.g., available, off-line). Both the status of SCADA/ADMS systems and other remote computer systems that are active shall be shown.

2) An overview display shall be provided which shows the status of each connection (e.g., active, available, off-line, or error). On a connection basis, controls shall be provided for: separate bilateral agreement, bilateral agreement number, and retry connection rate. The User shall be able to control permissions on a point-by-point basis (both for Domain and VMD data) per connection. Currently all data is VMD and most sites have permission to all data items. This display shall include pages to show the connection status in both a tabular and graphical format. The graphical display shall use full graphics capabilities and color to visually diagram the TASE.2 connections and indicate their status. The connection status shall include status of SCADA/ADMS systems and other computer systems at the remote end. The connection status shall also be available for alarming.

3) Displays shall be provided which allows the Operator or User to view and control configured Associations. Color shall be used to distinguish active and inactive Associations. The time of creation of each Association shall be shown. This display shall show a list of the TASE.2 systems and connections for User selection. The display shall provide the capability for a User to disable Associations. Disabling Associations implies a graceful close of any existing Associations. Entry capability shall be provided for the Operator or User to enter the In-service or Out-of-service status tag for each Association or possible Association. For example, TASE.2 systems in alternate control centers will be placed out-of-service until needed. TASE.2 shall dynamically control each Association based on the User–entered in or out of service tag.

TPNODL will work with the Supplier to design the Operator interface graphical displays and shall have reviewed and approval rights for all TASE.2 displays provided.

6.2.6.4 Maintenance Tools

The TASE.2 system shall provide tools to allow the User to view and maintain the TASE.2 system and database. These tools shall allow the User to select a particular data set, connection, or association (or all) to view and modify the selection. The maintenance tools shall provide the following features:

1) Display parameters of data set objects (created by both sides of a connection) including: descriptions, triggers, transmit, and time of creation. The tools shall allow the User to perform the following operations for manipulating Data Set objects: Create Data Set, Delete Data Set, Get Data Set Element Values, Set Data Set Element Values, Get Data Set Names, and Get Data Set Element Names.
2) Display each data point value, sign, time tagged (time last received), last time of change, and quality code (TASE.2 quality codes). The tools shall allow the User to perform the following operations for manipulating Data Value objects: Get Data Value, Set Data Value, Get Data Value Names, and Get Data Value Type.
3) Display all data items by data set (Block 1 & 2) including: Object ID (including Indication Point or Control Point), the attributes Point Value/Sign, TASE.2 Quality, Select-Before-Operate (if applicable), and Time Stamp and Change of Value counter (when available).
4) Display the complete contents of Block 4 messages.
5) Display all data items Source and Source Object ID along with TPNODL Object IDs.
6) Provide an interface to the MMS-EASE debug facility, which can be activated or deactivated on User command. The MMS_EASE debug tool shall provide the User with tools to help solve TASE.2 problems.
7) Provide tools to perform OSI and IP pinging of any connection.

6.2.6.5 Performance Monitoring

The TASE.2 Quality of Service (QOS) attribute shall provide the User with performance statistics on a connection and association basis. Performance statistics shall include: throughput, residual error rate, priority, transit delay, and protection. Displays shall be provided to allow the user to select the connection, association, or all connections or associations and view the performance statistics for the selection.

6.3 Data Processing

The SCADA/ADMS shall support the following types of data processing:

1) Data quality
2) Analog data
3) Status data
4) Accumulator data
5) Sequence of Events data
6) Non-telemetered data
7) Calculated data
8) Redundant data
9) Network Status Processor.

6.3.1 Data Quality

Quality codes are attributes of database points that identify some conditions affecting a database point. All quality codes that apply to a point shall be maintained in the database for that point and shall be accessible for display, inclusion in reports, and use by SCADA/ADMS functions. Typically, only the most severe code will be presented on a display or report. However, it shall be possible to access and present the most severe code and all codes individually. (Severity is defined later in this section.)

For calculated data, the presence of a quality code on any of its arguments shall not disrupt the calculation using that value. The quality code of the calculated value shall be the most severe quality code of the arguments. Results of calculations that are manually overridden by users shall be denoted with a quality code that can be differentiated from the propagation of a 'manual substitution quality code from one its arguments. Results of calculations that are manually suspended by users shall be denoted with a quality code that can be differentiated from the propagation of an "acquisition suspended" or a "calculation suspended" quality code from any its arguments.

Quality codes included with data from data sources using standard protocols such as IEC104 and TASE.2 shall be mapped to the SCADA/ADMS's quality codes. Similarly, data transmitted from the SCADA/ADMS to other computer systems using the TASE.2 protocol shall map SCADA/ADMS quality codes to TASE.2 quality codes.

Quality codes shall be accessible from the database, as another data item. Quality codes shall be available for use in calculated values as Boolean (true/false) values. For example, it shall be possible to define a calculated point in which the value of the result is dependent on the presence of selected quality codes using the conditional execution operators (if-then-else) of the generalized calculations.

This Specification assumes that each quality code can be set or reset independently of all other codes. Thus, the number of possible combinations of quality codes for a given point shall be 2^n, where n is the number of codes (attributes).

The following quality codes, when applied to a point, shall be interpreted as invalid or "bad" data:

1) Acquisition suspended
2) Calculation suspended
3) Telemetry fail
4) ADC error
5) Reasonability violation
6) Inconsistent result
7) Long value (for the first accumulator reading after telemetry failure).

Values with a manually substituted quality shall be considered valid.

6.3.2 Analog Data

Prior to storage in the SCADA/ADMS database, analog data shall be processed as follows:

1) ADC accuracy monitoring.
2) Reasonability checking.
3) Conversion to engineering units.
4) Limit checking.
5) Rate-of-change checking
6) Sign convention

6.3.2.1 ADC Accuracy Monitoring

Selected data sources will report one or two reference points for each analog-to-digital (ADC) converter in the source. These reference points shall be scanned as part of the normal data acquisition process and compared against high and low limits. These limits may be the same limits used for the

limit checking function described in Section 6.3.2.4, Operating Limit Checking. When the value of any reference exceeds its high or low limit, an ADC error shall be declared. All analog points converted by that ADC shall be marked with an 'ADC error' quality code, the analog points shall be processed as for a telemetry failure, and an alarm shall be generated for the ADC (not for the individual analog points). When the ADC reference returns to within its limits, the quality codes shall be removed, the analog points shall be returned to normal processing, and a return-to-normal alarm shall be generated for the ADC.

6.3.2.2 Conversion to Engineering Units

Analog points shall be converted to engineering units by assuming a linear characteristic of the form:

$$Converted\_value = (a * Telemetered\_value) + b$$

Where *a* and *b* are signed coefficients defining the scaling and offset of the conversion. The coefficients may be of any sign and shall be individually defined for each analog point.

The following algorithm shall be used to convert selected analog points that use 'expanded scale' transducers (this conversion form is also referred to as "clamp to zero"):

$$if\ (Telemetered\_value \geq z)$$
$$Converted\_value = (a * Telemetered\_value) + b$$
$$else$$
$$Converted\_value = 0$$

Where *a* and *b* are as above and z is a positive value defining the lower limit of the transducer.

Analog points representing the tap positions of tap-changing transformers shall be converted into, and displayed as, discrete integer values.

6.3.2.3 Reasonability Checking

All analog points shall be compared against high and low reasonability limits each time they are processed. The reasonability limits shall represent the extremes of valid measurements for the point's value. An alarm shall be generated when a reasonability limit violation is detected, the value shall be marked with a 'reasonability violation' quality code, and the value shall be processed as for a telemetry failure. When the data returns to a reasonable value, the new value shall be accepted, the 'reasonability violation' quality code shall be removed, and a return-to-normal alarm shall be generated.

6.3.2.4 Operating Limit Checking

All analog points shall be compared against operating limits that define various operating ranges for the point. Pairs of high and low limits shall be supported for each point (refer to Table 3-6: Application Capacity). The initial value of each limit shall be defined as part of the point's database definition. The SCADA/ADMS shall ensure that the limit values obey the following relationship for every analog point:

Low reasonability limit ≤ low limitn ≤ … ≤ low limit1 < high limit1 ≤ … ≤ high limitn ≤ high reasonability limit

The SCADA/ADMS shall enable users to override the value of any limit. Overridden limits shall be marked with a "limit override" quality code and shall be used in place of the initial limit value. When the user removes the override, the limit shall revert to its initial value. All overridden limits shall be presented on the alarm inhibit and manual replace summary displays.

It shall be possible for a user to mark any limit as inactive. Inactive limits shall not be checked. Users shall override an inactive limit similarly to overriding an active limit and to return a limit to the inactive state by removing the override. Overridden inactive limits shall be checked like overridden active

limits. Marking a limit as inactive is not to be confused with inhibiting alarms (refer to Section 4.2.6, Alarm Inhibit/Enable). Alarm inhibiting shall apply only to active alarms.

The “normal range” of an analog point is defined as the set of values between the innermost low and high limits. Whenever an analog value crosses a limit in a direction away from its normal range, a limit violation alarm shall be generated and the analog value shall be marked as being in the “off-normal” condition; however, analog limit violations that are the result of supervisory control actions shall be reported as events rather than as alarms. All analog points that are “off-normal” shall be included in an off-normal summary display.

Whenever a monitored point crosses a limit in a direction towards its normal range, a return-to-normal alarm shall be generated. Whenever an analog point crosses more than one limit, each limit crossing shall be alarmed.

A deadband shall be applied to each of the limits to derive the return-to-normal level, so that repeated alarming does not occur when the value of a point repeatedly crosses a limit. It shall be possible to specify a unique deadband for each analog point.

6.3.2.5 Rate-of-Change Checking

Selected analog points shall be checked against rate-of-change limits. A rate-of-change limit shall be defined for every analog point subject to rate-of-change limit checking. An alarm shall be generated when the change in the value of the analog point between two successive scans exceeds the point’s rate-of-change limit. Filtering shall be applied to the change. Filter constants shall be set for each point checked. The check against the limit may be either against the absolute value of the change (where a violation is declared if the value is increasing or decreasing) or against signed value (where a violation is declared only when the change in value is in the same direction as the sign of the limit) as selected for each checked point.

Rate-of-change alarming shall be inhibited for analog changes caused by supervisory control operations.

It shall be possible for a user to override the limit values. Overridden limit values shall be marked with a “limit override” quality code. When the user removes the override, the limit shall revert to its initial value.

It shall be possible for a user to mark the rate-of-change limit as inactive. An inactive limit shall not be checked. Users shall be able to override an inactive limit similarly to overriding an active limit and to return a limit to the inactive state by removing the override. An overridden inactive limit shall be checked like an overridden active limit.

Whenever a rate-of-change alarm has been declared for an analog point, the point shall be marked as being in the “off-normal” condition. All analog points that are “off-normal” shall be included in an off-normal summary display. As soon as the change in the analog’s value is less than the rate-of-change limit, a return-to-normal alarm shall be generated and the point shall be removed from the off-normal summary display.

6.3.2.6 Operating Limit Sets

The SCADA/ADMS shall support operating limit sets. (Table 3-6: Application Capacity, presents the quantity of operating limit sets to be supported.) Each operating limit set shall include an entry for each operating limit in the database. Upon user command, the current operating limits for an individual point or for all points in the SCADA/ADMS shall be overwritten with the corresponding entry from the selected operating limit set. The SCADA/ADMS shall not overwrite a limit that is marked as overridden. Instead, the point and limit with the conflict shall be listed on a limit conflict display. This display shall identify the point and limit, along with the value of the initial (non-overridden) limit, the value of the override limit, and the value of the limit from the operating limit set.

6.3.2.7 Sign Convention

The sign conventions for the display, data entry and reporting of active and reactive power flow shall be used universally by all SCADA/ADMS functions. All imports to bus bars shall be represented with + sign and all exports from bus bars shall be with –ve sign.

6.3.3 Status Data

Prior to storage in the SCADA/ADMS database, status data shall be processed to convert the input data to a meaningful state and to identify and report changes in state.

6.3.3.1 State Conversion

The SCADA/ADMS shall include the following state data conversions (where supported by the data source and the protocol used to communicate with the data source):

1) *Two-state points*, typically reported as a single bit, that represent one of two possible states of a power system device or other equipment or process: Any value of the input shall be converted to any defined state for the point. The SCADA/ADMS shall support at least the number of two-state definitions specified in Table 3-6: Application Capacity, including open/closed, trip/close, on/off, alarm/normal, auto/manual, and remote/local. TPNODL shall define the state definitions. The assignment of the value conversion and state definition shall be made on a per-point basis.

2) *Three-state points*, typically reported as two bits, which represent one of three possible states of a power system device or other equipment or process: Any value of the input shall be converted to any defined state for the point. The SCADA/ADMS shall support at least the number of three-state point definitions specified in Table 3-6: Application Capacity, including open/closed/in-transit and remote/local/automatic. TPNODL shall define the state definitions. The “fourth state” shall be designated as “invalid”. The assignment of the value conversion, state definition, and fourth-state designation shall be made on a per-point basis.

3) *Momentary change detection (MCD)* – two-state points that may incur multiple operations between scans: Typically, such points are identified with circuit breakers with high-speed reclosers. All state definitions for two-state points shall be supported. Based on the state of the point from the previous scan, the state of the point from the current scan, and the state of the change indication from the current scan, the following operations shall be detected:

    a. Initially closed:
        i. Trip (open).
        ii. Trip, close.
        iii. Trip, close, trip.
    b. Initially open:
        i. Close.
        ii. Close, trip.
        iii. Close, trip, close.

6.3.3.2 Normal State Processing

One of the states of each status point shall be designated as its “normal” state. The designation shall be made individually for each point. It shall also be possible to define a point as having no normal state. Users shall be able to override the normal state definition and to remove the override. Overriding the normal state designation shall establish a normal state override quality code on the point. Removal of the normal state override shall remove the normal state override quality code. All points with an overridden normal state shall be listed on the off-normal summary display.

6.3.3.3 State Change Detection

Each time a status value is acquired, its state shall be compared to the state currently resident in the database and any change of state shall be reported. Changes in state that are the direct result of a supervisory control action initiated within the SCADA/ADMS shall be reported as events. Spontaneous changes in state (changes not the direct result of a supervisory control action) shall be reported as alarms.

All status points that have a normal state designated and whose state is not the normal state after a state change shall be included in the off-normal summary display8).

The reporting of changes of state of three-state values into the third state or fourth state shall be delayed by an adjustable time to allow for completion of the action of slow-moving devices such as motor-operated switches. However, the point's state shall be the third state or fourth state even if the delay time has not expired. Reporting of changes into the fourth state shall also be processed as a telemetry failure.

6.3.4 Accumulator Data

Prior to storage in the SCADA/ADMS database, accumulator data shall be processed as follows:

1) Conversion to engineering units
2) Reasonability checking
3) Limit checking
4) Accumulator substitution.

6.3.4.1 Conversion to Engineering Units

Data sources will report accumulator points in two forms, as a continuous count value and as a resetting count value. This specification considers accumulator values collected from data sources that have been processed by the data source to be a form of resetting count values. That is, even though the value may have been converted to engineering units and checked for limit violations prior to transmission to the SCADA/ADMS, the SCADA/ADMS shall process the value as if it had not been previously processed. This will, for example, enable the SCADA/ADMS to convert kWh values to MWh values, and to check the value against different limits.

Data reported in raw count form shall be converted to engineering units using the following linear conversion algorithm:

$$Converted\_value = a*(Raw\_value_n - Raw\_value_{n-1})$$

Where *a* is a signed coefficient defining the scaling of the conversion, *Raw value*$_n$ is the current telemetered value, and *Raw_value*$_{n-1}$ is the previous telemetered value. The coefficient may be of any sign and shall be individually defined for each accumulator value.

TPNOLD will specify the maximum and minimum count value for each accumulator point. The conversion shall accommodate accumulator rollover. That is, when the raw value reaches it maximum value and rolls over to its minimum value.

Data reported in resetting count form shall be converted using the following linear conversion algorithm:

$$Converted\_value = a*(Raw\_value_n)$$

Where *a* and *Raw_value*$_n$ are as defined above. *Raw value*$_n$ will be reset to zero after it has been successfully read from the data source.

Each component of the accumulator value, including the current and previous (if applicable) raw values and the converted value, shall be stored in the SCADA/ADMS database. TPNODL prefers an implementation that stores the raw value(s) in count form and the converted value as an analog value.

6.3.4.2 Reasonability Checking

All converted accumulator values shall be compared against high and low reasonability limits. The reasonability limits shall represent the extremes of valid measurements for the point's value.

An alarm shall be generated when a reasonability limit violation is detected, the value shall be marked with a reasonability violation quality code, and the value shall be processed as for a telemetry failure. When the data returns to a reasonable value, the new value shall be accepted, the 'reasonability violation' quality code shall be removed, and a return-to-normal alarm shall be generated. The SCADA/ADMS shall provide the ability for TPNODL to change the high and low reasonability limits, which shall be unique for each point.

6.3.4.3 Operating Limit Checking

All accumulator points shall be compared against high and low operating limit pairs **(refer to Table 3-6: Application Capacity,).** The initial value of each limit shall be defined as part of the point's database definition. Users shall be able to override this limit value. Overridden limits shall be marked with a 'limit override' quality code and shall be used in place of the initial limit value. When the user removes the override, the limit shall revert to its initial value. Limits (both initial and overridden limits) shall be constrained to be within the reasonability limits of each analog point.

It shall be possible to mark any initial limit as inactive. Inactive limits shall not be checked. Users shall be able to override an inactive limit similarly to overriding an active limit and to return a limit to the inactive state by removing the override. Overridden inactive limits shall be checked like active limits.

The "normal range" of an accumulator point is defined as the set of values between the low limit and the high limit. Whenever an accumulator value crosses a limit in the direction away from its normal state, a limit violation alarm shall be generated and the accumulator value shall be marked as being in the "off-normal" condition. All accumulator points that are "off-normal" shall be included in an Off-Normal Summary display.

Whenever a monitored point crosses a limit in the direction towards its normal range, a return-to-normal alarm shall be generated. The return-to-normal alarm message shall contain the same information as a limit violation alarm message except that it indicates that the alarm region has been exited.

6.3.4.4 Long Value Accumulator Quality Code

As described in Section 6.1.4, Telemetry Failure and Manual Substitution, if the value of a telemetered accumulator point is not acquired because of a telemetry failure, the point shall be marked with a "telemetry failure" quality code.

Generally, during periods of telemetry failure, the accumulator continues to collect data. The first time the data source reports continuous count accumulator data after data acquisition is restored, the reported value will represent the accumulation of the whole period of failure, and not just the most recent period of accumulation. As a consequence, the first value of accumulator data acquired after the restoration of data acquisition shall be marked with a special "long value" quality code.

6.3.4.5 Accumulator Substitution

The SCADA/ADMS shall support the substitution of other data for invalid accumulator values. The substitution shall be triggered by any of the following conditions:

1) Telemetry failure of an accumulator point
2) An accumulator point with a long value quality code

3) When the difference between the accumulator value and another analog or accumulator value (typically a calculated analog value) exceeds a predefined value (a “meter error”). TPNODL shall specify, for each accumulator value, the association between the accumulator value and the other value and the maximum difference value.

Note that the accumulator value may be the result of redundant data processing (Section 6.3.8). To ensure that the redundant data processing completes prior to the accumulator substitution processing, accumulator substitution processing shall be delayed by 15 seconds from the completion of the accumulator value conversation and storage of the converted value in the database. Note also that an accumulator value that has been manually entered by a user shall be considered a valid value.

The value to be substituted shall be selected by TPNODL for each point from any of the following:

1) A calculated or telemetered accumulator value
2) A calculated or telemetered analog value
3) A value of zero (0).

Only a single substitution value will be selected for any point. That value shall be substituted only if its quality codes indicate a current and valid value. (Values outside alarm limits shall be deemed valid.) If the substitution value is not current or not valid, a zero value shall be substituted. This substitution shall occur in lieu of retaining the last good value as defined for telemetry failure. Substituted values shall be marked with a suitable quality code, in addition to a telemetry failure code and distinguishable from the redundant data processing quality code.

6.3.5 Sequence of Events Data

SOE data shall be stored in the ISR function (Section 7) for presentation on displays and reports.

6.3.6 Non-Telemetered Data

Certain data in the database will not be updated from data sources or SCADA/ADMS functions, but will be manually entered by the users. These data points shall include analog, accumulator, and status points.

Event messages shall be generated for each change made to a non-telemetered value. Non-telemetered points shall be marked with a ‘non-telemetered’ quality code, but not with a ‘telemetry failure’ quality code or a ‘manual entry’ quality code. Non-telemetered points shall be otherwise indistinguishable from telemetered or calculated points. This non-telemetered input shall be capture in ISR for all operation purpose.

6.3.7 Calculated Data

Calculated points shall be derived from TPNODL-defined algorithms (generalized calculations) and pre-defined algorithms supplied with the SCADA/ADMS (such as MVA calculations and analog value integration). This Specification assumes that calculations will be performed periodically and that the periodicity of calculations shall be assigned on a per-point basis. An implementation where a calculation is triggered whenever any of the arguments of the calculation change is also acceptable. In this case, the execution periodicity shall be interpreted as the maximum allowable time from the change of the argument until the calculation is completed and the result is stored in the database.

It shall be possible to suspend and enable the calculation of any calculated data point. A “calculation suspended” condition shall be set for any point for which the calculation was suspended.

It shall be possible to use any value of any type from the database for arguments of the calculation, including other calculated points and values produced by SCADA/ADMS functions. TPNODL prefers an implementation in which analog and accumulator calculations produce results that can be stored as either analog or accumulator values.

The calculation function shall detect arithmetic exceptions such as division by zero and over-range results. Such conditions shall be place a "calculation failure" quality code on the resultant calculated point. (This may also be represented by a "telemetry failure" quality code.)

6.3.7.1 Generalized Calculations

Generalized calculations shall be defined from the following operators and rules:

1) *Mathematical operators* – addition, subtraction, multiplication, division, square root extraction, exponentiation, and logarithmic functions
2) *Trigonometric functions* – including sin, cos, tan, and inverse functions
3) *Min/max functions* – selection of the minimum and maximum value from a set of arguments
4) *Logical operators* – including AND, OR, NOT, and XOR
5) *Comparative operators* – including greater and less than, equal to, and combinations thereof
6) *Conditional execution operators* – including if-then-else statements.

Each calculation may consist of up to ten arguments. Multi-level parenthesis shall be supported. It shall be possible to use the quality codes of database values for use as arguments.

The SCADA/ADMS generalized calculation engine shall support the capability to drag and drop points from displays or the database into the calculation definition.

System administrator shall able to create/modify analog & digital calculation/logic by him accordingly to the requirement.

6.3.7.2 MVA Calculation

MVA shall be calculated using any of the formulae specified below. The formula to be used shall be selected for each MVA calculation.

1) $MVA = \sqrt{MW^2 + MVAr^2}$ – sign always positive
2) $MVA = \sqrt{MW^2 + MVAr^2}$ – sign the same as the sign of the MW
3) $MVA = \frac{kV * A * \sqrt{3}}{1000}$ – sign always positive
4) $MVA = \frac{kV * A * \sqrt{3}}{1000}$ – sign the same as the sign of the MW.

6.3.7.3 Integration

The integration calculation will typically be used to produce MWh and Mvarh values from MW and Mvar inputs respectively. The integration period shall be defined for each point and the result for the current period stored and a new integration started at the end of each period. Two values shall be maintained in the database as analog values for each integration point:

1) The *current value* – the value for the current (in-progress) period
2) The *previous value* – the result for the previous (completed) period.

Each integration point shall be recomputed each time the argument is scanned and the argument is judged to be valid (refer to Section 6.3.1, Data Quality). (That is, the current value shall be recomputed to reflect the integrated value at the time of the sample.) A count of valid samples for each integration point shall be maintained through the integration period. The count shall be compared against a TPNODL-entered minimum count for each point at the end of the integration period. If the count of valid samples for a period is below the minimum value, a calculation failure shall be considered to exist and the (calculated) current value shall be stored with the "calculation failure" quality code. The count shall be reset at the expiration of each period.

6.3.7.4 Processing of Calculated Data

After a data item is calculated, it shall be processed as follows:

1) Analog value
    a. Reasonability limit checking
    b. Operating limit checking
    c. Rate-of-change checking
2) Status value:
    a. Normal state checking
    b. Change checking
3) Accumulator value:
    a. Reasonability limit checking
    b. Operating limit checking.

6.3.8 Redundant Data Processing

Selected values in the SCADA/ADMS database may be obtained from more than one source. Typically, the "best available" source of the value is chosen for use in displays, reports, and other functions. The function of choosing the best available source is called "redundant data processing."

The redundant data processing inputs are called "arguments", and the chosen source is called the "resultant best value." The arguments may include telemetered values, calculated values, and values generated by SCADA/ADMS functions. The resultant best value shall be stored in the SCADA/ADMS database.

Generally, the arguments and the resultant best value will be the same database type. However, it shall be possible to use analog and accumulator values as arguments for an accumulator resultant.

When defining the calculation for a resultant best value, the user will rank the arguments in a priority order. The resultant best value shall be determined by selecting the "best available" from among the arguments. The highest-ranking argument with a valid value (see Section 6.3.1, Data Quality) shall be stored as the result. If none of the arguments have a valid value, the highest-ranking item with the best quality shall be stored as the result. The SCADA/ADMS shall allow TPNODL to define the ranking of the quality codes for redundant data processing.

Users shall be able to override automatic selection and manually select any argument. Restoration of automatic redundant data processing shall require manual action by a user. Automatic and manual changes of the selected argument shall be reported as an event.

6.3.9 Network Status Processor

The energized/de-energized state and in-service/out-of-service status of each generator, synchronous condenser, bus section, transmission line, transformer, load, capacitor, and reactor defined in the real-time network model (Section 9) shall be determined and stored in the database as a status points. The network status shall be derived directly from the real-time network model without additional TPNODL input. Any changes to the model shall be automatically reflected in the network status calculation.

6.3.9.1 Determination of Energization Status

A circuit element (transmission line, bus section, or distribution line segment) shall be considered energized if one of the following conditions exists:

1) There is a non-zero measurement of voltage associated with the element
2) A breaker or switch at either end of the element is closed and the adjacent section is energized.

A power system device shall be considered energized if it is connected to an energized circuit element or power system device.

Energization shall be treated as a calculated status point, and as such, the data quality of the arguments shall be propagated to the result.

If the SCADA/ADMS identifies a contradiction in calculating circuit Energization (for example, a circuit element is isolated but is associated with a non-zero voltage measurement), it shall issue an alarm identifying the contradictory database points and shall set an inconsistent result quality code for the Energization.

6.3.9.2 Determination of In-Service Status

The NSP shall also determine the in-service status (in-service or out-of-service) of each circuit element. A circuit element shall be considered in-service if it is conducting power. Any circuit element that is energized and connected to a load shall be considered "in-service". It is to be noted that an energized circuit element may still be out-of-service as would be the case, for example, if one end were connected by a closed switch to another energized segment, but the switch at the other end were open.

6.4 Tagging

Tags are conditions applied to database values in order to call the users' attention to exception conditions for field devices and to inhibit supervisory control actions.

6.4.1 Tag Types and Supervisory Control Inhibit

The SCADA/ADMS shall support the number of tag types and the number of tags to be set on an individual point per Table 3-6: Application Capacity. The tag types shall be ordered by TPNODL to indicate its relative priority to other types.

The tag types shall be defined by TPNODL L to correspond with the field device tagging scheme. The definition shall include the tag type name (such as, planned, unplanned, warning, caution, hot line, and do not operate) and its supervisory control inhibit properties. The control inhibits properties shall be selected by TPNODL for each tag type from the following:

1) All control allowed
2) Control inhibited in one direction, such as close
3) Control inhibited in the other direction, such as trip
4) All control inhibited.

The supervisory control function shall check for the presences of a control inhibit tag as part of the control permissive scheme defined in Section 6.5.8.

Minimum Following tag type shall be used

Control Inhibit

This tag shall be used for interlocking and inhibit the output of remote control commands for the tagged network element or the tagged area (station, voltage level, or feeder).

The tag shall be used for an analog value that is a set point.

Removed from Operation

This tag shall be used to mark network elements whose current tele-transmitted status is invalid and is not taken into the Real time. It shall be possible that the tag can also be used for set points, analog values, and accumulated values.

Setting the tag Removed from Operation shall inhibit the entry of all tele-transmitted switch statuses from the tagged technological area into the Real time database. In this case, the operator shall be able to manually update the Real time database. The output of control commands shall be inhibited for the tagged elements as well.

Deleting the tag shall cause an automatic update process, which supplies the Real time database with the current tele-transmitted network status. Thus, clearing this tag shall cause automatic overwriting of the status of manually updated network elements of the respective technological area by the current network status.

The tag Removed from Operation shall also set on a network element, if an alarm referring to this element is blocked by the operator in a summary.

Alarm Inhibit tag

Using this tag the operator shall be able to define another configuration of message distribution for the associated elements e.g. no audible alarm, no displaying in alarm summaries, but displaying on an Alarm inhibit Events Summary.

When alarms are already active before the tag is set on the alarm area, then the alarms shall be automatically acknowledged when the tag is set.

It shall be possible that this tag can also be used for analog values and accumulated values.

Caution tag

When a 'Caution' tag is set on a device and the operator tries to control this device, a message shall be displayed, warning the operator that a caution tag is set. The operator shall be able to override this tag.

Information tag (or Notes)

This tag shall have no impact on supervisory control. The corresponding icon beside an element in the single-line diagram shall indicate that information is available for the element. The operator shall be able to open the 'Tags' tab of the technological information display to read the information.

Permit-to-Work

The tag Permit-to-Work shall be used for network areas, where Planned and un planned maintenance work is performed. It shall inhibit any remote control command for the tagged network element or the tagged area.

If more than one Permit-to-Work tag is set to a technological element, each person that has received work permission and each intended work shall be displayed separately.

6.4.2 Tag Application

It shall be possible to apply a tag to any database item. A user shall place tags by selecting the database item to which the tag is to be applied and by then selecting a tag menu command. The use shall be required to enter, for each tag, the following information:

1) Date and time of tag placement
2) Tag type
3) Substation and point identification (supplied by the SCADA/ADMS)
4) Comment

As part of the tag placement process, the SCADA/ADMS shall prompt the user to enter alphanumeric comment information to be stored with the tag. The comment field shall be at least sixty characters in length.

5) The user ID of the user applying the tag.

Each tag shall be uniquely identified with the user who placed the tag. This user identification shall occur automatically by attaching the user login name (Section 4.1.1) in the user assignment field.

Each Tag placed in the system shall have a system generated unique 6 digit ID number, associated with the tag and shall be displayed in the tag summary display.

Each tag shall be presented on a tag summary display. The display shall order the tags by substation. It shall be possible to edit and delete tags from this display. Tag application and removal shall be recorded as events. Each database item presented on a display shall have an associated attribute to indicate the highest-priority tag applied to the item. An indication shall be provided that multiple tags are associated with the device. Selection of the device tag shall bring up the tag summary display.

6.5 Supervisory Control

The SCADA/ADMS shall issue supervisory control commands to field devices when directed by a user or an application program. While this specification states that commands are sent to a "field device", the SCADA/ADMS typically communicates with some intermediary device such as an RTU that operates the field devices or passes on the commands to the field device. Therefore, for the purposes of this Section, the term "field device" shall be interpreted to mean the data source or other device communicating with the SCADA/ADMS.

Control actions requested by a user shall include a confirmation step subsequent to selection of the field devices to be controlled and the control action to be commanded. After the user confirms the control action, the supervisory control message exchange process shall be initiated. The message exchange with the field devices shall use a select-check back-execute command sequence if available in the protocol. The execute command shall be issued only if select and check back messages are exchanged without error and if the check back message indicates that the correct field device and control action have been selected. The select and execute messages shall not be retried. Any errors in the control command exchange shall be reported as alarms to the user and the command shall be cancelled.

If, after selecting a field devices and control action, the user does not execute the control action within 20 seconds (a programmable interval) or if the user performs any console action other than executing the control action, the selection shall be cancelled and the user informed. The user shall not be prevented from requesting other displays, performing a different supervisory control action, or performing any other operation while the SCADA/ADMS waits for a report-back on previously executed control actions.

6.5.1 Single State Control Devices (Relay Reset)

The SCADA/ADMS shall support the supervisory control of devices, such as under frequency reset relays, that can only be commanded to one state. It shall not be possible to select a command into the second state for these devices.

6.5.2 Two- and Three-State Control (Switching Devices)

Controllable switching devices include circuit breakers, recloser relays, circuit switchers, and motor-operated disconnect switches. Three-state points may also be commanded only into one of two states. It shall not be possible to select a command to a third or fourth state for three-state points.

6.5.3 Two- and Three-State Control – Delayed Close (Capacitor and Reactor Switching)

Selected two- and three-sate control points shall be designated as "delayed close" points. The procedure for controlling these devices shall be the same as that of a switching device except that any supervisory control action shall be inhibited for a specified interval after the switch has been opened. The interval shall be determined by TPNODL, and specified individually for every device subject to delayed close. If a user attempts to operate the device prior to expiration of the time interval, the error shall be managed as a permissive check failure (Section 6.5.8, Control Permissive).

6.5.4 Incremental Control (On Load Tap-Changing Transformers)

Incremental control is typically used to raise and lower the tap position of On-Load Tap Changing (OLTC) transformers and the control settings of similar devices such as voltage regulators and static var compensators.)

The initial selection and control of the device for a raise/lower operation shall follow the same sequence as for switching device control: select-checkback-execute. However, it shall not be necessary for the user to reselect the device for additional raise/lower operations; the user shall only have to repeat the desired number of raise/lower execute commands, which shall be performed immediately. The user shall be able to cancel the operation at any time. The SCADA/ADMS shall cancel the operation 20 seconds after a control execute has been issued or if the user performs any console action other than the control execute command. The timer shall be reset with each subsequent control execute command. The data acquisition function shall not be suspended between the times that repeated raise/lower execute commands are issued. Control actions that would result in movement of the device beyond its defined operating range shall be rejected (assuming that a position feedback value is telemetered).

6.5.5 Set point Control

The SCADA/ADMS shall provide the capability to issue set point control to field equipment and to other computer systems. With set point control, the SCADA/ADMS shall transmit a numerical value to the device being controlled, to indicate the desired operational setting of the device.

6.5.6 Automatic Supervisory Control

The Automatic Supervisory Control (ASC) function shall permit multiple supervisory control commands to be programmed for automatic execution in a predefined sequence.

Commands to be supported shall include:

1) All supervisory control commands
2) Pause execution for a given time delay
3) Stop execution until an user commanded restart or continue
4) Conditional check before execution
5) Jump (pass control to another ASC sequence)
6) Manual Entry.

After executing a supervisory control action, the SCADA/ADMS shall pause to obtain an indication of a successful control completion check (see Section 6.5.7). If the control completion check is not received, or does not have the expected value, the SCADA/ADMS shall terminate the execution of the ASC sequence and shall declare an alarm. Apart from waiting for control completion checks, and unless there is an explicit command for a delay, such as a “Pause” or “Stop” command, the SCADA/ADMS shall not introduce any artificial delays in the execution of an ASC command sequence.

No limit shall be placed on the number of ASC command sequences, which may execute in parallel.

The following manipulation of ASC lists shall be possible:

1) Display a catalog of the lists
2) Display, build, copy, edit, and delete a list
3) Name the list and enter a description
4) Store the list
5) Select the list for execution
6) Execute the list.

At any time during the execution of a list, the user shall be able to stop further execution via an ASC cancel feature.

In addition, telemetry and control permissive checks shall be incorporated in the sequence with user override capability. Upon failure of the telemetry and control permissive checks, the ASC sequence shall pause and require user interaction. Resumption of the ASC sequence at any point shall be provided.

Initiation of any ASC list shall be recorded as events, and events shall also be recorded noting the time of any “stop”, “continue”, or “cancel” command. All control malfunctions and control commands successfully completed shall also be recorded as events.

If the user is using a list to perform a repetitive function, such as issuing set points, the user shall be allowed to inhibit event messages for the sequence.

6.5.7 Control Completion Check

The response to all control actions shall be verified by monitoring a feedback variable designated individually for selected control points. If a feedback point is not defined for a control point, the control completion check shall be deemed successful as long as the control command is successfully transmitted to the field device. A report-back timer, independently defined for each device, shall be started when the execute command is issued. Each delay time shall be adjustable from two seconds to at least ten minutes to a one second resolution.

The user shall be provided with an indication that a control action is in progress, and a report of the result of the control action. A control action shall be deemed successful if the appropriate success indication described below is recognized prior to expiration of the report-back timer:

1) For *single-state and two-state devices (including delayed close devices)* – the corresponding status feedback point of the device under control changes to the desired state. Even if the change is momentary, the control action shall be reported as successful. The data acquisition and processing functions shall then report the subsequent change a way from the controlled state as an alarm.
2) For *incremental control devices* – the corresponding analog feedback point of the device under control changes to the desired value, within a tolerance, individually specifiable for every device.
3) For *setpoint outputs* – the corresponding analog feedback point of the output under control changes to the desired value, within a tolerance, individually specifiable for every device.

Successful controls shall be recorded as an event. If the control was unsuccessful, an alarm shall be generated. The alarm shall differentiate between failures due to communications problems and failures of the device to achieve the desired end state.

For supervisory control commands issued as part of a group control or load shedding operation (Section 6.7), the successful completion of all control actions shall be reported via a single message. If any operation is unsuccessful, the user shall be informed of those devices in the group that failed to operate by individual alarms.

Where a supervisory control action is initiated by an application (via the programming interface described in Section 2.2.1, Open Systems Interfaces), the interface shall include features to report the success or failure of the control action to the application.

6.5.8 Control Permissive

The supervisory control function shall perform a permissive check immediately after the user has selected the device and control action. The presence of any, all, or none of the following conditions for the selected point shall be deemed as a failure of the check:

1) The feedback point for the control point is in the state to be realized by the control command
2) A status value from the SCADA/ADMS database, designated for each controllable point, evaluates as true

3) A tag with a supervisory control inhibit property is set.

If the permissive check fails, the user shall be informed of the failure by a message that clearly indicates the permissive failure and that differentiates among the check types. The user shall be presented with the options of canceling the control action and of overriding the permissive. If the user elects to override the permissive check, the message presented for the execute step and all records of the control action shall clearly indicate that the user has overridden the permissive check.

If the permissive check passes, the control sequence shall proceed to the execute step.

Where a supervisory control action is initiated by a Contractor- or TPNODL -supplied application (via the programming interface described in Section 2.2.1, Open Systems Interfaces, the interface shall include features to report the presence of a control inhibit tag and to accept override commands from the application.

6.6 Switching Orders

A switching order is a list of operations to be directed by the user when carrying out a procedure for switching elements of the power system. The SCADA/ADMS shall support the manual creation, automatic creation, execution, display, modification, maintenance, and printing of switching orders. This shall include the ability to define time delays and breakpoints as part of switching orders.

After a switching order has been created, the user shall be able to have it saved.

Once defined, switching orders shall be executable in real-time and in study mode. Study mode execution shall allow the user to check out the switching order's potential impact on the power system prior to actual execution.

6.6.1 Manual Creation of Switching Orders

The user shall be able to create a switching order by using a full screen editor to enter information for the header and the body of the switching order. Preparation of the switching order shall require as little user interaction as possible. This shall include the ability to start from an existing order.

The header shall contain information such as the following:

1) Switching order sequential number
2) Circuit name
3) Permit required (Yes/No)
4) Start date and time
5) Complete date and time
6) Crew ID: Service car number and crew names
7) Nature of work
8) Location of work
9) Prepared by whom and when
10) Checked by whom and when.

The body of the switching order shall consist of multiple entries defining the actions to be taken. Each entry shall have an entry number automatically assigned by the SCADA/ADMS. The user shall be able to enter the text of each entry directly, or employ a macro capability in which the macro has already been defined as a complete or partial switching order.

When the user enters a switching order macro, the macro shall be automatically expanded to the full text. The user shall be able to edit the text of the macro expansion. In some cases, the user will have to fill in the blanks in the macro expansion to complete the entry.

TPNODL will determine the exact form and content of the switching order headers and macros during the course of the project.

6.6.2 Automatic Switching Order Creation and Execution

The user shall be able to initiate the automatic creation and execution of a switching order that will reconfigure lines, buses, or feeders according to rules supplied by TPNODL This shall include the rules used by the Fault Isolation and System Restoration function (Section 10).

To initiate automatic creation and execution of a switching order, the user shall be able to identify (e.g., by a point-and-click operation) the transmission line, bus, feeder, or feeder sections to be reconfigured (i.e., disconnected or reconnected) and then request the SCADA/ADMS to automatically create and execute the appropriate switching operations.

If desired, the user shall be able to review the switching operations created by the SCADA/ADMS, make any necessary changes, and then request their automatic execution of the same. Each switching operation shall be listed in the order in which the switching devices need to be controlled (tagged, opened, closed, etc.).

6.6.3 Automatic Generation of a Blackout Order

Most switching orders are created to perform temporary work. When the work is completed, there is often a requirement to restore or backout the circuit to normal conditions. This is frequently the opposite procedure from the one used initially.

The SCADA/ADMS shall provide a mechanism to automatically generate a backout switching order. Starting from an initial switching order, when the user requests "Generate Backout Order", the SCADA/ADMS shall reverse the order of all entries in the body of the initial switching order and shall change each of the "reversible" entries to its opposite. For example, an entry CLOSE BREAKER shall be reversed to OPEN BREAKER, an entry PLACE TAG shall be reversed to REMOVE TAG. The ultimate list of "reversible" entries and their associated "opposites" will be developed in coordination with TPNODL during the course of the project. The user shall be able to edit the text of the various entries. Before the user is permitted to save the backout order, the SCADA/ADMS shall prompt the user to edit its header.

6.6.4 Maintenance of Switching Orders

After a switching order has been created, the user shall be able to have it saved. The SCADA/ADMS shall save the actual expanded text of the switching order, not the text of the macros or the supervisory control procedure used to create it.

The SCADA/ADMS shall maintain a directory of switching orders, organized by area of authority. The user shall be able to use the directory to review, copy, rename, print, and delete switching orders, and to call them up for review and modification.

The SCADA/ADMS shall also maintain a file of switching order macros, organized by area of authority, and sorted alphabetically. The user shall be able to add, delete, and modify the macros in this file according to the console's assigned areas of jurisdiction. While manually creating a switching order, the user shall be able to open a window, view the contents of the macro file, and select the macro to be expanded and placed in the switching order being created.

6.6.5 Switching Order Execution and Checkout

Once defined, switching orders (including backout orders) shall be executable in real-time and in study mode. Execution shall take place in proper sequence automatically or in manual step-by-step mode based on assigned breakpoints. All built-in time delays and breakpoints shall be recognized. Alternatively, the user may temporarily assign new time delays and breakpoints.

Study mode execution shall allow the user to check out the switching order's potential impact on the power system prior to actual execution. This capability shall also be available during the course of

preparing the switching orders. In particular, it shall be possible to verify whether a planned switching order will result in power system overloads and voltage problems. The new circuit configuration, the energization of the circuit segments (as described in Section 10.2.5, Distribution Power Flow), and the ampere and voltage values expected from the planned switching order shall be shown on study versions of the power system world-map displays using dynamic coloring to highlight all possible limit violations.

6.7 Load Shedding and Restoration

A load shed and restore function shall be provided. The load shed function shall consist of four packages:

1) Under frequency relay monitoring (Optional)
2) Manual load shed
3) Rotational load shed
4) Restore.

The results of any load shed operation shall be archived in the ISR (Section 7).

7. Information Storage and Retrieval (ISR)

7.1 General requirements

The purpose of ISR is to facilitate storage, archival and retrieval of process parameters for creating information through comparison and contrast and messaging of stored values to create valuable information for business of grid operation. ISR system shall store real-time process values and their quality codes in an auxiliary memory, and also provide the means to access this data and display it through high-quality graphics, plots, trend and Management Information System (MIS) reports.

Any data value in the SCADA/ADMS shall be available for collection, calculation, retention, and archiving by ISR. This includes scanned data, data received via data exchange such as ICCP, SCADA/ADMS calculated data and data produced by SCADA/ADMS applications.

Any authorized, designated SCADA/ADMS user shall be able to access all ISR functions, review scheduling and historical information, and edit information from any SCADA/ADMS console. ISR shall also be accessible from TPNODL's Enterprise LANs.

At a minimum, ISR shall consist of a commercially available Relational Database Management System (RDBMS), capable of supporting two-tier client/server or three-tier client/application/server architecture, through the TCP/IP protocol. ODBC (Open Database Connectivity) is required, with documented and demonstrable compatibility with Microsoft Access, Microsoft Excel, and other common front-end software. The RDBMS must be accessible by SQL and DDE based data management tools. It shall also be possible to automatically save selected ISR data to the corporate data warehouse system.

A solution that includes the capability to capture (for future analysis and/or replay) of all changes of real-time data (similar to a flight data recorder) is strongly preferred.

Any third-party license(s) provided to support these functions must allow TPNODL "full-use" of the software. It shall provide for all use by TPNODL for all databases and applications delivered with the system by the Supplier, as well as permit TPNODL to develop additional applications and/or databases generally related to the functionality of the system.

7.1.1 ISR Data Archival

The ISR system shall have the capability to capture the data points from the different sources (raw data) in native resolution and provide long-term data storage on-line The raw data can be captured

either by exception or periodically. ISR system shall have the capability to store quality information together with raw data. The results of all calculation created, including the original input data must be stored on-line for five (5) years, in its original collected resolution. The addition, deletion, or modification of data to be collected and processed shall not result in loss of any previously stored data during the transition of data collection and processing to the revised database.

The ISR system shall have feature of the manual correction of the archived data with a unique flag. This shall be limited to only to the authorized users. All such changes shall be logged to the audit file for future reference.

The ISR system shall have feature of creation of forms and screens for manual data entry.

Different templates need to be prepared by the supplier so that ISR user can create customized reports for business purposes.

The alarms and events shall be stored in the RDBMS. The Supplier shall provide user-friendly forms that allow the operator to build ad hoc queries of any combination of the individual fields stored with each entry. These fields include date, time, substation name, point name, alarm category, alarm priority, alarm type, data type, and message text. Queries may be saved and query results may be viewed, printed or written to a file. In addition, each entry may have an operator-entered comment.

Data shall be recorded in such a manner that it is possible to retrieve a complete picture of the power system from any date and time specified by a user (i.e., a “snapshot”). This snapshot shall include all power system telemetered and derived measurements and statuses (including quality codes, analog limits in effect at the time, etc.) as well as system alarm and events. The Supplier shall provide all tools necessary to retrieve this data using SQL and ODBC-compliant applications.

The ISR system shall also be used for mass storage of data and files such as SCADA/ADMS application save-cases, Output results of ADMS applications, Outage Schedules and Continuous real-time data of selected time window.

Facilities to sort and search and selectively display and print the contents of the system message log shall be provided through the ISR user interface. A user shall be able to select the display of system message log entries based on the following sort or search parameters and combinations of these parameters:

1) Alarms – Select a set of alarms based on alarm partitioning and severity level
2) Events – Select a subset of events based on user action (including specific users) and application function detected condition (including specific applications)
3) User log messages – Select a subset of log messages based on specific or all users
4) Substation – Select a subset of alarms or events based on a specific or all substations
5) Device Type – Select a subset of alarms or events based on specific device types
6) Device – Select a subset of alarms or events based on specific devices
7) Time Period – Specific time periods shall be supported.

A display shall be provided to permit the user to define the selection criteria for sorting or searching. When a user calls up the display, the user may select an existing selection criteria previously defined by the user.

Software utilities shall be provided in the ISR system to back-up the ISR data to a SAN System available on network. This software should have the feature of automatic as well as the manual backup of data. This utility shall also provide the feature of retrieval of data for selected period to be used in generation of reports through User friendly pull down menu and drag and drop facilities.

7.1.2 ISR Data Processing

The processing of incoming data inputs for calculations shall be supported on all input data of the ISR system including digital and analog values. The ISR system shall allow calculations to be easily configured, verified, documented, and modified. The ISR system shall perform the calculations in real time and allow results to be trended and archived with the raw data without affecting the operations of the source systems. The equations of these calculations shall be able to use mathematical functions, logical operators, conditional operators and trigonometrically functions. The frequency of these calculations shall be configurable on per calculation basis. The calculation tool shall also have

a. Ability to define static variables.
b. Ability to define logic based expressions
c. Standard math library and facility to add new formula in standard math library by the user.
d. user definable calculation frequency
e. Adding new calculation without affecting the existing calculation service
f. Ability to define return error codes for any calculation

7.1.3 ISR External Interface

The ISR system shall allow Web Services to publish data into the database through multiple offline applications.

It should be able to compress data, and should have 100% retrieval accuracy. However, the retrieval of compressed historical streams should be of the same performance levels as normal SCADA retrieval. The ISR should be able to interface over ICCP, OPC, ODBC and CIM/XML to external systems for analytics over SOA / ESB for Integration with IT Systems, over the Enterprise Services Bus & SOA Architecture. The ISR system shall act as the real interface between SCADA/ADMS and ERP/other System, where-by the real-time operational system is not affected with a transaction processing system in IT, and the Integration efforts will not in any way effect the real-time operationally of SCADA/ADMS System.

ISR System shall have inbuilt OPC Server functionality so that OPC Client shall be able to take the data from ISR system using a defined OPC interface.

The ISR system shall also have an ODBC (Open Database Connectivity) interface which shall allow all the historical data to be accessible by Personal Computers (PCs) running Microsoft-Windows based applications. A dynamic link between the ISR system and the spreadsheet shall enable an automatic update of the spreadsheet whenever data point change.

7.1.4 ISR User interface (UI)

The UI of ISR system shall have the capability for the data points to be presented in various formats .These shall include trends i.e. time series data, Tabular & Graphic and Static reports. It shall allow users to create interactive, configurable displays for publishing on the operator workstations as well as on the web system.

The ISR system shall provide a development tool to develop customized display screens. This tool shall provide the ability for developing their own display screen independent of user and workstation. It shall be possible to search for a data point by defining a search criterion in the system.

The ISR system shall provide the simple user interface for creation of reports through drag and drop functionality. The ability for report to carry some parameters for manual entry shall be supported. The ISR system shall provide the facility of creation of user friendly screen for manual entry.

The ISR system shall have the feature for presenting the data on 3 dimensional trend, graphical displays and contour Map.

The sample of reports and displays is enclosed at Appendix-B. The detailed shall be finalized during the engineering Stage.

7.1.5 Historical Trending

The Historical trending facility should have feature/facility to

1) Rescale and Re-label axis
2) 3 dimensional display
3) Zoom in and Zoom out on data by rubber banding
4) Selection of points through drag and drop features
5) display the timestamp and value of all the trends for any point on the trend while hovering over it with the mouse
6) save the configuration (trend point, sampled interval, trending period etc) for viewing at later stage
7) Configure up to 6 points in a single trend.
8) plot raw, average, interpolated, min and max over a user defined sampled time
9) Compare up to 4 different time periods on the same plot simultaneously.
10) Compare (trend) of two different days for the same parameter.
11) Customize trend properties such as Foreground and Background colour, scaling, line colour, thickness, font size, plot style, type of data marker.
12) Overlay alarm thresholds on the trend display.

7.2 Server Support requirements

For the purposes of computer and memory sizing, the SCADA/ADMS shall be capable of storing the information listed in the ISR System Sizing Requirements (Table 3-4: ISR Data). Sufficient capacity shall also be provided to extract and store the data needed for a query when that query covers the maximum number of retention days for the highest periodicity data retained. “On-line” storage is defined as the set of data that is maintained locally on the ISR high-performance (i.e., “hard”) disks.

The ISR facility shall be logically separate, redundant nodes within the SCADA/ADMS environment and optionally, a non-redundant replication node on the Enterprise WAN. It shall service a large number of information users while ensuring that the security and performance of the SCADA/ADMS are not affected. The ISR facility shall be configured such that impact to the SCADA/ADMS processors and network is deterministic (i.e., fixed and not dependent on external users’ activities). The response of SCADA/ADMS applications shall in no way be affected by access to the ISR from outside the SCADA/ADMS environment.

7.2.1 ISR System Monitoring

System and database administrators shall have a facility through which they can monitor RDBMS health, resource utilization and performance.

7.3 Client Capabilities

ISR shall provide data access to the ISR database by SCADA/ADMS users, and users attached to TPNODL Enterprise LANs using all of the data retrieval capabilities of the RDBMS. The PCs or consoles will be connected either to the SCADA/ADMS LAN or TPNODL Enterprise LAN/WAN which is connected to the ISR LAN via bridges, routers, servers, firewalls, or gateways depending on the security requirements of TPNODL Data retrieval shall meet the latest SQL standard. Remote data retrieval shall be subject to appropriate security measures but shall not be dependent upon TPNODL staff help or intervention. The Supplier shall provide the database client software, and any additional Supplier-developed client software needed to utilize the ISR capabilities.

7.3.1 User Access

SCADA/ADMS users shall not require additional login (user name and password) to the ISR facility (i.e., their unique SCADA/ADMS login shall be used). TPNODL prefers that “Single Sign-On” (SSO) technology

be employed (i.e., a user logs on once to the SCADA/ADMS using individually defined user name and password which permits appropriate level of access to all SCADA/ADMS facilities, including ISR. Further, the facility should be compatible with TPNODL enterprise-wide SSO capabilities.

ISR data shall be available for display in tabular and graphic form using all of the capabilities of the RDBMS, including an ad hoc query capability. The ISR user interface shall comply with the general user interface requirements specified in User Interface (Section 4). The user interface display creation capabilities provided by the graphical user interface (GUI) of the RDBMS supplier or other commercially recognized package using fourth-generation languages shall be available for generating displays.

It shall be possible to display any calculated data value as a stand-alone value; that is, it shall not be necessary to display any collected data that is used in the calculation in order to display calculated data on a summary-type display. Any quality code, tag, or data value stored for any ISR data value shall be displayable. The retrieval function shall incorporate the following features as a minimum:

1) Menu driven data selection process
2) Pre-formatted sets of data retrieval request displays built via the User Interface Development software
3) Sets of predefined, generic access routines for typical types of access, such as all analog points at a specific time, maximum or minimum of a value over a specific time period, etc.
4) Capability to define ad hoc queries to call for any specific value(s) that have specified similar characteristics over specified periods of time
5) Capability to display data graphically
6) Restrictions on access to confidential information based on user access control.
7) A Web Browser User Interface is strongly preferred.

Sufficient relationships shall be maintained between the ISR data and the SCADA/ADMS database to ensure that selections can be made based on comparison between stored ISR values (such as a periodically saved bus voltage value) and any related, fixed SCADA/ADMS value (such as the bus voltage limit). Data that is archived off-line must be manually brought on-line before viewing.

7.3.2 Data Integration

ISR shall be designed to relate disparate data types at a specific period in time from data stored in the RDBMS. Examples of such data relations include operational data, alarms and events, dispatch instructions, and energy accounting data. Through this integration it shall be possible to easily recreate periods in history so that activities such as supporting dispute resolution can be handled efficiently.

7.3.3 Data Entry and Edit

Operating, billing, maintenance, and other personnel will need to enter and edit data in the RDBMS. The data entry front-end shall be consistent and compatible with the GUI. Commercially recognized and available tools (e.g., Oracle Forms, Access Forms, and other third party packages) are preferred. The Supplier shall describe the method by which this is accomplished in the proposed system.

7.3.4 Audit Trail Event Report

An audit trail of all changes made to the ISR database shall be maintained and made available for display and printout. This audit trail shall identify every change made to the ISR database content or structure, the time and date of the change, and the logon ID of the user making the change. The audit trail shall include both before and after values of all content and structure changes. Printouts and displays of the audit trail event report shall be available in formats sorted by period (from date/time to date/time), by data value(s), and by logon ID of the user making the change.

7.3.5 Function Access

The Supplier shall provide a library of programming interfaces to allow any function added by TPNODL to access ISR for information storage and retrieval. The capability to embed special SQL statements directly into the program (i.e., embedded SQL capable compilers) shall be provided for all supplied programming languages. Program callable APIs shall also be provided. The data storage times closest to the date and time specified by the user shall be used to select values from the ISR database.

The ISR database shall also provide an interface to other commercially available software packages such as spreadsheets, word processors, report generators, and other RDBMS products via the latest standard SQL data requests or ODBC drivers. Information retrieved from ISR shall be able to be imported into PC-based applications such as Microsoft Office Professional.

7.4 Database Generation and Maintenance

A commercial RDBMS shall be used to create and maintain the ISR database. Analog and status data points that are to be collected shall be defined in the SCADA/ADMS database and shall not require separate ISR definition. It shall be possible to specify any SCADA/ADMS data value to be collected upon occurrence. It shall also be possible to specify the calculations to be performed on selected data being collected. Data is stored in the Historical database by exception.

The Supplier shall provide a library of programming interfaces to allow any SCADA/ADMS function added by TPNODL to access information from ISR or send information to ISR for storage.

Stored data shall not be affected by any subsequent database changes. All ISR data shall remain retrievable regardless of content or structure changes to the SCADA/ADMS or ISR databases.

7.4.1 Data Model

To take maximum advantage of the ISR RDBMS for data storage and retrieval, it is necessary to formally relate to each other the various items of data that are being stored. For example, TPNODL schedules a transaction with a particular company but each company has multiple contracts with TPNODL When these relationships are determined and documented, the resulting document can be called a Data Model. The Data Model can then be used to set up the RDBMS. This Data Model shall be compatible with the specifications of the Common Information Model (CIM). The Supplier shall describe the process of developing the Data Model as well as using it to set up the RDBMS.

The domain of the data determines the form and content of a particular data model. Network Analysis data models may, for example, be very different from interchange transaction data models. The Supplier shall describe the structure of their proposed data model and the process of maintaining this model and developing new models, as they become needed.

7.4.2 Time Oriented Data

The ISR database shall be structured for handling of leap year and century changes (a design that stores time in UTC is preferred).

7.4.3 ISR Data Calculation

ISR is primarily meant to be a data collection and storage subsystem. In general, the data shall be made available to the SCADA/ADMS and other computer systems, workstations, and/or PCs on TPNODL Enterprise LAN/WAN for their data manipulation and analyses. Capability is required, however, for the ISR to be able to perform the standard calculations described below, on any of the data.

The results of the real-time SCADA/ADMS calculations and application programs shall be collected in the same manner as any other real-time data for storage in the ISR database. This section specifies the additional calculations that can be performed on collected data prior to storage into the ISR database. The ISR Report Generator shall perform an additional set of calculations at the time of report printout.

It shall be possible to perform predefined calculations on any collected data value at specified periodicities. It shall also be possible to perform further calculations on previously calculated data and on constants. These calculations shall be definable by the users via the RDBMS. No SCADA/ADMS database generation shall be required, nor shall a system restart be necessary, after calculation data has been edited or entered or calculation steps have been redefined.

Calculations of the following types within a data set (particular snapshot in time) shall be supported:

1) Algebraic summation and subtraction
2) Add if positive or add if negative
3) Absolute value
4) Multiply, Multiply if positive, or Multiply if negative
5) Divide, Divide if positive, or Divide if negative
6) Square root
7) Exponential
8) Conditional testing (>, □, =, ±, □, □,□)
9) Boolean operations
10) Nested If, Then, Else
11) Trigonometric functions
12) Calculations of multiple samples (over time) of the same data value shall be supported. This includes minimum, maximum, average, and total for the following time periods:
    a. Quarter hourly
    b. Half hourly
    c. Hourly
    d. Daily
    e. Weekly (starting on a user-specified day of the week, default to Sunday
    f. Monthly (starting on a user-specified day of the month, default to the 1st)
    g. Yearly (starting on a user-specified month, default to January).

All calculated data shall include a quality code derived from the quality codes of the data used in the calculation. The quality code of the calculated data shall be derived in a similar fashion to the quality code of calculated real-time data points.

It shall be possible to request recalculation of ISR data after a manual modification of stored data by the user; the calculation definitions must be stored with each data set. As long as the data modified by the user lies within the specified minimum retention period (i.e., the data is still available online), the ISR shall propagate the results of the calculation within the data set that the data was modified; except for totals such as, day total, monthly total, etc. The recalculation shall use the same formulas as the original calculation.

7.5 Information Delivery

The Supplier shall provide enterprise information delivery tools that support ad hoc data retrieval reports as well as the creation and maintenance of periodic and on demand reports. The tools shall be highly interactive and preferably web-based, allowing the user to see representative output from the report during the building procedures. The reporting software shall have full read-only access to the ISR database and real-time database and shall support sorting, filtering, algebraic, logical, and arithmetic functions such as spreadsheet calculations, to allow for creation of reports. The software provided shall be a commercially available package capable of generating complex reports. The ISR shall provide the capability for TPNODL users to configure report formats. Version control of report definitions shall be integrated with the source control system established for the development system. Any report may be displayed on the screen, sent to any printer, or sent through an industry standard messaging system (e.g., Email) to any destination. The display of time-related data shall be as described in Section 7.4.2, Time Oriented Data.

7.5.1 Reports

Any authorized SCADA/ADMS user shall be able to schedule the generation of ISR reports by time and date or on demand. In addition, the user shall have the capability to specify conditions detected by the SCADA/ADMS where designated reports are automatically initiated. Reports shall have the capability of being regenerated if a value in the report is adjusted and all dependent values are re-calculated.

The facility shall be able to securely publish these reports in any format (including HTML, XML, PDF, delimited text, Postscript, and RTF) to any destination (including e-mail, Web browser, and file system). The user shall be able to designate the format and destination to which reports are generated. If the destination is a hard copy printing device, the system shall use available (i.e., base operating system) print file spooling logic. This shall include automatic redirection to a compatible output device and notification to the system administrator and to the report requestor of the redirection. The report shall not have to be rebuilt to send it to additional destinations. The ISR shall track successful report distribution and receipt and shall generate a notification for any delivery failures.

7.5.2 Ad Hoc Reporting Functions

The ISR database tool set shall include a method for extracting data using industry standard SQL or ODBC.

7.6 Data Archiving

The retention period given in the ISR Sizing Requirements (Table 3-4: ISR Data), is the minimum length of time the data shall be kept on-line for validation and editing purposes. Whenever unachieved data is older than the retention period, it shall be capable of being transferred to the archival system. It shall be possible to manually archive any data set. Any data within the time range of the archiving periods shall be available on-line, through the same user interface and not require any manual intervention to load or unload archival media.

ISR shall provide alarm messages that indicate when the archival media used for archiving is approaching its capacity so that it can be removed from the system for off-line storage.

ISR shall include a directory containing information on all historical information that has been recorded by the ISR, whether it is still in on-line retention or has been removed from the system for off-line archive storage. It shall be possible to reload any ISR archival media that has been removed from ISR and access the archived data without disturbing the collection, storage, and retrieval of ISR data in real-time and without requiring that any current on-line archives be removed from the ISR system.

The proposed data archiving solution shall be consistent and compatible with the ISR data redundancy requirements of Section 2.1.3, Information Storage and Retrieval System. TPNODL's preference is for a standard, commercially available solution from an appropriate third party supplier.

7.7 Historical Information Applications

The SCADA/ADMS shall have the capability to create a picture of the state of the power system at given points in the past. This picture not only requires a snapshot of the power system telemetered and derived measurements and statuses, but also the results of various application programs (e.g., limits and associated existing conditions), as well as prevailing alarms.

Historical information shall be used to support control room activities in the current day/hour operating timeframe. The ISR shall record historical information in a manner that can be accessed quickly for control room functions. Outside of the control room operating timeframe, performance requirements are less stringent, but the ability to access data through ad hoc queries becomes more important.

Historical snapshots of the power system are required to support the following processes:

1) Historical data required by TPNODL to support business processes and decision support. For example, various forecasting activities are based on past history.

2) Disturbance analysis by TPNODL to analyze and report on power system events defined by operating policy.

7.7.1 Disturbance Data Collection

Data describing the condition of TPNODL Power System just prior to and immediately following disturbances shall be captured and stored at the fastest scan rate. The SCADA/ADMS shall automatically trigger disturbance collection upon detection of a defined condition or on demand. These conditions shall be user definable and shall consist of designated device state changes or other SCADA/ADMS alarm conditions. The user shall be able to temporarily enable/disable any initiation condition. A user may also be able to designate a disturbance "after-the fact". In this case, all available system data for the designated time period shall be saved as if the system had detected a disturbance. A unique alarm/event message shall be generated indicating the initiation and conclusion of a disturbance.

The data shall be captured and stored for contiguous pre-disturbance, disturbance and post-disturbance periods. The duration for each period shall be user-adjustable. Storage for independent disturbances (case files) is defined in the ISR Sizing Requirements (Table 3-4: ISR Data). A user interface shall be provided to allow authorized users to manage the disturbance case files. Through this user interface, the user may enter or modify descriptive text associated with the case, delete case files or lock them to prevent removal. The system shall generate an alarm prior to the last available case file being written.

The user shall be able to view captured disturbance data on displays and printed reports for after-the-fact disturbance analysis. The data shall be accessible via Open Data Base Connectivity (ODBC) tools. The Supplier shall describe the standard reports available along with any related ad hoc analysis tools.

Data points in the disturbance case file may be trended or played back on SCADA/ADMS tabular and graphical displays. Playback control shall allow the viewing of data both forward and backward in time, as well as pause and fast forward/reverse. The user shall also be able to designate an instant within the disturbance case file for as a "snapshot" to be used in other power systems applications (e.g., Power Flow or Operator Training Simulator). Within a disturbance case file, the user may select events for conversion and inclusion in a training simulator scenario.

7.7.2 Network Analysis Save Cases

The Operators and users shall be able to save specified network analysis save cases in the archive save case library. The utility programs of the archive save case function shall be used to save network analysis data sets including input data, output data, and, if necessary, the power system network model associated with the save case. The archive save case function may save only the dynamic data, however, sufficient data shall be saved to reconstruct the original network analysis solution. The Power System network Analysis User Interface (Section 8.1.2) shall be used to view and execute save cases retrieved from the archive library. The storage requirements are defined in Section 3, Capacity and Performance, Table 3-4, ISR Data.

7.7.2.1 Archive Save Cases

The Operators and users shall be able to manually or automatically save real-time or study save cases to the archive save case library. The user shall be able to specify the periodicity and length of time to automatically archive a set of real-time save cases. Study save cases shall be archived by manual user request. The utility program shall allow the user to enter a description of each save case. Archiving a save case to the archive library shall be a simple function requiring a minimal number of steps for the

user to implement the save case request. Archive save cases created shall be read only to prevent corruption of the original data.

After a user-definable period of time (depending on the number of save cases that are archived), the older save cases in the archive library shall be transferred to permanent storage.

7.7.2.2 Retrieving Archived Save Cases

The utility program shall be used to view the description of the save cases in the archive library and retrieve the save case. Archived save cases shall not become out-of-date due to power system configuration changes. The SCADA/ADMS shall archive the power system network model whenever changes are implemented in the model. Each network analysis save case shall include an identifier specifying the version of the power system network model associated with the save case. Retrieval of a network analysis save case shall also retrieve the power system network model associated with the save case if required.

8. Power System Network Analysis

8.1 Overview

The Supplier shall provide a suite of Power System Network Analysis functions. The network analysis functions comprise a set of tools for power system security analysis and simulation. The network analysis functions, for both real time and study applications, shall be sized according to the power system sizing tables provided in Section 3, Capacity and Performance, Table 3-5: Power System Data.

The performance of the network analysis functions shall meet the performance requirements set out in the tables in Section 3, Capacity and Performance, Table 3-8: Function Periodicity and Execution Time.

The network analysis functions shall enable the Operators to monitor, control and plan the reliable and economic operation of TPNODL sub-transmission system.

The Operators will be the primary users of network analysis functions in the real-time mode. Other users supporting daily operational planning and analysis may also utilize the network analysis functions in the study mode.

Network analysis and security control monitoring shall provide the tools required for the analysis of the transmission system to ensure that individual elements are operated within TPNODL overall reliability criteria. Some of TPNODL criteria for reliable operation require:

1) Loading of equipment to respect continuous thermal limits
2) Voltage on equipment to respect corresponding voltage limits
3) Loading of equipment following credible contingencies be within time-limited thermal limits
4) Voltage on equipment following credible contingencies be within specified limits
5) Voltage and angular stability is maintained following credible contingencies.

Functional capabilities and user interface capabilities of the network analysis functions shall be designed to provide TPNODL Operators with tools that help them evaluate, control, and correct operational problem that occur or may occur. The user interface to these functions shall be designed for Operators and shall be tailored toward the resolution of operational problem in a highly interactive manner. The fact that requirements have been defined by function shall not lead to the conclusion that it is acceptable to provide a set of functions executing in isolation, on the contrary, a highly integrated set of functions is required.

The Supplier shall propose a standard product whenever possible and where this is not feasible, the Supplier is encouraged to offer alternative solutions that leverage the standard product to best advantage.

A common power system model database shall be used for all power system network analysis functions.

8.2 Load Forecasting

The Load Forecast (LF) function shall provide load forecasts every fifteen (15) minutes, based on historical load and weather data and forecasted weather data. The output of the LF function shall be available for use by the Operator via the full graphic User interface, and will be used by other functions.

8.2.1 LF User Capabilities

The LF function shall be executed on demand for a User-defined study period to forecast loads on fifteen (15) minute basis. In addition, LF shall be executed to re-forecast the loads should weather forecasts change significantly or should new telemetered data indicate a significant difference between the actual load and forecasted load. There shall also be a User-selectable option to execute LF automatically each hour in a single-day forecast mode to update and refine the current day's load forecast based on the most recent load data. Excessive deviations between actual and forecasted load and weather data shall be reported.

The need for User input shall essentially be limited to input of weather forecast data. Any other inputs shall be related only to executing control and editing. Capability must exist to import weather data from an external file as provided by a forecasting service.

Capability shall be provided to store historical load and weather data for future load forecast purposes. The impact of any load management activities (reference Section 6.7, Load Shedding and Restoration) in progress at the time the historical load data was captured shall be properly accounted for. The following capabilities shall be provided:

1) Manual or automatic retrieval of data for input to LF
2) Automatic storage of new data as it becomes available
3) Interactive access to historical LF data profiles for tabular and graphical display
4) Interactive editing to support maintenance of LF data profiles.

It shall be possible to store a working case as a save case for permanent storage. One of the save cases shall be assigned to the Current Load Forecast as the basis for retrieval of load forecast data by other functions.. The User shall be able to make changes to disposable working areas without affecting the original save cases..

Tools shall be provided that facilitate a search for historical LF profiles that will match the current-day situation. It shall be possible to view these profiles and load them in a User's working area to be used as a basis for further load forecasting. The User shall be able to initiate an automatic adaptation of a selected historical profile based on differences between historical weather variables and the current weather forecast. The User shall also be able to copy one day's forecast to another day.

The User shall be able to edit load forecasts as well as weather forecasts by either editing individual hourly values or entering parameters that will reshape daily curves. It shall be possible for the User to reshape a forecast by specifying a scaling factor (multiplying all forecast values by a number) or a bias factor (add a positive or negative number to all forecast values). As an alternative to specifying a scaling factor, it shall also be possible to enter a new peak load value. Capability shall also be provided for the User to graphically modify a daily load curve. Individual changes to weather forecast input parameters shall also be permitted.

Flexible tools shall be provided for entry of weather forecast data. It shall be possible to predefine blocks of hours during a day for which weather data will be entered. It shall be possible to override block values by hourly values or directly enter hourly values. It shall be possible to automatically use real-time telemetered data and/or forecast data from a weather service, if available.

The LF function shall be useable in a real-time mode to forecast the load for a number of days into the future or in study mode to provide a forecast for any future period.

The LF function shall compute error statistics using the actual load data and the forecasted load data. An error corrective feature shall be provided to adjust the forecasted load for the remaining hours of the day. The adjustment shall be calculated and shall be a function of the error between the actual load and the forecasted load from the previous hour.

8.2.2 Weather Variables

The LF function shall support multiple weather variables per load forecast area. The modeled weather variables shall typically include:

1) Temperatures (ambient , drybulb, heating degree days, and dewpoint)
2) Rainfall
3) Cloud coverage
4) Wind speed
5) Wind direction.

The relative humidity shall be calculated from the ambient and dew point temperatures.

The User shall be able to select the weather variables to be used in the search for the best load pattern match. In addition, the capability to weight variables more heavily than others shall be provided.

8.2.3 LF Solution Requirements

The LF function shall utilize one or more of the following algorithms:

1) Pattern Matching Forecast
2) Weather Adaptive Forecast
3) Neural Network Forecast.

The pattern matching forecast compares the current conditions, such as day type, time of the year and weather forecast to historical data profiles for the best match. For every match, an index shall be computed that is a measure for the quality of the match. Upon selection of a match, the pertinent data for that match shall be displayed together with the selected curves. The User shall have the capability to select the load profile to be used by Load Forecasting. Storage for a number of years of historical data profiles shall be provided.

The weather adaptive forecast shall use actual load data, actual weather data and weather forecast data to calculate a load forecast. The actual forecast shall be based on a load model whose parameters have been calculated using a parameter identification algorithm. The parameter identification algorithm shall calculate model parameters that best fit the recent load behavior. As an alternative, the Supplier may propose a method, which uses a load profile selected by the pattern-matching algorithm as the basic load pattern and adapt this load pattern using a load model that is based on differences between actual and historical weather conditions. Tools shall be available to periodically update the weather sensitive load models. Model analysis software shall be available to identify the best forms of the load models.

The neural network forecast shall correctly process the different variables that characterize system load including load patterns and weather variables. The neural network shall use state-of-the-art techniques for pattern recognition and short-to-mid-term prediction of load.

Initial load models shall be developed by the Supplier using historical load and weather data provided by the Purchaser. Purchaser support is available to coordinate the collection and population of historical load and weather data.

The Supplier shall supply all programs, off-line and on-line, that are necessary to develop new load models along with the necessary training and documentation so that the Purchaser will be able to maintain those models in the future. Any graphical tools necessary for model identification and parameter estimation shall also be provided.

Capability shall be provided to perform an after-the-fact analysis, which would compare actual and forecasted load and weather data for each area. Significant differences shall be summarized.

The LF function shall be capable of producing load forecasts for the next 24 hours at hourly intervals with a percentage error of less than 2.5%. The error shall be defined as the average of the absolute value of the difference between actual values and forecasted values (using perfect weather forecast data) divided by the actual value, for the forecasting period.

8.2.4 LF User Interface

The LF User Interface shall be highly interactive and versatile. Tabular displays and graphical plots of all load forecast data shall be provided.

The following displays shall be provided as a minimum:

- Load Forecast Data
- Weather Forecast Data
- Historical Load Data (actual system load plus the estimated load shed or managed)
- Historical Weather Data
- Load Model Parameters
- Graph showing the forecast and actual load
- Error Analysis Displays
- Execution Control Displays
- Execution Message and Alarm Summary
- Save Case and Study Control Displays.

9. Operator Training Simulator

The Supplier shall provide an Operator Training Simulator (referenced as Simulator). The Simulator shall be a computer system designed to respond to the user's inputs the same way the real power system does, and to interface with and respond to the computer systems designed for monitoring and control of the real system with the same level of fidelity as the real system. The intent is to use such a Simulator as a training facility for TPNODL staff and other users who participate in the management and administration of the power system, as a facility for testing software, applications and database changes, as a study facility for analyzing changes to the System, and as a test bed for developing and testing operating procedures. To support these goals, the Simulator shall also provide functionality to help setup simulation and manage simulation scenarios, for simulation oversight and control, and for review of simulation results and the trainees' performance. As such, the Simulator shall consist at a minimum of the following components:

1) Power system network simulator
2) Power system dynamics simulator
3) Scenario builder, including interfaces to historical, forecast and other data sources that can be used to set up a simulation scenario (normal and high activity)
4) Simulation management capabilities, including management user interface
5) Interfaces to and copies of the System and other systems whose full functionality is desired
6) Interfaces to and simplified implementations of those systems whose functionality is to be approximated.

The Simulator shall include the functionality listed in Table 9-1: Operator Training Simulator – System Requirements, exactly as implemented on the SCADA/ADMS System, using the same power system model databases.

Specification Volume and Section	System Requirements Executing on the Operator Training Simulator	Req.
Volume II, Section 2	SCADA/ADMS Architecture (As required for the Simulator)	
Volume II, Section 3	Capacity and Performance (As required for the Simulator)	
Volume II, Section 4	User Interface (As required for the Simulator)	
Volume II, Section 5	System Hardware (As required for the Simulator)	
Volume II, Section 6	Data Acquisition and Processing (As required for the Simulator)	
Volume II, Section 7	Information Storage & Retrieval (As required for the Simulator)	
Volume II, Section 10	Advance Distribution Management Requirements (As required for the Simulator)	
Volume II, Section 11	Documentation (As required for the Simulator)	
Volume II, Section 12	Quality Assurance and Testing (As required for the Simulator)	
Volume II, Section 13	Training (As required for the Simulator)	
Volume II, Section 14	Project Implementation (As required for the Simulator)	

Table 0-1: Operator Training Simulator – System Requirements

The Simulator operation shall not affect the real-time operation or adversely affect the performance of the production System, and the real-time operation shall not adversely affect simulation.

9.1 Simulator Functional Requirements

The Simulator shall accurately reproduce the actions of the power system, Users, and the computer systems for monitoring and control of the power system. The simulation shall operate within such time constraints that the response is reasonably consistent with real-time operation as perceived by TPNODL system Operators or Users.

The power system simulation shall include simulation of power flows in the power system network (including both transmission and distribution where required), Automatic Voltage Regulator (AVR) simulation, area frequency dynamics simulation, and simulation of protection, including action of the special protection schemes. Simulation of the electromagnetic transients in the power system is not required. The Simulator shall support multiple islanded operations, with each island having its own frequency.

9.2 SCADA/ADMS Components to be Included

The Simulator shall provide simulation to a degree that functions associated with real-time operation may be used. The Simulator shall simulate the response of the power system to functional controls from TPNODL Operators, as if the transmission owners receiving these controls complied and executed the controls. This means that, in the case of transmission owners who normally receive directives by means of communications requesting control actions, these messages shall be directed to the trainer console. The trainer will be expected to perform actions to model the response of the transmission owners to the directives. The Simulator shall also offer the feature of a trainer implementing the controls, after receiving a telephone dispatch from the trainee. The trainer shall be able to perform each directive request with a minimal number of actions from the trainer's console.

9.3 SCADA/ADMS Components to be approximated

The Simulator shall permit the trainee to practice operations alone or together with a trainer.

Power system load modeling shall be done using predefined daily area load curves or forecasted daily area load profiles from the real-time system. The instructor may select, via display, which method to use in modeling loads. Several daily load curves for 24 hourly periods are required and the load curve shall be selectable in a convenient manner through displays. The instructor shall be able to select and change a particular hourly load value (e.g., peak), after which the entire load curve shall be automatically scaled in proportion to the instructor's change. Further, a convenient method, via displays, shall be provided to define and modify the daily load curves.

All Purchaser Operator-specified functional control actions shall be implemented such that the power system dynamic response may be observed in the simulation. External generation shall also be simulated. The software and database for the Simulator shall be identical to that of the real-time system with the addition of simulation databases for items that are normally not present in the real-time system, such as the parameters for simulation of the dynamics.

The capability to use a snapshot of the real-time information shall be provided to initialize the starting conditions of a training session. In this regard, the Simulator shall simulate the response of the power system accurately so that the trainee may study various scenarios as they relate to the current power system conditions.

The Simulator shall provide the function to permit the logging of all instructor, trainee, and power system activities.

The capability shall be provided to initialize the Simulator from historical data stored in the Information Storage & Retrieval system. In addition, the Simulator shall also be used to replay historical data without running power system network or dynamic simulator models. Successive snapshots of

historical data shall be read from the Information Storage & Retrieval at a periodicity selected by the user. The simulated real-time database shall be replaced each time a historical snapshot is read. All Simulator displays shall be updated accordingly.

The sizing and performance required for the Simulator is included in Section 3, Capacity and Performance.

9.4 Scenario Builder

Scenario definition and building for a training session is one of the most important capabilities of the Simulator. The capability shall be provided by the Supplier to define up to a 48-hour long scenario. Provision shall be made for the definition of multiple training cases. Each training case shall be described by defining events. As a minimum, it shall be possible to create scenarios with the following dispatches, operations, and events:

1) Circuit Breaker Operation - Manual and Automatic
2) Trip or Trip/Close on a Breaker
3) Failure of a Breaker to Operate
4) Relay Malfunction
5) Local Control Malfunction (Load Tap Changers, Load Shedding, Generation Control)
6) Limit violations (all types)
7) Area Load Change
8) Loss of an Interconnection line
9) Occurrence of a Fault (meaning relay operation only, not the simulation of faults)
10) Loss of a Line or Transformer
11) Receipt of operational alarms
12) Receiving trouble calls and dispatching field crew

9.5 Simulation Management Capabilities

The Supplier shall provide the Simulator user interface, including displays, control requests, and all other user interface activities that shall be identical to the user interface of the System and all of its features. In addition, the Supplier shall provide user interface for and the functionality to support the following operational capabilities, as a minimum:

1) Start the training sequence at any time within a scenario
2) Stop the training sequence at any time within a scenario
3) Pause the training sequence at any time in the scenario
4) Resume the training sequence at any point in the scenario
5) Replay of a session from an earlier state including all Operator actions
6) Variable real-time speed (fast, normal, slow)
7) Initialize the training base case from any of the following sources:
    a. Measurement data as it exists on the System (real-time snapshot) and /or the bid data from the market participants
    b. A Simulator save case
    c. A real-time snapshot case saved in the Information Storage & Retrieval
8) Scale the system load for different operating conditions
9) Multiple save cases
10) Store a scenario and the associated initialization data in the Simulator database. Scenario recall shall be preserved through power system model changes, to the greatest possible extent.

The operational capabilities described above shall be available in a convenient manner.

It shall be possible to connect any console to the Simulator as well as any number of consoles at the same time, right up to the maximum available on the System. The difference between a trainee or

instructor console shall be based on log-on security. All real time operational log-on authorities and restrictions shall apply within the Simulator, governed by the log-on security system.

The trainee's console shall be able to take on the functionality of the different Operator positions in TPNODL. The instructor shall be able to designate the desired trainee console operating position at the start of a training session.

The Simulator user interface shall contain all applicable displays provided on the SCADA/ADMS such as:

1) Tabular displays
2) Alarm displays
3) Overload summaries
4) One-Line Diagrams
5) Substation and plant status and control displays to allow the instructor to change device status.

These displays shall be available on the Simulator exactly as they are available on the System. In addition, control displays shall be available to edit and create training cases for the definition and modification of training sequences and events as well as to re-execute a particular training sequence. It shall be possible for the instructor to modify the training scenario of a particular training sequence during the training sequence; e.g., cause outages for the trainee to respond to.

The messages and alarms on the Simulator shall be identical to those of the SCADA/ADMS.

10. Distribution Management Requirements

10.1 Distribution System Operations Model (DSOM)

The System shall include a Distribution System Operations Model (DSOM). The DSOM shall serve as a central interface and information resource by representing the operating state of Utility's distribution network as well as the operating state of the System, other systems with which this System communicates, field devices, and communication systems. To support the above capabilities, the DSOM shall provide as a minimum the complete network model including data of electrical network e.g. line (i.e. length, type of conductor, technical particular of conductor & transformer etc, land-base data. Suitable GIS interface adaptor to enable the compatibility with GIS software/ data format /model shall be provided.

The Graphic data import from GIS systems shall support native formats of GIS systems which shall be potentially used for data import. The data shall be transferred on global & incremental basis on manual request & automatically, at least once in a day .It shall be possible to import related reference layers such as streets, buildings, poles etc. and other background information.

All Technological addresses (TAs) shall be automatically assigned within the system to the tags linking the graphic data to the attribute data in the GIS, the attribute data shall be loaded into the SCADA /ADMS data base and the data /text shall be displayed on SCADA/DMS diagrams if viewed in GIS mode shall display GIS in background with zoom, pan, scaling & UI navigation techniques in synch with SCADA/ADMS system displays.. This model repository will be the single model authority for the entire TPNODL network to be used by utility. This repository is maintained by the GIS System,

The GIS will interface using CIM/XML adapters to other applications. SCADA will have model aware adapters to read from GIS network model repository, and update its own models. The system shall utilize an IEC 61970 and IEC 61968 compliant interface. The system shall enable export of all data via a CIM-XML interface per standard.

The DSOM shall allow representation of typical power system elements such as generators, substation buses, on-load tap changing transformers, reactors, breakers, recloser, overhead lines, underground cables, voltage regulators, load break switches, fuses, switched capacitor banks, distribution transformers, loads (with parameterized voltage dependencies), automatic transfer switches, and temporary connections and disconnections applied in the field using jumpers, grounds, and cuts or any other parameters and equipment's.

The load profile, customer profile of distribution transformer shall be collected from AMR/MDM system of TPNODL interface to run the ADMS application.

Network Model

The ADMS applications shall maintain and use a single common network model comprised of different voltage levels, feeders and devices. All ADMS applications shall be able to run successfully for the complete distribution system network, including both substations and feeders. **In case of 33/11 KV PSS level manual network model will be created in SCADA data base and attribute linkage will be established with GIS for technical parameters data collection.**

The ADMS shall get the network connectivity and device information (i.e., equipment attributes) from Purchaser's Geographic Information System (GIS). The GIS is the system of record for the "as built" network connectivity and the ADMS shall be the system of record for the "as operated" network connectivity.

The network model in the ADMS shall be created from the GIS imported data and then enhanced and expanded to provide all the data needed for its distribution management applications. The ADMS shall

support the single-phase (i.e., un-ganged) operation of multi-phase devices (e.g., 3 phase reclosers with single phase tripping) and the network real-time connectivity shall reflect it appropriately

Compliance Questionnaire

Req. ID	Distribution Management System	Capability Supported?	Bidder Response
	Shall the DSOM serve as a central interface and information resource by representing the operating state of TPNODL distribution network as well as the operating state of the System, other computer systems with which this System communicates, field devices, and communication systems. ▪ Is the analytic models of electrically connected elements of TPNODL s distribution network, including the low voltage (secondary) network, and the associated loads ▪ Displays of the electrical facilities, showing individual elements and interconnections, along with the operating state and related information ▪ Information for geographically oriented displays of the distribution network showing the individual elements, their operating state, landbase information, operations data, facilities, equipment, locations of field crews, and other related information ▪ The application shall display operations data such as feeder and device status indications, associated statistics, tags, operating limits, set points, power flows, voltages, currents, transformer tap positions, quality codes, alarms, outage locations, and locations of field crews ▪ Is it display the facility and equipment information such as status, alarms, location and site details, electrical and mechanical design parameters, operating instructions, and maintenance procedures ▪ Field crew information such as names, planned assignments, completed assignments, and current location ▪ Landbase information such as street maps, buildings, waterways, and other landmark details ▪ The system shall have all necessary interactive features that allow the user to execute System functions via display point-and-click, drag-and-drop, and other convenient user interface features		
	The DSOM shall allow representation of typical power system elements such as generators, substation buses, on-load tap changing transformers, reactors, breakers, reclosers, overhead lines, underground cables, voltage regulators, load break switches, fuses, switched capacitor banks, distribution transformers, loads (with		

Req. ID	Distribution Management System	Capability Supported?	Bidder Response
	parameterized voltage dependencies), automatic transfer switches, and temporary connections and disconnections applied in the field using jumpers, grounds, and cuts		

Network Connectivity Analysis

An accurate insight into the actual topology of the distribution network (normal or disturbed) is invaluable for management of distribution networks. Network connectivity analysis (NCA) analytical function is a general tool for various topology analysis of the distribution network represented in form of graphs. On the basis of network connectivity and switchgear statuses, this function provides the network topology that is used in other functions.

Main analyses provided by the Network connectivity analysis are:

- Locating an element of the network (transformer, section, etc.) by name or ID.
- Locating and marking supply paths of network elements.
- Determining and marking of statuses of network elements (making distinction among energized and de-energized network elements, switchgear statuses, etc.).
- Locating and marking of networks loops.
- Locating and marking of all network elements downstream a selected element.
- Locating and marking of all elements supplied in a radial way by a selected root.
- Locating and marking of all sources and flow directions that supply a point.
- Coloring by voltage level.
- Coloring of grounded parts of network.
- Coloring by on/off status of elements.
- Coloring by phase shifting of three-phase transformers.
- Coloring by element area (feeder, transformer or substation area).
- Coloring by active phases.
- Coloring by network groups (Network Division and Area of Responsibility)
- Graph topological searching procedures are basis for this function establishment. Different types of coloring are mainly applied for presentation of results of the function running. The function can be used in both the On-line and Simulation mode.

10.1.1.1 Tracing

NCA function shall also have the capabilities of network tracing when requested by the dispatcher. Dedicated colors shall be used for feeder and circuit tracing and also when information available is not complete or inconsistent. The trace shall persist through subsequent display call-ups, until the operator explicitly removes it or requests another trace. In addition, at the bottom of the geographic view the number of transformers and customers passed by the trace are shown.

- **Feeder tracing**
  - This feature shall aid dispatcher to identify the path from a source to all connected components by same colour.
- **Circuit tracing-**
  - This feature shall enable operator to select any device and identify the source and path by which it is connected through the same colour.
- **Between Tracing:**
  - This feature shall enable the operator to select any two components of the network and shall able to trace all components connected in between them.
- **Upstream /Downstream Trace**

- From a selected circuit element the trace identifies all devices that are downstream of the selected element. In the case where a downstream trace is performed on a de-energized section of the network, the trace highlights all devices electrically connected to the element.

Distribution operational modification (Jumper, Ground & Cut)

The functionality allows temporary modifications at any point in the distribution network to change the network configuration, to isolate faults, restore services or perform maintenance. A Summary shall list the jumpers, cuts and grounds that are currently applied. The function is performed by the DMS through connectivity analysis .Any temporary modifications shall not be affected due to incremental up-gradation in network topology.

10.1.1.2 Jumper

Jumpers are a means of providing a temporary, switchable connection between two points on the network. The operator should be able to select two points and place the jumper with relevant details. The initial state of the jumper may be set to open or closed. The jumper popup automatically defaults to show the phases available for connection between the two points but other partial or cross-phase connections may be made if required. The popup shall warn the operator about abnormal connections such as not all phases being connected or the nominal voltage being different at the two connection points. Once the jumper has been placed the switch symbol in the centre can be selected and switched open or closed. The topology of the network model is updated accordingly. There is no restriction on the placement of jumpers between lines connected to different feeders or different substations.

Temporary connections between phases on the same line segment, known as a phase jumper shall be supported. This can be used in conditions where one phase is de-energized and it is desired to restore customers by energizing the dead conductor from one of the live phases. Jumper shall only allow if network in de energized mode to depict real operational scenario.

10.1.1.3 Ground

Temporary grounds should only be placed, for obvious reasons, on de-energized sections of a line. These grounds represent the mechanical grounding of lines for safety purposes during maintenance or construction.

A temporary ground may be placed on one or more of the available phases. It must be given a name and addition information can be included in the description field. If a line segment is re-energized while a temporary ground is still applied, the ground will be automatically removed or warn to Dispatcher.

10.1.1.4 Cuts

Cuts facilitated in any line segment in the network. The cut may be applied to one or more available phases of the conductor. The cut could also be applied as a temporary switch inserted in the line.

- The cut must be given a name or id number for identification, which is displayed as a label on the geographic network view.
- It should be possible to select the position of the label relative to the cut symbol.
- The position can be altered after the cut has been placed.

Once placed the cut symbol can be selected and switched on and off by the operator in the same way as a standard disconnect switch. Cuts can also be tagged.

10.1.1.5 Reports and Displays

The reports and displays shall be generated indicating the followings as a minimum:

a) Abnormal switches in tabular display

b) De-energized components of network in tabular display
c) Presence of loops & parallels on network displays
d) Un-served/ disconnected loads (loads affected due to tripping of CBs) in tabular displays
e) List of temporary jumpers/cuts /grounds

These lists must cover all abnormal points in the system at the time of report generation regardless of their age. Provision for notes to be attached to each abnormality which will remain till the abnormality is restored and the same should appear in the reports.

10.2 Distribution Management Applications

Distribution Management Applications consists of a set of tools to help the Operator monitor, control and aid in the restoration of the distribution system. This application includes:

1) Operations Monitoring
2) Fault Detection, Isolation, and Restoration (FDIR)
3) Volt/Var Optimization (VVO)
4) Distribution Power Flow

These applications are functionally defined in the following subsections.

10.2.1 Operations Monitoring

The Operations Monitoring function shall track the number of operations made by every breaker, capacitor switch, recloser, and load break switch that is monitored by the System through telemetered and non -telemetered. It shall also track an associated contact-replacement index. Devices shall be identified by area of responsibility, substation, feeder, and device ID to provide the necessary information for condition-based maintenance of these devices.

Req. ID	Distribution Management System Application	Capability Supported	Bidder Response
10.2.1.1	Each monitored device shall be associated with a total operations counter. This counter shall be incremented whenever the associated device changes state. When a multiple change (such as a trip-close-trip sequence) is reported by an RTU, each transition shall be counted separately		
10.2.1.2	A fault operations counter is required. This counter shall be incremented for commanded and un commanded trip operations. The date and time of the last operation shall be saved for each device when one of the counters is incremented.		
10.2.1.3	An Operator with proper authorization shall be able to enter total operations and fault operations limit for each counter. An alarm shall be generated when a counter exceeds its limits. No additional alarms shall be generated if the counter is incremented again before it is reset. For each counter, the System shall calculate the present number of operations expressed as a percent (which may exceed 100%) of the corresponding limit.		
10.2.1.4	The ability to reset individual counters shall be provided. In addition, a user shall be able to inhibit operations counting for individual devices. Such devices shall be included in summaries based on areas of responsibility. Resetting and		

Req. ID	Distribution Management System Application	Capability Supported	Bidder Response
	inhibiting counters shall be permitted only for devices that belong to the areas of responsibility to which the console is assigned, and resetting shall require the console to be assigned to an appropriate mode of authority. The date and time when each counter was last reset shall be saved.		
10.2.1.5	Report :- The counters, contact-replacement index values, and other related information shall be available for display and inclusion in reports. The user shall be able to view the date and time of a device's last operation together with its accumulated operations data by simply selecting the device on any display where it appears. Also user should be able to generate a single report of all equipment in system/jurisdiction area.		

10.2.2 Fault Detection Isolation and Restoration (FDIR)

The ADMS has a fault location, isolation and service restoration module that determines the likely location of the fault based upon fault indication available from SCADA switches, breakers, and fault indicators through SCADA & Intelligent electronic device (IED) fault current & impedances calculation methodology to identify the location .

The ADMS FDIR has the ability to be in manual mode, pre-populate a switching plan and presents to user for review and approval. The DMS FDIR module has the ability for the auto-generated switching plan to be executed by the user for restoration of customers around the fault location.

The ADMS FDIR should also intimate user of possibility of overloading in the system in the next 48 hrs (based on trend load analysis) due to restoration by proposed switching plan.

As the user makes step wise restoration of the affected area, system should be able to calculate and store MUs affected (estimated) and consumer hours affected for preparation of reports & Quality indices.

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.2.1.	For a permanent substation fault, The application shall act to restore power to all affected feeders by switching to alternative sources of power, as may be available by closing the substation's load transfer switch or the tie-switches that can be used to connect the feeders to other feeders or substations. In this way, the effect of the outage shall be limited to the time it takes to complete the required reconfiguration		
10.2.2.2.	For a permanent fault on a line , The application shall capable to ▪ Isolate the faulted section by opening the closest available line reclosers or load break switches ▪ Restore power to any healthy upstream feeder sections by reclosing the line's originally tripped circuit breaker or line recloser Once an outage is cleared, The application shall be capable of returning the power system to its pre-fault configuration.		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.2.3.	Is it capable of handling phase-to-ground and phase-to-phase faults and shall not be restricted by their time of occurrence on one or more feeders. Thus, the ability to handle multiple faults of different types, on multiple feeders, shall be available.		
10.2.2.4.	It should allowed the substitution of an auxiliary circuit breaker or line recloser that may temporarily function in place of a circuit breaker or line recloser that is undergoing maintenance by dispatcher		
10.2.2.5.	At the discretion of the Operator, shall be capable of acting automatically. The Operator shall also have the option, however, of implementing the FDIR -determined switching actions through the System's supervisory control and switching order management facilities. In this case, The application shall determine the necessary switching actions following its automatic detection of a permanent fault, but shall present the switching actions to the Operator as a set of recommendations.		
10.2.2.6.	To avoid potential difficulties during severe storm conditions, the Operator shall be able to suspend FDIR restoration capabilities by activating a single control point. The Operator shall be able to resume FDIR's normal operation by deactivating the storm-mode control point. When this occurs, FDIR shall be ready to restore power as well as detect and isolate faults following the next outage event.		
10.2.2.7.	This shall discriminate between commanded and un-commanded trips and the determination of lockout conditions.		
10.2.2.8.	The application shall be capable of determining the switching orders that can be used to restore power to all healthy feeder sections that are de-energized by the power system's protective devices. Before any switching takes place, however, FDIR shall ensure that no potential overloads or problems such as excessive voltage drops shall occur within 48 hrs.		
10.2.2.9.	The application shall be capable of using data derived from substation RTU/FRTU to recognize faults in substation transformer banks or any fault on the primary side of these banks that cause loss of outgoing feeder voltage and current. Substation protective devices will normally clear these faults. On the other hand, if it monitors a continuous loss of feeder supply beyond a Operator-adjustable time interval, it shall determine the switching orders that can be used to reconfigure available tie-switches in order to connect the de-energized feeders to alternative energy sources, such as other substations and/or feeders.		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	This shall be capable of checking the fault indications from RTU/FRTU to determine the line section where the fault has occurred. After the fault has been located, FDIR shall issue an event message that identifies the faulted feeder section.		
10.2.2.10.	The application shall be capable of estimating and displaying the load that is to be restored following each recommended control action. In addition, the Operator shall have access to an interactive environment to investigate the impact of alternative restoration strategies, based on operator selectable objective functions, prior to the Operator's actual execution of a final restoration control sequence. This shall include comparisons based on line loadings, voltage profiles, load restoration levels, system losses, number of affected customers, etc. One of the operator selectable functions shall be restoration of lowest loss feeders first. A list of lowest loss feeders shall be provided by TPNODL .		

10.2.3 Volt/Var Optimization

The ADMS has a voltage and VAR Optimization module that uses an optimal power flow algorithm and objective function to improve the distribution systems voltage profile and VAR support.

The ADMS V VO module has an option where the objective function for the optimization is to reduce system losses. The VVO optimization algorithm will generate control sequences for load tap changers (LTCs), Capacitor Banks, and remote controlled switches.

The VVO has an option where the object function is to flatten the voltage profile and then reduce demand by reducing voltage for Conservation Voltage Control (CVR) and Demand Response (DR).The VVO module has the capability to use bellwether or end of line measurements to verify that voltage reductions actually stay within limits and will make adjustments to the solution when they are not.

The ADMS VVC module has an event trigger that turn on the VVO function when certain conditions are met such as system load above a specific value.

10.2.3.1 Var Control

The Var Control function shall be used to limit reactive power flows in the related distribution network. This shall be accomplished by sending on/off control signals automatically to the switchable shunt capacitor banks in the system, including those on feeders and in substations. The objective is to minimize losses by controlling reactive power, consistent with maintaining customers' delivery voltages within defined norms (±5% of nominal), under continuously varying load conditions.

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.3.1.1	The Application shall capable of ▪ Identifying the switchable shunt capacitors that are available ▪ Monitoring substation active and reactive power loads and voltages ▪ Estimating voltages at the critical locations on the feeder and the low voltage lines (i.e. the highest and the lowest voltages delivered to customers)		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	▪ Checking power factors against desired limits, where the limits may be expressed in either leading or lagging vars ▪ Sending control signals to bring capacitors on-line or off-line, as appropriate, if power factors are outside their limits, where the limits will be established by TPNODL and shall be Operator-adjustable.		
10.2.3.1.2	Var Control shall execute continuously. It shall use deadbands to ensure that no unnecessary control actions are taken. Var Control shall use the Distribution Power Flow calculation(Section 5.5.4) to estimate voltage effects prior to switching a capacitor bank, so that Operator-adjustable voltage limits shall not be violated, i.e., if the expected voltage violates a limit for any customer, control of the associated capacitor bank shall be skipped. Control shall also be skipped if the capacitor bank was last operated by the function within an adjustable time period, e.g., 10 minutes.		
10.2.3.1.3	Var Control shall confirm the correct operation of each control action, and shall issue an alarm if a controlled capacitor bank fails to operate. In the case of capacitor banks controlled by one-way radio or pager, Var Control shall monitor the change in vars at the substation to confirm the action.		
10.2.3.1.4	Var Control shall calculate and maintain system, substation, and feeder records that can be used to report capacitor operating statistics and the effect of the function's control actions on power factors. The records shall be used for review and analysis and for producing hard-copy reports.		
10.2.3.1.5	A report shall be generated that provides the Operator with the operational status and health of the capacitor bank, and the likely nature of any detected problem, including ▪ The bank's switch position is in a different operating state than expected ▪ The fuse of the capacitor for an individual phase is blown ▪ A switch malfunction ▪ A single-phase capacitor value is different than expected (too much or not enough capacitance) ▪ A control malfunction ▪ A communications problem.		
10.2.3.1.6	The Operator shall be able to execute the Var Control function on demand as well as in its normal automatic mode, and shall be able to enable and disable the automatic operation. In addition, the Operator shall be		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	able to inhibit the function from controlling any capacitor bank on an individual basis		

10.2.3.2 Voltage Control

The Voltage Control shall provide the capability to raise or lower voltage levels on the distribution feeders. During periods of peak demand, the Voltage Control function will be used to reduce voltage levels in order to reduce the overall system load.

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.3.2.1	The Operator will initiate the function by specifying the targeted percentage raise or drop in nominal voltage (typically 2.5% or 5%). The Voltage Control function shall respond by commanding a change in the secondary voltage in the load tap changers (LTCs) associated with individual substation transformers and line voltage regulators or a predefined group of the same.		
10.2.3.2.2	The Voltage Control function shall send target voltage setpoints to transformers that accept setpoint controls, and shall send tap raise or lower commands (after first placing the transformer in "manual" mode) to those transformers that do not accept setpoint commands		
10.2.3.2.3	The Application shall capable of ▪ Identifying the transformers subject to remote control ▪ Distinguishing those transformers whose controllers accept voltage setpoint controls from transformers where the tap position has to be controlled directly ▪ Monitoring the controlled voltages ▪ Monitoring the tap positions of transformers ▪ Calculating the changes in tap position that most closely correspond to the requested reduction in nominal voltage ▪ Estimating voltages at the critical locations on the feeder and the low voltage lines (that is, the highest and the lowest voltages delivered to customers) that would result from the requested control action.		
10.2.3.2.4	When initiated, the Voltage Control program shall send voltage control setpoints or tap raise or lower pulses that result in adjustments to the tap positions of transformers, as appropriate for the transformer type, to all transformers that are subject to control. However, no controls shall be sent to transformers if the resultant voltage for any customer affected by that transformer is estimated to be outside the permitted range. The Voltage Control shall estimate customer voltages automatically by calling on the Distribution Power Flow (Section 5.5.4) in study mode		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.3.2.5	The Voltage Control program shall provide a simple mechanism for the Operator to return voltages to their initial values. It shall be possible for the Operator to direct an immediate return or a stepwise return of voltages to their initial values. If the Operator requests a stepwise return, the Voltage Control program shall immediately change the target voltage by a predetermined amount (a parameter, initially 1¼%) on all transformers under control, then wait a period of ten minutes (Operator-changeable), and then repeat the procedure until all transformers are returned to their initial state.		
10.2.3.2.6	While the Voltage Control program is operating and feeder voltages are not at their nominal levels, the System shall place a message on the monitor of every Distribution Operator indicating either "VOLTAGE REDUCTION IN EFFECT" or "VOLTAGE BOOST IN EFFECT", as appropriate.		
10.2.3.2.7	The System shall provide the Operator with a quick mechanism to temporarily change the customers' allowable voltage range; e.g. from ±5% to ±10%. An entry shall be made in the Abnormal Summary when the allowable range is not at its normal value.		
10.2.3.2.8	The Voltage Control function shall use deadbands to ensure that no unnecessary control actions are taken. Voltage Control shall also calculate and maintain system, substation, and feeder records that can be used to report the effect of its voltage control actions. This shall include estimates of the load reductions achieved, the corresponding load reduction percentages for a one percent voltage reduction, as well as tap position and voltage data		
10.2.3.2.9	The voltage control records shall be used for review and analysis and for the output of hard-copy reports.		
10.2.3.2.10	The Operator shall be able to inhibit the function from controlling any transformer on an individual basis		

10.2.4 Distribution Power Flow

The Distribution Power Flow (DPF) shall calculate the state of the distribution network based on (a) real-time measurements at substations and a limited number of locations along the feeders, (b) manually/interfaced-entered input, (c) facilities data imported from the GIS, (d) a model of the operation of automatic devices such as LTCs, voltage regulators, and capacitor banks, and (e) a model of the loads along the feeder.

The DPF shall be designed explicitly for three-phase unbalanced distribution systems.

Distribution Load/power Flow shall be an event-triggered and interval based application that uses network topology information provided by the Connectivity Analyses application, as well as the current estimated load demands and trend, the network's state shall consists of: complex voltages, currents, flows of active and reactive powers, voltage drops, losses etc. Generally, load (power) flow model of power systems. (Distribution networks included) represents a mathematical description of the active and reactive power balance in the system (the power supply equals to the load and losses),

for selected voltage conditions. The Load Flow application shall provide estimated values for those electrical quantities at network locations where telemetered measurements are not available/not provided by user. Load Flow shall be the base for establishment of all other ADMS functions.

The DPF shall take the following into consideration:

a) Real time data from SCADA
b) Manual entered data
c) Estimated data from last state estimator/LF raw.
d) Power source injections including DER generation, if applicable
e) Loops and parallels
f) Unbalanced & Balanced loads
g) Manually replaced values
h) Temporary jumpers/cut/ grounds
i) Electrical connectivity information from the real-time distribution network model
j) Transformer tap settings
k) Generator voltages, real and reactive generations
l) Capacitor/reactor bank ON/OFF status value.
m) HVDS and Non HVDS Network
n) Data from MDMS for load allocation amongst transformers
o) Save case data

The ADMS power flow includes functionality that calculates the impedances from the line lengths based upon the geographical coordinates of the conductors and conductor parameters for wire size, wire type and construction type.

The DPF function should ideally be able to conduct these studies based only on the network and consumer (numbers, categories) information which is available in GIS and the feeder source telemetered data. When smart meters are installed at one or more points in the feeder, the system should be able to take into account their input through meter management system (MDM).

The ADMS power flow function has the ability to generate alarms when the voltage and current flow results are outside of predefined limits that are configurable. This includes fuse, switch, and line overload warnings. The ADMS power flow function has the ability to generate transformer overload alarms when the voltage and current flow results are outside of predefined limits that are configurable. The DMS power flow has the ability to perform feeder reconfiguration (load balancing and optimal switching).

The ADMS power flow has the ability to perform cable capacity calculation. The ADMS power flow has the ability to run against the current electrical model and loads; and then reduce demand by reducing voltage for Conservation Voltage Control (CVR).

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.4.1	The DPF shall run periodically at the frequency (a user definable parameter) Capacity and Performance, Function Periodicity and Execution Time, as well as when triggered by an event (whenever a change in the topology of the distribution network or pre-defined change in status or analog data is detected		
10.2.4.2	The Operator must be able to execute DPF on demand for an Operator-specified feeder or all feeders associated with a substation via the graphical User Interface and see the results on the same display.		
10.2.4.3	**Study mode**		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	DPF shall also run in study mode in conjunction with other application programs, such as the Var Control, Voltage Control, and FDIR functions The DPF shall also allow the user to execute power flow studies in study mode on selected areas within the distribution power network to determine, for example, the effects of feeder configuration and/or voltage adjustments on feeder load balancing, voltage drops, and losses. Study mode will be used to run "What If" scenarios. The application must provide the capability for storage and retrieval of the number of "Save Cases" The operator will have the capability to modify the parameters such as connectivity, device parameters and other operational parameters before running a "What If" scenario. Study mode operation shall be distinguished by a unique background color for the window or such other means so that it is not confused with real time window		
10.2.4.4	**The DPF application shall be capable of** The discrete transformer tap positions of LTCs and line voltage regulators shall be adjusted to maintain specified voltages while complying with prescribed ranges on voltages and tap positions. The switching deadband shall also be modeled Line charging effects shall be modeled, including the insulation losses of underground cables where applicable Provision shall be made to accommodate capacitor banks that are switched on and off based on locally measured parameters Automatic transfer switch positions shall be modified according to associated line energization status values It shall be possible to model each load as proportional to a pre-specified normalized load profile. The real and reactive components of each load profile will be specified independently as functions of time, day-type, and season. The DPF shall accommodate a minimum of twenty distinct load profiles (for example, residential, small commercial, large commercial, school, etc.). Each load profile shall be defined as a set of 48 hourly values of real and reactive load for a minimum of five day-types and three seasons. The DPF shall also allow for individual telemetered loads whose values are acquired through direct telemetry or through an interface with a future AMR (automatic meter reading) system. The modeled load shall be scaled by multiplying the load from the load profile by a scale factor which may be defined to be proportional to the capacity of the distribution transformer, be proportional to the customer's monthly kWh usage, or be another scale factor specified by TPNODL The network topology, connectivity, symbology, attribute data and location of the loads shall be derived from input from the GIS or another source. If the information is not available in the GIS database regarding the distribution of the loads along a feeder, the		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	DPF shall be built as the sum of individual, user-specified loads plus a uniform distribution of loads along the feeder. The variation of load with voltage shall be modeled using separate expressions for real and reactive power. Loads shall be adjusted to account for the changes in voltage that occur during the iterative power flow solution process. Transformers shall be modeled by explicitly considering their copper losses, core losses, and voltage dependence. Voltage drops on LV lines may be calculated with a simplified model that assumes that the LV voltage drop is proportional to the transformer loading of the distribution transformer and that the maximum designed LV voltage drop (a parameter initially set to 10%) occurs when the transformer load is the nominal loading.		
10.2.4.5	User Input The Power Flow function shall be designed to run in periodic or event trigger mode without user intervention and to require a minimum amount of user input when run on demand. This input shall largely be limited to identifying the base case for the study and then making all desired changes prior to execution. Line-out, re-sectionalizing, or other configuration change studies shall simply require the user to change the status of the appropriate switching devices on the associated one-line diagram display. Other changes shall only require simple numerical entries and, where appropriate, the selection of any relevant solution option available. The user shall be able to execute the Power Flow function for a particular circuit, a particular substation, or a particular "area" (that is, combination of substations) selected by the user, using current base case or postulated load conditions. Multiple independent users shall be able to execute the Power Flow function simultaneously, starting from the last execution or a selected save case. In these “what if” studies, alarms generated by Power Flow shall not be treated as real-time alarms, but shall be retained for display at the console on which the function was run. In modifying the base case prior to execution, the user shall be able to scale loads, specify loads individually, modify bus voltages, and change device status values.		
10.2.4.6	Output of DPF should minimum calculate following parameters ▪ Real power, reactive power, and current for all circuit elements ▪ Voltage on each phase at all buses, including secondaries of distribution transformers ▪ Total real and reactive losses, line losses (load and no load), and transformer losses (load and no load), both in kWh and kvarh, and in percent ▪ Monthly accumulated losses, in kWh and kvarh, and in percent ▪ Tap positions for substation transformers and line voltage regulators		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
	▪ Switch positions for capacitors and automatic transfer switches ▪ Feeder voltage drops along MV and LV lines ▪ Phase imbalance of 3-phase circuits (e.g., average phase current minus minimum phase current, divided by the average current) ▪ Voltage imbalance of 3-phase buses (e.g., maximum voltage minus average voltage, divided by the average voltage).		
10.2.4.7	The Power Flow results shall be presented on the graphical displays used for real-time dispatching as well as in tabular form on dedicated displays. The results of the Power Flow calculation shall be subject to the same limit alarm processing as other calculated data, i.e., each calculated variable shall be tested against three pairs of alarm limits, and an alarm shall be generated when a limit violation is detected. Alarms and overloads determined by Power Flow shall be indicated to the user simply and clearly. All line sections that are overloaded and all buses that have voltage violations shall be highlighted in color. All loops and parallel-fed loads shall be highlighted in a distinct manner.		

10.2.5 Load Shedding application (LS)

The load-shed application shall automate and optimize the process of selecting the best combination of switches to be opened and controlling in order to shed the desired amount of load. Given a total amount of load to be shed, the load shed application shall recommend different possible combinations of switches to be opened, in order to meet the requirement. The dispatcher is presented with various combinations of switching operations, which shall result in a total amount of load shed, which closely resembles the specified total. The dispatcher can then choose any of the recommended actions and execute them. The recommendation is based on Basic rules for load shedding & restoration.

In case of failure of supervisory control for few switches, the total desired load shed/restore will not be met. Under such conditions, the application shall inform the dispatcher the balance amount of load to be shed /restore. The load-shed application shall run again to complete the desired load shed /restore process.

10.2.5.1 Basic rules for load shedding & restoration

The load shall be shed or restored on the basis of following basic rules:

a) By load priority

The LS shall have a priority mechanism that shall allow the user to assign higher priorities for express consumer or any other important load. The load assigned with the higher priorities shall be advised to be shed later and restore earlier than load with relatively lower priorities. Each load priority shall be user definable over the scale of at least 1-10.

b) By 24 Hrs. load shed /restore history

The loads of equal priorities shall be advised for restoration in such a way that loads shed first shall be advised to be restored first. The application shall ensure that tripping operations is done in a cyclic manner to avoid the same consumers being affected repeatedly, however, priority loads shall be

affected least. Switches, those are affected due to any other reason like breakdown/plan, un-plan shut down shall generate alarms to Dispatcher to take appropriate decision

c) By number of consumers affected

The consumer with equal priority and similar past load shed history shall be considered by the application in such a way that minimum number of consumers are affected during the proposed load shed. The data for number of consumers connected to a feeder /device shall be taken from consumer indexing (CI) of GIS or may be through billing system.

10.2.5.2 Modes of operation

The load-shed application shall operate in the following modes:

(a) Manual load shed/ restoration
(b) Auto load shed/restoration

Each mode of operation can be enabled or disabled by operator independently. The load can be shed & restore in possible combination i.e. manually shed & auto restore vice versa or both operations in the same modes. **Provision to incorporate DLR schedule (as informed to customers) into the process**

Manual load shed/ restoration

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.10.2a.1	**Manual Load Shed** In this mode operator specifies a load to be shed in a project area The software shall determine & propose all the possible combinations of switches to be operated for the requested load shed considering the basic rules for load shed & restoration		
10.2.10.2a.2	In case more than one options are possible, then the application shall identify all such options with the priority of consumers along with the number of consumers are likely to be affected for the particular load shed option. The dispatcher shall select & execute one of these options for affecting the load shed.		
10.2.10.2a.3	**Manual Load Restoration** In this mode operator specifies the desired load to be restored. The software shall determine the switches to be operated for the requested load restore considering the basic rules for load shed & restoration		
10.2.10.2a.4	In case more than one options are possible, then the application shall identify all such options with the priority of consumers along with the number of consumers are likely to be restored for the particular load restore option if chosen by dispatcher. The dispatcher shall select & execute one of these options for effecting the load restoration.		
10.2.10.2a.5	The Load shed Application shall maintain a load restore timer, which shall automatically start after tripping of CB due to manual load shedding. An alarm shall be generated to remind the operator to restore the loads when this timer expires. For manual mode of operation the dispatcher shall enter the value of load restore timer.		

a) Auto Load Shed

This shall have two modes namely frequency based load shed & time of day based load shed as described below.

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.10.2b.1	**Frequency based Load Shed** The function shall execute the tripping of breakers based on the system frequency automatically considering the basic rules for load shed & restoration.		
10.2.10.2b.2	The software shall automatically execute the switching operations as soon as system frequency reaches at load shed start (LSS_str)frequency threshold and it shall continue to do so unless system frequency crosses the load shed stop (LSS-stp) frequency limit. The frequency limits shall be dispatcher assignable up to single decimal points. Once frequency crosses below LSS_stp limit , then load shed can only be started again when frequency attains LSS_str. Limit LSS_str shall be lower than LSS_stp& suitable protection to ensure that shall be provided in user interface such as discard ,forbidden etc if user accidently enters LSS _str higher or equal to LSS_stp or LSS are entered higher than LSR .		
10.2.10.2b.3	The application shall integrally intact with load schedule/actual drawl of project area so that Under draw & over draw of power based on frequency shall also suggest appropriate switching.		
10.2.10.2b.4	**Time of day based Load Shed** The function shall operate to shed load at the predefined time of the day & load to be shed. The software shall automatically execute the switching operations considering the basic rules for load shed & restoration		
10.2.10.2b.5	**Auto Load Restoration** This shall have two modes namely frequency based load restoration & time of day based load restoration as described below		
10.2.10.2b.6	**Frequency based restoration** The function shall execute the closing of breakers based on the system frequency automatically considering the basic rules for load shed & restoration		
10.2.10.2b.7	The software shall automatically execute the switching operations as soon as system frequency attains load restore start frequency limit (LSR_ str) and it shall continue to do so as long as system frequency is crosses below the mark load shed restore stop frequency limit (LSR_stp)_.		

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.10.2b.8	The frequency limits shall be dispatcher assignable up to single decimal points. Once frequency crosses below LSR_stp limit , then load shed can only be started again when frequency attains LSR_str. Limit LSR_str shall be higher than LSR_stp& suitable protection to ensure that shall be provided in user interface such as discard ,forbidden etc if user accidently enters LSR _stp higher or equal to LSR_str or LSR limits or LSS _str higher or equal to LSS_stp or LSR limits, lower than LSS . The sequence of frequency limits shall be permitted as LSR str>LSR_stp>LSS _stp>LSS_str. Adequate protection as mentioned above shall be given if user tries to violate the same.		
10.2.10.2b.9	In case if fluctuation in frequency band will be rapidly ,it will generate alarm to Dispatcher to take appropriate action		
10.2.10.2b.10	**Time of day based restoration** The function shall operate to restore load at the predefined time of the day & load to be restored. The software shall automatically execute the switching operations considering the basic rules for load shed & restoration		

10.2.5.3 Alarms/Events

All Loads shed & restore operations executed shall be logged in the system as events. In case the supervisory control fails during the operation in predefined time, an alarm shall be generated with the possible reason for the failure

10.2.5.4 Summary Report

Req. ID	Distribution Management System Application	Capability Supported?	Bidder Response
10.2.10.4.1	Load shed application shall generate Summary Reports for project area on daily basis. These reports shall be available online for minimum period of two days.		
10.2.10.4.2	The following reports shall be made. ▪ Daily Load shed report indicating, substation name, feeder/device name, date/time, duration of load shed and amount of load shed, Number of consumers affected based on consumer indexing information, mode of load shed including planned outages of feeders/network equipment's. ▪ Daily Alarm summary pertaining to LSA, substation wise. ▪ Substation wise daily Served, un-served power & energy for every 15 minute time block		

10.2.10.4.3	Served & un-served power for last seven days for every 15-minute time block to calculate Load forecast for the next day. The report shall contain a column to define weightage factor (multiplier) by dispatcher to calculate Load forecast for the next day. The weightage factor is required to consider the type of the day such as holiday, festivals, rainy day, etc. Separate report for total load forecast of complete project area shall also be generated from above two reports (Sec 10.2.10.4.2)		

10.3 Studies

The Vendor shall provide at least the following studies:

- Switching Study
- Outage Restoration Analysis Study

The purpose of the studies is to assist the dispatcher in assessing how switching or other dispatcher actions would affect the system under different circumstances.

The Vendor shall provide a simple user interface that allows the dispatcher to operate the studies. The user interface shall contain a dialog that allows the user to select the desired study. Circuits and devices for study shall be selected by clicking on the desired items in the map-based display.

The results of a study shall be provided to the dispatcher in a report that can be printed or viewed using the normal user interface. Further details on the studies are provided below.

10.3.1 Switching Study

The purpose of the switching study is to allow the dispatcher to observe what would happen if a switch were opened or closed without actually doing it.

When the study results are ready, the user shall be able to view them in a resizable popup window. The study shall show the before and after results for the feeder, including the total loss or gain at the switch. The results shall include the total current for the feeder, the real/reactive load, real/reactive loss. A pushbutton shall allow the user to view the corresponding expected volt/loss profile along the feeder.

The results shall be printable to any printer available to the SCADA /ADMS user interface.

Once the user has viewed or printed the results, it shall be possible to select a new switch for study.

10.3.2 Outage Restoration Study

The Outage Restoration study shall generate a recommended set of switching actions to restore service both above and below a faulted line section.

After selecting the study, the user shall select the faulted circuit element by simply clicking on it in the map.

When the study results are ready, the user shall be able to view them in a resizable popup window.

The study shall generate a report of switching actions for both fault isolation and service restoration. The report shall show alternatives for the switching actions and shall contain the restored kW and number of customers for each alternative as well as the remaining kW to be restored and the number of un-serviced customers. The switching actions shall be presented in the following order:

Above the fault:

- Switching actions that isolate the fault on the line side

- Switching actions that restore service above the fault

Below the fault:

- Switching actions that isolate the fault on the load side
- Switching actions that restore service below the fault (via interties)

The recommended switch actions shall be based on margin and capacity.

The results shall be printable to any printer available to the SCADA user interface.

Once the user has viewed or printed the results, it shall be possible to select a new faulted circuit element for study.

It shall be possible by means of a pushbutton to transfer the recommendations from the report to a switching order.

10.4 Outage Management System (OMS) Applications

10.4.1 Overview

The following section describes the OMS component of ADMS. The OMS shall be flexible Outage Management System designed to maximize the performance of TPNODL dispatchers by working with a single SCADA/ADMS user interface to help operators and dispatchers better handle system outages.

Main features –

- Outage Management
- Outage Analysis & Prediction
- Crew Management
- Switch Management
- Field Scheduling & Dispatching
- Reports

Implementation of the integrated OMS is intended to provide TPNODL with the following functions:

- A graphical display of the electric sub-transmission and distribution network with dynamic symbols indicating outages, crews and predicted failure points
- A predictive engine to identify potential outage devices based on the number, type and location of customer outage calls
- A management information capability to allow management and executives access to summaries and details of outage status and progress via the intranet
- A database capable of calculating monthly, year-to-date, and annual industry standard outage statistics using the latest IEEE heuristics or other industry standard
- A predictive engine to provide information on expected restoration time
- Crew scheduling and tracking capability to manage crews and field personnel during outages
- A switch management module that supports the initiation of Power Out requests, schedules Power Out requests, generates suggested switching plans for both a geographical view and an operating schematic view of the networks.
- A set of geographical views of the facilities that provide both a geographical view and an automated operating schematic view generated of the networks
- A set of field based tools that facilitates status reporting and outage completion collection.

10.4.2 Outage Management

A key requirement is for the OMS to support a well-defined life-cycle of an outage event and to give the dispatcher visibility at all times as to what state an outage is in and how much time is left to restore the outage.

Compliance Questionnaire

Req. ID	Outage Management	Capability Supported?	Bidder Response
10.4.2.1	The system shall support the notion of an outage event life cycle. Describe your system's support for ▪ unacknowledged – new events unacknowledged by any dispatcher yet ▪ acknowledged - looked at/being analyzed by a dispatcher ▪ dispatched - manually or automatically assigned time and confirmed by a crew that is on the way to it ▪ arrived – time crew has arrived at dispatched event ▪ assigned - assigned to specific crew for future work ▪ planned – switch plan related outage event ▪ restored - crew got power back ▪ Complete - detailed root cause, failed device, weather conditions, follow-up routine work orders generated, etc…		
10.4.2.2	The system shall highlight via blinking and use of colors, all outage events that are in their unacknowledged state.		
10.4.2.3	The system shall present to the user the list of outage events associated with his area of control.		
10.4.2.4	The user shall be able to sort his list of outage events by any combination of the displayed sets of fields.		
10.4.2.5	The user shall be able to select any outage event and see the detailed customer called-in comments entered by the customer service representative associated with the predicted or confirmed event.		
10.4.2.6	The user shall be able to push any predicted outage event upstream to the next device.		
10.4.2.7	The user shall be able to push any predicted outage event downstream. The system shall generate a new predicted outage for each of the devices (typically lateral fuses) that are immediately downstream from the currently predicted outage device.		
10.4.2.8	The user shall be able to dispatch an event to one or more crews.		
10.4.2.9	The user shall be able to assign multiple events to a single crew for him to work on in the future.		
10.4.2.10	The user shall be able to manually enter in the start time for an outage event. The system shall save all outage events that had their start times manually overridden in a table, identifying the user, time of override, current and overridden values.		
10.4.2.11	The user shall be able to add non- grouped calls to an existing event.		
10.4.2.12	The user shall be able to create a temporary jumper to capture the current configuration of a circuit as reported by the crews.		
10.4.2.13	The user shall be able to add one or more tags to a device. Describe the tagging capabilities of the Proposed OMS system, including the number of tags available, multiple tags on a device etc.		

Req. ID	Outage Management	Capability Supported?	Bidder Response
10.4.2.14	The user shall be able to add one or more notes to a device.		
10.4.2.15	The user shall be able to raise and remove conditions on a device as they are created and removed in the field to indicate: ▪ grounds exists ▪ a device in local mode ▪ a device in lightning mode ▪ the communication to device has failed ▪ a device in loop scheme ▪ a device in auto reclosing mode		
10.4.2.16	The user shall be able to generate a tabular list of all devices that are currently operating in their abnormal state.		
10.4.2.17	The system shall display via symbology on all graphical views that a device is located on, its conditions that have been raised either automatically or manually.		
10.4.2.18	The system shall automatically refresh all users' displays that contain a device whose status has changed or had an operating condition raised or removed.		
10.4.2.19	The system shall automatically refresh all users' displays that contain an event that has just been created or restored.		
10.4.2.20	The system shall be able to integrate with a on call crew roster (RDBMS based) and contact crews for acknowledged events that occur after normal operating hours.		
10.4.2.21	The system shall automatically indicate an event has been dispatched once the crew has accepted the event.		
10.4.2.22	The system shall automatically remind the dispatcher that he hasn't received an acknowledgement back from the crew for a dispatched event, after a user defined period of time, whom he attempted to contact via the radio or was automatically called. This reminder shall be saved by the system in an event logger.		
10.4.2.23	The user shall be able to open and close a device by selecting it graphically and performing the operation. Please indicate if the proposed system supports select before operate approach.		
10.4.2.24	The user shall be able to enter all outage event details required to complete the outage.		
10.4.2.25	The user shall be able to enter appropriate information to generate a follow-up work order for the outage event.		
10.4.2.26	The system shall be able to create a work order request based on the previously entered information in the work management system.		
10.4.2.27	The system shall track all work orders that were created for an outage event.		
10.4.2.28	The user shall be able to generate a tabular list of work orders that were created for an outage event and see their current status information or completion dates.		
10.4.2.29	The user shall be able to enter completion details for partial restoration events.		
10.4.2.30	The system shall keep track of all partial		

Req. ID	Outage Management	Capability Supported?	Bidder Response
	Restoration events that were part of restoring all customers. Each partial step shall have its own ending time stamp for the set of customers it restored.		
10.4.2.31	The user shall be able to list all partial events that belong to an outage event.		
10.4.2.32	The user shall be able to list all partial events that belong to an outage event.		
10.4.2.33	The system shall be able to generate a list of executives and managers to be used to page, email or phone with the related outage details when a set of Critical customers are affected by either a probable or confirmed outage event.		
10.4.2.34	The system shall use line color or symbology or dynamic attribute such as blinking to indicate the current operating state of a section of circuit: ▪ energized ▪ de-energized ▪ grounded ▪ dual sources		
10.4.2.35	The system shall use line color or symbology to indicate the number of phases on a section of circuit.		
10.4.2.36	The system shall use line color to differentiate circuits. To support this, the system shall use its own color map of at least 256 colors to generate the color to be used for each circuit such that no circuits that could be tied or jumpered together have the same circuit color.		
10.4.2.37	The user shall be able to toggle between which of the two types of circuit line colors they want to view: single circuit vs. phase based.		
10.4.2.38	The system shall automatically generate its single circuit view and 3-phase schematic backbone view from its topology model each time the topology model is reloaded from the GIS.		
10.4.2.39	The system shall accept schematic drawings as input and generate the connectivity to the topology model based on the devices that appear on both the geo-reference view that has already been loaded from the GIS and the new schematic that is being imported.		
10.4.2.40	The system shall maintain all device states, tags, notes, conditions, jumpers, crew locations and crew assignments after its topology model has been updated from the GIS.		
10.4.2.41	The system shall support an automated restoration verification process. Please describe your system's use of IVR to support an automated verification process. Please describe your system's current or potential use of intelligent field devices to support an automated restoration verification process.		

10.4.3 Outage Analysis & Prediction

The ADMS will provide an analysis engine that processes the trouble call information received from the trouble call entry system, from the IVR system and device state change messages from the SCADA/ADMS system. The outage prediction engine will generate a probable outage event based on the currently defined set of heuristic rules that typically takes into consideration: number of calls

received, time between calls, trouble call codes, network topology, currently available crews, currently dispatched crews and type of probable outage device; the outage prediction engine will generate a probable outage event.

Compliance Questionnaire

Req. ID	Outage Analysis & Prediction	Capability Supported?	Bidder Response
10.4.3.1	The system shall support incoming calls that have multiple call codes on a single call that indicate whether there may be an outage, there is an emergency situation, there is a need for maintenance or there is a request for service.		
10.4.3.2	Please explain how your system groups calls into probable outage events.		
10.4.3.3	Please explain what your system does with emergency call types.		
10.4.3.4	Please explain what your system does with non-emergency and non-outage requests for maintenance or service.		
10.4.3.5	The system shall provide a configuration mechanism for authorized non-programmers to change the prediction and grouping behavior of the system.		
10.4.3.6	The authorized user shall be able to name and save his changes to the configuration of the outage prediction engine to a catalog of configuration.		
10.4.3.7	The system shall support a catalog of named configurations that can be loaded and put into production during special storm conditions. Describe in detail what happens to your call processing engine and interfaces with SCADA /ADMS and IVR systems during the cut over to a new heuristic set of rules to be used for the outage prediction engine.		
10.4.3.8	The system shall support call types that indicate a service or premise level outage and it will not try to roll these types of events into events upstream, nor will the system try to group and close these events when upstream events are restored and completed. Please describe in detail your system's native support for this service level and other nested device outages.		
10.4.3.9	The system shall support momentary outages and provide for automatically grouping of call types such as lights flickering to a momentary outage event.		
10.4.3.10	The system shall support automatic notification of confirmed or real outages via an automated interface with a SCADA system and automatically group all future related calls to the outage event.		
10.4.3.11	The system shall assign an estimated restoration time based on device type, number of active outage events, and number of active crews.		
10.4.3.12	The system shall assign a start time to the outage event based on the earliest of the first call associated with the event, or the automated interface message that raised the event.		
10.4.3.13	The system shall support multiple voltage classes in its topology model used to predict outage events: Sub-transmission Voltages Distribution Voltages		

Req. ID	Outage Analysis & Prediction	Capability Supported?	Bidder Response
10.4.3.14	The system shall use the transmission substation breaker as its source for sub-transmission category outages and trace to source functionality.		
10.4.3.15	The system shall use the distribution substation breakers as its source for distribution category outages and trace to source functionality.		
10.4.3.16	The system shall use the DMS/SCADA monitored device information to keep predicted outages from rolling up to the set of DMS/SCADA monitored devices based on trouble calls processed.		
10.4.3.17	Describe the system's algorithm(s) for breaking up outage prediction zones across sub-transmission and Distribution voltages. Assume connectivity exists in the topology model through the distribution substation.		
10.4.3.18	Describe the system's behavior for generating outage prediction events when receiving calls that are being served by a network grid configuration.		
10.4.3.19	Describe the system's behavior when receiving a trouble call or emergency call when it can't logically group or assign to a Device or existing outage event.		
10.4.3.20	The system shall include an automated process to create and replay outage calls to simulate single outages, small storms, and major storms for training purposes. The process shall include a mechanism to capture and re-create real storms events including replaying ADMS messages in time sequence.		
10.4.3.21	Please describe your analysis engine's current use of AMR /AMI information and your support capabilities for intelligent field devices.		

10.4.4 Crew Management

The ADMS shall be able to create tickets, manage tickets, and operator dispatching of crew(s) for assignment to outages, including outage definition, number of crew members, type of crew, and equipment information.

The ADMS provides the user the ability to assign outages to one or more crews simultaneously and/or sequentially. The ADMS provides the ability for the user to indicate that a crew is at the work site.

The ADMS shall be a GUI based Crew Management module that has functionality to manage crews, allocate/re-allocate resources, track contact information and their history of all previous calls and whether they were reached, whether they came in, or declined when called.

The ADMS crew functionality tracks crew hours worked and monitors and alarms when crews are about to exceed their workload requirements.

The ADMS crew functionality can indicate the type of vehicle associated with the crew.

The ADMS user can create new crews using the crew administrative tools, to define as permanent or temporary; and the new crews are immediately available in the system.

The ADMS shall have ability to call out a crew when no crew is available by providing Crew Callout functionality.

ADMS shall have ability to calculate the number of crew recommended to achieve a system-wide estimated restoration time.

Compliance Questionnaire

Req. ID	Crew Management	Capability Supported?	Bidder Response
10.4.4.1	The user shall be able to define preconfigured crews. The crews are made up of crew members, trucks and special equipment.		
10.4.4.2	The user shall be able to mark a crew as active or inactive.		
10.4.4.3	For each individual crew member, the system shall contain his contact information: ▪ cell number ▪ radio number ▪ truck id ▪ emergency contact number		
10.4.4.4	The user shall be able to quickly create new crews containing contractors and make them active so they can have events dispatched or assigned to them.		
10.4.4.5	The user shall be able to quickly split or merge crews based on crew restrictions or outage event conditions.		
10.4.4.5	The system shall track hours on the job for each individual Crew member.		
10.4.4.6	The system shall generate an alarm that color codes the crew on both the graphical and tabular displays they are displayed on when any member of the crew has reached a user definable threshold of hours on the job.		
10.4.4.7	This system shall alarm the dispatcher when a crew member is overdue for a meal or rest period.		
10.4.4.8	The user shall be able to generate a list of crew members that have reached a threshold number of hours on the job.		
10.4.4.9	The user shall be able to list for each crew, its members and the hours (and partial hours to the tenth of an hour) currently on the job for each crew member and all events that have either been dispatched or assigned to the crew.		
10.4.4.10	The user shall be able to view the list of available crews.		
10.4.4.11a	The user shall be able to view list of crews that have been dispatched to trouble events in the field.		
10.4.4.11b	The user shall be able to view the list of crews who have no trouble events dispatched or assigned to them.		
10.4.4.12	The system shall generate and display for each crew the estimated time they have left on the trouble events that have been dispatched or assigned to them.		
10.4.4.13	The system shall be able to generate the number of additional crews required based on the current set of known and predicted outages and the number of active crews, their remaining availability and the user entered desired outage completion time.		
10.4.4.14	The system shall provide remote access (via a secure Web based application) for all of its crew management functionality.		

10.4.5 Switch Management

The ADMS shall have the ability to have temporary network conditions applied such as jumpers, grounds, cuts, etc. A separate list of these network changes shall be maintained and easily accessible to the operator.

Compliance Questionnaire

Req. ID	Switch Management	Capability Supported?	Bidder Response
10.4.5.1	The system shall support a catalog of switching templates.		
10.4.5.2	The system shall maintain an archive of switching orders for 3 years.		
10.4.5.3	The system shall pre-fill in the switching header from the details it receives from a work order.		
10.4.5.4	The user shall be able to select a group of devices or sections of circuit and have the system automatically generate a suggested switching order to isolate the selection based on load flow analysis, minimum number of switching steps and the current network configuration.		
10.4.5.5	The user shall be able to query the catalog of switching templates and instantiate his current Power Out request based on the selected template.		
10.4.5.6	The user shall be able to manually select and operate devices and the system shall record the steps into a switching order.		
10.4.5.7	The system shall support an import mechanism to load existing switching templates and historical switching orders from a RDBMS.		
10.4.5.8	The user shall be able to go into a planning mode that doesn't affect any of the outage management users to generate his proposed switching orders and to verify them by playing them forward against a copy of the current network configuration.		
10.4.5.9	The user shall be able to add safety and operational steps at the appropriate locations in the switching order. The user shall also have the capability to insert additional instructions, checks or otherwise edit the system generated step.		
10.4.5.10	The user shall be able to group multiple work orders and manually entered Power Out requests and generate a single switching order for that set of work orders.		
10.4.5.11	The system shall track all work orders supported by a switching order.		
10.4.5.12	The user shall be able to create multiple switching orders for a single work order or Power Out request.		
10.4.5.13	The switching order shall be printable, faxable, and be able to be sent electronically to crews in the field.		
10.4.5.14	The user shall be able to generate a list of affected customers for each planned outage and use the list to generate door hangers, mailers and phone calls.		
10.4.5.15	The user shall be able to generate additional switching orders based on switching orders that have been saved.		
10.4.5.16	The system will provide assistance to the user once he has indicated the start of a planned switching order has been executed in the field. It will timestamp the switching steps as the dispatcher		

Req. ID	Switch Management	Capability Supported?	Bidder Response
	acknowledges them. It will keep the active step highlighted within the switching order for the dispatcher.		
10.4.5.17	The system will provide assistance during the planning of Power Out requests by displaying a list of existing planned switching orders that affect overlapping facilities with the Power Out request's isolation area during an user definable window of time (within next 2 days, week, 2 weeks, etc…)		
10.4.5.18	The system will provide signature review cycles for planned switching orders.		
10.4.5.19	The system will notify the work management system when all necessary switching orders have been created for a work order/Power Out request.		
10.4.5.20	The user will be able to adjust the steps within a switching order after it has been started. To support this, the system shall support alphanumeric numbering of switching steps within a switching order.		
10.4.5.21	The system shall have a module for users to manually enter Power Out requests as well as supporting the interface with a WMS to accept Power Out requests from an external system.		
10.4.5.22	The system shall support GUI based management screens for users to display, sort, and group Power Out requests.		
10.4.5.23	The system shall provide management reports about the status of Power Out requests.		
10.4.5.24	The system shall provide graphical scheduling aids of Power Out requests that support detection of network based overlaps and conflict detection between Power Out requests.		

10.4.6 Field Scheduling & Dispatching

The necessary interface mechanism to send both pre-assigned trouble work and unassigned trouble work to a scheduling module is part of this project., we are asking to Bidders who have such scheduling modules to answer the following set of requirements.

Compliance Questionnaire

Req. ID	Field Management	Capability Supported?	Bidder Response
10.4.6.1	The system shall automatically generate a schedule to be used by either the auto dispatching module or a human dispatcher. It will be based on the trouble call codes, the location of the predicted device and the location and skill types of the crews that are active.		
10.4.6.2	The system shall accept pre-scheduled requests, that is, events already manually assigned to a specific crew by the dispatcher.		
10.4.6.3	The system shall accept cancellation requests for all work order types. Describe the system's behavior when the cancellation request arrives after the work order has been scheduled and dispatched to the field.		
10.4.6.4	The system shall generate new estimated restored times for all events that have been extended beyond their original estimated restore time because of the lack of resources to dispatch to.		
10.4.6.5	The system shall accept multiple work order types to be scheduled:		

Req. ID	Field Management	Capability Supported?	Bidder Response
	▪ service (turn on, shut off, meter checks) ▪ maintenance & inspection trouble ▪ emergency ▪ construction work orders ▪ switching orders ▪ street light service requests		
10.4.6.6	The system shall generate a resource-loaded schedule of distinct work order tasks assigned to distinct crews for the next 6 calendar weeks.		
10.4.6.7	The system shall treat emergency and outage types of tasks with higher priority and schedule the closest qualified crew to be dispatched.		
10.4.6.8a	The field crew will be given the option to keep their previously assigned work orders for the day when they receive a trouble event.		
10.4.6.8b	The system will automatically reschedule all work order tasks sent back to it by field crews when they accept new trouble work order tasks.		
10.4.6.9	The system will generate the forecasted resource skill requirements for all work orders with need dates within the next 6 months.		
10.4.6.10	The system will accept maintenance and inspection work orders and use them to fill out the day for all qualified crews.		
10.4.6.11	The system shall accept as input the personal calendar for each Crew member.		
10.4.6.12	The user shall be able to enter the company's workday calendar and shift definitions.		
10.4.6.13	The system shall accept appointment requests.		
10.4.6.14	The system shall generate a list of 10 alternative time slots if the requested appointment time slot is not available.		
10.4.6.15	Describe the type of location details required to be included as part of a work order to be auto scheduled and dispatched.		
10.4.6.16	Describe the skill type details required to be included as part of a work order to be auto scheduled and dispatched.		
10.4.6.17	Describe the inter work order dependencies details required to be included as part of a work order to be auto scheduled and dispatched with its related work orders.		
10.4.6.18	Describe the system's scheduling algorithm in enough detail to address how the system ensures two different crews with similar skill sets won't be assigned work orders on the same street and area in the service territory.		
10.4.6.19	During major storm events, the system will take back all work orders from their scheduled crews, generate a new schedule based on the estimated restoration times for all of the known outages and generate a list of customer executives to be paged and/or a list of customers to be called or to receive a mailer to notify them that their work order has been rescheduled past its need date.		
10.4.6.20	The user shall be able to generate a schedule for this week, this month, or the next two months and either:		

Req. ID	Field Management	Capability Supported?	Bidder Response
	print a hard copy post it to all crews personal calendars		
10.4.6.21	Please provide the hardware Requirements required executing the scheduling module.		
10.4.6.22	The system shall auto dispatch to the field a complete days' worth of work before the crews sign on for their shift.		
10.4.6.23	The system shall dispatch all work orders previously dispatched to a crew who doesn't sign on within 10 minutes of his shift's scheduled start time.		
10.4.6.24	The user shall be able to manually dispatch a crew to a work order by dragging the crew to the work order or the work order to the crew.		
10.4.6.25	The user shall be alarmed when a crew is in jeopardy of missing his current work order's estimated end time, so the dispatcher can proactively take over the rest of the crew's work orders and reassign them.		
10.4.6.26	The user shall be presented all crews in a scrollable tabular list.		
10.4.6.27	The user shall be presented all work orders in a scrollable tabular list.		
10.4.6.28	The user shall be able to sort all tabular lists by any combination of fields that are displayed.		
10.4.6.29	The user shall be alarmed when the system attempted to auto dispatch a trouble or emergency work order and the crew hasn't acknowledged it within a user defined period of time.		
10.4.6.30	For each type of work order, Describe the life-cycle model supported by the dispatching module.		
10.4.6.31	The user shall be able to print a copy of the day's schedule by crew.		
10.4.6.32	The system shall display the current location of the crew if the system supports AVL.		
10.4.6.33	The user shall be able to replay the history of a crew's location for the past 6 months.		
10.4.6.34	The system shall automatically re-dispatch all work orders not marked to stay with the crew at the end of the shift.		
10.4.6.35	The system shall be able to send to the field either with the original trouble work order header information or as requested by the field, a map of the probable outage device, a list of critical customers affected, a list of customers who have called in, a list of all customers affected and the alternative views that contain the various customer lists plotted on the outage map as well.		
10.4.6.36	The system shall be able to send to the field either with the original trouble work order header information or as requested by the field, details associated with each of the customers affected, including the actual text message collected by the customer service representative.		
10.4.6.37	The system shall be able to track when a work order has been dispatched, acknowledged by a crew, crew is in route, crew has arrived at the location, crew has restored service and crew has completed work order.		

Req. ID	Field Management	Capability Supported?	Bidder Response
10.4.6.38	Please provide bandwidth and throughput metrics and bandwidth recommendations for the following type of connections: LAN, WAN, modem and wireless; for these types of work load scenarios: ▪ The down load of a day's set of work orders ▪ Trouble work order set of maps and related details ▪ Interactive timing metrics of field entered estimated restoration times and device state changes ▪ Upload of a day's worth of orders to be re-dispatched for crews who are getting trouble work orders ▪ Upload of a day's worth of work order completion details ▪ Upload message traffic of your AVL component ▪ Traffic required to support field user on demand queries for detailed customer information, work order information, outage summary information		
10.4.6.39	Please provide the set of wireless mediums and protocol supported by the dispatching and field components		
10.4.6.40	Please provide the hardware requirements of the dispatching module to handle 200 crews being managed by 4 dispatchers and 48 Zone offices		
10.4.6.41	The system shall allow centralized and de-centralized business models. Normal dispatching is typically done centrally. Certain severe storm situations may require de-centralized dispatching. Describe the scalability of the system to support both business models.		

10.4.7 Notifications

The OMS shall be able to integrate with IVR and corporate website to provide notification of planned and unplanned outages status via customer phone lines (work phone, cell phone and home phone, etc.), emails, or text messages to customers.

The OMS shall provide method(s) to contact a customer electronically with outage status updates using IVR, Email, and SMS text messaging.

10.4.8 Tabular List

All dynamic lists have sorting capability on any column, including the capability to have multiple nested sorts, in order to rank and sort outages in an order that is quick to locate information (i.e., medical alert customers).

All dynamic lists have filtering capability, with the ability to filter on multiple fields.

The sorts in the outage list can be sorted at a minimum with the following column information: customer hours and minutes interrupted priority customers, customer type, outage types and number of customers out.

The OMS dynamic list of grouped calls supports a dynamic status indicating current status of event (acknowledge, crew on site, ETA, restored).

OMS has the functionality to generate estimated restoration times for each outage with the ability for manual override of the calculation.

The OMS solution has the ability to provide an estimated number of customers out of power (versus actual), per outage prediction.

The OMS dynamic list have the ability to filter on multiple fields and the ability to export in xml format or other reporting generators.

10.4.9 Storm Management

An optional Storm Management Module (SMM) shall be available to be added on to the ADMS

The SMM should have the ability to group outages together under a Storm, e.g. Irene, Sandy

Grouping outages under a Storm shall provide the following abilities

Generate reliability and outage statistics for the storm – such as the number of customers effected by the storm, total customer interruption minutes, number of switch operations, etc.

The SMM shall have a complimentary tablet based feature which can be used for damage assessment. Damage Assessment personnel can use these tablets to gather data related to damage.

The tablets can be connected in real-time with the ADMS to upload the damage reports and allow dispatchers to dispatch crews to rectify the damage.

Tablets may optionally also be offline without any internet connectivity. Once the damage assessor is back in the office the damage assessment reports can be uploaded to the ADMS.

Damage reports shall be easily accessible by dispatchers via the ADMS GUI.

10.5 Analysis/Reports/Dash Board for ADMS

The user shall be able to select a ADMS report from a drop down menu. The user shall then select the desired feeder by clicking on any circuit element of that feeder. The user shall be able to view the report in a resizable window or print the report. The sample report formats has been attached as appendix B with this volume

10.5.1 Category-1

Req. ID	Advanced Distribution Management System Report	Capability Supported?	Bidder Response
10.5.1.1	Load Flow Data Report This report shall display, for each phase of each circuit element of the selected feeder, the following: ▪ Voltage ▪ Current ▪ Real and reactive load ▪ **Real and reactive**		
10.5.1.2	Load/Losses Report This report shall display, for each phase of each circuit element of the selected feeder, the following: ▪ Voltage ▪ Current ▪ Real and reactive load ▪ Total accumulated real and reactive load upstream of this circuit element ▪ Real and reactive losses ▪ Total accumulated real and reactive losses upstream of this circuit element ▪ Length of the circuit element		
10.5.1.3	▪ Margins Report		

Req. ID	Advanced Distribution Management System Report	Capability Supported?	Bidder Response
	This report shall display, for each phase of each circuit element of the selected feeder, the following: ▪ Voltage ▪ Current ▪ Current carrying capacity ▪ Percent current margin available on that circuit element ▪ Location and value of the minimum margin circuit element upstream of this circuit element ▪ Location and value of the minimum voltage circuit element downstream of this circuit element		
10.5.1.4	Limit Check Report This report shall display, for the selected feeder, the per phase voltage, current and power factor of each circuit element in the feeder that contains limit violations. The report shall identify each calculated value that exceeds defined alarm limits		
10.5.1.5	**Margins Report** This report shows a list of Automatic Fault Switching Response events for a selected feeder. When the user selects an event, the report shall display the details of that event in a separate resizable window. ▪ For each event the report shall include the following information in the order of occurrence: ▪ Information related to the feeder lockout ▪ Information describing the analysis that led to the determination of the fault location based on remote fault detection devices ▪ Information describing the analysis related to the isolation of the fault ▪ Information describing the analysis related to the restoration of the feeder above the fault ▪ Information describing the analysis related to the transfer of the circuit below the isolated area to other feeders ▪ Information related to the actual load transfer controls		

10.5.2 Category-2

The OMS system should provide a browser-based outage reporting application that provides a configurable environment for displaying 'real-time' summary information about current outages. The summaries should provide a geographical view of the location of outages as well as the number and scope of outages of each status.

The OMS standard reports include a report of all outages from the previous day, week, month, or year; including location, customer hours lost, crew, outage start and stop time, cause, failure, remedy and size of each outage.

The OMS includes dashboards or portals that can reflect current outage and system operating conditions that can be made available to a large user base internally. Describe the dashboard or portal technology and available functionality.

Compliance Questionnaire for OMS report:-

Req. ID	Reporting	Capability Supported?	Bidder Response
10.5.2.1	The system shall provide a set of daily operational reports: ▪ Outage Summary ▪ Outage Detailed ▪ Circuit Summary ▪ Line Summary ▪ Area Summary ▪ Crew Summary ▪ Crew Detailed ▪ Daily Outage Completions ▪ Outage Completion Forecasts ▪ Crew Resource Forecasts ▪ Abnormal Device Summary ▪ Abnormal Device Detailed ▪ Tomorrow's Switch Plans ▪ This Week's Switch Plans ▪ Today's Planned Outages ▪ Tomorrow's Planned Outages ▪ Next Week or Next Four Weeks Flash Report		
10.5.2.2	The system shall provide a set of outage index performance reports in accordance with the guidelines established in IEEE P1366TM/D14: ▪ CAIDI ▪ CAIFI ▪ SAIDI ▪ SAIFI ▪ ASAI ▪ MAIFI ▪ MAIFIE Please describe your update release cycles for these published indices and the revisions to their set of specifications. Please indicate your use of the 2.5β "beta method" for major event day normalization algorithm or other normalization algorithms. Please list all of the IEEE P1366TM/D14 set of indices that your system currently generates. Please describe your support of user-defined durations (1 minute, 5 minutes, 15 minutes) to be used to define momentary and sustained outages.		
10.5.2.3	The system shall provide an ad-hoc reporting environment that allows users to develop their own reports against the system's data mart.		
10.5.2.4	The user shall be able to name and save his reports in a catalog of reports.		
10.5.2.5	The user shall be able to view any report definition and copy it to re-use its logic as a starting point for a new report.		

Req. ID	Reporting	Capability Supported?	Bidder Response
10.5.2.6	The system will provide the user with access to a data dictionary that describes the tables and fields within its data mart.		
10.5.2.7	The user shall be able to print the results of any reports that are executed.		
10.5.2.8	The user shall be able to designate Microsoft Excel as his output format and the system will start up Excel and load the results of his report into Excel.		
10.5.2.9	The system shall provide reporting and read only access of graphical and tabular screens for customer service and management users.		

10.5.3 Reliability Indices

The system shall provide the ability to calculate quality of service indices that can be used to track and report on the performance characteristics of TPNODL Distribution Network over various time periods specified by the user. This shall include quality of service indices pre-defined in the database or created by the user on-line

At least, the following quality of service indices shall be implemented: SAIDI, MAIFI, SAIFI, and CAIDI.

The standard ADMS reporting package should generate standard Reliability index reports for user supplied time frames; and in real time. These reports should be able to run by equipment, customer, or system wide for the previous year, year to date, rolling twelve-month period, previous month(s), current month to date, previous week or day. Reports to include: SAIFI, SAIDI, CAIFI, CAIDI, and MAIFI.

The OMS standard reports calculate the reliability indices; with and without the inclusion of outages for major event days and/or loss of supply.

The user shall be able to calculate the quality indices at any voltage level & area specific i.e. district wise

The user shall be able to view the quality of service indices and the variables used to calculate them via interactive displays that allow the user to:

- Create, verify, and edit quality-of-service formulas
- Verify and edit individual values of the calculation variables
- Enable and disable one or more index calculations
- Enter schedules for index calculations.

The calculation variables shall include any values available, including real-time and historical data. Tools shall be provided to compare sets of indices created at different times and over different time periods. These tools shall allow statistical information to be generated for user-selected indices. In addition, the user shall be able to generate, review, and schedule reports based on the quality of service indices.

Example for calculation of different indices is shown below. The actual calculation formula will be decided by TP-DDL during project implementation.

Given the following symbols definitions:

Ni = number of interrupted customers per interruption event i
NT = total number of customers served
ri = restoration time per interruption event i,

the Contractor shall implement the quality of service indices defined as follows:

SAIFI = Ni / NT
MAIFI = Ni / NT, where only events of duration less than 5 minutes are counted
SAIDI = ri Ni / NT
CAIDI =ri Ni / Ni

Where:

SAIFI = System Average Interruption Frequency Index
MAIFI = Momentary Average Interruption Frequency Index
SAIDI = System Average Interruption Duration Index
CAIDI = Customer Average Interruption Duration Index

The above indices shall be calculated for up to different customer categories as defined by TPNODL

11. Documentation

Documentation shall be provided for all equipment and functions provided by the Supplier as part of this procurement. All documentation shall be in English. The documentation shall describe the SCADA/ADMS, including all of its hardware, software, and interfaces and shall cover functionality, testing, installation, system startup, operations, and maintenance.

11.1 Definitions

For the purposes of this project, the following definitions shall be used:

Documents or Documentation – Textural and graphical information describing the SCADA/ADMS or equipment, systems, and other items peripheral to the SCADA/ADMS, whether embodied in hardcopy or electronic form such as common word processor files. Documents may also be referred to as manuals, guides, books, drawings, transmittals, and specifications. Documents are further divided into standard, OEM, and custom documents.

Standard documents – Documents produced by the Supplier and used prior to the award of this contract that are applicable to all users of the equipment and software, including TPNODL. It is expected that the Supplier will use a formal revision control scheme to maintain its standard documents. Documents not maintained under such a scheme shall be considered custom documents.

OEM documents – OEM (original equipment manufacturer) documents are those standard documents produced by Subcontractors. Documents produced by Subcontractors for customized elements of the System shall be deemed custom documents.

Custom documents – All documents not categorized as standard or OEM documents including the Supplier's standard documents that are modified to meet TPNODL specific requirements.

Project Documents – Project documents are those documents produced for the conduct of the project but which do not directly describe the SCADA/ADMS. Examples of project documents include transmittal cover pages, correspondence between TPNODL, the Supplier, and other parties, electronic mail messages, records of telephone conversations, meeting minutes, action item lists, test plans and procedures, and transmittal and document lists.

The requirements for project documents are addressed in the following sections:

1) Documentation plan – Section 14.3.1
2) Project progress report – Section 14.3.2
3) Project meeting, agenda, and minutes – Section 14.3.3
4) Detailed implementation schedule – Section 14.3.5
5) Variance recording and resolution – Section 12.5
6) Factory test documents – Section 12.9
7) Site test documents – Section 12.10

8) Availability test documents – Section 12.11
9) Training documents – Section 13.2.

The remainder of this section addresses the requirements for documents other than project documents.

11.2 Document Format

Documents shall be delivered in two phases:

- Approval documents, submitted for TPNODL review and approval
- Final documents.

TPNODL prefers that documents be delivered as softcopy on magnetic media or by electronic transfer (electronic mail or ftp, for example). Final documents shall be delivered on hardcopy, on-line on the PDS, and on softcopy on CD-ROM. Any user shall be able to access on-line documentation including functional design documents, user guides, maintenance manuals, on-line help, and operating procedures via a simple procedure involving a one-click operation.

Documents shall be supplied in a format that can be edited by TPNODL Handwritten texts are not acceptable. TPNODL's standard word processing software is Microsoft Office 2013™ . The Supplier is encouraged to use this software for documents. If the Supplier uses other word processing or document production software, four copies of the software, suitable for installation on a personal computer shall be provided.

Documents delivered as hardcopy shall be printed on both sides of 8½" x 11" paper and bound in three-ring binders. Divider pages with appropriately labeled tabs shall separate chapters. The spine of each volume shall be labeled with the document title and volume number so it may be easily identified when shelved.

Documents delivered on softcopy media shall be formatted for printing on A4 size paper.

Each document shall include a title or information page showing the document number, title, and revision record. The document number shall be a unique number assigned in accordance with the Supplier's standard practice. The title page shall include a space into which TPNODL may enter a document number assigned from TPNODL document management system. The revision record shall describe each new version of the document since its original production. The revision record shall include:

1) The date of the change
2) A brief description of the change
3) In indication that the change has been reviewed and approved in accordance with the Supplier's quality assurance procedure
4) The version or release of the hardware or software to which the document applies.

Each document shall include a table of contents. If a document is divided into several physical volumes, each volume shall contain the complete table of contents of the whole document. Furthermore, each document shall have a cross-reference table, listing all topics of significance covered by the document, and giving the page or section references of all pages or sections with discussions of the topic.

Documents that describe generic or typical SCADA/ADMS elements will not be acceptable to TPNODL unless the specific material applicable to this project can be readily identified and materiel not applicable to this project can be similarly identified. Custom documents shall not contain any material that is not pertinent to this project.

Where the phrase "on-line documentation" is used in these Specifications, it shall be interpreted to mean the ability to view the document from any SCADA/ADMS workstation. The Supplier shall provide all software necessary to provide this capability. For non-OEM documentation (documentation

produced by the Supplier), the Supplier shall also provide the capability to edit and annotate the document.

11.3 Document Review and Approval

All standard and OEM documents provided pursuant to this contract shall be subject to review by TPNODL Custom documents provided pursuant to this contract shall be subject to approval by TPNODL

11.3.1 Document Review

TPNODL review of documents shall be limited to determining that:

1) The documents have been produced in accordance with the documentation standards of the Supplier or Subcontractors
2) All hardware and software is in full conformance with the contract
3) For software, that the software has been produced in accordance with the coding and display standards of the Supplier or Subcontractors
4) The documents clearly and accurately describe the features and options of the hardware and software that pertain to the SCADA/ADMS
5) The documents are written in English, and hard copies are printed legibly, and well bound.

TPNODL will review documents within ten working days of their submittal. If TPNODL does not transmit comments on the documents within the review period, the Supplier may assume that the document is fully acceptable to TPNODL

If TPNODL transmits comments on any documents, the Supplier shall respond to the comments within ten working days of receipt of the comments. If the comments address OEM documents, the Supplier shall act as an advocate of TPNODL to initiate and facilitate resolution of the comments with the Subcontractor.

11.3.2 Document Approval

All custom documents shall be subject to a formal approval process. The review for approval performed by TPNODL will be similar to that for document review process, but will more closely examine the functionality and design aspects of the hardware or software. Clarity and completeness of the presentation of the material within the documents will be a key element of the review for approval.

The approval process shall proceed as follows:

1) The Supplier shall transmit documents subject to the approval process to TPNODL The transmittal cover shall identify the document as requiring approval and shall identify the date by which TPNODL must respond. The Supplier shall allow at least ten working days for TPNODL reading of the document. This time may be adjusted by mutual agreement to accommodate the other activities of TPNODL and the Supplier. Requests by either party to change the time shall be made within two working days of receipt of the documents by TPNODL

2) TPNODL shall return comments to the Supplier within the agreed time. The transmittal cover for the comments shall clearly indicate that the document is either:

   Approved – If approved, the Supplier may proceed with the work covered by the document. No further approval action is required.

   Approved with Comments – If approved with comments, the Supplier may proceed with the work covered by the document and the comments.

   Not Approved – If not approved, the Supplier may proceed with the work covered by the document and the comments only at their risk. No schedule or cost relief will be granted for any work undertaken prior to approval of the appropriate documents.

3) If desired by any party, the comments may be discussed to clarify TPNODL intent.

4) The Supplier shall then revise and resubmit the documents within five working days after receipt of the comments from TPNODL This time may be adjusted by mutual agreement to accommodate the other activities of TPNODL and the Supplier. Requests by either party to change the time shall be made within two working days of receipt of the comments by the Supplier.

   All changes made to documents to reflect approval comments shall be clearly highlighted and the revision record shall be updated to reflect the changes. TPNODL prefers the use of the change-tracking feature of the word processor used to produce the documents.

5) The review and comment process shall be repeated until the document is accepted. After the document is accepted, Supplier shall deliver the required number of final copies free of highlighting due to tracking of changes.

   All changes made to documents to reflect approval comments shall be clearly highlighted and the revision record shall be updated to reflect the changes. TPNODL prefers the use of the change-tracking feature of the word processor used to produce the documents.

11.3.3 Scope of Reviews and Approvals

The acceptance or approval of any documents by TPNODL shall not relieve the Supplier of the responsibility to meet all of the requirements of the contract or of the responsibility for the correction of the documents. The Supplier shall have no claim for additional costs or extension of time on account of delays due to revisions of the documents that may be necessary for ensuring compliance with the contract.

All deliverable documentation shall be revised by the Supplier to reflect the delivered System. Any modifications to the SCADA/ADMS resulting from the factory and site acceptance tests shall be incorporated in this documentation. All previously submitted documents that have been changed because of engineering changes, contract changes, or errors or omissions shall be resubmitted for review or approval as appropriate.

11.4 Deliverable Documentation

Table 11-1: Deliverable Documentation lists the minimum documentation to be delivered, quantities to be delivered, and the desirable delivery dates for the first submission review or approval copies. One soft copy and One hard copy shall be provided for review and approval. One soft copy and five hard copies shall be provided for all the final documentation.

Document	Delivery Date
Documentation standards	One month after Award Of Contract (AOC)
Basic hardware documents ▪ List of deliverables, configuration diagram ▪ Network configuration, interconnection lists ▪ Site installation drawings and procedures	▪ One month after AOC ▪ One month prior to delivery of the System ▪ Three months prior to delivery of the System
Equipment manuals	With each hardware delivery
Hardware maintenance manual	With each hardware delivery
Software list of deliverables	One month after AOC
Software development standards	One month after AOC

Document	Delivery Date
Database definition	▪ For standard software – one month after AOC ▪ For other software – with the software functional description
Interface Requirements Document	With the software functional description
Software functional description	Per the project schedule
Installation images and source code	With the System delivery
Detailed design document	Per the project schedule
System maintenance manual	With the System delivery
Display style guide	Two months AOC
Simulation instructor user's guide	With Simulation training

Table 0-1: Deliverable Documentation

TPNODL recognizes that the documentation scheme used by the Supplier may not match that described in this and other sections. Therefore, the Supplier is not expected to supply the specific documents presented herein. However, the documentation supplied shall provide all of the information described in the following sections.

11.5 Documentation Standards

The Supplier shall provide a document defining the standards used to create and maintain all documentation supplied by the Supplier. The standards shall define:

1) The word processing or document production software used to create the documents
2) Templates for each document type
3) Definitions of the contents for each document type
4) Drawing standards to be followed
5) The approval process to be followed for document releases.

11.6 Hardware Documentation

The following documentation shall be provided for all hardware provided pursuant to this contract:

1) List of deliverable hardware
2) Equipment configuration diagram
3) Network configuration diagram
4) Interconnection list
5) Site installation drawings and procedures.

The other hardware documentation to be supplied shall be commensurate with the hardware maintenance philosophy to be employed by TPNODL (Please refer to Volume I, Section 3, Maintenance and Upgrade Program.)

Equipment manuals shall be provided for all hardware to be maintained by the Supplier or a third-party maintenance supplier. This documentation shall be that normally supplied by the OEM as long as it includes the information described in Section 11.6.6, Equipment Manuals.

Equipment manuals and hardware maintenance manuals shall be provided for all hardware to be maintained by TPNODL

11.6.1 List of Deliverable Hardware

The list shall itemize each hardware item and include equipment configuration information. The configuration information shall be sufficient so that TPNODL can procure an identical item from the manufacturer. The list shall also include network names and addresses (or these shall be included in the network configuration diagram) and shall include a space for TPNODL to enter equipment identification for their own purpose.

11.6.2 Equipment Configuration Diagram

The equipment configuration diagram shall depict the logical interconnection of all of the Supplier-supplied equipment and its connection to TPNODL -supplied equipment. The configuration diagram shall use the same terminology as the list of deliverable hardware so that the correspondence between the two can be readily determined.

11.6.3 Network Configuration Diagram

This document shall show the design of the local and wide area networks supplied by the Supplier as well as the communications network supplied by TPNODL Both logical and physical depictions shall be provided for the network supplied by the Supplier. Only a logical depiction is required for the network supplied by TPNODL

11.6.4 Interconnection List

The physical interconnections among the SCADA/ADMS components, other than those shown on the network configuration diagram, shall be depicted. Each cable shall be identified, along with its terminations.

11.6.5 Site Installation Drawings and Procedures

The site drawings shall depict the physical arrangement of the SCADA/ADMS components. References to the appropriate equipment manuals are acceptable. The drawings and procedures shall include:

1) Equipment physical drawings showing dimensions, cabinet internal arrangements, and the size and weight of each enclosure
2) Unpacking, moving, handling, and other installation details
3) The location of external connections including types and sizes of connectors
4) Input power and grounding requirements
5) Environmental requirements.

11.6.6 Equipment Manuals

Equipment manuals shall contain the following:

1) A description of the function of the equipment
2) Installation, setup, and operating instructions
3) A block diagram showing the logical and physical interconnections among the major components
4) Expansion and upgrade capabilities and instructions
5) Preventative maintenance instructions
6) Detailed functional, logical, electrical, and mechanical characteristics of all interfaces to the device, including protocol descriptions
7) Troubleshooting and repair guides including a description of and instructions for the diagnostics furnished.

11.6.7 Hardware Maintenance Manual

The hardware maintenance manual shall describe the preventive maintenance and restorative procedures required to maintain the equipment in good operating condition. The information in the manuals shall include:

1) Operating details – This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment. Descriptions of external data transfers with other equipment, including data patterns, security check-codes, and transfer sequences shall be included. The operational sequence of major assemblies within the equipment shall be described and illustrated by functional block diagrams and timing diagrams. Detailed logic diagrams shall also be provided as necessary for troubleshooting analysis and field repair actions.
2) Preventive maintenance instructions – These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the equipment. Instructions on how to load and use any test and diagnostic program and any special or standard test equipment shall be an integral part of these procedures.
3) Corrective maintenance instructions – These instructions shall include procedures for locating malfunctions down to the field-replaceable module level. These guides shall include adequate details for quickly and efficiently locating the source of an equipment malfunction. The instructions shall also include explanations for the adjustment or replacement of all items, including printed circuit cards. Schematic diagrams of electrical, mechanical, and electronic circuits, parts-location illustrations, photographs, cable routing diagrams, and sectional views giving details of mechanical assemblies shall be provided as necessary to replace faulty equipment. For mechanical items requiring field repair, information on tolerances, clearances, wear limits, and maximum bolt-down torque shall be supplied. Information on the loading and use of special off-line diagnostic programs, tools, and test equipment, as well as any cautions or warnings that must be observed to protect personnel and equipment shall be included.
4) Parts information – This information shall include the identification of each replaceable or field-repairable module. All other parts shall also be identified. The identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between the Supplier's part numbers and the manufacturer's part numbers shall be provided.

11.7 Software Documentation

The following documents shall be provided for all software:

1) List of Deliverable Software
2) Software development standards.

The Supplier or Subcontractors shall provide the following documents for all software that has been produced for the SCADA/ADMS. This specifically includes the support software of Section 2, SCADA/ADMS Architecture, as well as all application software:

1) Database definition and data flow, along with an explanation of stored procedures
2) Interface Requirements Document
3) Software functional description
4) Installation images and source code
5) Source code version control and revision control documentation.

The following documents shall be produced for all software produced specifically for this contract:

1) Software Requirements Matrix
2) Detailed design documents.

11.7.1 List of Deliverable Software

The list shall itemize each software item and include version and license information. The distribution media for each software item shall be identified. The list shall also indicate for each item whether source code is supplied.

11.7.2 Software Development Standards

The Supplier shall document the development standards used to develop the SCADA/ADMS software. TPNODL reserves the right to reject software that does not conform to the development standards. The standards shall define:

1) Program design disciplines
2) Resources under which the program must operate
3) Basic services
4) Interface definitions
5) Linkage conventions
6) Input and output specifications
7) Database naming and access conventions
8) Storage rules
9) Quality assurance procedures
10) Configuration design review methods
11) Software configuration control schemes.

11.7.3 Database Definition

The database definition shall identify the characteristics of all SCADA/ADMS databases. It shall include, but shall not be limited to, the following:

1) The name or identification of the database
2) A description of the intended use of the database. If the database is specific to a single application, the application shall be identified
3) A description of the organization of the database (the database schema or model)
4) A description of each field of each data item
5) Instructions for generating and populating the database
6) Details of programming interfaces. This shall encompass access methods, address schemes, and read, write, and modify actions
7) Initialization description – How or by what software is the data initialized and to what value(s)
8) Details of maintenance actions.

TPNODL encourages the use of "self-documenting" database technology, where the database definition is developed and stored with the data. The resulting documentation should be printable.

11.7.4 Interface Requirements Document

The Interface Requirements Document shall describe in detail the interfaces between the SCADA/ADMS and TPNODL -provided systems and networks. The Interface Requirements Document will be used by both the Supplier and TPNODL as the definition of the interface between the SCADA/ADMS and all other systems, so that each system can be designed or modified to meet its requirements. TPNODL will provide all required information to the Supplier so that it can prepare the document accordingly.

As a minimum, the Interface Requirements Document shall cover the following aspects:

1) Description of the hardware interface
2) Description of the communication protocols, including the lower level network protocols, the upper level session, presentation, and application protocols, and the options and parameters selected

3) Description of the database access methods and capabilities, including specific displays, commands, and access and authorization requirements
4) Description of relevant database models, structures, and contents for these databases
5) Data exchange requirements including timing, priority, volume, and security requirements. A specific list of data to be exchanged during factory and site testing shall also be included.
6) Description of the performance requirements
7) Exception (for example, error) processing
8) Failover/Backup processing
9) Alarm conditions
10) Archiving requirements.

11.7.5 Software Functional Description

The intent of the software functional description shall be to describe the functions to be performed by each software module from the standpoint of a user. (Software functional descriptions are also referred to as user guides.) The functional operation of the SCADA/ADMS shall be clearly described so that it can be understood without understanding the detailed operation of each software module.

Software functional descriptions shall also be used as the first step in the design of a custom (for example, new functionality). Thus it shall have sufficient information for TPNODL to determine that the new functionality will meet the requirements of the contract.

The software functional description shall include the following minimum content:

1) Functional description – A narrative description of each program. Where appropriate, solution algorithms shall be described
2) Performance requirements – The execution periodicity, processing capacity, and tuning and execution parameters that control or limit the capabilities of the software
3) Resource requirement – The expected minimum requirements for main memory, auxiliary memory, processor capacity, and other resources required by the software
4) User interface – A description of the interface used to control the software, including all user inputs and program responses
5) Software interface requirements – A description of the logic interfaces with other programs
6) Data requirements – A description of all data and databases accessed by the software, including execution parameters
7) Error messages – A concise description of all error messages and possible corrective actions
8) Diagnostic messages – Where the software generates a record of its internal operations, the messages shall be described
9) Maintenance and expansion procedures – A description of either maintenance procedures or expansion procedures that is relevant to maintenance of the program or expansion of the program.

It is TPNODL strong preference that software functional descriptions are provided as on-line documentation.

11.7.6 Installation Images and Source Code

All software shall be delivered in three forms:

1) As a fully operational system installed on auxiliary memory
2) As distribution images suitable for installation on the system
3) Buildable source code including libraries, compilers, and linkers for building software.

The distribution images shall include all operating system, platform software, application software, and the code management library of modifications incorporated into the delivered software. All standard software shall be supplied on the original installation media used by the Supplier to build the system. TPNODL prefers CD-ROM as this media. All customized software shall be supplied as part of the code management library along with the source code or other distribution image against which the code changes are to be applied.

It shall be possible for TPNODL to completely generate, build, install, and configure the entire System from the distribution images, source code, and software utilities provided with the System. To this end, "make files" or other compilation, generation, and installation tools, scripts, and directives shall be delivered.

For the purposes of this requirement, "software" shall specifically include the databases supplied with the System. That is, sufficient definition and content images shall be supplied such that the System databases can be created and installed on the SCADA/ADMS.

11.7.7 Software Requirements Matrix

The Supplier shall provide a list of all software requirements, cross-referenced to show where each requirement is discussed in the relevant software document.

The Software Requirements Matrix shall list each of the requirements for the SCADA/ADMS stated in this specification, in numerical order, referenced by chapter, section, and paragraph number. This list of specified requirements shall be supplemented by a list of all functions provided by the Supplier's software system that go beyond the specified requirements.

For each requirement on the list, a reference shall be given to the chapter and section where the requirement is described or covered in each of the following of the Supplier's documents:

1) Item on the List of Software Deliverables
2) Software Functional Description
3) Operations Manual
4) Factory Acceptance Tests
5) Site Acceptance Tests.

11.7.8 Detailed Design Document

The detailed design documents are intended as a second level of detail to the software functional descriptions. In general, a detailed design document shall relate to a single software functional description. It is expected that, for customized software, the Supplier will first deliver a software functional description for approval by TPNODL After approval, the Supplier will then produce a detailed design document for approval. Production of the software will proceed after approval of the detailed design document.

The detailed software design documentation shall include, but shall not be limited to, the precise design information needed for planning, analysis, and implementation of the software. It shall include a show the divisions of the software design entities; a dependency description specifying the dependent entities, their coupling, and required resources, an interface description providing details of external and internal interfaces not provided in the software functional description; and a detailed design description containing the internal details of each design entity.

The detailed software design documentation shall provide a detailed description of how the software will support the functions described in the software functional description. Detailed software design documentation shall include a diagram of the software indicating major modules and an overview of the operation of each module. It shall describe data structures and flow, and a diagram or description of the manner in which the modules interfaces with other modules.

For each software module, the detailed software design documentation shall include, but shall not be limited to, the following items:

1) Program abstract
2) General technical description of the module
3) The module logic (the use of pseudo code or structured English is preferred)
4) External interfaces to the program including applicable calling sequences
5) Initialization considerations
6) Identification of any databases referenced or modified
7) A high-level flowchart or program design language to enhance the technical description of the module
8) Error codes and error handling processes.

Each program module, including subroutines, shall be sufficiently documented to allow an experienced programmer (with supervision of the designer) to perform the coding of the module, as well as allow TPNODL personnel to maintain such software in the future. All job control files (batch or make files) required for compilation, assembly, and linking of each program shall be documented in detail as part of the detailed software design documentation.

11.8 System Maintenance Manual

The System Maintenance Manual shall describe all user procedures necessary to build and maintain the software system of the SCADA/ADMS. It shall include complete instructions on performing a system generation from sources for all processors. It shall provide information on optimizing system performance. It shall describe the hierarchy of disk directories used by the SCADA/ADMS software system, and the location of all categories of files: including executable programs, displays, databases, sources, build files, etc. It shall also describe the procedures to configure the SCADA/ADMS computer system and backup the system.

The System Maintenance Manual shall also include documentation of the distributed system software supporting the configuration control function, data integrity, startup, restart, and the network management subsystem.

The manual shall provide a list of the Internet Protocol (IP) addresses of all devices in a manner compatible with TPNODL security standards and shall describe the procedures for upgrading or adding additional workstations, loggers, storage devices, and other peripheral devices. The System Maintenance Manual shall provide detailed information on troubleshooting all processors of the SCADA/ADMS. It shall describe the use of error logs, the meaning of all program-generated error or informational messages, and the recommended response to these messages. It shall explain what the user should do to save information after a processor failure, and shall describe the procedures to gather this information to allow the user to communicate in an informed manner with maintenance personnel. It shall include a description of the procedures to restore normal operation after a failure of the SCADA/ADMS.

11.9 Display Style Guide

The Supplier shall furnish a Display Style Guide that describes the discretionary aspects of display design and implementation. This guide shall be used by the Supplier to develop all displays supplied with the SCADA/ADMS. TPNODL will also use this guide as input to the development of its display conventions and standards. The objective of the display conventions and standards shall be to promote a consistent look and feel across all SCADA/ADMS displays.

11.10 Operating Manual

The Supplier shall submit, for review and approval, operating manuals for all SCADA/ADMS functions. The operating instructions associated with all features shall be incorporated into these manuals. Context sensitivity shall be used to go directly to the appropriate place in the manual.

The manuals shall be organized for quick access to each detailed description of the user procedures that are used to interact with the SCADA/ADMS functions. The manuals shall present in a clear and concise manner all information that a user needs to know to understand and operate the SCADA/ADMS satisfactorily. The manuals shall make abundant use of screen snapshots to illustrate the various procedures.

11.10.1 Operator's Manual

The Operator's Manual shall be custom documentation written specifically for TPNODL SCADA/ADMS. All snapshots used as illustrations shall be of genuine displays on TPNODL actual SCADA/ADMS.

The Operator's Manual shall be written for system operators as the audience. It shall be organized in a logical sequence and shall fully describe the user interface of all operational functions of the SCADA/ADMS. Each step of a multi-step procedure shall be described, with a clear indication of which menu items are selected to proceed to the next step.

The manual shall describe the SCADA/ADMS in a manner and at a level of detail that allows the user to detect and isolate problems in the SCADA/ADMS. All program-generated messages (such as, alarms, prompt messages, and error messages) shall be listed along with easily understood meanings and recommended remedial actions, where appropriate.

The Operator's Manual shall be provided on-line. The system operator shall be capable of accessing the Operator's Manual from the operator console via a one-click approach.

11.10.2 Database Editor's Manual

The Database Editor's Manual shall describe the procedures to define, build, edit, archive, and expand all the databases of the SCADA/ADMS. It shall contain information describing how a user may define and add new attributes to an existing database entity. It shall also describe how to restore any database to a previously saved version if the database had been corrupted. The database editor's manual shall document development of application function models, such as the network analysis and load forecast models.

The Supplier shall provide documentation that describes the Supplier's implementation of the CIM. This documentation shall include the following:

1) The detailed model definitions and objects
2) Maintenance manual
3) User's guide for toolkit.

11.10.3 Display Editor's Manual

The Display Editor's Manual shall describe and fully illustrate the capabilities of the Display Editor, including procedures to auto-generate and edit single-line displays for the SCADA/ADMS and to link display fields with entities in the database of the SCADA/ADMS. It shall describe how to generate new device symbols. It shall present a clear description of the principles behind zooming and decluttering, and shall explain how the user can assign declutter levels to display elements in order to achieve a satisfactory decluttering upon zooming.

11.11 Simulator Instructor User's Guide

This document shall describe the instructor-oriented capabilities of the Simulator and how to use them. The Simulator instructor user guide shall include:

1) How to operate the Simulator to provide training, including how to operate the:
    a. Training case set-up
    b. Scenario builder (if supplied)
    c. Database management system, including retrieval of cases from historical data
2) How to start, pause, stop and interact with a training session
3) How to monitor students' performance, including the recording of the training sessions, for example:
    a. Successful problem resolution
    b. Time taken for resolution
    c. Steps taken during resolution
4) How to replay scenarios for evaluation with students

12. Quality Assurance and Testing

To ensure that the Supplier produces a well-engineered and contractually compliant SCADA/ADMS, a quality assurance program shall be followed and both structured and unstructured tests shall be performed.

12.1 Quality Assurance Program

The Supplier must employ documented Quality Assurance (QA) techniques and practices throughout this project. This QA program shall be adhered to for the preparation of all Contract deliverables, including documentation, hardware, firmware and software. The program shall provide for the minimization of defects, the early detection of actual or potential deficiencies, timely and effective corrective action, and a method to track all such deficiencies.

12.2 Inspection

TPNODL shall be allowed access to the Supplier's facilities during system design, manufacturing and testing and to any facility where hardware or software is being produced. The Supplier shall provide office facilities, equipment, and documentation necessary to complete all inspections and to verify that the SCADA/ADMS is being fabricated and maintained in accordance with the Specification to TPNODL representatives.

TPNODL shall be allowed to review and verify the functional implementation of SCADA/ADMS software informally in conjunction with scheduled project meetings at the Supplier's facilities. No test plans, procedures, or reports are required to support these informal software demonstrations.

TPNODL shall be allowed to inspect the Supplier's hardware and software quality assurance standards, procedures, and records. Documents identified in the approved software quality assurance plan will be inspected to verify that the Supplier has performed the required quality assurance activities.

The inspection rights described above shall not apply to subcontractors supplying standard computer or peripheral equipment and third party software products. However, inspection rights shall apply to subcontractors that are developing new software for inclusion in the SCADA/ADMS.

12.3 Test Responsibilities

Both TPNODL and the Supplier shall designate, in writing and prior to the start of the factory test, a test coordinator. Each coordinator shall be responsible for insuring that the tests are conducted in accordance with the requirements of this Contract. The coordinators shall each have the authority to make binding commitments for their employer such as approvals of test results and scheduling for variance corrections or, as a minimum, to cause such commitments to be expeditiously made.

Unless otherwise stated in this Specification, the Supplier shall be responsible for all factory tests. This responsibility shall include the conduct of the tests and all record keeping and document production.

TPNODL will support the factory testing by supplying staff to execute the test procedures under the Supplier's supervision.

Also unless otherwise stated in this Specification, TPNODL shall be responsible for all site tests. This responsibility shall include the conduct of the tests and all record keeping and document production. The Supplier shall support the site testing by supplying staff to monitor the tests. TPNODL expects that at least one Supplier staff will be on-site during these tests.

The SCADA/ADMS will be maintained throughout testing commensurate with the requirements of Volume I, Section 3.5, Hardware Maintenance.

12.4 Test Documents

Test plans, procedures, and records shall be provided by the Supplier for all tests (excluding inspections and software demonstrations pursuant to Section 12.2, Inspection) to ensure that each test is comprehensive and verifies the proper performance of the SCADA/ADMS elements under test. During the development of test plans and test procedures, emphasis shall be placed on testing each conditional logic statement, checking error conditions, and documenting the simulation techniques used. The test plans and test procedures shall be modular to allow individual test segments to be repeated as necessary.

All test plans and test procedures (standard, modified standard, and custom functions) shall be submitted to TPNODL for approval and shall be subject to the approval process as defined in Section 11.3, Document Review and Approval.

12.4.1 Test Plans

The test plans shall describe the overall test process, including the responsibilities of individuals and the documentation of the test results. The following shall be included in the test plans:

1) The schedule for the test
2) The responsibilities of Supplier and TPNODL personnel, including record-keeping assignments
3) Any forms to be completed as part of the tests and the instructions for completing the forms
4) Procedures for monitoring, correcting, and testing variances
5) Procedures for controlling and documenting all changes made to the hardware and software after the start of testing
6) Block diagrams of the hardware test configuration, including the Supplier- and TPNODL -supplied RTUs, external communication channels, and any test or simulation hardware.

Test plans shall be provided for the Factory Acceptance Test, Site Acceptance Test, and Availability Test.

12.4.2 Test Procedures

The test procedures shall describe the methods and processes to be followed in testing the SCADA/ADMS. The test procedures shall be modularized, such that individual functions of the SCADA/ADMS can be independently tested and so that the testing proceeds in a logical manner. This section uses the term segment to refer to a higher-level part of a test procedure and the term step to refer to the most detailed level of test instruction.

The test procedures shall include the following items:

1) The name of the function to be tested
2) References to the functional, design, user, and any other documents describing the function
3) A list of test segments to be performed and a description of the purpose of each test segment
4) The set-up and conditions for each segment, including descriptions of the test equipment and data to be supplied by the Supplier and by TPNODL

5) Descriptions of the techniques and scenarios to be used to simulate system field inputs and controlled equipment
6) Descriptions, listings, and instructions for all test software tools and displays
7) Step-by-step descriptions of each test segment, including the inputs and user actions for each test step
8) Forms for the recording of test results
9) The expected results for each segment, including pass/fail criteria
10) Copies of any certified test data to be used in lieu of testing, if approved by TPNODL

The Supplier shall note that TPNODL will not accept any certified test data in lieu of testing except where specifically stated in the Contract.

12.4.3 Test Records

Complete records of all tests result shall be maintained. The records shall be keyed to the test procedures. The following items shall be included in the test records:

1) Reference to the appropriate test procedure
2) Date of the test
3) Description of any test conditions, input date, or user actions differing from that described in the test procedure
4) Test results for each test segment including a passed/failed indication. All information recorded during the test such as measurements, calculations, or times shall be included in the results.
5) Identification of the Supplier's and TPNODL's representatives performing and witnessing the test
6) Provision for comments by TPNODL's representatives
7) References to all variance reports generated
8) Copies of reports, display copies, and any other hardcopy generated as part of the test.

12.5 Variance Recording and Resolution

A variance tracking system shall be placed in service no later than one month before the start of Pre-FAT and shall remain in use through the completion of the warranty. Both the Supplier and TPNODL may initiate variances at any time. Variances may be used to record system deficiencies at any time, even if the system is not undergoing testing. This variance tracking system shall record and track variances for:

1) Documentation deficiencies
2) Functional deficiencies
3) Performance deficiencies
4) Procedural deficiencies (as when deviations from contractually required QA procedures are observed)
5) Test deficiencies (as when the system cannot satisfactorily complete a test procedure due to a problem with the test).

The variance recording and tracking system shall produce reports of all variance information and shall produce subsets of the variances based on searches of the variance parameters singly and in combination. Variance reports shall be available to TPNODL at all times. The Supplier shall periodically distribute a variance summary that lists for each variance the report number, a brief overview of the variance, its category, and its priority.

12.5.1 Variance Records

The record of each variance shall include the following information:

1) The date of the initial discovery of the variance

2) A variance number – a sequential number assigned when the variance is entered into the tracking system
3) An identification of the person submitting the variance and the names of any other witnesses or knowledgeable TPNODL or Supplier staff
4) An identification of the SCADA/ADMS component, such as a hardware item or software function, against which the variance is being written
5) An identification of the test plan or procedure, if applicable. The stage or step of the plan or procedure shall be identified
6) An overview of the variance suitable for use in keyword searches
7) A detailed description of the variance
8) A variance category:
    a. Open (recorded but not scheduled for further action)
    b. Assigned (scheduled for further action)
    c. Pending (the variance has been resolved but not tested)
    d. Closed (TPNODL have accepted the resolution)
9) The date of assignment into each category
10) A variance priority:
    a. Critical – To be used only if the SCADA/ADMS is in commercial use, this priority identifies a problem that prevents the use of an SCADA/ADMS feature that is essential to TPNODL operation of the power system
    b. High – Denotes the failure of the SCADA/ADMS to perform a required feature in a manner that significantly reduces the utility of the SCADA/ADMS or feature or which delays further testing of the SCADA/ADMS or feature
    c. Normal – Denotes the failure of the SCADA/ADMS to perform a required feature in a manner that reduces the utility of the SCADA/ADMS or feature. By definition, normal priority variances shall not delay any testing
    d. Low – Denotes the failure of the SCADA/ADMS to perform a required feature in a manner that reduces the utility of the SCADA/ADMS only slightly. By definition, low priority variances shall not delay any testing. Variances that record transient failures, that is failures that cannot be readily reproduced, shall be initially assigned to this priority. Subsequent occurrences of the transient failure shall result in raising the priority of the variance.
11) A description of the resolution, including identification of all hardware, software, and documents modified or otherwise changed and the names of the Supplier or TPNODL staff involved with the resolution
12) A record of all testing performed
13) Identification of TPNODL staff accepting the resolution and the date of acceptance.

12.5.2 Schedule for Variance Correction

The Supplier and TPNODL shall meet periodically to review the variance list. Each new variance opened since the previous meeting shall be scheduled for correction at the meeting. TPNODL and Supplier shall follow these guidelines for scheduling corrections:

1) A schedule for the correction of critical and high priority variances shall be set within one working day of their discovery. The schedule for correction of all other variances shall be set within one working week of their addition.
2) TPNODL and the Supplier shall assign resources for the correction of critical variances with the intent of correcting the variance within two working days of their opening.
3) TPNODL and the Supplier shall establish a mutually agreeable date for the correction of high priority variances, with the overall objective of:

a. If the SCADA/ADMS is in productive use, correcting the variances within one calendar week of their discovery
b. Prior to the commencement of productive use, maintaining the overall project schedule

4) TPNODL and the Supplier shall establish a mutually agreeable date for the correction of normal priority variances, with the overall objective of:
   a. If the SCADA/ADMS is in productive use, correcting the variances within one calendar month of their discovery
   b. Prior to the commencement of productive use, maintaining the overall project schedule
5) Low priority variances may be scheduled for correction at any time, but shall not exceed 30 days after identification.

12.5.3 Variance Resolution

A variance shall be deemed resolved only upon written acceptance of the correction by TPNODL Prior to submitting the corrected variance for acceptance by TPNODL L, the Supplier shall take all reasonable steps to verify that the correction has resolved the variance and the Supplier shall update the variance record to reflect the corrective action taken. TPNODL shall then schedule any testing to be performed in conjunction with the Supplier.

A variance shall be deemed accepted and the variance record shall be completed only after TPNODL has tested the corrected variance to its satisfaction. The Supplier shall support any and all testing deemed necessary by TPNODL to verify the corrections.

12.6 Test Schedule

The sequence of tests to be performed and their scheduling with respect to other activities are presented in Section 14.4, System Testing, Shipment and Commissioning.

12.6.1 Test Initiation

The following conditions must be satisfied before starting any test (exclusive of inspections or demonstrations pursuant to Section 12.2, Inspection):

1) TPNODL has approved all plans and procedures for the test
2) TPNODL has reviewed or approved all relevant documentation
3) A copy of all relevant documentation including design and maintenance documents, user manuals, test plans, and test procedures has been placed on the test floor
4) A complete regeneration of the software under test has been performed immediately prior to the start of testing
5) All operating system parameters, files, and configuration information has been saved to archive media so that the SCADA/ADMS operating environment can be recreated
6) All database, display, and report definitions have been saved to archive media so that the System databases, displays, and reports can be recreated if necessary
7) All source code libraries have been saved to archive media so that SCADA/ADMS software can be regenerated if necessary
8) For the factory test, preliminary testing, as described in Section 12.8, Preliminary Factory Testing, has been completed and the Supplier has submitted written certification that the preliminary testing has been successfully completed
9) For the availability test, all critical, high, and normal variances have been corrected and verified to the satisfaction of TPNODL

12.6.2 Test Completion

A test shall be deemed to be successfully completed only when:

1) All variances have been resolved to the satisfaction of TPNODL

2) All test records have been transmitted to TPNODL
3) TPNODL acknowledges, in writing, successful completion of the test.

12.6.3 Test Suspension

If TPNODL believes, at any time, that the quantity or severity of SCADA/ADMS variances warrants suspension of any or all testing, the test shall be halted, remedial work shall be performed, and the test shall be repeated. The repeat of the test shall be scheduled for a date and time agreed upon by both the Supplier and TPNODL

12.7 Modifications to the SCADA/ADMS during Testing

No changes shall be made to the SCADA/ADMS after factory testing has started without the express authorization of TPNODL (This requirement does not apply to Pre-FAT.) It will be TPNODL intent to carefully control the test environment so that all changes can be readily identified and so that any changes installed for any purpose can be removed and the previous test environment restored. TPNODL shall have the right to suspend testing, to revert to a previous version of any software or hardware, and to restart any testing previously performed if, in its opinion, changes have been made to the system under test without authorization.

12.8 Preliminary Factory Testing

The Pre-FAT shall be a complete dry run of the FAT, following the test plans and procedures. The intent is for the Supplier to detect and correct most design, integration, database, display, and performance of SCADA/ADMS prior to the FAT. The Supplier's project manager shall sign off each test. The completed test results shall be sent to TPNODL for inspection before TPNODL personnel travel to the Supplier's facilities for the FAT. All tests shall be conducted using TPNODL -specific databases unless TPNODL authorizes the Supplier to use a test database.

The Supplier shall notify TPNODL at least thirty days prior to the start of the Pre-FAT, and TPNODL shall have the option to witness all or parts of it. The Supplier shall notify TPNODL when the Pre-FAT has been successfully completed and the SCADA/ADMS is ready for FAT.

12.9 Factory Test

Factory tests shall include:

1) Equipment test
2) Functional test
3) Performance test
4) Stability test
5) Unstructured test.

12.9.1 Equipment Test

The equipment test shall verify that the SCADA/ADMS includes all required equipment, that the equipment is properly configured, and that the equipment can successfully execute the diagnostic programs provided.

The equipment tests shall include a visual inspection for proper workmanship, including cables, connectors, and labeling. The assembly drawings and configuration drawings shall also be verified at this time. These tests shall also verify that the required SCADA/ADMS capacity and expansion requirements of Section 3, Capacity and Performance have been satisfied.

12.9.2 Functional Test

The functional test shall use an equipment configuration that may include an extension of the Supplier’s deliverables as required to prove the correct functionality of the SCADA/ADMS. The test

procedures shall take into account all additional test equipment and shall ensure that the additional equipment does not create false test results. The functional tests shall rigorously exercise all functions and devices, both individually and collectively, and shall verify the correct functional operation of all hardware and software. These tests shall include the following, as may be applicable to the system under test:

1) Verification of all required functionality of the system, such as SCADA, network analysis applications, data exchange, and information storage and retrieval. Verification shall include all standard and custom functions as well as purchased options.
2) Verification that all software has been correctly sized and meets TPNODL capacity requirements
3) Verification of proper acquisition, processing, and storage of data from appropriate sources, and verification of protocol and data exchanges with all external system of SCADA/ADMS that will interface with the system. Where necessary, the Supplier shall provide appropriate simulations of the external systems; such simulations must themselves be verified before being used.
4) Verification of all user interface functions
5) Verification of the proper operation of local and wide area network devices, including bridges, routers, gateways, and the network as a whole by monitoring network traffic using diagnostic procedures and reconfiguration tests
6) Verification of the application program and system development capabilities including, software configuration management, source code development, documentation management, user interface development, real-time data set development, RDBMS development, database generation and maintenance, report generation and modification, alarm and event message definition, test environments, and other utility functions
7) Verification of communications maintenance capabilities including diagnostics, communications maintenance (DCU/RTU, data links, interfaces etc), and local input/output maintenance
8) Verification of all hardware maintenance capabilities
9) Verification of the proper response of the system to at least the following abnormal situations:
    a) Loss and restoration of processors and servers, including auxiliary memory
    b) Loss and restoration of user interface equipment
    c) Loss and restoration of archive storage devices
    d) Loss and restoration of external subsystems
    e) Loss and restoration of input power (UPS failure)
    f) Loss and restoration of communication network processors
    g) Loss and restoration of any other peripheral devices
    h) Loss and restoration of local and wide-are network elements
    i) Detection of and recovery from communication errors (simulated by Supplier).
10) Demonstration of the security of the system from unauthorized access
11) Verification of the redundancy and failure recovery schemes of the system
12) Verification that changes of system time will not prevent the system from operating properly and that the system can correctly handle the beginning of a new day, month and year; leap years and the change in century and decade; and changes to and from Daylight Savings Time
13) Documentation verification that will verify that all documentation to be delivered with the system is present and meets requirements.

12.9.3 Performance Test

The performance test shall verify that the specified performance requirements are met. Simulation shall be provided by the Supplier, where necessary, to create the conditions for the specified performance scenarios (refer to Section 3, Capacity and Performance). The simulations shall be tested first to verify that the desired activity is being simulated. Execution of the performance tests shall be automated as much as possible so that test runs can be reproduced.

12.9.4 Stability Test

A 100-hour continuous run of the system shall be performed after successful completion of the functional and performance tests. The stability test will be considered successful if no critical function is lost, no major hardware failure occurs, no failover occurs, and no restarts occur within the test period.

Major hardware failure is defined for the purpose of this test as the loss of hardware such as a processor, disk, user console, etc. Non-repetitive mechanical failures of printers, loggers, pushbuttons, etc., are not considered major failures.

During this test, the system shall be exercised (with simulated inputs, events, and conditions) in a manner that approximates an operational environment. TPNODL will simulate unstructured user activity during this test. TPNODL will not purposely cause any hardware or software failure, that is, failover and restart testing is not a goal of this test.

The Supplier shall assist TPNODL in this test as required by TPNODL; this assistance will be primarily in the form of helping the set-up of the test, explaining the best procedures to run the test, and explaining all unexpected results.

12.9.5 Unstructured Test

The test schedule shall allow time throughout the functional testing for unstructured testing by TPNODL Time for unstructured testing shall be reserved at the rate of at least two hours of unstructured testing for each eight hours of structured testing, but no less than four days total. This time will be used by TPNODL to perform additional tests, the need for which may be recovered during the formal testing, and to investigate any potential problems detected. The unstructured tests will be performed during the functional and performance test period and during the stability test at the discretion of TPNODL

The Supplier shall assist TPNODL in this test as required by TPNODL; this assistance will be primarily in the form of helping the set-up of the test, explaining the best procedures to run the test, and explaining all unexpected results.

12.10 Site Test

The site test includes the installation test, the functional test, and the performance test that will be conducted at TPNODL site after shipment and installation of the SCADA/ADMS.

12.10.1 Installation Test

The installation tests shall be conducted by the Supplier and include:

1) A repetition of the equipment test of Section 12.9.1, Equipment Test
2) Loading of the SCADA/ADMS software and starting the system. At the option of TPNODL , all software shall be recompiled from the source or distribution media
3) In cooperation with TPNODL , attachment of the SCADA/ADMS to communications facilities for all data sources and other systems that interface with the SCADA/ADMS
4) Initialization and preliminary tuning of application software as needed.

12.10.2 Functional and Performance Tests

The site functional and performance tests shall be comprised of a subset of the functional and performance tests of Sections 12.9.2, Functional Test, and 12.9.3, Performance Test. The tests to be performed shall be proposed by the Supplier and approved by TPNODL These tests shall be extended as necessary to test functions simulated during the FAT, such as communications with all field devices and all other systems that interface with the SCADA/ADMS. The extended tests shall be performed to a test procedure prepared by the Supplier and approved by TPNODL Unstructured tests shall also be employed, as necessary, to verify overall operation of the SCADA/ADMS under actual field conditions.

12.11 Availability Test

SCADA/ADMS and device availability in accordance with the criteria specified in Section 2.5, System Availability shall be demonstrated by the availability test.

12.11.1 Test Activity

The test activity shall consist of normal SCADA/ADMS operations with the system in commercial use. TPNODL will modify the SCADA/ADMS databases, displays, reports, and application software during the availability test. Such modifications will be described to the Supplier at least 48 hours in advance of implementation to allow assessment of impact on the availability test, except where such changes are necessary to maintain control of the power system.

12.11.2 Test Definitions

The definitions of the time periods used in determining the duration of the test and the success of the test shall be as follows:

1) Downtime – Downtime occurs whenever the criteria for successful operation defined in Volume II, Section 2.5.1, Availability Requirements – Core SCADA/ADMS, are not satisfied. Downtime shall be measured from the start of diagnostic procedures until full service is restored. In the event of multiple failures, the total elapsed time for repair of all problems (regardless of the number of maintenance personnel available) shall be counted as downtime.

2) Hold time – Certain periods of time during which the SCADA/ADMS is down may be due to circumstances that are beyond the control of either party. These contingencies may prevent successful operation of the SCADA/ADMS but are not valid for the purpose of measuring SCADA/ADMS availability. Such periods of unsuccessful operation may be declared hold time by mutual agreement of TPNODL and the Supplier. Specific instances of hold time are:

   a) Scheduled shutdown – During scheduled shutdowns or if an equipment failure occurs while its backup device is scheduled out-of-service, the resulting system outage shall be hold time, provided that service can be restored according to the Supplier-specified procedures within 30 minutes.

   b) Power interruption and environmental excursion – Loss of power or manual shutdown of the SCADA/ADMS in the event of power excursion or the loss of environmental control shall be considered hold time. If the SCADA/ADMS is operated during periods of power or environmental conditions beyond those specified, any resultant downtime shall be considered hold time.

   c) Intermittent failure – Periods during which an intermittent, recurring failure is experienced will be considered hold time, provided that the Supplier is engaged in remedial action and normal operation of the SCADA/ADMS can be restored within 30 minutes by Supplier-defined procedures whenever the failure occurs. Instead of accounting for the actual intermittent downtime, one hour of downtime shall be counted for each 120 hours of otherwise successful operation while the problem persists.

d) Failure of TPNODL software – Time during which the SCADA/ADMS is down due to failure of software written or provided by TPNODL shall be considered hold time. (Programs developed by TPNODL under Supplier supervision are specifically excluded from this provision.) If a failure in such software cannot be overcome by Supplier- defined procedures, execution of the failed program shall be suspended.

e) Corrected design defect – Hold time may be declared by mutual agreement to ensure against similar future occurrences if a failure occurs due to a defect in design for which the Supplier defines and implements corrective measures. In such a case, sufficient hold time shall be allocated to allow verification of the corrective action.

f) Logistics delays – If repairs are delayed due to previous use of spare parts or because of TPNODL failure to purchase recommended spare parts, hold time will be declared after diagnosis of the failure and while the Supplier is pursuing replacement parts in an expeditious fashion. A maximum of 48 hours of hold time will allowed for each occurrence of logistics delay.

g) Service response time – Hold time shall be declared from the time that a failure is detected until diagnostic procedures are begun. A maximum 24 hours of hold time will be allowed for each failure.

3) Total time – The time elapsed from the start of the availability test until the end of the availability test

4) Test time – The time elapsed from the start of the availability test until the end of the availability test, excluding hold time. That is,

12.11.3 Duration and Criteria for Passing

The minimum duration of the availability test shall be 1000 consecutive hours of test time.

In order to establish that all failures have been satisfactorily repaired prior to the end of the availability test, no downtime, intermittent (hold time) failures, or more than one uncommented failover shall have occurred within 200 hours of the test's conclusion. The test shall be extended, if necessary, to satisfy this requirement.

After 1000 consecutive hours of test time have elapsed and contingent on the conditions of the above paragraph, system availability shall be computed using the following formula:

If the system availability requirements presented in Section 2.5, System Availability, have not been met, the test shall continue until the specified availability is achieved. Alternatively, and at TPNODL's discretion, the test may be restarted.

When it has been determined that the system availability requirement has been met, the availability of each System device shall be calculated and compared against the device availability requirements of Section 2.5.1, Availability Requirements – Core SCADA/ADMS. If one or more devices do not meet the requirements, the test shall be extended until TPNODL and the Supplier mutually agree that corrective action has been completed for those devices. Corrective action shall include all necessary procedures to test and verify proper operation to TPNODL satisfaction.

12.12 Testing of Phased Deliveries

The SCADA/ADMS will be delivered in at least two phases. Deliverables of each phase are described in Table 2-6, Phased Delivery. Other phases may also be presented in this Specification and the Contract may be amended after award to include additional phases. The requirements of this clause shall be applied to each phase as follows:

1) SCADA/ADMS System – The SCADA/ADMS shall undergo factory, site, and availability tests.

2) Applications - The SCADA/ADMS Applications shall undergo factory, site, and availability tests.
3) Other deliveries – The hardware and software for each phase shall individually undergo factory and site tests. Availability tests shall be conducted individually on each delivery and on the complete SCADA/ADMS. If any.

13. Training

The Supplier shall prepare and deliver a comprehensive training program on the operation and maintenance of the SCADA/ADMS. Software training shall teach TPNODL the skills required for the SCADA/ADMS maintenance and expansion and for the preparation and integration of new functions. Hardware training shall qualify TPNODL to perform routine preventive maintenance and perform diagnostic tests on the processors and their peripheral equipment, LANs, and display and communications equipment.

13.1 Scope of Training

The training curriculum shall comprehensively train TPNODL staff on all hardware and software to be provided with the SCADA/ADMS, with the following exceptions:

1) General-purpose office applications such as Microsoft Office 2013 or latest
2) Internet browsers such as Internet Explorer
3) Personal computer operating systems such as Microsoft Window 2013 or latest.

The Supplier shall provide training on all Subcontractor software products used in the SCADA/ADMS using personnel of the software supplier whenever possible. This training shall cover their theory of design and operation, use, maintenance, and installation of upgrades or new releases. The Supplier shall provide extensions to all Subcontractor-provided training that covers how these products are used in the SCADA/ADMS, the specific features of these products implemented within the SCADA/ADMS, and features that cannot be used.

13.1.1 Self-Study Courses

TPNODL prefers classroom style courses for all training. Self-study training using books, computer-aided instruction (CAI) or computer-based training (CBT) may be used as supplementary training. A copy of any video file, CAI program, or CBT program used in training shall be provided to TPNODL as part of the training documents.

13.1.2 Recording of Courses

TPNODL shall be permitted to make video and audio recordings of all training classes. TPNODL will use these recordings solely for internal instruction purposes and will not release the recordings to third parties.

13.2 Training Documents

The Supplier shall prepare a training plan in cooperation with TPNODL The Supplier shall also be responsible for the preparation and production of all course material. Training documents shall be subject to the review and approval process of Section 11.3 Documentation Review and Approval.

13.2.1 Training Plan

The training plan shall support the SCADA/ADMS implementation schedule. A logical sequence of courses shall be arranged, so that training on base system elements (such as the hardware platform, operating system, languages, database, and displays) is given before the training for specific SCADA/ADMS elements (such as applications). The training program shall take into account the knowledge required by members of TPNOD's project team in order to participate in the project.

The training plan shall list each course to be taken, the dates for the course, and the expected number of students to attend. The plan shall reference the course description documents described below.

Training shall be scheduled to minimize the loss of knowledge through lack of use. Training shall be scheduled so that there will not be long periods of time between training and the use of the training.

13.2.2 Course Descriptions

Course descriptions shall be included with the training plan that shall provide the following information for each course included in the training plan:

1) The course name (and number if applicable)
2) A brief description of the course
3) A description of the intended audience for the course
4) A description of the relation of the course to others in the training plan
5) The duration of the course
6) A breakdown of the course schedule, identifying classroom, laboratory, and hands-on periods
7) A list of the training materials to be supplied
8) A list of reference material to be used in the course
9) A list of any prerequisite training or experience expected of the students.

At TPNODL request, the Supplier shall provide a description of all courses offered by the Supplier and its Subcontractors.

13.2.3 Course Material

The Supplier shall provide all necessary training materials, including course manuals and reference materials. Each trainee shall receive individual copies of the training materials and one additional set shall be provided for TPNODL's archives. Class materials, including documents sent before the training classes and class handouts, shall become the property of TPNODL

TPNODL prefers that all course material be transmitted to the students at least two weeks prior to the course.

13.3 Instructor Qualifications

Course instructors shall have demonstrated technical competence in the subject and previous instructing experience. TPNODL prefers instructors who specialize in courser presentation, as opposed to hardware or software developers who only occasionally present courses. However, for SCADA/ADMS elements produced specifically for this Contract, the Supplier may use the developer as the instructor. The developer shall use appropriate training staff as resources when developing the training course and materials.

Where practical, Subcontractors suppliers shall deliver training on their products directly. However, the Supplier shall remain responsible for selecting these courses, coordinating their delivery, and ensuring that all training objectives are met.

13.4 Training Curriculum

The training curriculum presented in this section is intended to describe the contents of the training when viewed as a whole. The subjects covered by individual courses may differ as long as the overall objectives are satisfied.

13.4.1 System Overview

The System overview course shall be the first course in the training sequence. The course shall constitute an introductory class for TPNODL personnel who are designated to attend additional

training later. It shall also provide each trainee with a general understanding of the SCADA/ADMS including those aspects of the SCADA/ADMS for which the trainee will not receive additional training.

This class shall be scheduled for duration of two days and shall provide ample opportunity for free interchange between the Supplier and TPNODL personnel. This class shall begin with a management seminar lasting half a day and providing a high level overview; this shall be followed by a more technical seminar covering hardware and software components and their inter-relationships.

13.4.2 Database and Display Building

The database and display building courses shall be scheduled to coincide with the delivery of the System. The courses shall teach students how to prepare the input data to define the SCADA/ADMS operating environment, to build the SCADA/ADMS database and displays and, to prepare the database administrator to maintain and modify the database and its structures. Specifically:

1) How to set up an SCADA/ADMS database and display building environment
2) How to identify database fields, entries, records, tables and contexts
3) How to structure data source table definitions
4) How to build tables and arrays
5) How to build application models, such as network analysis and load forecast models
6) How to build displays
7) How to import data from GIS and other TPNODL systems
8) How to perform database maintenance
9) How to generate the database from source materials
10) How to maintain symbol libraries and other display constructs.

At the end of this course, participants shall be able to:

11) Understand the Supplier's terminology
12) Perform data entry and data validation
13) Produce database reports
14) Identify the types of data needed to model TPNODL's power system
15) Describe the functional capabilities of the Supplier's graphical display editors
16) Create simple images with basic figure types
17) Create new symbols
18) Describe the use of icons
19) Define the visual attributes of symbols on one lines to show changing data values
20) Describe the use of color on one-lines
21) Construct the static parts of a one-line display
22) Design displays that use multiple view capabilities to change the amount of detail presented
23) Design displays to emphasize important information
24) Describe the application of full graphic technology to the user interface
25) Create a new data source and install it in the System, including:
    a) Describe the data requirements of the data source
    b) Describe the data addresses
    c) Build the linkage between the data source and these addresses
    d) Create, for the data source, a complete set of displays
    e) Build the linkage between the data addresses and multiple displays using symbols, colors, etc.
    f) Create poke points for display selection.

13.4.3 Data Engineering Workshops

The objectives of the workshops are to bridge the gap between the training on the mechanics of database and display building and understanding practical design and conceptual issues. These workshops shall utilize TPNODL actual data, displays, and models to ensure that TPNODL is properly engaged in database and display building activities. The workshops shall be scheduled after the

databases and display building courses. The workshops shall be centered on hands-on training using the development System.

Topics to be covered in the data engineering workshops include the following:

1) The most effective and expeditious way to input the data from the existing system to the new SCADA/ADMS
   a) Mapping between data in the existing system to the new SCADA/ADMS
   b) The identification of data that is not in the existing system that needs to be collected for input to the new SCADA/ADMS
   c) Procedures to transmit data between the development and the SCADA/ADMS staged on the factory floor.
2) Display building design issues
3) Discussion of application-specific modeling techniques
4) Discussions of the different approaches to storing and retrieving historical data
5) Development of a program for data and display development activities.

Separate workshop sessions shall be conducted for the following major topics:

1) SCADA database generation and conversion
2) Power Network Analysis, and other applications database development
3) Information Management database development
4) Display generation
5) Import of GIS data (Spatial data, connectivity data and attribute data)
6) Dispatcher Training Simulator database/scenario generation.

13.4.4 Information Management

The Information Management courses shall be designed to train TPNODL personnel in the use of the Information Management capabilities of the SCADA, including selections of items to be archived, calculations associated with historical data, and report building features. These courses shall be especially oriented for those TPNODL personnel who develop and maintain displays, reports, and calculations relating to Information Management data and for those TPNODL L personnel who maintain the SCADA/ADMS as an enterprise-wide resource.

At the end of these courses, students shall be able to:

1) Create and maintain the Information Management database
2) Understand SQL features and functions
3) Construct SQL queries to retrieve, sort, summarize, and change data
4) Develop strategies for writing efficient applications
5) Define and develop interfaces to external systems such as the corporate data store.

13.4.5 Operating System Administration

The Operating System (OS) administration course shall be designed to train the students in managing and maintaining the SCADA/ADMS at the operating system level. At the end of these courses, participants shall be able to:

1) Manage and maintain the system administration database and files
2) Manage and administer networks
3) Shutdown and restart the SCADA/ADMS from different media, such as disk, tape, CD-ROM, and over the network
4) Back up and restore all programs and data

5) Add processors and peripherals to the SCADA/ADMS
6) Add users to the SCADA/ADMS
7) Update the operating system software
8) Access Supplier and Subcontractor system level programming interfaces to facilitate the development of software by TPNODL

13.4.6 System Programming Languages

Courses shall be provided for each of the programming languages that are used in the System. The students will be experienced programmers, but the Supplier should assume that the students have minimum proficiency in the languages.

At the end of each course, the participant shall be able to:

1) Describe the language's program structure
2) Use data, expressions, and assignment statements
3) Use control statements, including Boolean and case statements
4) Use procedures and functions
5) Use arrays, structured elements, sets, and strings
6) Do simple file I/O and describe the language's I/O capabilities
7) Describe the pointer and dynamic storage allocation capability
8) Write a program
9) Write programs that can handle command-line arguments (when applicable)
10) Write programs that can use pointers and structures
11) Time a program's execution
12) Perform static analysis and dynamic analysis of programs
13) Maintain and control successive versions of source code
14) Compile and link modules using compile and link options
15) Debug programs.

13.4.7 Programming in the System Environment

This course shall instruct the student on the skills needed to program in the SCADA/ADMS software environment and shall be designed for the software engineers responsible for maintaining, expanding, or adding new functions. At the end of this course, the participant shall be able to:

1) Plan the implementation of a new software function
2) Describe the directory structure and locate applications and all supporting functions and software structures
3) Design and implement program data structures
4) Add new attributes to existing data structures
5) Write and test programs
6) Use Supplier- and Subcontractor-provided programming interfaces
7) Configure the failover and restart functions for Supplier- and TPNODL-provided software
8) Generate error messages
9) Use the trace and debug utilities
10) Extract code and check code using the source code utility
11) Describe the inter-program communication process.

13.4.8 Communications Software

The Supplier shall provide training on the communications among data sources, communications network software used for the SCADA/ADMS local and wide area networks, and on the interfaces or communications links with the external subsystems and networks. Training shall be provided for both Supplier- and Subcontractor supplied software and communications products.

At the end of this course, participants shall be able to:

1) Understand the basic communications theory
2) Understand the communications design and implementation of the SCADA/ADMS
3) Understand the protocol implementation
4) Be able to install, startup, and test the initial configuration
5) Be able to expand the communications
6) Be able to perform diagnostics and maintenance procedures
7) Be able to install communication upgrades.

13.4.9 System Administration

The system administration course shall familiarize participants with the procedures necessary to operate the system as an integrated entity, to recognize and respond to malfunctions, and to perform maintenance functions. The only prerequisite for this course shall be familiarity with the overall functionality and architecture of the SCADA/ADMS.

At the end of this course, participants shall be able to:

1) Start up the SCADA/ADMS and its components
2) Shut down the SCADA/ADMS and its components
3) Switch functions to backup equipment
4) Take equipment out of service
5) Restore equipment to service
6) Interpret and react to messages generated by error-monitoring functions
7) Test field device and communication links
8) Implement procedures for installing new or modified applications for operations use
9) Use procedures for altering and replacing the operations database
10) Identify procedures for using diagnostics
11) Describe the backup functions required for normal maintenance
12) Use the system's procedures to generate the SCADA/ADMS from source code or distribution media.

13.4.10 Application Software

The Supplier shall provide training on application software. These shall cover all applications other than those already covered in the database, display, and Information Management courses. Each application course shall be organized to be responsive to TPNODL's specific requirements and shall be regarded as an extension to the standard courses that are provided. Each course shall cover the following topics:

1) Functional design of the specific application program (using the approved functional specifications and displays as text)
2) Algorithms and models used by the application program
3) Programming techniques for the algorithms
4) Software implementation aspects, including each module's calling parameters and its interfaces with other modules as determined by these parameters and the data flags described
5) Database implementation aspects, including those portions of the database used by an application relative to content, structure, meaning, origin, and usage
6) Application program command language structure and common techniques
7) Application program procedures, including a review of standard procedures used to modify source code and compile, load, and install programs.

The design specifications and the user manuals prepared for the SCADA/ADMS shall be used as course text where applicable.

13.4.11 Simulator Trainer

This course shall cover the operation of the Simulator, scenario building, and maintenance. At the conclusion of this course, students shall be able to:

1) Prepare training scenarios using the scenario building tools provided
2) Guide operator trainees through prepared scenarios
3) Pause, resume, and bookmark the training scenario
4) Generate ad-hoc events during a scenario.

13.4.12 System Hardware Training

The course shall teach participants the essential knowledge and skills required to successfully progress through the hardware maintenance curriculum and shall stress lab exercises. Emphasis shall be on the practical application of tools and commands that relate to SCADA/ADMS maintenance activities. The course shall include entry-level training in the use of operating system skills, an introduction to the critical directories and files that drive the operating system, and a discussion of diagnostic tools, system boot process, networking concepts, and terminology for computer hardware.

The course shall be designed for the hardware maintenance technician, who has computer maintenance experience, but no detailed knowledge of the SCADA/ADMS hardware.

At the end of this course, participants shall be able to understand the general features, characteristics, and the trouble shooting issues for all hardware supplied with this procurement.

13.4.13 Hardware Maintenance Training

This training shall qualify the students to maintain and troubleshoot to the level of field replaceable modules for all SCADA/ADMS equipment. The level of training shall be commensurate with the maintenance responsibilities for each equipment item as described in Volume I, Section 3.5 Hardware Maintenance. It shall include practical training on preventive and corrective maintenance of all equipment, including use of special tools and instruments. The training shall be provided on SCADA/ADMS equipment or on similarly configured systems.

These courses shall teach participants to install, configure, diagnose, and verify the proper operation of processors, desktop workstations, communication interfaces, and all SCADA/ADMS peripheral equipment. Participants shall troubleshoot malfunctions introduced into the system using all available diagnostic tools. The majority of time shall be spent in labs to maximize hands-on exposure to all SCADA/ADMS hardware. These courses shall enable participants to perform SCADA/ADMS fault isolation and repair.

13.4.14 Training In-Residence (Option)

As an option, to supplement formal training and to assist the Supplier in developing customized application software, TPNODL proposes to locate staff at the Supplier's site. One database specialist and two applications specialists will be so assigned. This resident staff will attend training courses scheduled to promote early involvement in the implementation work. These individuals will spend at least 75% of their time at the Supplier's facility during system implementation and shall participate in the design, coding, testing, and integration of SCADA/ADMS programs as their primary responsibility. The resident staff will also be involved in system integration and testing. The resident staff shall be trained to utilize the Supplier's standard software development, documentation, and quality assurance practices.

The Supplier shall utilize the resident staff as working members of the project team. The resident staff will begin assignments at a time recommended by the Supplier and approved by TPNODL Work assignments by the Supplier shall be subject to TPNODL approval. The Supplier shall schedule the resident staff work assignments to no more than 75% of each individual's time on site, during normal

working hours, to be used to perform the Supplier-assigned tasks. The Supplier shall retain responsibility for all work assigned to or completed by TPNODL resident technical staff.

The supplier shall allocate a specified amount in the contract budget for this purpose including travel and living expenses.

13.4.15 Operator Training

The objective of this course is to train TPNODL staff in preparation for development of Operator training courses by TPNODL The operations training course shall include:

1) A system overview that presents the SCADA/ADMS configuration, application, capability, and performance concepts
2) General operating procedures that cover basic user interface features, display and report capabilities, log-on steps, areas of jurisdiction, user access restrictions, error messages, etc.
3) Use of real-time and study applications under a full range of typical operating conditions, including purpose, theory of operation, and the user interface features that support each application
4) Equipment handling such as minor system maintenance activities that do not require a technician
5) Verification that the information in the SCADA/ADMS user's manual is valid.

13.5 Location and Number of Students

The number of the students that shall attend each training course and the desired location for the course are listed in the following table.

Course	Number of Students per Session	Number of Sessions	Location
SCADA/ADMS Overview	30	2	TPNODL site
Database and Display Building	30	2	TPNODL site
Data Engineering Workshops	20	2	TPNODL site
Information Management	5	2	Per Supplier recommendation
Operating System Administration	5	2	Per Supplier recommendation
System Programming Languages	5	2	Per Supplier recommendation
Programming in the SCADA/ADMS Environment	5	2	Per Supplier recommendation
Communications Software	5	2	Per Supplier recommendation
System Administration	5	2	Per Supplier recommendation
SCADA Application Software	5	1	Per Supplier recommendation
ADMS Application Software	5	1	Per Supplier recommendation
Simulator Trainer	5	1	Per Supplier recommendation
System Hardware Training	5	1	Per Supplier recommendation
Hardware Maintenance Training	5	1	Per Supplier recommendation
Operator Training	59	4	TPNODL site

Table 13-1: Course Attendants and Location

The supplier to allocate the budget for travel and living costs while attending these courses at supplier's site.

13.6 Training Budget

TPNODL site expects that the courses to be taken and the number of students attending each course will change over the course of this Contract. Therefore, the total cost of all training included in this Contract shall be considered as an allocation, and TPNODL site, in consultation with the Supplier, will revise the training curriculum and the attendants at each course as long as the training allocation is not exceeded. If, at the expiration of this Contract, the training allocation has not been used, the remainder shall be refunded to TPNODL site. The Supplier shall update the training budget each month with the actual costs of the courses taken by TPNODL site throughout the duration of the project via the periodic progress reports. In addition, the Supplier shall provide the per student cost to attend training at the Supplier's facility as well as the per course cost to perform the training at TPNODL site.

13.7 No Additional Charges

Payment for any training in excess of the allocation will be the responsibility of TPNODL site. However, the Supplier shall be responsible for the cost of additional courses and the travel and living expenses of students attending the courses where the need for such training is attributed to any of the following conditions:

1) Delays in the project schedule caused by the Supplier
2) Inadequate or poor quality training that fails to meet TPNODL site requirements for quality, content, or timeliness
3) Changes to any hardware or software deemed necessary during the project to meet the requirements of this Contract
4) Any change in the scope of this Contract, unless the cost of the additional training is included in the cost of the change.

14. Project Implementation

This section specifies project implementation requirements, including TPNODL site and the Supplier responsibilities, project management procedures, project documents, the activities leading up to shipment of the SCADA/ADMS, and the installation, commissioning, and site test activities.

14.1 Implementation Responsibilities

The general responsibilities of TPNODL site and the Supplier are presented below. Other sections in the Specification may also present responsibilities. If the requirements of any other sections conflict with the responsibilities of this section, the responsibilities of the other sections shall take precedence over this section.

14.1.1 Supplier Responsibilities

The Supplier's specific responsibilities shall include:

1) Providing all SCADA/ADMS equipment and related support materials, including all interconnecting cables and wiring between all Supplier-provided equipment and between the SCADA/ADMS and any equipment furnished by TPNODL site
2) Defining the stock of spare parts needed to maintain for system availability
3) Providing all engineering, software design, development, and integration services necessary for SCADA/ADMS implementation

4) Providing and integrating all application software except that to be developed by TPNODL site. This responsibility extends to all software developed by Subcontractors.
5) Providing all SCADA/ADMS displays and reports
6) Import of GIS Data
7) Using the Development System to create displays and generate reports according to samples and templates provided by TPNODL site
8) Implementing the database for TPNODL site network and installing the database into the Development System. In addition, the Supplier shall identify any data elements required in the Supplier's database and shall be responsible for integrating such data elements into the Supplier's database.
9) Interface development like ICCP, SAP-PM,MM, CIS , MDM, etc.
10) Supplying a display style guide defining all discretionary display parameters used by the Supplier when developing standard displays and reports
11) Defining and coordinating a software and database management methodology that shall ensure synchronization of the system databases and applications software, between the Supplier's factory and TPNODL site , until acceptance of the SCADA
12) Ensuring that all reasonable security measures have been incorporated in the SCADA/ADMS and all software, upon delivery, is free of viruses, trapdoors, and other software contaminants, contains no software enabled with "electronic self-help", is purged of all sample scripts and sample code, and has had all default accounts and passwords removed or disabled
13) Managing, coordinating, and scheduling the activities of all Subcontractors employed by the Supplier for this project. This shall include the resolution of all problems that may arise in connection with the hardware, software, and services supplied by the Subcontractors.
14) Implementing the SCADA/ADMS according to the quality standards acceptable to TPNODL
15) Training TPNODL staff so that they will be self-sufficient and able to operate, maintain, and upgrade the complete SCADA/ADMS
16) Supplying SCADA/ADMS documentation such as instruction manuals, maintenance manuals, drawings, software design and user documentation, and other appropriate material that together fully defines the supplied system and allows TPNODL to operate, maintain, backup, restore, and upgrade the SCADA/ADMS hardware and software
17) Supplying final ("as built") documentation that is accurate and complete.
18) Providing adequate facilities and resources for, as well as performing, factory testing
19) Providing an environment that allows for reproducible execution of all SCADA/ADMS functional performance tests conducted during factory acceptance testing
20) Transportation and delivery of all Supplier-provided equipment and materials TPNODL sites
21) Verification of existing infrastructure such as the power distribution, air conditioning, power grounding, seismic protection, dust protection, fire protection, equipment size, and other site requirements as necessary for the proper environmental control and operation of all SCADA/ADMS equipment
22) Performing the installation of the SCADA/ADMS at TPNODL site.
23) Performing, with TPNODL s assistance, system start-up after satisfactory system installation, i.e., powering up the system, loading correct versions of all software and databases, activating data

links, verifying correct operation of the system, and turning over to TPNODL an operational system ready for site testing

24) Performing after delivery and start-up of the system, but prior to any site testing, setting up all functions for proper operation (system and function “tuning”)
25) Performing the test at TPNODL site, including correcting all reported variances
26) Ensuring and periodically demonstrating that the work is progressing according to the approved schedule
27) Providing office space and services for TPNODL personnel at the Supplier's site
28) Providing secure remote computer access from the Supplier's factory to support the field-installed systems
29) Maintaining the SCADA/ADMS up to the start of the warranty
30) Providing and implementing all required warranty services

14.1.2 TPNODL Responsibilities

TPNODL will be responsible for the following:

1) Providing input power to equipment enclosures
2) Providing WAN and DCU/RTU communications media including routers to connect to the System LAN
3) Supplying display conventions and standards to be followed by the Supplier when preparing or customizing displays for this project
4) Reviewing and approving project deliverables such as, but not limited to, detailed implementation schedule, software and hardware functional design documents, user manuals, custom display and report formats, drawings, progress reports, training program, quality assurance plan, test plans and procedures, test results, support services (including maintenance), and as-built system documents
5) Providing documentation, interface details, engineering drawings, and schematic diagrams of TPNODL -furnished equipment to be directly interfaced with the SCADA/ADMS
6) Coordinating and supervising the Supplier’s work to be performed at TPNODLs facilities
7) Attending pre-factory tests (at TPNODL 's discretion)
8) Participating in factory tests and approving test results
9) Assist the Supplier with the installation
10) Monitoring the site tests and approving test results
11) Monitoring the availability test and approving test results
12) Providing test data for processes external to the SCADA/ADMS
13) Preparing variance reports, resolving variance issues, and approving corrected variances
14) Determining if the Supplier's work is progressing in accordance with the schedule
15) Verifying that all Supplier materials, installation practices, and workmanship conform to requirements
16) Providing facilities for on-site training and Supplier offices.

14.1.3 Third-Party Software

Where any Supplier-provided applications software or software modules developed by a third-party are integrated into the SCADA/ADMS, the Supplier shall be responsible for integrating, testing, and meeting the functional, security, and performance requirements of this software in the SCADA/ADMS environment.

14.2 Project Organization

The primary points of contact between TPNODL and the Supplier shall be their respective project managers.

14.2.1 TPNODL Project Managers

TPNODL project manager shall be responsible for representing TPNODL interests throughout the project. TPNODL project manager will, from time to time, authorize other staff to act in this regard for specific tasks. The project manager will also change such assignments from time to time. Such actions shall be submitted to the Supplier in writing.

All correspondence with TPNODL shall be addressed to TPNODL project manager.

14.2.2 The Supplier's Project Manager and Project Personnel

The Supplier shall designate a project manager who shall be responsible for the co-ordination of all project work and for the communications between the Supplier and TPNODL Except for conditions outside the control of the Supplier, the Supplier's project manager shall not be removed or replaced without the approval of TPNODL

The project shall be staffed with a core project team. Additional personnel shall be assigned to work under the direction of the core team as required to effectively implement the SCADA/ADMS. Core project team members shall have previous experience in a similar position on at least one other project that is similar in size and scope to this project.

The Supplier shall inform TPNODL of any pending or possible changes in the use or status of all Supplier project personnel. Any changes to Supplier staff, including work assignments and participation level, shall be announced as soon as practical and shall be subject to TPNODL approval. TPNODL shall have the right to have any Supplier staff removed from the project for cause.

14.2.3 On-Site Offices

Both TPNODL and the Supplier shall make available office facilities for use by the other party. TPNODL will provide offices for up to two Supplier staff at TPNODL offices throughout the project. Offices for an additional four Supplier staff will be made available after delivery of the system to site and until completion of the site testing.

The Supplier shall provide offices dedicated to TPNODL use suitable for up to five staff. These offices shall be contiguously located and shall be kept available for the exclusive use of TPNODL throughout the duration of the project such that confidential documents, personal effects, and other materials may be stored. Offices for an additional three TPNODL staff shall be made available during factory testing.

14.3 Project Documents

Project documents shall specifically include the following and shall be delivered to TPNODL by the dates indicated in the reference section (where the content of the document is also further defined):

Document	Reference Section
Documentation Plan	

Document	Reference Section
Project Progress Report	
Project meetings, Agendas and Minutes	
Project Correspondence	
Detailed Implementation Schedule	
Test documents	Section 12
Training documents	Section 13

Table 0-2: Project Documents

14.3.1 Documentation Plan

A documentation plan shall be submitted to TPNODL after contract award. The documentation plan shall describe, in detail, the Supplier's plan for the submittal of all subsequent documentation. It is expected that certain major documents, such as the detailed hardware and software design documentation, will consist of a series of submittals made over a period of time. The documentation plan shall address this by including a detailed list of all individual documentation submittals for the project.

This list shall include, but shall not be limited to, the following information for each document:

1) Document name
2) Document number based on TPNODL File Plan
3) Document type (such as, functional design, detailed design, listing, or user guide)
4) Estimated and actual date of submittal
5) Document status (such as, submitted for review, submitted for approval, returned for correction, or approved.).

The plan shall serve as a checklist throughout the project and shall be revised and resubmitted by the Supplier as necessary.

Documents shall be submitted in a sequence that allows TPNODL to have all of the information necessary for reviewing or approving a particular document at the time of its submittal. Documentation shall be submitted in a manner that allows for a reasonably paced review effort. The documentation plan shall be subject to TPNODL approval.

14.3.2 Project Progress Reports

A project progress report shall be prepared by the Supplier and sent to TPNODL every two weeks through the start of the warranty period. The report shall be submitted to TPNODL s project manager no later than the 10th calendar day of each month. The report shall cover the project from the start of the contract through the last working day of the month.

The progress report shall include a general assessment of the progress on the project. This assessment shall reference the latest implementation schedule, which shall be included in the report. The schedule shall show the baseline and the current schedule, progress on individual tasks, and the forecasted completion dates for upcoming tasks and the entire project. Updated training and documentation plans shall be included.

The report shall include an explanation of existing and forecast schedule variances, the cause or source of the variance, alternatives considered, solutions adopted or recommended, and the outcome achieved or anticipated. In particular, the report shall note the needed delivery date of TPNODL-furnished information. The Supplier shall be responsible for any schedule delays due to insufficient notification to TPNODL of the need for such information.

The report shall identify unresolved contract issues. This shall include a description of the item and the current due date, the consequences of any delay in resolution, and any recommendations pertinent to the decision process.

The report shall also include the following items:

1) A list of action items, including the following information:
   a) The action item number
   b) The date the item was opened
   c) References to the originating transmittal and any reference documents
   d) Action item status (open, closed)
   e) Resolution due date
   f) The responsible organization or person
   g) A description of the action required
   h) The date of action completion (when each item is closed)
   i) References to transmittals or other documents recording the resolution.
2) Correspondence logs, one for transmittals to TPNODL from the Supplier and one for transmittals to the Supplier from TPNODL Each log shall have the following information for each transmittal:
   a) The transmittal number
   b) The date of transmission (not the date written)
   c) The date received
   d) The subject of the transmittal
   e) Identification of any action items addressed by the transmittal
   f) A list of any documents attached to the transmittal.
3) A contract change log containing the following information for each required change in requirement:
   a) An identifying number
   b) References to documentation of the change
   c) A list of the affected contract sections
   d) A concise summary of the change
   e) Cost information.
4) Training Budget Status (Section 15.6, Training Budget).

14.3.3 Project Meetings, Agendas, and Minutes

Project meetings shall be held to review project progress, to ensure correct interpretation of the contract, to review technical and commercial issues, and to maintain co-ordination between TPNODL and Supplier. Meetings shall be scheduled at appropriate times, but shall be scheduled every month on average. The meetings shall be divided between TPNODL's and Supplier's offices. The Supplier's project manager shall prepare a meeting agenda in time for review by TPNODL before the meeting.

The Supplier shall prepare minutes of each meeting. Both TPNODL and the Supplier shall review and approve the minutes. The approved minutes shall be considered binding agreements, subject to concordance with the contract. Where the approved minutes conflict with the contract, either the minutes shall be revised or a change order to the contract shall be generated. Where the minutes of a meeting conflict with the approved minutes of a previous meeting, the conflict shall be documented in the later minutes and those approved minutes shall have precedence.

14.3.4 Project Correspondence

All requests and transfers of information between the parties shall be made in writing, and shall be documented with letters of transmittal. All correspondence from each party shall be dated (with the date of transmittal, not the date of writing) and uniquely numbered. With the exception of the meeting minutes, each letter or other project correspondence shall be limited to a single topic to simplify

correspondence management. Correspondence transmitted via facsimile shall be considered as binding if a printed copy of the correspondence is delivered within four weeks of the facsimile transmission.

Correspondence may be exchanged by electronic mail. Such correspondence shall not be considered a substitute for formal correspondence, however. Agreements established through e-mail transmittals must be recorded as formal correspondence before they become binding. A printed copy of e-mail attached to a transmittal cover sheet shall be considered a formal transmittal.

All project management documentation, such as, correspondence, memos, meeting minutes, and monthly progress reports, shall be produced using the Microsoft Office productivity suite. A mutually agreeable file numbering scheme shall be developed and used to minimize file storage and retrieval efforts.

14.3.5 Detailed Implementation Schedule

The Supplier shall submit for TPNODL approval a detailed implementation schedule. This shall describe all the project activities of both the Supplier and TPNODL As a minimum, this schedule shall include the following:

1) Payment milestones
2) Hardware procurement, integration, and testing
3) Delivery dates for TPNODL -furnished data, interface equipment, and software
4) Software development on a per-function or per-interface basis
5) Software unit testing
6) Subsystem integration and testing
7) Interface testing
8) Preparation of test plans and procedures
9) Factory and site tests
10) Variance correction and retest
11) System disassembly, delivery, and installation
12) Final system and user documentation
13) Training
14) Submittal dates, review cycles, and acceptance dates for the hardware, software, and interface requirements documents.

The training and documentation schedules may be maintained outside the implementation schedule. However, the implementation schedule shall include all of the dependencies of tasks contingent on documentation and training tasks.

The Supplier shall use a commercially available project management application (for example, Microsoft Project) to maintain the project schedule. This project management application shall be used to track the progress of the project from start through completion. Schedule monitoring shall be based on a comparison of completed tasks versus scheduled tasks and estimation of the required effort to complete the remaining tasks. The schedule presented to TPNODL shall be that used by the Supplier to manage their internal resources.

14.4 SCADA/ADMS Testing, Shipment, and Commissioning

The transition of activities from the implementation of the SCADA/ADMS in the Supplier's facilities through testing, shipment, installation, and commissioning is crucial to the success of the project. This section sets out the sequence of these activities and expands on the responsibilities of TPNODL and the Supplier for these activities.

14.4.1 Factory Test Sequence

Factory tests are described in Section 12, Quality Assurance and Testing, along with conditions for test initiation and completion. These tests include a preliminary factory test, a factory test, and a stability test. These tests shall be executed in the following sequence:

1) Preliminary factory test – Successful completion of Pre-FAT is a prerequisite for factory testing. This activity shall be scheduled as necessary to maintain the overall project schedule.
2) Factory test – The FAT including the Performance Test shall be started no sooner than two weeks after successful completion of Pre-FAT. The factory test schedule shall be set such that any member of TPNODL test staff is required to be at the Supplier's facility for no more than three consecutive weeks. After three weeks at the Supplier's facility, TPNODL staff shall be scheduled for at least one week away from the facility.
3) Stability test – The stability test shall be started immediately after successful completion of the FAT.

The supplier shall allocate budget for travel and living expenses for five (5) TPNODL representatives for the purposes of witnessing FAT and stability tests at the supplier's site.

14.4.2 Authorization for Shipment

Acknowledgement of the successful completion of all factory tests shall be deemed as authorization for the Supplier to ship the tested hardware and software to T TPNODL site. Shipment will not be authorized until all variances have been corrected to TPNODL satisfaction. However, the Supplier shall submit an official notice of intent to ship at least one month prior to completion of the factory test. The notice shall indicate the contents, names of all carriers, estimated shipping weight, size of shipment, insurance provisions, date scheduled to leave the factory, and estimated date and time of arrival at TPNODL facilities.

TPNODL reserves the right to delay shipment if this notice is not given by the required time. Such delay shall be completely to the account of the Supplier – no schedule or cost relief will be granted.

14.4.3 System Installation

After the equipment is delivered to TPNODL site and received by TPNODL, the SCADA/ADMS installation activities shall commence:

1) Movement and placement of the equipment
2) Interconnection of the equipment, including interconnection with previously delivered equipment
3) The installation test (refer to Section 12.10.1, Installation Test).

The Supplier shall be responsible for these tasks. Prior to delivery to TPNODL site, the Supplier shall meet with TPNODL to discuss the work necessary to install the SCADA/ADMS and to estimate TPNODL labor to be provided. The Supplier shall become familiar with TPNODL labor and safety rules governing the installation work and shall design the installation work in accordance with these rules.

14.4.4 Site Test

The site test shall be started after installation and TPNODL field update activities are complete.

14.4.5 Commissioning

Commissioning of the SCADA/ADMS shall start immediately after the successful completion of the site test. Commissioning activities shall include but shall not be limited to checking that the on-site operation of the SCADA/ADMS, including its communications interfaces to all relevant field devices and external systems are ready for commercial operation. Specific tasks include:

1) Verification of all SCADA/ADMS interfaces with TPNODL -provided data sources and systems

2) Verification of all SCADA/ADMS interfaces with Supplier-provided data sources and systems
3) Verification that the system is protected against cyber intrusion, whether originating with intruders outside the utility's firewall, or within the trusted environment of the corporate WAN, or from attacks on unsecured communications lines to remote equipment
4) Validation of System databases, displays, and reports using field data
5) Validation that all software is free of contaminants, is purged of all sample scripts and sample code, and has had all default accounts and passwords removed or disabled
6) Validation of the output of SCADA/ADMS functions using field data.
7) Customer shall be responsible for this activity, with support from the Supplier. The project schedule shall allow a minimum of two months for this activity. The Supplier shall allocate a minimum of two people full-time at TPNODL site throughout this activity.

14.4.6 Availability Test

The availability test shall be started after site Acceptance Tests and SCADA/ADMS commissioning have been successfully completed, all variances have been corrected, and the availability test prerequisites (Section 12.6.1, Test Initiation) have been completed to TPNODL satisfaction.

APPENDICES

Appendix – A: Questionnaire

The following contains questions regarding each Supplier's qualifications and the capabilities proposed in response to this specification. TPNODL will use the responses to these questions during the final evaluation and Supplier selection. Answers to these questions will be incorporated as clarifications into the final Statement of Work when the response clarifies the capabilities of the proposed SCADA/ADMS and services selected by TPNODL

Financial and Corporate

1) State the number of years your company has been in the business of supplying SCADA/ADMS systems.
2) Are you now or have you ever been in the last three years in a declared state of bankruptcy? If so, describe your present situation.
3) Please describe any pending or active litigation that your organization is involved in.
4) What is the size of your current order backlog? Please describe in terms of total dollar value as well as number of systems and phase of projects.
5) Describe any pending or possible future changes in ownership, or external investment in the division or corporate entity responsible for SCADA/ADMS projects.

Company Resources

Please respond to these questions in context of the facility where the system will be staged, built, tested and delivered, even though the Supplier may have other facilities from where similar systems can be delivered.

1) Briefly describe (physical size, location, number of employees, etc.) the facilities where the proposed system would be prepared, staged and tested. Is customer training conducted at the same facilities? Is this the same facility from which field support would be provided?
2) State the number of technical staff whose duties relate solely to the engineering, building, and testing of SCADA/ADMS systems. Describe staff assigned within the following categories:
    a) Developing and maintaining new applications for the proposed SCADA/ADMS standard baseline (i.e., product development).
    b) Delivering, testing & installing customer programs.
    c) Managing customer projects.
    d) Training customer personnel.
    e) Performing field service and maintenance.
3) Please identify how many of these technical staff members produce software and how many work with hardware. Indicate the average number of years that the members of each group have worked for you.
4) Please provide an organizational chart of your company.
5) Describe how you would typically staff a project team for a job of this size and scope.

System Projects

1) Substantiate your experience by filling out a copy of the Installation Summary Form (Exhibit A-1) for each system that has been installed by your company within the last five years and all systems installed in India, if any.
2) Identify all SCADA/ADMS system presently under order by filling out the In-House Project Summary Form (Exhibit A-2) for each system.
3) Provide a list of all SCADA/ADMS projects shipped in the past five years. Include the scheduled and actual ship dates and final acceptance dates for each system.
4) Are there any systems that your company has failed to complete? If yes, please identify and explain circumstances.

System Design

1) Describe your commitment to the basic system design that you would propose; that is, describe any plans that you have to modify or replace it in the future.
2) Please provide a brief summary of your R&D plans for standard system enhancements and indicate the portion of your revenue invested in R&D.
3) Discuss the release process for new versions of the baseline system. Describe how often new versions are released and how the releases are managed relative to projects in progress and fielded systems.
4) Identify (by name and revision level) the major OEM software elements that would be used in the SCADA/ADMS System proposed by you, such as operating system, relational database management system, etc.
5) What is your policy regarding upgrades to third party software? How are upgrades to third party software managed for fielded systems?
6) Describe any development work to your standard SCADA/ADMS System design that will be required to meet TPNODL requirements, if any.
7) Do you modify any of the OEM software in any way? If so, describe how and why.
8) Describe the modularity of your system and the capability to replace subsystems or system components without replacing the whole system.

System Database

1) Where the DBMS is currently fielded operational?
2) Is an RDBMS used? If so, which one (including version)? Please describe its uses in the system and how it is integrated.
3) If your system has a proprietary database, indicate your willingness to publish interface specifications for it.
4) Is the database CIM-compliant? Describe your current activities toward providing CIM compliant interfaces.
5) Does your database design provide for a single point of entry for all database development and maintenance?
6) Does your database system allow changes to be incorporated without taking the system down or without failing-over?

7) What is the mechanism for reversing a database change that has just been implemented in the system database?
8) Describe your experience in keeping databases synchronized between two systems at geographically different locations.
9) Discuss the tools and techniques used for converting the existing database(s) to the format needed by your system.
10) Describe the capabilities of your base system to perform the following configuration control tasks: tracking and time-stamping of database changes and identification of references for additional uses of deleted/renamed data points.
11) Describe the database backup and restoration philosophy and the tools provided to support this task.
12) How is your database accessed by third party software? Do you support access via SQL and ODBC drivers? Do these drivers also support access to the real-time data structures?

User Interface (UI)

1) Describe the full graphics user interface functional and performance capabilities of your company's SCADA/ADMS System offering. “Boiler plate” documentation and/or data sheets will be sufficient.
2) Describe how the full graphics UI support resizing/scaling of character fonts to allow displays to be readable at various zoom levels.
3) Provide color hard copies of full graphics displays for each application that illustrate the maturity of your product, that is, practical uses of full graphics.
4) Describe the use of the Microsoft-Window system and/or Windows GUI if Windows 2015 based in the user interface to be proposed.
5) Describe your adherence to User Interface guidelines for Microsoft Windows based UI or Unix/Linux based UI. How do you maintain a consistent graphic/data presentation throughout your system?
6) Indicate the development status of the full-graphics, display maintenance tools. Can they be completely demonstrated in the factory? If not, what features cannot be demonstrated? When can they be demonstrated?
7) Please describe the standard user functional partitioning capabilities of your system. Include a discussion of how user logins are employed and managed, maximum number of unique user logins, how many different partitions or functional areas of authority or responsibility are available, etc. Describe how authority can be transferred, both intra- and inter-site.
8) Please describe how your standard UI can interact with third-party products executing on other PCs and workstations. How are applications running under Microsoft Windows accessed and executed from user-interface consoles?
9) Describe the system tools that are available to support using the Intra/Internet to provide access to tabular and graphical data.
10) Describe the user-interface capabilities available for your system through a web-browser. Are all control-center user functions supported through the browser? Please include a discussion of how user authentication is performed, and describe any special security service or mechanism employed to guarantee authentication for supervisory controls (if controls are supported).

11) Describe how a dispatcher can access context-sensitive help and/or on-line documentation within the standard user interface.

12) Does your standard system provide a facility for database-defined operational notes that are associated and displayed with specific points? For example, procedures associated with specific control points that require the dispatcher to take other, perhaps non-SCADA/ADMS related, actions prior to operating.

13) Describe the tagging capabilities of your baseline system. How many different tags are supported? How many of each tag can be defined? Describe how a new tag type is added.

14) Describe how your system supports operations across multiple time zones. Describe how event messages are properly time-tagged and ordered chronologically regardless of what time zone the data is acquired from. Include in your discussion how time is managed within the IS&R and associated displays and reports.

15) How are electronic and printed copies of logs, reports and displays distinguished from one system to another (e.g., real-time, OTS, Development, etc.)?

Networking and Communications

1) Briefly describe experience with SCADA/ADMS system interfaces with Corporate WANs. Consider:
   a) Ability of PCs on the WAN to securely view real-time SCADA/ADMS data
   b) Ability of PCs on the WAN to securely access the relational historical database
   c) Equipment and Software required facilitating secure interface (e.g., firewalls, routers, etc.)
   d) Data access permission schema.

2) Describe the local area network of your typical SCADA/ADMS system. Consider:
   a) Redundancy
   b) Type (Ethernet, Token Ring, 10BaseT, 100BaseT, etc.)
   c) Segmentation.

3) Describe your experience with the ICCP datalinks with other utilities. Was the proposed ICCP product developed by your organization or it is a third party product?

4) Describe your experience with the SOA based architecture datalinks with other utilities.

5) Describe your experience with the ESB interface delivered/developed with other utilities

6) Is it possible for a maintenance person to dial into the SCADA/ADMS master station from a PC (not on the Corporate WAN) for maintenance purposes? What hardware and software is required at the master station? What software is required at the PCs? How is the security of this access enforced?

7) Describe your experience with communications and support of Intelligent Electronic Devices (IEDs). What IED protocols does your baseline system support?

8) Describe your experience communicating with intelligent substations interconnected over a utility WAN communications channels. Have you implemented or contracted to deliver any different system configurations of this type? Please describe the configuration of any unique communications.

Applications

1) Do you supply a standard Dispatcher Power Flow (sub-transmission (66KV or 33KV/ Distribution level (11KV & below) package? If so, indicate is this in house developed or third-party software, describe your licensing arrangements with the third party software supplier, if any and describe your field experience with the software.

2) Do you supply a standard Dispatcher Training Simulator (DTS) package? If so, indicate who developed the software, describe your licensing arrangements with the software supplier, and describe your field experience with the software.

   a) Confirm and describe how your DTS supports simulation of a black-start scenario.

   b) Describe how the DTS can be initialized from IS&R data to begin simulations of actual disturbance events.

   c) Describe how changes to the SCADA/ADMS system are reflected in the data base model.

   d) Also describe the load flow used by the DTS and compare it to the baseline SCADA/ADMS load flow, and in particular, describe the data setup steps required to initialize the DTS from the SCADA/ADMS real-time conditions.

3) Describe the capabilities of your standard system to interface with a variety of energy marketer's systems. Describe any specific projects where you have implemented these capabilities. Also, describe how the system could be expanded/revised in the future as TPNODL's needs to interface with different market systems evolves.

4) Describe the design approach of your proposed Information Storage and Retrieval system (IS&R). Consider:

   a) Name of RDBMS package used
   b) Maximum rate of database snapshots for typical system
   c) Post-disturbance review capability
   d) Energy accounting capability
   e) Report capability including graphical presentations
   f) Ad hoc query capability
   g) Storage constraints
   h) Field experience.

5) What capabilities does your proposed system have to capture snapshots and/or time intervals of complete system data? Describe how the data is captured, managed, and archived. Include a discussion of tools available to view, replay, and analyze the data. Can the data be reviewed on the same displays used for operations? Are associated alarm and event lists captured and stored? Can State Estimator data be captured and maintained for future analysis through the supplied study network applications?

6) Describe the capabilities of your standard Applications including: DPF, SE, CA, Distribution PF, FISR, Quality Indices, and Volt/VAr Scheduling, prediction logic, call grouping.

7) Describe the information provided to the on-line user when the real-time sequence does not solve.

8) With the changes occurring in the electric power industry at this time, many utilities are reorganizing to become more competitive. Due to these changes, many functions that were being performed by one organization may be shifted to a different organization or may be a shared responsibility of both organizations. The division of responsibilities will include limits on data access between the organizations due to required codes of conduct

   a) Please describe how your system functions can be compartmentalized and reconfigured (both during system implementation and after delivery, by the utility) to support this dynamic, competitive environment.

   b) Specifically TPNODL expects that its marketing department may use certain system functions, but be limited to certain sets of data, and be restricted from accessing other system functions. Responsibility for some functions may be shared. Please describe how the system can be configured to support shifting of responsibility/shared responsibility.

Third-Party Software

1) Identify all third-party software that would be in an SCADA/ADMS system proposed by you.
2) Describe how your system design supports the integration of third-party software into the system.
3) Describe in which areas of expertise your company would likely establish subcontractor relationships to meet TPNODL needs.

System Architecture

1) State all standards or de facto standards being followed and state plans for moving toward industry acceptable standards. Address your use of local area network,
2) Identify the proposed computer equipment OEM (or OEMs if more than one "platform" can be used).
3) Describe your capability to use platforms of different manufacturers, that is, your ability to provide platform independence. Describe what must be done to replace an existing platform with a new one of different manufacture using an operating system do so.
4) Describe your experience with the proposed multi-level failover process within the local site and between the MCC and BCC. Identify the failover time and any potential data loss.
5) Describe how users at a site will know when to assume operations for the failed system.

Data Acquisition

1) Describe your field experience with an industry standard RTU/DCU/FRTU protocol such as IEC 870-5, profiles 101 and 104. Also describe the level of implementation, e.g. full or partial implementation.
2) Describe your experience with LAN based remote Front End Processors and are these currently being used by your utility customers.
3) Explain the failure management scheme proposed for the FEPs.
4) Describe your activities relating to support of IEC 61850 system.
5) Explain how RTU/DCU errors are reported to the on-line user.
6) Describe your experience and techniques used in synchronizing time among sites in different time zones and between geographically dispersed locations.

Project Management/Implementation/Support

1) Describe any existing User Groups that are currently supported, identify (name and telephone number) the current utility chairperson of each group, and summarize typical meeting schedules, meeting sites, and practices. Include any electronic bulletin board or Internet services.
2) Describe a reasonable project schedule for an SCADA/ADMS system of the size desired by TPNODL Identify the level of resources required and tasks to be performed by TPNODL to support the proposed schedule.
3) Describe the level of support (and the tools used) that you typically include in a project's implementation to help a utility get its network model and advanced applications operational during system manufacture and after delivery. Also provide incremental costs (rates for additional support staff) to provide additional assistance if requested by TPNODL

Training

1) Provide a brief overview of the recommended training that you and/or your OEMs can provide and their respective locations. How would the training differ between TPNODL maintaining the hardware versus using a third-party to do so?
2) Enumerate the training you would recommend if TPNODL were to plan on purchasing spare parts and performing self-maintenance for the system hardware.
3) Describe the permanent training organization within your company and their training facilities

Documentation

1) Describe the levels of documentation normally provided with your company's SCADA/ADMS system offering for hardware and software maintenance (including functional design, implementation, reference, and user's manuals).
2) What documentation and drawings can be supplied in electronic format so TPNODL can maintain them after system delivery? Identify the word processing program used. Is the documentation stored on the system?

Maintenance

1) Do you recommend that TPNODL be responsible for post-warranty hardware maintenance or that it purchase maintenance from you or a third-party? Why?
2) Describe the capabilities (organization, location, resources) in India for servicing the equipment that is being supplied by you.
3) Indicate the types of post-warranty hardware maintenance services that are offered by your company and by suppliers of major system elements; identify the customers that have purchased these services.
4) Indicate the types of post-warranty software maintenance services that are offered by your company, and by suppliers of major system elements such as, operating system, database, and applications; identify the customers that have purchased these services.
5) Indicate the types of post-warranty software upgrade services that are offered by your company; identify the customers that have purchased these services.
6) Describe your field service organization in India and the duties that it can perform.
7) State the location(s) of the field service representatives closest to TPNODL

Licenses and Warranties

1) Describe your warranty policies for hardware and software including all hardware/software supplied by third parties.
2) Describe your company’s policy regarding providing source code for all of the programs in the SCADA/ADMS.
3) Please provide pricing alternatives for TPNODL to supply licenses for all data based related products required for the proposed SCADA/ADMS. Please indicate what specific software products (and their versions) are required. Confirm that development licenses (for all work done at the Supplier’s facility) are covered by Supplier licenses.

Additional Questions

1) Confirm your commitment to support an extended, on-site demo (approximately 3 to 4 days) of your baseline system at TPNODL , should you be selected as one of the finalists. What level of TPNODL support staff do you recommend to make this process most effective for TPNODL?
2) Describe how the proposed system supports the expansion of communication links to additional DCUs/RTUs. Please itemize the additional equipment and software required to support this expansion.
3) Itemize any additional software or hardware required for TPNODL to use existing WAN connected PCs as remote consoles. Identify the additional per PC unit costs for these required additions to their existing PC's.
4) Describe how the proposed system will interface to the TPNODL supplied firewalls.
5) Describe the expected availability of the proposed system. Identify any single points of failure.
6) Explain the process by which a dispatcher can identify and store real-time data on-line for future study in the Information Storage and Retrieval database.
7) Describe import capabilities of your system for importing geographic data from industry leading GIS systems (GE Smallworld, ESRI and Intergraph), your experience (with references) with each of these systems and in which formats are supported and your comfort with interface.
8) Describe your experience (with references) in delivering a LED projection system as part of the SCADA/ADMS system.
9) For scheduled backup, does your system have a reminder mechanism to remind the user on a periodic bases?
10) Describe your process for committing DB and One line display updates to the system.
11) Describe your experience with Enterprise Application Integration and have you implemented Enterprise Application Integration using Middleware products, Message Bus, IEC standard 61968 and Common Information Model. If yes, provide references.

Exhibit A-1:

Form to be used for Description of Installed Systems

Utility Name: _____

Contact Name: _____

Address: _____

_____

_____

Telephone/Fax: _____

E mail _____

Contract Date: _____

Actual

Delivery Date: _____

CONFIGURATION - Attach a block diagram that identifies the following (including Master Control System, Backup Control Center, Operator Training Simulator, Development System, Video Projection Screens, Interfaces etc.):

- Main Processors
- Database Processors
- User Interface Devices (CRTs/Consoles)
- Data Acquisition Processors
- Bulk Storage Devices
- Peripherals (Printers/Loggers)
- Data Links (Gateways)
- Local Area Networks

SIZING - Indicate initial and ultimate system sizing in the following areas:

ITEM	INITIAL	ULTIMATE
DCU/RTUs	_____	_____
3 or 4 - CRT Consoles	_____	_____
2 - CRT Consoles	_____	_____
1 - CRT Console	_____	_____
Scanned Status Points	_____	_____
Scanned Analog Points	_____	_____

Operating System and RDBMS (Name and Revision Level):

_____

RDBMS Engine used for the Historical Information System:

_____

Application Functions (check all that apply):

[ ] SCADA
[ ] RTUs
[ ] DCUs
[ ] ICCP
[ ] Real-Time Calculations
[ ] Video Trending
[ ] Dispatcher Power Flow
[ ] State Estimator
[ ] Contingency Analysis
[ ] Dispatcher Training Simulator
[ ] Historical Information System
[ ] Historical Information System based on Commercial RDBMS
[ ] Web Based UI
[ ] GIS interface (specify GIS Vendor)

[ ] Distribution Network Power Flow
[ ] Switching Order Management
[ ] Fault Isolation and System Restoration
[ ] Quality of Services Indices Calculation
[ ] Prediction Logic
[ ] Call grouping

Other Applications (list):

_____

_____

Exhibit A-2:

Form to be used for Description of Systems on Order

Utility Name:
_____

Contact Name:
_____

Address:
_____

_____

_____

Telephone/Fax: _____

E-mail: _____

Contract Date: _____

Current Scheduled

Delivery Date: _____

CONFIGURATION - Attach a block diagram that identifies the following (including Master Control System, Backup Control Center, Operator Training Simulator, Development System, Video Projection Screens, Interfaces etc.):

- Main Processors
- Database Processors
- User Interface Devices (CRTs/Consoles)
- Data Acquisition Processors
- Bulk Storage Devices

- Peripherals (Printers/Loggers)
- Data Links (Gateways)
- Local Area Networks

SIZING - Indicate initial and ultimate system sizing in the following areas:

ITEM	INITIAL	ULTIMATE
RTUs	_____	_____
Multi-Screen Consoles	_____	_____
Remote UI Consoles	_____	_____
Scanned Status Points	_____	_____
Scanned Analog Points	_____	_____

Operating System and RDBMS (Name and Revision Level):

_____

RDBMS Engine used for the Historical Information System:

_____

Application Functions (check all that apply):

[ ] SCADA
[ ] RTUs
[ ] CDUs
[ ] ICCP
[ ] Real-Time Calculations
[ ] Video Trending
[ ] Dispatcher Power Flow
[ ] State Estimator
[ ] Contingency Analysis
[ ] Dispatcher Training Simulator
[ ] Historical Information System
[ ] Historical Information System based on Commercial RDBMS
[ ] Web Based UI
[ ] GIS interface (specify GIS Vendor)
[ ] Distribution Network Power Flow
[ ] Switching Order Management
[ ] Fault Isolation and System Restoration
[ ] Quality of Services Indices Calculation
[ ] Prediction Logic
[ ] Call grouping

Other Applications (list):

Appendix – B

Sample Report attached with this document

Appendix - C

GSAS & DA station data points: The Signal list are indicative for system Tag calculation purpose. Bidder has to ensure 100 % Scalability of Hardware & software without cost implication to utility.

TPNODL Signal Details: -

S. No.	Grid Name	SP	SC	DP	DC	MF/IT	ST
A	**33 KV PSS**	150	15	15	15	300	10
	Sub -Total@315 PSS	47250	4725	4725	4725	94500	3150
B	**RMU/SEC/Auto**	8	2	2	2	10	0
	Sub-Total	11304	2826	2826	2826	14130	0
	Grand Total	58554	7551	7551	7551	108630	3150

TPNODL 11 KV Distribution Automation Equipment

PROPOSED	UoM	TPNODL				
		Year-1	Year-2	Year-3	Year-4	Year-5
RMU	Nos.	0	21	70	65	72
Sectonalizer	Nos.	0	36	75	81	54
Auto-Reclosure	Nos.	0	12	25	24	18
FPI	Nos.	0	200	240	220	200

Appendix – D
SCADA/ ADMS Bill of Material

TPNODL BoM

S. No.	Equipment		Balasore (MCC)	--------- (BCC)	total
A	**Server/ workstation Hardware with panel**	**Unit**			
	SCADA server	No.	10	10	**20**
	FEP server with interface switches	No.	10	10	**20**

	ISR server	No.	10	10	**20**
	NMS server	No.	10	10	**20**
	DTS server	No.	5	5	**10**
	Developmental server	No.	5	5	**10**
	Interface Server (ICCP/GIS/Network Planning / ODBC / Web services)	No.	10	10	**20**
	Workstation with dual TFT Monitors additional required for Bhadrak, J. Road, Keonjhar and Baripada	No.	10	10	**35**
	Developmental console with dual TFT	No.	5	5	**10**
	DTS/Workstation Console with dual TFTs	No.	5	5	**10**
	DLP based Video Projection system with 2x3 Module configuration with each module at least 67" diagonal with common projector at MCC and 80 Inch TV at Bhadrak, J. Road, Keonjhar and Baripada	No.	1	1	**5**
	Storage & Backup Devices				
	External Mass storage device (for year online backup)	No.	5	5	**10**
	Exteranl DAT drive	No.	5	5	**10**
	Switches				
	Layer II switch (SCADA/DMS LAN)-48 ports	No.	8	8	**16**
	Layer II switch (Development system LAN)-24ports	No.	4	4	**11**
	Security system (DMZ)				
	Web server with load balancing	No.	2	2	**4**
	Patch Management / Mail / SMS server	No.	2	2	**4**
	Firewall & network IDS/IPS	No	4	2	**6**
	Layer II switch	No.	4	4	**8**
	Other Active Devices				
	GPS Time synchronization system	Set	2	2	**4**
	Time, day & date digital displays	Set	1	1	**2**
	Printers				
	B/W Laser printer additional required for Bhadrak, J. Road, Keonjhar and Baripada	Set	1	1	**5**
	Color Laser printer additional required for Bhadrak, J. Road, Keonjhar and Baripada	Set	1	1	**5**
	Cabling System				
	Cable, Jacks, Patch Panel, labelling etc. additional required for Bhadrak, J. Road, Keonjhar and Baripada	Lot	1	1	**5**
B	**Software for Control Centre**				
	SCADA software	Lot	5	5	**10**

	ISR Software	Lot	5	5	**10**
	DTS software	Lot	5	5	**10**
	Developmental software	Lot	5	5	**10**
	Network Management Software	Lot	5	5	**10**
	WEB /Network security software (incl in web server)	Lot	5	5	**10**

Note:- The above BoM are minimum requirement envisaged by Customer. Bidder can provide better configuration to meet the specification without virtualization of hardware resources.

ANNEXURE XIII

Schedule of Deviations

Bidders are advised to refrain from taking any deviations on this TENDER. Still in case of any deviations, all such deviations from this tender document shall be set out by the Bidders, Clause by Clause in this schedule and submit the same as a part of the ***Technical Bid.***

Unless specifically mentioned in this schedule, the tender shall be deemed to confirm the TPNODL's specifications:

S. No.	Clause No.	Tender Clause Details	Details of deviation with justifications

By signing this document we hereby withdraw all the deviations whatsoever taken anywhere in this bid document and comply to all the terms and conditions, technical specifications, scope of work etc. as mentioned in the standard document except those as mentioned above.

Seal of the Bidder:

Signature:

Name:

ANNEXURE IV

Schedule of Commercial Specifications

(The bidders shall mandatorily fill in this schedule and enclose it with the offer Part I: Technical Bid. In the absence of all these details, the offer may not be acceptable.)

S. No.	Particulars	Remarks
1.	Prices firm or subject to variation (If variable indicate the price variation clause with the ceiling if applicable)	Firm / Variable
1a.	If variable price variation on clause given	Yes / No
1b.	Ceiling	--------- %
1c.	Inclusive of Excise Duty	Yes / No (If Yes, indicate % rate)
1d.	Sales tax applicable at concessional rate	Yes / No (If Yes, indicate % rate)
1e.	Octroi payable extra	Yes / No (If Yes, indicate % rate)
1f.	Inclusive of transit insurance	Yes / No
2.	Delivery	Weeks / months
3.	Guarantee clause acceptable	Yes / No
4.	Terms of payment acceptable	Yes / No
5.	Performance Bank Guarantee acceptable (For 3% of order value for guarantee period)	Yes / No
6.	Liquidated damages clause acceptable	Yes / No
7.	Validity (180 days) (From the date of opening of technical bid)	Yes / No
8.	Inspection during stage of manufacture	Yes / No
9.	Rebate for increased quantity	Yes / No (If Yes, indicate value)
10.	Change in price for reduced quantity	Yes / No (If Yes, indicate value)
11.	Covered under Small Scale and Ancillary Industrial Undertaking Act 1992 (If Yes, indicate, SSI Reg'n No.)	Yes / No

ANNEXURE V

Checklist of all the documents to be submitted with the Bid

Bidder has to mandatorily fill in the checklist mentioned below:-

S. No.	Documents attached	Yes / No / Not Applicable
1	EMD of required value	
2	Tender Fee as mentioned in this RFQ	
3	Company profile/ organogram	
4	Signed copy of this RFQ as an unconditional acceptance	
5	Duly filled schedule of commercial specifications (Annexure I, II, IV, V, VI, VII, VIII, IX, XI, XII, XIII, XIV, XV, XVI)	
6	Sheet of commercial/ technical deviation if any (Annexure III)	
7	Balance sheet for the last completed three financial years; mandatorily enclosing Profit & loss account statement	
8	Acknowledgement for Testing facilities if available (duly mentioned on bidder letter head)	
9	List of Machine/ tools with updated calibration certificates if applicable	
10	Details of order copy (duly mentioned on bidder letter head)	
11	Order copies as a proof of quantity executed	
12	Details of Type Tests if applicable (duly mentioned on bidder letter head)	
13	All the relevant Type test certificates as per relevant IS/ IEC (CPRI/ ERDA/ other certified agency) if applicable	
14	Project/ Supply Completion certificates	
15	Performance certificates	
16	Client Testimonial/ Performance Certificates	
17	Credit rating/ Solvency certificate	
18	Undertaking regarding non blacklisting (On company letter head)	
19	List of trained/ Untrained Manpower	

Annexure VI

Acceptance Form for Participation In Reverse Auction Event

(To be signed and stamped by the bidder)

In a bid to make our entire procurement process more fair and transparent, TPNODL intends to use the reverse auctions as an integral part of the entire tendering process. All the bidders who are found as technically qualified based on the tender requirements shall be eligible to participate in the reverse auction event.

The following terms and conditions are deemed as accepted by the bidder on participation in the bid event:

1. TPNODL shall provide the user id and password to the authorized representative of the bidder. *(Authorization Letter in lieu of the same shall be submitted along with the signed and stamped Acceptance Form).*
2. TPNODL will make every effort to make the bid process transparent. However, the award decision by TPNODL would be final and binding on the supplier.
3. The bidder agrees to non-disclosure of trade information regarding the purchase, identity of TPNODL, bid process, bid technology, bid documentation and bid details.
4. The bidder is advised to understand the auto bid process to safeguard themselves against any possibility of non-participation in the auction event.
5. In case of bidding through Internet medium, bidders are further advised to ensure availability of the entire infrastructure as required at their end to participate in the auction event. Inability to bid due to telephone line glitch, internet response issues, software or hardware hangs, power failure or any other reason shall not be the responsibility of TPNODL.
6. In case of intranet medium, TPNODL shall provide the infrastructure to bidders. Further, TPNODL has sole discretion to extend or restart the auction event in case of any glitches in infrastructure observed which has restricted the bidders to submit the bids to ensure fair & transparent competitive bidding. In case of an auction event is restarted, the best bid as already available in the system shall become the start price for the new auction.
7. In case the bidder fails to participate in the auction event due any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid as submitted by the bidder as a part of the tender shall be considered as the bidder's final no regret offer. Any offline price bids received from a bidder in lieu of non-participation in the auction event shall be out-rightly rejected by TPNODL.
8. The bidder shall be prepared with competitive price quotes on the day of the bidding event.
9. The prices as quoted by the bidder during the auction event shall be inclusive of all the applicable taxes, duties and levies and shall be FOR at TPNODL site.
10. The prices submitted by a bidder during the auction event shall be binding on the bidder.
11. No requests for time extension of the auction event shall be considered by TPNODL.
12. The original price bids of the bidders shall be reduced on pro-rata basis against each line item based on the final all-inclusive prices offered during conclusion of the auction event for arriving at Contract amount.

Signature & Seal of the Bidder

Annexure VII

General Scope of Work

Requirements from Bidder

Overview:

1. Supply, Installation and configuration of a state-of-the-art GIS technology as per the specifications laid out under section, 'Annexure-2: Technical Specifications Compliance'
2. Deployment of standard utility data-model and facility of flexibility and customization to match as per the requirements laid out under section, 'Annexure-3: System Requirement Compliance'
3. Deployment of an integrated solution for efficient and effective functioning of business processes related but not limited to - Network planning, Project execution (as-built updates), Operations Management, Commercial Management, Asset management, Customer management, enabling business analytics and GIS System Administration as per the requirements laid out under section, 'Annexure-8: Integrated Business Process Requirement Compliance'
4. Quality compliance for customized applications as laid out under section, 'Annexure-9: Quality Assurance Compliance'
5. Data survey, name plate writing and painting, capture and update of Pilot Area for testing of deployed functionalities. The same shall be treated as the base for system acceptance and sign-off. Refer 'Annexure-10: Field Survey Compliance'
6. Data survey, name plate writing and painting, capture and update of remaining area (Balasore-BED Division)
7. Performance of the system must be excellent as laid out under section, 'Annexure-11: Performance Compliance'
8. License Compliance as laid out under section, 'Annexure-12: Licensing compliance'.
9. Documentation, Training & Hand Holding as laid out under section, 'Annexure-13: Documentation, User Manual and Training Compliance'
10. Transfer of complete customization code, Inspection Testing and Acceptance as mentioned in section, 'Annexure-14: Inspection Testing and Acceptance'
11. Support & Maintenance of the solution for a period of 5 years post commissioning & go live as per requirements laid out under, Annexure-15: Warranty-Post implementation Support Compliance
12. Solution's compatibility for "On-premise" and "cloud deployment"

Selection of Service Resources

The selection of Service Resources will be done by BA. BA is required to take final approval from TPNODL designated authority before deploying the manpower at TPNODL. Approval will be provided post interaction with TPNODL representative. BA is required to conduct background verifications for Service Resources and submit the report to TPNODL.

Replenishment Policy

BA needs to implement its resource replenishment process to ensure proper knowledge transfer and at least fifteen days overlapping before releasing of the resource.

Training and Skill Improvement

BA needs to ensure skill improvement of deployed manpower by training so that the manpower will be able to work on latest version of deployed product / equipment.

A. Language

The Service resources deployed by the BA should be well versed in Odia, Hindi, English languages and shall ensure the fluency in conversion.

G. Disaster Management plan

1. BA Shall ensure 100% manpower availability in case of any lockout / pen down scenarios and submit a report within next 24 hours and finalize the action plan in concurrence with TPNODL.
2. BA should have the suitable infrastructure facility available for operating the call center from their location in case of disaster at Bhubaneswar site (if any change it will be intimated later).

Working Timing

Above mentioned services shall follow the six days working in a week for resolution of issues in TPNODL. However, they need to provide services as per requirement through remote / telephone etc. for critical users and shall be available at site for important assignment and IMAC activity during off period as per requirement.

TPNODL

ATTACHED AS ANNEXURE TO THIS DOCUMENT

1.0ORGANIZATIONAL VALUES

The Tata Group has always been a value driven organization. These values continue to direct the Group's growth and businesses. The six core Tata Values underpinning the way we do business are:

Integrity - We must conduct our business fairly, with honesty and transparency. Everything we do must stand the test of public scrutiny.

Understanding - We must be caring, respectful, compassionate and humanitarian towards our colleagues and customers around the world and always work for the benefit of India.

Excellence - We must constantly strive to achieve the highest possible standards in our day to day work and in the quality of goods and services we provide.

Unity - We must work cohesively with our colleagues across the group and with our customers and partners around the world to build strong relationships based on tolerance, understanding and mutual co-operation.

Responsibility - We must continue to be responsible and sensitive to the countries, communities and environments in which we work, always ensuring that what comes from the people goes back to the people many times over.

Agility - We must work in a speedy and responsive manner and be proactive and innovative in our approach.

2.0ETHICS

In our effort towards Excellence and in Management of Business Ethics at TPNODL, an Ethics Management Team is constituted.

The main objective of the Ethics Management Team is to:

1. Record, address and allay the issues and concerns on ethics raised by different stakeholders like employees, consumers, vendors, Associates etc. by initiating immediate corrective actions.
2. Ensure proper communication of the ethics policies and guidelines through prominent displays at all offices of TPNODL and through printed declarations in all concerned documents where external stakeholders are involved.
3. Ensure proper framework of policies as preventive measures against any ethics violation recorded by them.
4. Prepare and submit MIS of all issues and concerns, corrective and preventive actions on monthly basis to the top management for their information.

All Associates and Stakeholders are requested to register any grievance on ethics violation on reported to the following e-mail ID: ceooffice@tpnodl.com

3.0CONTRACT PARAMETERS

3.1 Issue/ Award of Contract

TPNODL awards the contract to the Associate in writing in the form of Purchase order (PO) or a Rate Contract (RC), hereafter referred as Contract, through in any or all of following modes-physical handover / post / e-mail / web document / fax with all the attachments/enclosures which shall be part of the contract document

On receipt of the contract, the associate shall return to TPNODL copy of the contract document duly signed by legally authorized representative of associate, within two days of Effective Date of Contract for contracts having contract execution time less than 30 days and within five days for all other contracts.

3.2 Contract Commencement Date

The date of issue/ award of contract shall be the Effective Date of Contract or Contract Commencement date.

3.3 Contract Completion Date

The date of expiry of Guarantee Period shall be deemed as the Contract Completion Date.

3.4 Contract Period/Time

The period from Contract Commencement Date to Contract Completion Date shall be deemed as the Contract Period/Time.

3.5 Contract Execution Completion Date

The stipulated date for completing the execution of all items in the schedule of quantities (Supply, Service and or both as applicable) shall be deemed as the Contract Execution Completion Date.

3.6 Contract Execution Period/Time

The Period from Contract Commencement Date to Contract Execution Completion Date shall be the Contract Execution Period/Time**.** Timely Completion of Works/Timely Delivery of Materials is the essence of the contract. The period from effective date of contract to the date stipulated for completion of delivery of all items/completion of all the works/services, as per schedule of quantities of the contract is defined as contract execution completion time. The Delivery of Materials /The Completion of Works, as applicable, should be achieved in all respects as per schedules of quantities and all the terms and conditions of the contract, in the contract execution time.

Any revision/amendment in the originally stipulated contract execution time has to be approved by authorized representative of TPNODL.

3.7 Contract Price /Value

The total all inclusive price/value mentioned in the PO/RC of the contract document is the Contract Price/Value and is based on the quantity, unit rates and prices quoted and awarded and shall be subject to adjustment based on actual quantities supplied/actual measurement of work done and accepted and certified by the authorised representative of the company unless otherwise specified in schedule of quantities or in contract documents.

3.8 Contract Document

The Contract Document shall mean and include but not limited to the following:

- NIT/Tender Enquiry, QR, Instruction to Bidders, Special Condition of Contract (SCC) of tender, GCC, Technical & Commercial Specifications including relevant annexure and attachments).
- Bids & Proposals Received from Associate including relevant annexure/attachments.
- Letter of Intent (LOI/RC/PO) with agreed deviations from the tender/bid documents.
- All the Inspection and Test reports, Detailed Engineering Drawings.
- Material Dispatch Clearance Certificate (MDCC).
- Minutes of Meeting (MoM)

3.9 Contract Language

All documents, instructions, catalogues, brochures, pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries and any other data shall be in English Language.

The Contract documents and all correspondence between the TPNODL, Third Parties associated with the contract, and the Associate shall be in English language.

However, all signboards required indicating "Danger" and/or security at site and otherwise statutory required shall be in English, Hindi, and local languages.

3.10 Reverse Auction

TPNODL reserves the right to conduct the reverse auction (instead of public opening of price bids) for the products / services being asked for in the tender. The terms and conditions for such reverse auction events shall be as per the Acceptance Form attached in Annexure I. The bidders along with the tender document shall mandatorily submit a duly signed copy of the Acceptance Form as mentioned in the Annexure I as a token of acceptance for the same.

4.0 SCOPE OF WORK

All the activities that are to be undertaken by the Associate to realize the contractual deliverables in completeness form Scope of Work. Following clauses list, but not limited to, major requirements of the scope of work.

The associate shall satisfy himself fully with the details and undertake fully the works as listed in schedule of quantities and conditions, under which the same to be performed. Associate may visit site to equip themselves with all the information required for the execution of work. Unless otherwise stated in the contract, the scope of work shall also include, but not limited to, the following.

The associate shall deliver equipment/material at site/stores, carry out erection, testing and commissioning and put into satisfactory operation as defined in contract. Unloading at site, storage, preservation, security and handling of the items at workplaces till completion of contract is also in scope of work.

The associate shall obtain statutory clearances for the works executed by him.

The associate shall provide comprehensive insurance for entire works for contract value and third party liability insurance to cover all risks till completion of contract.

All transport / lifting/ unloading/ storage/preservation of items at site shall be arranged by the Associate at no extra cost to TPNODL. All these activities shall be performed in line with original equipment manufacturers' recommendations and/or as per best engineering practices, with due consent of TPNODL Engineer-in-charge.

Completeness: Any supplies and services which might have not been specifically mentioned in the Contract but are necessary for the scope mentioned in Special Terms & Conditions and/or completeness of the works at the highest possible level, including any royalties, licence fees & compensation to be paid, whether incurred by the associates or by a third party for the work covered in the scope, regardless of when incurred, shall be supplied/provided by the associate without any extra cost and within the time schedule for efficient , smooth and satisfactory operation and maintenance of the works at the highest possible level under Indian conditions (but according to international standards for facility of this type), unless expressly excluded from the scope of supplies and services in this Contract.

TPNODL have the right, during the performance of the Contract, to change the scope and/or technical character of the Project and/or of the supplies and services stipulated in the Contract by submitting a request in writing to the Associate. The Associate shall, within fifteen days of receipt of such request from the TPNODL, provide Purchaser with a reasonably detailed estimate of the cost of the change outlined in the request.

In the event, TPNODL requests a change, the Contract price and time shall be adjusted upwards or downwards, as the case may be and shall be mutually agreed to. The associate shall not be entitled to any extension of time unless such changes adversely affect the time schedule.

The Associate shall not proceed with the changes as requested till adjustment of contract price and time schedule where so applicable in terms of or otherwise directed by the TPNODL.

4.1 Indemnity

Associates shall undertake to fully indemnify TPNODL (also referred to as the Company in the GCC) against all kinds of liabilities or damages, of whatsoever nature, including compensation arising from any accident to the person or property of those in Associate's employment or to any other person or properties including those of TPNODL, arising due to reasons attributable to any, act, omission of the Associate the Associates, for the entire period of contract including period of guarantee.

Within 7 days of award of work, the Associates shall submit Indemnity Bond in the format as per Annexure-D to Order Issuing Authority.

In case of Labour /Erection/ Services Contracts having value more than Rs 2 Cr per Annum, Associates shall submit Indemnity Bond on Rs 100/- Non Judicial Stamp Paper in the format as per Annexure- D to Order Issuing Authority.

4.2 Display of Notice Boards at Work Sites

The Associate shall put up display notice board at each project site where the works are in progress indicating the information given below:

- Name of the Project.
- Estimated Cost of Project.
- Date of Commencement.
- Expected date of completion.
- Name of Associate and his telephone number.
- Name of Engineer-in-Charge and his telephone number.

4.3 Disposal of Waste at Site

Significant quantities of waste are generated during the execution of project and an integrated approach for effective handling, storage, transportation and disposal of the same shall be adopted. This would ensure the minimization of environmental and social impact in order to combat the climate change.

The associates shall follow the below criteria for disposal of waste at site during the execution of project.

- Associate shall ensure that the detailed project plan include the waste management, segregation of all designated waste material (Recyclable/Non-Recyclable), collecting, storing, disposing and transferring the same to pre-arranged facility/destination in timely and safe manner as per environmental legislations during the execution of project. The project plan shall also include the innovative construction practice to eliminate or minimize waste, protect surface/ground water, control dust and other emissions to air and control noise during the execution of project. The copy of same shall be given to EIC before the commencement of project.

- The purchase policy of BA shall encourage the procurement of material with recycled and minimum packaging of goods during delivery. Associate shall provide the appropriate means for site to site transportation of materials to avoid damage and litter generation.
- Associate shall educate and inform to its project team about the requirement and responsibilities for waste minimization and disposal in general and provide training of practices that support this. Waste management should be treated like a safety program.
- In the event that area of contaminated or biological hazard is identified, Associate shall ensure that plant, equipment, personnel and any activity associated with the work is carried out in consultation with EIC of TPNODL.
- Associate shall ensure that the residents living near the site are kept informed about proposed working schedule and shall informed timings and duration of any abnormal noise full activity that is likely to happen.
- Associate shall ensure the regular maintenance and monitoring of vehicles and equipment for efficient fuel use so that emissions and noise are within acceptable limits to avoid air pollution.

4.4 Deployment of Work Force

Associate shall deploy adequate labour, as considered necessary by TPNODL for execution of the contract including Sundays and Holidays whenever required to do so with no extra cost to TPNODL. However, prior permission shall be taken from the site Engineer to carry out the work beyond normal working hours or on Sundays and Holidays. Female employees shall not be deployed beyond normal working hours/days and no child labour shall ever be deployed. Associate shall depute full time qualified and experienced engineers to supervise the work at site. All such staff shall be maintained from commencement to completion of all works to the entire satisfaction of the Engineer-in-Charge. Associate's employees deployed for the works under this contract will not be considered in Company's employment at any time. Associate shall continue to be responsible for all such employees, their safety, all types of statutory compliances related thereto and in any other manner whatsoever. The company will stand indemnified by the Associate in respect of all the above. At the same time Company upon noticing any breach or default on any statutory compliances, may at their sole discretion, decide to act in a manner as deemed fit at the risks and costs of the Associate.

TPNODL shall have the right to instruct the Associate to change the Sub- Associates or skilled /unskilled workers in case the conduct, the workmanship or speed of the work is not satisfactory.

Associates shall submit duly signed undertaking regarding engagement of competent staff / employee commensurate to the nature of job to Engineer–in–charge in the format attached as Annexure – G.

4.5 Damages of Properties

The Associates shall take necessary steps to ensure that the equipment and installations of the Company, Third parties, including other utility services like water supply pipelines; open drains telephone cables etc. are not damaged during execution of the works. The Associates shall be responsible for all such damages and shall have to repair/ replace and/or compensate for the entire claims in respect of such damages at its own cost.

4.6 Issuance of Materials

The material issued to the Associate shall be in the custody of the Associates who shall be fully responsible for the same. After completion of the works, the Associates will reconcile the material. Any cost of material which is short or damaged/lost will be deducted from Associate bill/ deposits.

4.7 Company's Right To Use Works

If Taking Over Certificate is delayed for any reason, for which TPNODL's decision shall be final and binding upon the Associate, the Company shall be entitled to use the works or portion thereof without affecting Associate's responsibility and liability to complete the balance works as per company's directives from time to time, though Associate shall be afforded reasonable opportunity by the company to enable Associates to complete all balance works required for issuance of 'Taking Over Certificate' by the company.

4.8 Rights of TPNODL to vary the scope work

TPNODL shall have the right, during the performance of the Contract, to change the scope and/or technical character of the Project and/or of the supplies and services stipulated in the Contract by communicating the intent to do so in writing to the Associate. On receipt of such communication the Associate shall, within the time frame specified in the contract shall provide TPNODL with a reasonably detailed estimate of the cost of the change in scope outlined in the TPNODL communication. The change in the Contract price and time shall be revised upwards or downwards, as the case may be, and shall be mutually agreed to. The Associate shall not be entitled to any extension of time unless such changes adversely affect the time schedule.

The Associate shall not proceed with the changes in the scope of work till such time revision of Contract price and time schedule are approved and communicated to the associate by TPNODL.

Any change in the Scope of Work and/or Terms & Conditions of the order shall be intimated by TPNODL through an amendment to the contract. The amendment shall be treated valid only if signed by the authorized signatory of the original contract.

4.9 Technical Evaluation

TPNODL reserves the right to assign scores to different parameters including but not limited to the following while evaluating the bids. TPNODL reserves the right to change the parameters and score without prior information to the associates:

S. No.	Evaluation Parameter	Max. Score
A	**For bidders already Registered with TPNODL**	**100**
A.1.	**No violation of statutory compliances in last 1 year.** Deduction of 2 marks for each instance of violation in last 1 year. **Safety** Deduction of 2 marks for each instance of safety violation in last 1 year. Deduction of 5 marks for each reported Non-Fatal Accident in last 1 year In case of any reported fatal accident: *ZERO MARKS*	20 20
A.2.	**Timely Execution of Contracts** Total Achieved Score = {30 – 3 x (Avg. percentage LD deductions in last 2 years)	30
A.3.	**Legal Issues with TPNODL**	30

S. No.	Evaluation Parameter	Max. Score
	Zero instances of Arbitration procedures / Court Cases / PBG forfeitures in last 2 years: 30 marks else 'Zero' marks	
B	**Bidders new to TPNODL**	**100**
B.1.	**Visits** Client Site Visit where the bidder is providing similar services. The visits as above shall be arranged by the bidder. However, all costs towards conveyance, lodging, boarding etc. shall be borne by TPNODL. The score assigned by TPNODL based on the above visits shall be final and binding on the bidder (Vendor Evaluation form attached as annex L). **Safety** Score achieved against BA Safety Management System Questionnaire	30 20
B.2.	**Client Referrals** At least 3 nos. Customer References for similar services in last 3 years. All customer references shall be either of the following: ▪ Govt. Organizations/ PSUs/ Power Distribution Utilities. ▪ Private Organizations with an annual turnover of >= 500 cr. PO copies or Completion Certificates will be admissible. Each reference: 10 marks	30
B.3.	**Blacklisting Information** Not blacklisted / debarred by any reputed organization/utility in last 2 years: 20 marks else 'Zero' marks	20

- Bidder shall be considered as technically qualified if they are able to achieve a technical score of >70 marks on the above parameters. 'A' or 'B'.
- The bidder must have the PF and ESI registration. In case it is not there (provided the bidder is not exempted from the PF and ESI), bidder shall not be evaluated on the above parameters and will be considered as disqualified.

5.0 PRICES/RATES/TAXES

The Prices and Rates are inclusive of cost of materials supplied as per contract terms and for which MDCC is issued by TPNODL and to the extent required for completion of works, cost of service executed as per schedule of quantities, cost of testing as per contract terms, cost of documentations including all relevant test certificates and other supportive documents to be furnished as per contract terms. The rates shall remain firm till actual completion of contract.

The Prices/Rates are inclusive of all taxes, levies, cesses and duties, particularly Goods and Services Tax as applicable. All government levy / taxes shall be paid only when the invoice is submitted according to the relevant act.

The prices shall remain unchanged irrespective of TPNODL making changes in quantum in all or any of the schedules of items of contract.

5.1 Changes in Statutory Tax Structure

If rate of any or all of the statutory taxes and duties applicable to the contract changes, such changes shall be incorporated by default if the changes occur within the contract execution time and shall be applicable if the contract is executed by the Associate within the Contract Execution Time.

For execution of contracts beyond contract execution time, where the delay is not attributable to TPNODL no upward revision in tax /duties shall be considered irrespective of changes in the statutory tax structure either within the contract execution time or beyond. However, in such cases, benefits due to any downward revisions in statutory tax rates shall be passed on to TPNODL.

6.0 TERMS OF PAYMENT

6.1 Pre-Requisites for Payment

- Associate should have completed execution of that part of contract, for which payment is sought, to the satisfaction of TPNODL's Engineer-in-Charge responsible for the contract and obtained certification for execution of the work.
- Associate has taken C-3 Form
- Associate has undertaken joint measurement of the work executed along with TPNODL's Engineer-in-charge.
- Associate's bills/invoices submitted have been certified by Engineer-In-Charge.

6.2 Bills & Invoices

Unless specified otherwise in the special conditions of contract, Associate shall raise not more than one invoice/contract per month for the services rendered in the prescribed Tax Format and the invoice shall be submitted within 15 days of the following month at EIC, TPNODL**.**

All Bills shall be supported by joint measurement of work done, quality test report and a copy of wage sheet, if applicable (showing proof of having disbursed wages as per applicable law) and a copy of statement substantiating that statutory payments having been affected.

Bills/ invoices shall mention Associate's GST Registration Number, PAN number as applicable.

Final bill submission after completion of project or execution of job must be within 30 days from the actual date of completion/execution of work awarded.

6.3 Payment & Statutory Deductions

Payment shall be released within 45 days from the submission of the bills. The associate shall submit "No Demand Certificate" in the format as per Annexure-D at the time of receipt of full and final payment. In case any non-compliance to contract conditions comes to TPNODL's notice, TPNODL will be entitled to deduct 30% of estimated wages plus 20% of wages as TPNODL's overheads. Associates would be obliged to provide the copy of monthly wage sheet in any case, failing which no payment shall be made. TPNODL at their sole discretion may deposit the PF etc. with statutory authorities. TPNODL will deduct the amounts of TDS as per statutory requirement under the income tax act and the DVAT Act and certificates (wherever applicable) will be issued to associate accordingly

In case of non-submission of PAN No TDS @ 20% shall be deducted from all payable amounts for which no TDS certificate shall be issued. TDS once deducted as above shall not be revised in any condition.

6.3.1 Statutory Deductions

TPNODL will deduct the amounts of TDS, TCS as per statutory requirement under the income tax act, the Goods and Services tax act, BOCW Act, or any other applicable tax act and certificates (wherever applicable) will be issued to associate accordingly.

For consumption of TPNODL's Water and Electricity by Associate for execution of Contract, Associate shall pay 0.5% & 1.0% respectively of contract value and it shall be deducted from the running bills.

The Engineer-in-Charge as stated in the Order shall be responsible for certification of the work executed and the bills. Bills (including original) shall be submitted in triplicate at Bill Office of CFO, TPNODL located at TPNODL located at TPNODL Corporate Office, Januganj, District Balasore ,Odisha, India – 756019.

6.4 Quantity Variation

Payment will be made on the basis of actual quantity of supplies/actual measurement of works accepted by TPNODL and not on the basis of contract quantity.

6.5 Full and Final Payment

Full & Final Payment in all contracts shall be made subject to the associate submitting "No Demand Certificate", in the format as per Annexure-C.

7.0 MODE OF PAYMENT

Payment shall be made NEFT or RTGS whichever of the two modes chosen by the Associate, in favour of Associate's Bank Account on TPNODL records, on whose name Contract has been issued. Those Associates opting for the RTGS mode shall submit the details of Bank Account and other details as per annexure J. Further, for any payments made, TPNODL is not responsible for any consequences/disputes Associate have among the owners channel partners, sub-Associates and all such dispute/concerns shall be settled solely by the Associate.

In case of service contracts, mostly the quantities of items indicated are estimated and preliminary. However, payments shall be made on the basis of actual quantity of work carried out and measured jointly by the Company and the Associate. Associates shall be responsible to organize joint measurements of works with TPNODL Engineer-in-Charge before raising any bill of work done. In the event Associate fails to do so, TPNODL at their sole discretion, may take measurements of work done and proceed as deemed fit and in such an event Associate's right to lodge any subsequent claim shall stand forfeited.

8.0 SECURITY CUM PERFORMANCE DEPOSIT

Associates shall submit within 15 days from the effective date of issue of PO/RC, Security cum Performance Bank Guarantee (SPBG) in the format as per Annexure B of this document from banks acceptable to TPNODL for:

- 3% of the RC value as per prevailing Govt. Orders however same can be change or enhanced in case of any change in Govt. direction BA is supposed to be paid the difference of PBG amount as and when demanded by TPNODL. This shall remain valid till the Guarantee period plus one month.
- For PO/RC values less than Rs. 5 lacs, Associate may request for deduction of amount equivalent to SPBG value from their first invoice. Such amount shall be withheld by TPNODL while processing the invoice and shall be released after completion of Guarantee Period plus one month.
- For PO/RC values less than Rs. 3 lacs, the clause (8.0) for Security cum Performance Bank Guarantee (SPBG) shall not be applicable.
- In case of RC (Rate Contract) after the expiry of RC validity, Associate shall have to submit SPBG. However, the Associate has the option to re-submit the SPBG as per actual RO (Release Order) value issued against the RC, valid for Guarantee Period plus one month. The Guarantee Period shall be considered as per the

last RO issued against the said RC. The original SPBG as submitted against the RC shall be released on submission of the new SPBG to TPNODL. Alternatively, Associate may extend the validity of original SPBG only till the requisite period, i.e. guarantee period plus one month.

9.0 STATUTORY COMPLIANCE

9.1 Compliance to Various Acts

Associate should ensure adherence to the Anti-Lobbying, Debarment, Drug-Free, Child Labour, Factories Act and Shop and Establishment Workplace Certification, Registration details under GST, Sales Tax and Works Contract Tax Act.

Associate shall bear the entire responsibility, liability and risk relating to coverage of its workforce under different statutory regulations including Workman's Compensation Act, ESI Act, Factories Act, 1948, the Contract Labour (Regulation and abolition) Act 1970, and any other relevant regulations as the case may be. Associate shall also be solely responsible for the payment of all benefits such as Provident Fund, ESI, Bonus, Leave compensation and other benefits as may be applicable under applicable labour laws, etc. as per the various statutory regulations and shall keep TPNODL indemnified in this regard against any such claim and provide documentary evidences of the same to TPNODL. TPNODL shall be entitled to, if necessary, make such payment and recover the amount from Associate.

Associate should ensure adherence to all applicable laws, rules and regulation applicable under this contract from time to time. In case of violation any risk, costs etc. shall be in associates account and keep TPNODL indemnified always till completion of contracts.

9.2 SA 8000

TPNODL expects its Associates to follow guidelines of SA 8000:2014 on the following aspects

1. Child Labour
2. Forced or Compulsory Labour
3. Health & Safety
4. Freedom of Association & Right to Collective Bargaining
5. Discrimination
6. Disciplinary Practices
7. Working Hours
8. Remuneration
9. Management System

9.3 Affirmative Action

TPNODL appreciate and welcome the engagement/employment of persons from SC/ST community or any other deprived section of society by their business associates.

Relaxation in Contract Clauses under Affirmative Action for SC/ ST Business Associates**

TPNODL believes that inclusive growth is the key to sustainable development, and to promote the same Policy on Affirmative Action for Scheduled Caste & Scheduled Tribe Communities has been adopted across the company.

Under the same pre-text, and to promote entrepreneurship among SC/ST community TPNODL has taken initiative by proposing relaxations in contract clauses as per below:

SL. No	Initiative	for SC/ ST BA's	Guideline Document
1	Tender Fees	100% waiver for SC/ST community	All Open Tenders
2	Earnest Money Deposit	50 % relaxation of estimated EMD value	All limited and Open Tenders
3	Performance Bank Guarantee	50% relaxation in PBG for order value above 50 lacs else 25% relaxation	All limited and Open tenders
4	Turnover	25% relaxation in company turnover unde qualifying requirement criteria	All Open Tenders

****Classification of BA s under SC/ST shall be governed under following guidelines:**

- Proprietorship/ Single Ownership Firm: Proprietor of the firm should be from SC/ST community. Governing document shall be duly audited latest balance sheet bearing name of all the partners.
- Partnership Firm: Only such firms shall qualify which have SC/ST partners holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Partnership Deed and duly audited latest balance sheet bearing name of all the partners.
- Private limited company: Only such firms shall qualify which have SC/ST directors holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Memorandum of Understanding (MoU) and/or Article of Association (AoA).

Certification from SC/ST commission shall be required for deciding upon SC/ST status of a person.

9.4 Compliance to Labour Laws

Bidder needs to ensure compliance to applicable labour laws including timely disbursement of wages. In case wages are not disbursed as per the stipulated timelines, then TPNODL shall pay the wages to BA employees on behalf of BA. Apart from deducting the amount of wages paid, TPNODL shall deduct an additional service charge equivalent to 25% of the wages paid from the payment due to BA.

9.5 Compliance to Construction and Demolition Waste Management Rules & Environment (Protection) Amendment Rules

BA is liable to follow the Construction and Demolition Waste Management Rules- 2016, Environment (Protection) Amendment Rules- 2018 and Guidelines on dust mitigation measures in handling construction material and C&D wastes issued by CPCB.

Following are some main points of above Rules/Guidelines for Construction work, cable laying jobs etc.

1. Barricading to be provided at site to cover complete area.
2. Construction material and waste should be inside the closed area made by using barricading.
3. Water sprinkling/fine spray from nozzles to be done to suppress the dust.

4. The board of Dust mitigation measures shall be displayed at site for public viewing with required details.
5. Loose sand or soil and construction material that causes dust shall be covered.
6. Transport material that are easily wind borne need to be covered by a sheet made of either jute, tarpaulin, plastic or any other effective material.
7. All areas for storing C&D waste/construction material to be demarcated and preferably barricaded particularly those materials that have potential to be dust borne.
8. Grinding and cutting of building materials in open area shall be prohibited.
9. Construction material and waste should be stored only within earmarked area and road side storage of construction material and waste shall be prohibited.
10. No uncovered vehicles carrying construction material and waste shall be permitted.
11. Construction and demolition waste processing and disposal site shall be identified and required dust mitigation measures to be notified at the site.

10.0 QUALITY

10.1 Knowledge of Requirements

The Associate shall be deemed to have carefully examined and to have knowledge of the equipment, the general and other conditions, specifications, schedules, drawings, etc. forming part of the Contract and also to have satisfied himself as to the nature and character of the work to be executed and the type of the equipment and duties required including wherever necessary of the site conditions and relevant matters and details. Any information thus procured or otherwise obtained from TPNODL/Consultants shall not in any way relieve the Associate from his responsibility and executing the works in accordance with the terms of contract.

10.2 Adherence to Rules & Regulations

The Associate shall procure and/or fabricate/erect all materials and equipment in accordance with all requirements of Central and State enactment, rules and regulations governing such work in India and at site. This shall not be construed as relieving the Associate from complying with any requirement of TPNODL as enumerated in the Contract which may be more rigid than and not contrary to the above mentioned rules, nor providing such construction as may be required by the above mentioned rules and regulations. In case of variance of the Technical Specification from the laws, ordinance, rules and regulations governing the work, the Associate shall immediately notify the same to the TPNODL. It is the sole responsibility of the Associate, however, to determine that such variance exists. Wherever required by rules and regulations, the Associate shall also obtain the statutory authorities' approval for the plant, machinery and equipment to be supplied by the Associate.

10.3 Specifications and Standards

The Associate shall follow all codes and standards referred in the Contract Document. Codes and standards of other may be followed by the Associate with the prior written approval of TPNODL, provided materials, supplies and equipment according to the standard are equal to or better than the corresponding standards specified in the Contract.

Brand names mentioned in the Contract documents are for the purpose of establishing the type and quality of products to be used. The Associate shall not change the brand name and qualities of the bought out items without the prior written approval of the TPNODL. All such products and equipment shall be used or installed in strict accordance with original manufacturer's recommendations, unless otherwise

directed by the TPNODL. In any circumstances the codes, specimen and standards prescribed by any government agency should not be violated.

11.0 SAFETY

All Associates shall strictly abide by the guidelines provided in TPNODL's Contractor Safety Management System (CSMS) as applicable at all stages during the contract period. Associate shall execute the contracts ensuring the following in and as order of priority:

- Safety of Human Beings.
- Safety of Equipment/Assets.
- Timely Completion of Contract.

Safety related requirements as mentioned in our Contractor Safety Management System is attached as annexure K and is an integral part of this GCC. TPNODL may revise this CSMS document as a when required and the revised version shall be applicable on all contracts – current or future.

12.0 GUARANTEE

12.1 Guarantee of Performance

Associates shall stand guarantee that the equipment and material supplied/service or work rendered under the contract is free from design, manufacturing, material, construction, erection & installation and workmanship & quality defects and is capable of its due, rated and intended quality performance, as an integrated product delivered under the contract or a specific period termed as Guarantee Period(as elaborated elsewhere in this clause) The Associate should also guarantee that the equipment/material is new and unused except for the usage required for the tests and checks required as part of quality assurance.

12.2 Guarantee Period

The Guarantee Period will be equipment/service/work specific and shall be as specified in the Standard Specifications of TPNODL for the equipment/material/service/work and where standard specifications are not part of contract documents or guarantee period is not specified in the standard specifications,, the guarantee period shall be as per the Special Terms and Conditions of the Contract. In case of no mention of the guarantee period in standard specifications or SCC Guarantee Period will be 12 Months from the Date of Commissioning or 24 months from the date of delivery of final lot of supplies made, whichever is earlier.

12.3 Failure in Guarantee Period (GP)

If the equipment and material supplied/service or work rendered under the contract fails to perform its due, rated & intended quality performance, during the Guarantee period, the associate is liable to undertake repair/rectify/replace the equipment and material supplied/service or work rendered under the contract within time frame specified in the SCC or elsewhere in the contract documents at associate's cost to make the equipment and material supplied/service or work rendered under the contract of performing its due, rated and intended quality performance. If Associate fails to repair/rectify/replace the equipment or material supplied/service or work rendered under the contract, failed in Guarantee Period, TPNODL will be at liberty to get the same done at Associate's risks and costs and recover all such expenses plus the TPNODL's own charges (@ 20% of expenses incurred), from the Associate or from the "Security cum Performance Deposit" as the case may be.

If during the Warranty/ Guarantee period some parts of the supplies are replaced owing to the defects/ damages under the Warranty, the Warranty period for such replaced parts shall be until the expiry of twelve months from the date of such replacement or renewal or until the end of original Guarantee period, whichever is later.

Any repairs during the Guarantee Period shall be carried out by the Associate within 30 days of reporting the issue to Associate by TPNODL. However, if replacement of the Equipment is required, Associate shall notify the same to TPNODL within 7 days of reporting the issue by TPNODL. Thereafter, the total time for supply of new equipment/ material shall be equal to the original delivery period of that equipment/ material as specified in the Contract. In case the Associate is not able to rectify/ replace the faulty equipment/ material within the stipulated timelines as mentioned above, penalty shall be levied as per the Liquidated Damages clause mentioned in this document. The penalty amount shall be recovered from the payment due to the vendor or by encashment of the SPBG as the case may be.

12.4 Cost of repairs on failure in GP

The cost of repairs/rectification /replacement, apart from the actual cost of repairs/rectification/replacement is also inclusive of all associate costs of required transportation, site inspection /mobilization/dismantling and re-installation costs as applicable. The Associate has to ensure that the interruption in the usage of intended purpose of the equipment is minimized to the maximum extent In lieu of the time taken for repairs/rectification/replacement.

12.5 Guarantee period for Goods Outsourced

If the Associate outsources partly equipment/materials/services from third party as mutually agreed upon at the pre award stage of contract, TPNODL shall have the benefit of any additional guarantee period if provided by the third party for the part supplied/executed by them.

12.6 Latent Defect

Hidden defects in manufacturing or design of the product supplied and which could not be identified by the tests conducted but later manifested during operation of the equipment are termed as latent defects. Associates shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Company.

13.0 LIQUIDATED DAMAGES

a) For Services which are of standalone use, multiple in quantities and having a single final completion schedule, Liquidated damages shall be levied without prejudice to any of the other contractual rights of TPNODL, as described below:

For delay of each week and part thereof from the completion schedule specified in the contract, 1% of contract value corresponding to unexecuted work, provided full execution is done within 130% of the original contract time. If full contractual service/work rendered is not completed within 130% of contract time for execution, TPNODL has the right to levy LD on the entire contract value, subject to a maximum of 10% of the total contract value.

b) For services having phased completion schedule(milestone) as per contract terms, standalone use and multiple in quantities, Liquidated damages shall be levied without prejudice to any of the other contractual rights of TPNODL, as described below:

For the purpose of calculating and applying LD, each milestone shall be considered separately. For delay of each week and part thereof, from the execution of work schedule specified in the milestone, 1% of the contract value corresponding to the unexecuted work of the milestone, subject to a maximum of 10% of the total contract value of that milestone shall be levied. However, if full contractual service/work rendered is not completed within 130% of contract time for execution, TPNODL has the right to levy LD on the entire contract value, subject to a maximum of 10% of the total contract value. Deduction of LD shall be on landed cost i.e. contract value inclusive of taxes and in pursuant statutory compliance GST would be applicable at the stipulated rate and the same shall be borne by Business Associate. In case of LD deduction, a GST invoice shall be issued by TPNODL as a proof of deduction/ recovery.

13.1 LD Waiver Request

Any request of LD waiver shall be submitted within thirty (30) days of deducting LD. Request submitted beyond the timeline shall not be entertained. The TPNODL management will review on the LD Waiver Request on the facts and will decide about the LD Waiver which may be part or the % of the LD imposed, however the TPNODL's management decision will be full and final.

13.2 Material Recovery

In case of any recoveries for materials or services (for material free issued by TPNODL and not reconciled by BA or for services claimed and paid in excess at the time of running bills), the total cost which shall be recovered from the BA, shall be the gross amount of material or services (i.e. including taxes) plus applicable taxes as prevailing at the time of such recoveries.

14.0 ASSIGNMENT OR SUBCONTRACTING

Associates shall not assign/subcontract/outsource the schedule of activities of contract TPNODL enters with the associate, in part or full, without TPNODL's prior written approval. However, outsourcing of materials/equipment/services by Associate to make the integrated product for which TPNODL's has placed the contract with the associate from suppliers, makes and agencies which have been mutually agreed upon during contract pre-award stage is permitted subject to following conditions.

In such cases where outsourcing is done by the Associate

- Shall ensure that outsourced suppliers comply with the technical and financial qualification requirements specified by TPNODL in the contract document

- Shall furnish all particulars about the proposed outsourcing agencies and the details of the goods/services/work outsourced to the Associate while seeking approval of TPNODL for inclusion for outsourcing. The Associate shall give approval or shall refuse approval in writing within thirty (30) days of receipt of such request. However, the Associate shall not be entitled for any additional contract execution time whatsoever in lieu of the process for approval for outsourcing agencies, and shall be held responsible for any delay in the project execution time.

- Shall remain jointly and severally liable for any action, deficiency, and/or negligence on the part of his outsourcing agencies. The approval extended by the Associate to outsourcing agencies recommended by the Associate shall not discharge the later from his Contract obligations.

Shall submit to the Associate unpriced copies of purchase orders with technical specifications included in the orders, placed on outsourcing agencies as soon as the respective orders have been placed by the Associate.

15.0 UNLAWFUL ACTIVITIES

The Associate shall have to ensure that none of its employees are engaged in any unlawful activities (whether covered under the scope of the present GCC or not) subversive of the TPNODL's interest failing which appropriate action (legal or otherwise) may be taken against the Associate by the TPNODL, in accordance with the terms of the present GCC.

16.0 CONFIDENTIALITY

Associate and its employees or representatives thereof shall strictly maintain the confidentiality of various information they come across while executing the contract as detailed below.

16.1 Documents

All maps, plans, drawings, specifications, schemes and other documents or information related to the Contract/Project and the subject matter contained therein and all other information given to the Associate by the TPNODL in connection with the performance of the contract shall be held confidential by the Associate and shall remain the property of the TPNODL and shall not be used or disclosed to third parties by the Associate for any purpose other than for which they have been supplied or prepared. The Associate may disclose to third parties, upon execution of confidentiality agreements, such part of the drawings, specifications or information if such disclosure is necessary for the performance of the Work provided such third parties agree in writing to keep such information confidential to the same extent and degree as provided herein, for the benefit of the TPNODL.

16.2 Geographical Data

Maps, layouts and photographs of the unit/plant including its surrounding regions showing vital installation for national security of country or those of TPNODL shall not be published or disclosed to the third parties or taken out of the country without prior written approval of the TPNODL and upon execution of confidentiality agreements satisfactory to the TPNODL with such third parties prior to disclosure.

16.3 Associate's Processes

Title to secret processes if any developed by the Associate on an exclusive basis and employed in the design of the equipment shall remain with the Associate. TPNODL shall hold in confidence such processes and shall not disclose such processes to the third parties without prior approval of the Associate and execution by such third parties of secrecy agreements satisfactory to the Associate prior to disclosure. Upon completion of contract, such processes shall become the property of the TPNODL. Title to technical specifications, drawings, flow sheets, norms, calculations, diagrams, interpretations of test results, schematics, layouts and such other information, which the Associate has supplied to the TPNODL under the Contract shall be passed on to the TPNODL. The TPNODL shall have the right to use these for construction, erection, start-up, Trial Run, operation, maintenance, modifications and/or expansion of the works including for the manufacture of spare parts.

16.4 Exclusions

The provision of Clauses 16.1 to 16.3 shall not apply to information:

- Which at the time of disclosure are in the public domain which later on become part of public domain through no fault of the party concerned, or
- Which were in the possession of the party concerned prior to disclosure to him by the other party, or

- Which were received by the party concerned after the time of disclosure without restriction on disclosure or use, from a third party who did not acquire such information directly or indirectly from the other party or has no obligation of confidentiality for such information.

16.5 Violation

In case of violation of this clause, the Associate is liable to pay compensation and damages as may be determined by the competent authority of TPNODL.

17.0 INTELLECTUAL PROPERTY RIGHTS

If, in the course of performance of its functions and duties as envisaged by the scope of the present GCC, the Associate acquires or develops, any unique knowledge or information which would be covered, or, is likely to be covered within the definition of a trademark, copyright, patent, business secret, geographical indication or any other form of intellectual property right, it shall be obliged, under the terms of this present GCC, to share such knowledge or information with the TPNODL. All rights, with respect to, or arising from such intellectual property, as afore mentioned, shall solely vest in TPNODL.

Moreover, the Associate undertakes not to breach any intellectual property right vesting in a third party/parties, whether by breach of statutory provision, passing off, or otherwise. In the event of any such breach, the Associate shall be wholly liable to compensate, indemnify or make good any loss suffered by such third party/parties, or any compensation/damages arising from any legal proceeding/s, or otherwise. No liability of TPNODL shall arise in this respect, and any costs, damages, expenses, compensation payable by TPNODL in this regard to a third party/parties, arising from a legal proceeding/s or otherwise, shall be recoverable from the Associate.

18.0 INDEMNITY

The Associate shall at all times indemnify, keep indemnified and hold harmless the TPNODL and its officers, directors, employees, affiliates, agents, successors and assigns against all actions, claims, demands, costs, charges and expenses arising from or incurred by reason of any infringement of patent, trade mark, registered design, copy rights and/or industrial property rights by manufacture, sale or use of the equipment supplied by the Associate whether or not the TPNODL is held liable for by any court judgement. In this connection, the TPNODL shall pass on all claims made against him to the Associate for settlement.

The Associate assumes responsibility for and shall indemnify and save harmless the TPNODL from all liability, claims, costs, expenses, taxes and assessments including penalties, punitive damages, attorney's fees and court costs which are or may be required to be paid by the TPNODL and its officers, directors, employees, affiliates, agents, successors and assigns arising from any breach of the Associate's obligations under the Contract or for which the Associate has assumed responsibilities under the Contract including those imposed under any local or national law or laws, or in respect to all salaries, wages or other compensation for all persons employed by the Associate or his Sub-Associates or suppliers in connection with the performance of any work covered by the Contract. The Associate shall execute, deliver and shall cause his Sub-Associate and suppliers to execute and deliver, such other further instruments and to comply with all the requirements of such laws and regulation as may be necessary there under to conform and effectuate the Contract and to protect the TPNODL.

The TPNODL shall not be held responsible for any accident or damages incurred or claims arising, due to the Associate's error there from prior to completion of work. The Associate shall be liable for such

accidents and after completion of work for such accidents as the case may be due to negligence on his part to carry out Work in accordance with Indian laws and regulations and the specifications set forth herein.

19.0 LIABILITY & LIMITATIONS

19.1 Liability

Except for any specific liability which may be identified in the Contract and which may be payable hereunder, Associate shall not be liable for any special, incidental, indirect, or consequential Damages or any loss of business Contracts, revenues or other financial loss (or equivalents thereof no matter how claimed, computed or characterized) arising out of or in connection with the Performance of the Work or supply of Goods ***unless caused by Associate's negligence, willful misconduct or breach of contract.***

If the Associate is a joint venture or consortium, all concerned parties shall be jointly and severally bound to the TPNODL for the fulfillment of the provisions of the Contract. The consortium or the joint venture shall designate one party as their leader, who will be the coordinator between the parties and TPNODL. The constituents & leader of the consortium or joint venture shall not be changed without the prior consent of TPNODL.

TPNODL shall have no liability or any special, incidental, indirect or consequential Damages for any loss of Business Contracts, revenues or other financial loss arising out of this Contract.

19.2 Limitation of Liability

The total liability of Associate against any contract shall be limited to the Total All Inclusive Contract Value.

20.0 FORCE MAJEURE

Force Majeure applies if the performance by either Party ("the Affected Party") of its obligations under Contract is materially and adversely affected.

"Force Majeure" shall mean any event or circumstance or combination of events or circumstances referred below and their consequences that wholly or partly prevents or unavoidably delays any Party in the performance of its obligations under this Agreement, but only and to the extent that such events and circumstances are not within the reasonable control, directly or indirectly, of the Affected Party and could not have been avoided even if the Affected Party had taken reasonable care:

- Act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, embargo, blockade, revolution, riot, bombs, religious strife or civil commotion, etc.
- Action or Act of Government or Governmental agency for which remedy is beyond the control of the affected parties.
- Any act of God.

Note: Causes like power breakdown/ shortages/fire/strikes, accidents etc. do not fall under Force Majeure.

Time being the essence of the Contract, if either party is prevented from the performance of its obligations in whole or in part due to an event of Force Majeure, then provided Notice of happening of any event by the Affected Party is given to the other party within seven (7) days from the date of occurrence of such event, which DIRECTLY has impact on works and submitted details and quantum of resulting effect, but at the same time had made all possible efforts to mitigate and overcome effects

thereof, the Affected Party's performance under this Contract shall be suspended until such event ceases and the Scheduled Completion shall be delayed accordingly.

If Force Majeure event(s) continue for a period of more than three months, the parties shall hold consultation to discuss the further course of action.

Neither party shall be considered to be in default or in breach of its obligation under the Contract to the extent that performance of such obligation by either party is prevented by any circumstances of Force Majeure which arise after effective date of Contract.

Neither party can claim any compensation from the other party on account of Force Majeure.

21.0 SUSPENSION Of CONTRACT

21.1 Suspension for Connivance

TPNODL may, at any time and at its sole option, suspend execution of all or any portions of the schedule of items of contract to be supplied/work to executed by Associate under the contract by providing to the Associate at least two business days written notice for contracts having contract completion period less than sixty days and at least seven business day notice for all other contracts.

Upon receipt of any such notice, the Associate shall respond as follows as applicable as per contract construction.

- Immediately discontinue further supply of material/goods specified in the suspension notice for supply contracts
- Immediately discontinue further service/work and supply of materials of those services/materials/work specified in the suspension notice for service /composite contract
- Promptly make every reasonable effort to obtain suspension, upon terms satisfactory to TPNODL, of all orders, outsourcing arrangements, and rental Contracts to the extent that they relate to performance of the portion of Work suspended by the notice.
- Protect and maintain the portion of the service/Work already completed, including the portion of the Work suspended hereunder, unless otherwise specifically stated in the notice.
- Continue delivering/carrying out the supply/service/work items as per contract conditions, which do not fall under purview of the suspension notice.

On receipt of resumption notice from TPNODL, the Associate shall resume execution of contract as specified in the resumption notice, within the time frame specified in the resumption notice.

21.2 Suspension for Breach of Contract conditions

TPNODL shall suspend execution of whole/or part thereof the contract till such time Associate complies with the conditions stipulated under section clause 22 for breach/default of contract conditions.

21.3 Compensation in lieu of Suspension

If the suspension of the contract in whole or in part is for convenience of TPNODL and not due to any breach of contract conditions by the associate, TPNODL at its discretion shall consider compensating all reasonable additional costs incurred by Associate in lieu of suspension of whole or part of contract, on representation of the Associate providing justified estimates of such additional costs and such estimates are found acceptable and approved by competent authority of TPNODL.

If the suspension of contract in whole or part thereof is due to breach of contract conditions (refer clause 24.3) by the Associate, Associate shall not be entitled for any compensation for any cost incurred in lieu of suspension of whole or part of contract and also shall be liable for compensating all the losses arising to TPNODL in lieu of suspension of contract. Resumption notice shall be subject to the Associate taking corrective action for the breach of contract conditions within the time frame and as per the terms specified in the suspension notice.

22.0 TERMINATION OF CONTRACTS

22.1 Termination for Default/Breach of Contract

The contract / PO shall be subject to termination by TPNODL in case of breach of the contract by the Associate which shall include but not be limited to the following:

a. Withdrawal or intimation by the Associate of its intent to withdraw or surrender the execution / completion of the contracted work /PO or failure in ensuring adherence to any delivery schedules, in deviation of the contract/PO

b. Refusal or neglect on the part of the Associate to supply material/equipment of quantity or quality as specified by TPNODL and within the timeframe as specified in the contract document or refusal or neglect to execute the services/work in terms of the agreed standards of quantity or quality and/or within the timeframe specified in the contract/PO.

c. Failure in any respect to perform any portion of the Work contracted with promptness, diligence, or in accordance with the terms of the contract.

d. Failure to furnish guarantees as specified and /or failure to comply with the terms thereof.

e. Failure to furnish such relevant documents or information within the time specified which may be necessary for due execution / completion of the works and documentation.

f. Liquidation, bankruptcy either voluntary or involuntary OR entering into any composition or compromise with its creditors, or Insolvency.

g. In case any reasonable information has been received by TPNODL that Associate has adopted/ or attempted to adopt any unethical conduct, action in award of the contract /PO or at any time thereafter.

h. Failure to comply with applicable statutory provisions as contained in the contract or failure to comply with the applicable laws.

i. Failure to comply with safety regulations/clauses stipulated in the contract or as may be generally instructed by TPNODL.

If the default or breach as specified under clause 22 (except sub clause g thereof) be committed by the Associate for the first time, TPNODL shall issue, along the with notice of default or breach, a warning notice instructing the associate to take remedial/corrective action within the time frame stipulated in the warning notice and not to repeat the same in future. The timeframe for corrective action by the associate shall be specific to the nature of breach of contract and the same shall not be objected to by the Associate. If the Associate fails to comply with the instructions in the warning notice or in taking corrective action to the satisfaction of TPNODL then TPNODL may terminate the entire or part of contract at its discretion by issuing termination notice without incurring any liability on this ground.

In case the contract is terminated for any breach of the nature specified in clause 24 g stated above, TPNODL shall have the right to terminate all the contracts TPNODL is having with the Associate by issuing termination notice which shall be without prejudice to the other rights of TPNODL available to it under law.

Without prejudice to its right to terminate for breach of contract, TPNODL may, without assigning any reason, terminate the Contract in whole or in part at any time at its discretion while the contract is in force by serving a written notice of two weeks to the Associate.

In the event of TPNODL having proceeded with termination of the contract the associate shall comply and proceed further in the following manner:

a. Associate shall discontinue the supply, on the expiry of the said period of two weeks.

b. Associate shall ensure that no further steps are being taken towards discharge of the obligations, terms and conditions as contained in the contract/PO. This shall include initiation of actions not limited to discontinuation of other allied and associated arrangements which the associate might have entered into with third parties for due discharge of its obligations under the contract with TPNODL.

c. The Associate shall perform thereafter such tasks as may be necessary to preserve and protect the terminated portion of the material/service/work in progress and the materials and equipment at TPNODL sites or in transit thereto. However, the associate shall continue to fulfill its contractual obligations with regard to the part of contract not terminated.

d. It shall be open for TPNODL to conduct a joint assessment with the associate of the material ,supplies, equipment ,works or in general as to the subject matter of the contract in regard to which the associate claims having completed its obligations before or during such termination.

e. It shall be open to TPNODL to seek invocation of the performance bank guarantee or any other guarantee or other security deposit by whatever name called submitted by the associate, which shall not be objected to or protested against by the associate.

In case of termination of the contract the parties agree to be governed inter alia by the following:

a. In case TPNODL exercises its right of termination as stated above the associate shall not dispute or object to the same.

b. The Associate shall be entitled to receive and claim only such payments OR sums of money from TPNODL as may be found payable to it in regard to works executed by it under the terms of the contract and no other claim of any nature whatsoever shall be made by the Associate.

c. All such provisions which the parties have agreed to survive and prevail even after termination of the contract shall remain effective despite the termination.

In the event of such termination, TPNODL may finish the Work by whatever method it may deem expedient, including the hiring of services and /or purchase of material equipment from such third parties as TPNODL may deem fit or may itself provide any labor or materials and perform any part of the Work. The associate undertakes to bear the incremental costs if any paid by TPNODL in such a case attributable to failure on the part of the associate. The Associate in such a case shall not be entitled to receive any further payments and any sums found payable to it may be adjusted by TPNODL against the

amount recoverable from him on this ground. The same shall be without prejudice to other rights available to TPNODL under law against the associate.

Upon the termination of any of the contract due to occurrence of any circumstances provided in clauses stated above and constituting repeated breach or misconduct, TPNODL shall be entitled to bar the associates its agents, affiliates from undertaking any negotiation / tendering, bidding, participation activities concerning TPNODL for a period of two years from date of such termination. The same shall be without prejudice to other rights available to TPNODL.

22.2 Termination for convenience of Associate

Associate at its convenience may request for termination of contract, clearly assigning the reason for such request. TPNODL has full right to accept, reject or partially accept such request. This convenience will be available to associate only after one year from the contract effective date. For this purpose, associate will provide a notice period of 90 days to TPNODL, Associate will have to pay TPNODL a 'termination convenience fee' equivalent to 5% of unexecuted contract value.

22.3 Termination for Convenience of TPNODL

TPNODL at its sole discretion may terminate the contract by giving 30 days prior notice in writing or through email to the Associate. TPNODL shall pay the Associate for all the supplies/ services rendered till the actual date of contract termination against submission of invoice by the Associate to that effect.

23.0 DISPUTE RESOLUTION & ARBITRATION

In case of any dispute or difference the parties shall endeavour to resolve the same through conciliatory and amicable measures within 15 Days failing which the matter may be referred by either party for resolution by the sole arbitrator to be appointed mutually by both the parties. The arbitral proceedings shall be conducted in accordance with Arbitration and Conciliation Act 1996 and the place of arbitration shall be Balasore. The language to be used at proceedings shall be English and the award of the arbitrator shall be final and binding on the parties. The parties shall bear their respective costs of arbitration. The associate shall continue to discharge its obligations towards due performance of the works as per the terms of the contract during the arbitration proceedings unless otherwise directed in writing by TPNODL or suspended by the arbitrator. Further, TPNODL shall continue making such payments as may be found due and payable to the associate for such works.

24.0 Governing laws and jurisdiction

The parties shall be subject to the jurisdiction of the courts of law in Balasore & the writ jurisdiction of Hon'ble High Court of Odisha at Cuttack and any matter arising here from shall be subject to applicable law in force in India.

25.0 ATTRIBUTES OF GCC

25.1 Cancellation

The Company reserves the right to cancel, add, delete at its sole discretion, all or any terms of this GCC or any contract, order or terms agreed between the parties in pursuance without assigning any reasons and without any compensation to the Associates.

25.2 Severability

If any portion of this GCC is held to be void, invalid, or otherwise unenforceable, in whole or part, the remaining portions of this GCC shall remain in effect.

25.3 Order of Priority

In case of any discrepancies between the stipulations in General Conditions of the Contract (GCC) and Special Conditions of Contract (SCC), the GCC shall stand superseded by the SCC to the extent stipulated hereinabove while balance portion of respective clauses of GCC shall continue to be applicable.

26.0 INSURANCE

The Associate shall arrange accident insurance policy for his foreign experts/specialists/personnel deputed to Site and Associate's/his sub-Associates' manufacturing works as well as for his Indian engineers and supervisory staff. The Associate shall also take out for his Indian workmen, where applicable, a separate policy as required under Workmen's Compensation Act.

Associates shall be responsible to suitably insure their entire work-force (to the extent of at least meeting requirements under Workmen Compensation Act) Tools, Plant, Third party liability at the project site, All Risk comprehensive insurance for the entire works (insurance for free issue items will be in TPNODL scope) for total contract value or any other such risks during execution of works, till the works are handed over to the company, in consultation with TPNODL and shall submit copies of such insurances to the Engineer-in-Charge for review / acceptance before commencing the work. Engineer-in-charge must ensure compliance to insurance requirement by Associate before commencement of works. TPNODL shall stand fully indemnified in this respect.

27.0 ERRORS AND OMISSIONS

The Associate shall be responsible for all discrepancies, errors and omissions in the drawings, documents or other information submitted by him, irrespective of whether these have been approved, reviewed or otherwise accepted by the TPNODL or not. However, any error in design/drawing arising out of any incorrect data/written information from TPNODL will not be considered as error and omissions on part of the Associate.

28.0 TRANSFER OF TITLES

The title of ownership and property to all equipment, installations, erections, constructions materials, drawings & documents shall pass to the TPNODL is after commissioning and complete handing over-taking over.

However, such passing of title of ownership and property to the TPNODL shall not in any way absolve, dilute or diminish the responsibility and obligations of the Associate under this Contract including loss or damages and all risks, which shall vest with the Associate.

The Associate shall take all corrective measures arising out of discrepancies, errors and omissions in drawings and other information within the time schedule and without extra cost to the TPNODL.

The Associate shall also be responsible for any delay and/or extra cost if any, in carrying out engineering, and site works by other agencies arising out of discrepancies, errors and omissions stated in as well as of any late revision/s of drawings and information submitted by the Associate.

29.0 SUGGESTIONS & FEEDBACK

We welcome all our Business Associates to write to us about their experience with TPNODL; be it our Company, our services or our people. Each and every concern, issue, query and suggestion from you will help us to become a better company to work with and shall help us develop a strong bonding of trust and a long term relationship with you.

You may send your feedback by filling up our Business Associate Feedback Form enclosed herewith as *Annexure-I.* You can also log on to our website www.tpnodl.com to provide your feedback according to the guidelines mentioned below:

30.0 CONTACT POINTS

In case Business Associate needs information with respect to payments or has any grievances, same may be lodged by log on to our website www.tpnodl.com.

31.0 LIST OF ANNEXURES

No.	bject	nnexure
	erforma for Bid Security Bank Guarantee	
	erforma for Performance Bank Guarantee (CP cum EP)	
	erforma for No Demand Certificate by Associate	
	erforma for Indemnification on Statutory Compliance	
	erforma For Application For Issuance of Consolidated TDS Certificate	
	R Service Level Agreement	
	ndertaking for competence of workmen	
	usiness Associate Feedback Form	
).	cceptance Form For Participation In Reverse Auction Event	
.	rm for RTGS Payment	
.	ntractor Safety Management System	
.	endor Appraisal Form	

ANNEXURE-A

PROFORMA FOR BID SECURITY BANK GUARANTEE

TP Northern Odisha Distribution Limited

Balasore

HEREAS, (Name of the Bidder) ……. (hereinafter called "the BIDDER") has submitted his bid dated …… for the (Name of Contract) …… (hereinafter called "the BID").

KNOW ALL men by these presents we (Name of the Bank) …….. of (Name of the Country) …… having our registered office at …….. (hereinafter called "the BANK) are bound unto TP Northern Odisha Distribution Limited (TPNODL) in the sum of …….. for which payment well and truly to be made to the TPNODL the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this ……. day of ……. 20 ……..

The CONDITIONS of this obligation are:

i) If the Bidder withdraws his Bid during the period of bid validity specified in the Performa of Bid

Or

ii) If the Bidder having been notified of the acceptance of his Bid by the TPNODL during the period of bid validity fails or refuses to furnish the Contract Performance Bank Guarantee, in accordance with the Instructions to Bidders.

We undertake to pay the TPNODL up to the above amount upon receipt of its first written demand, provided that in its demand the TPNODL will note that amount claimed by it is due to it owing to the occurrence of one or both conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date (No of days as mentioned in tender enquiry) days after the closing date of submission of bids as stated in the Invitation to Bid or as extended by you at any time prior to this date, notice of which extension to the Bank being hereby waived, and any demand in respect thereof should reach the Bank not later than the above date.

DATE…… **SIGNATURE OF THE BANK…….**

WITNESS…… **SEAL……..**

(Signature, Name & Address)

(At least 2 witnesses)

ANNEXURE- B

PROFORMA FOR PERFORMANCE BANK GUARANTEE (CP cum EP)

(On Rs.100/- Stamp Paper)

Note:

(a) Format shall be followed in Toto

(b) Claim period of one month must be kept up

(c) The guarantee to be accompanied by the covering letter from the bank confirming the signature to the guarantee

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TP Northern Odisha Distribution Limited

Balasore **CP cum EP BG No.……..**

Order/Contract No……dated……

1. You have entered into a Contract No _____ with M/s._____ (hereinafter referred to as "the Vendor") for the supply cum erection / civil work of _____ (hereinafter referred to as" the said Equipment") for the price and on the terms and conditions contained in the said contract.
2. In accordance with the terms of the said contract, "the Vendor" agreed to furnish you with an irrevocable, unconditional and acceptable bank guarantee for 3% of the value of contract and to be valid till the end of Guarantee period plus one month towards "Contract cum Equipment performance". For this purpose, you have agreed to accept the guarantee.
3. In consideration thereof, we, _____ hereby irrevocably and unconditionally guarantee to pay to you on demand but in any case before the end of five working days from the date of the claim and without demur and without reference to "the Vendor" such amount or amounts not exceeding the sum of Rs._____ (Rupees _____ only) being _____% (_____ percent) of the total value of the contract on receipt of your intimating that "the Vendor" has not fulfilled his contractual obligations. You shall be the sole judge for such non-fulfilment and "the Vendor" shall have no right to question such judgment.
4. You shall have the right to file / make your claim on us under the guarantee for a **further period of one month** from the date of expiry.
5. This guarantee shall not be revoked without express consent and shall not be affected by your granting time or any other indulgence to "the Vendor", which shall include but not be limited to, postponement from time to time of the exercise the same in you or any right which you may have against "the Vendor" and to exercise the same in any covenant contained or implied in the said contract or any other course or remedy or security available to you, and our Bank shall not be released from its obligations under this guarantee by your exercising any of your rights with reference to matters aforesaid or any of them or by reasons of any other act or forbearance or other acts of omission or commission on your part or any other indulgence shown by you or by any other matter or thing whatsoever which under the law would, but for this provision have the effect of relieving our bank from its obligation under this guarantee.

6. We also agree that you shall be entitled at your option to enforce this guarantee against our bank as a principal debtor, in the first instance, notwithstanding any other security or guarantee that you may have in relation to "the Vendor's" liabilities in respect of the premises
7. This guarantee shall not be affected by any change in the constitution of our Bank or "the Vendor" or for any other reason whatsoever.
8. Any claim / extension under the guarantee can be lodge-able at outstation banks or at Balasore branch and claim will also be payable at Balasore Branch (to be confirmed by Balasore Branch by a letter to that effect in case BG is from the branch outside Balasore)
9. Notwithstanding anything herein contained, our liability under this guarantee is limited to Rs._____ (Rupees_____ only and the guarantee will remain in force up to and including _____(Date) and shall be extended from time to time for such period or period as may be desired by "the Vendor".
10. Unless a demand or claim under this guarantee is received by us in writing within one months from_____ (expiry date) i.e. on or before _____ (claim period end date), we shall be discharged from all liabilities under this guarantee thereafter.

Dated at_____ this_____ day of _____ 200__

Witness

Bank's rubber stamp

1. _____ Banks full address

Designation of Signatory

2. _____ Bank official number

ANNEXURE-C

PROFORMA FOR "NO DEMAND CERTIFICATE" BY ASSOCIATE

(On Company's Letter head or with Company Seal)

(To be submitted by the Associate to TPNODL Accounts Department at the time of receipt of full and final payment)

(Certificate No. CCP/002)

Name of the Project

Order/ Contract No.

Dated

Name of the Associate

Scheme No. / Job No.

We, M/s._____ (Associate) do hereby acknowledge and confirm that we have received the full and final payment due and payable to us from TPNODL, in respect of our aforesaid Order No _____ dated_____ including amendments, if any, issued by TPNODL to our entire satisfaction and we further confirm that we have no claim whatsoever pending with TPNODL under the said contract / W.O.

Notwithstanding any protest recorded by us in any correspondence, documents, measurement books and / or final bills etc., we waive all our rights to lodge any claim or protest in future under this contract.

We are issuing this "NO DEMAND CERTIFICATE" in favour of TPNODL, with full knowledge and with our free consent without any undue influence, misrepresentation, coercion etc.

Dated **Signature**

Place **Name**

Designation

(Company Seal)

ANNEXURE – D

PROFORMA FOR "INDEMNIFICATION ON STATUTORY COMPLIANCES"

(To be submitted by the successful Bidder within seven days of award of work)

(Certificate No. CCP/001)

Name of the Project

Letter of Award / Contract No.

Dated

Name of the Associate

Scheme No. / Job No.

By this confirmation we, _____ (Associate) are formally bound to M/s. TPNODL towards any sum which may be imposed, levied or hereinafter recovered by the Provident Fund Organization under the provisions of the Employees of the Provident Fund and Miscellaneous Provisions Act 1952 in respect of employees employed by us.

We well and truly bind ourselves and our heirs executors administrators and representatives jointly severely and respectively for the above payment only to be paid to M/s. TPNODL.

AND WHEREAS we, _____ (Associate) is making compliance of the Employees Provident Fund and Miscellaneous Provisions Act 1952, have entered into the above written bond for the indemnity to M/s. TPNODL against all losses from the acts or default of the said Associate in respect of compliance of the Provident Fund Act.

Similarly, we hereby confirm that we have complied with all statutory and local laws and nothing is outstanding with regard to Local Sales Tax, Labour Laws, Local Municipal dues, Electricity dues etc. We have entered into the above written bond for the indemnity to M/s. TPNODL against all losses from the acts or default of the said Associate in respect of compliance of the Local Sales Tax Laws, Local Laws, Labour Laws, Local Municipal Dues, Electricity dues etc.

NOW THE CONDITION, of the above written bond is as such that if the Associate during the period of this contract commits any default or fails to make payment of Contributions in respect of his employees to the Employees Provident Fund Organization, he shall indemnify the Principal Employer M/s. TPNODL from all and every loss and damage caused to them from any act, omissions or negligence of the said Associate in respect of compliances under the Employees Provident Fund and Miscellaneous Provisions Act, 1952.

IN WITNESS to the above written bond we have here to set our hands, with our free consent.

Dated **Signature**

Place **Name Designation** **(Company Seal)**

ANNEXURE-E

PROFORMA FOR APPLICATION FOR ISSUANCE OF CONSOLIDATED TDS CERTIFICATE

To be printed on the letterhead

To,

TP Northern Odisha Distribution Limited,

Balasore

Sub: Application for issuance of Consolidated TDS Certificate for the FY _____

Dear Sir,

I / we hereby request / authorize you to issue me / us a consolidate TDS Certificate for the financial year _____ against tax deducted at source by you from my / our payments / bills during the said year from time to time under Chapter XVII – B of the Income Tax Act, 1961.

For and on behalf of

Signature

Name

Address

Contact No. (Land Line)

(Mobile)

PAN #

Assessing authority

ATTACH THE COPY OF PAN CARD

ANNEXURE - F

SERVICE LEVEL AGREEMENT

(To be adhered to by Business Associates (BAs) in TPNODL on Human Resource Issues)

1.0 The following shall be adhered to by the Business Associates during his / its association with TPNODL:

Shall Abide by TPNODL Core Values:

a) **Integrity –** We must conduct our business fairly, with honesty and transparency. Everything we do must stand the test of public scrutiny.

b) **Understanding –** We must be caring, show respect, compassion and humanity to our colleagues and customers and always work for the benefit of the communities we serve.

c) **Excellence –** We must constantly strive to achieve the highest possible standards in our day to day work and in the quality of services we provide.

d) **Unity –** We must work cohesively with our colleagues across the group and with our customers and partners to build strong relationships based on tolerance, understanding and mutual co-operation.

e) **Responsibility –** We must continue to be responsible and sensitive to the communities and environments in which we work and always ensuring that what comes from the people; goes back to the people many times over.

f) **Agility-** We must work in a speedy and responsive manner and be proactive and innovative in our approach.

2.0 The Business Associate / his manager / supervisor who is responsible for managing the project site / performance contract etc. in TPNODL would also ensure adherence of these values by his employees / persons deployed by him in connection with his works undertaken in TPNODL.

3.0 TPNODL is a signatory to the United Nation Global Compact as an integral part of its Governance principles / business. The Business Associates are required to:

a) Support and respect the protection of human rights and make sure that they are not complicit in human right abuses.
b) Respect freedom of association and effective recognition of the right to collective bargaining.
c) Not to resort to any form of forced and compulsory labour.
d) Shall ensure abolition of child labour in his area of work.
e) There is no discrimination in respect of employment and occupation in respect of his employees.
f) Support precautionary approach to environmental challenges.
g) Promote greater environmental responsibility by himself and his employees in his areas of work.
h) Deploy and defuse environmental friendly technologies while carrying out the works.
i) Work against corruptions in all its form including extortion and bribery by himself and his employees.

4.0 The Business Associates are required to adhere to all applicable Labour Laws with special reference to the following:

a) No person below the age of 18 years and no child labour will be engaged directly or indirectly for executing the work connected with the business of TPNODL.

b) Minimum wages along with other statutory dues like PF, ESI, etc. as applicable to the workers shall be made within the prescribed period of 7th / 10th day of the following month.

c) Deduction / deposit / record keeping and all other requirements under Employees PF Act 1952, Employees State Insurance Act 1948 and other applicable acts (if any) shall be adhered to.

d) Only statutorily authorized deductions (if any) shall be made in accordance with the relevant statutes.

e) All the provisions of Contract Labour (R&A) Act 1970 shall be complied with in respect of the workers engaged for TPNODL work. The work will be commenced only after completing necessary formalities for obtaining Labour License (if applicable).

f) Necessary registers / records, filing of returns etc. shall be maintained for verification by Statutory / TPNODL authorities.

g) Payment of wages shall be made only in presence of and with certification of authorized representative of TPNODL or shall be made in the form of cheque / bank transfer to the employee.

h) During the period of contract, the Business Associate will arrange for deployment of his supervisor / manager for total supervision and control of the work and their manpower. All the activities related to their manpower e.g. attendance, leave, wage disbursement etc. will be done under the supervision & control of Business Associates, while adhering to the prescribed standard / norms of production / productivity & quality. During execution of the work, Business Associate shall engage only such qualified / skilled manpower as may be envisaged / required for ensuring level of production / service into the contract / work order.

i) Clearances as follows shall be obtained from IR & Welfare Group:

a. Clearance for commencement (before start of the work).
b. No Objection Certificate (after completion / before final settlement).
c. Copies of PF / ESI Challans shall be deposited with IR & Welfare Group every month

j) The Business Associate shall indemnify TPNODL from any liabilities under applicable Labour Statutes.

k) The Business Associate shall ensure safety and health of his employees and shall also maintain hygienic working environment / condition in his area of work.

l) The Business Associate and his employee shall abide by Laws of Land and shall not violate any applicable provisions.

m) The Business Associate appreciates with and acquiesces to the right of TPNODL as principal employer to fulfil any of his legal obligations, if he fails to do so under applicable labour laws and deduct the same from his running bills / final payments / enchasing security deposit / Bank Guarantee as the case may be. If there is any further shortfall TPNODL has the right to recover the same from the Business Associate.

n) The Business Associate ensures that person employed by him adhere to the moral and legal conduct and shall not violate any standard conduct envisaged in the premise of TPNODL by all such as, Transparency, Safety, Discipline, Integrity etc. The Business Associate or his employees should refrain from corrupt practices, giving or taking bribe in connection with any TPNODL business.

5.0 The 'Statutory Compliance Enforcement System' in TPNODL is detailed below for adherence by all concerned. Corporate IR & Welfare Group will be the process owner for implementation of the system with the help of concerned Engineer I/c or Officer I/c.

a) Statutory Compliance being a professed value in TPNODL Code of Conduct, the concerned Engineer / Officer in charges are requested to adhere to the provisions and advise respective Business Associates in their domain to comply in letter and spirit.

b) Immediately after issuance of letter of intent, the authorized representative of the Business Associate will report to Corporate IR & Welfare group for completion of statutory requirements.

c) Normally, the work will be started only after 'Clearance for Commencement of Work (CCW) is issued by IR & W group to the Business associate. However, in exceptional exigencies in engineer I/c / Officer I/c may direct the Business Associate to start the work and inform IR & W group about the same. Statutory requirements in this case may be completed in parallel.

d) First monthly bill will be released only after producing CCW to the finance department. Similarly closure of work and final settlement will be affected after issuance of no objection certificate from IR & W group.

6.0 Requirements for 'Clearance for Commencement of Work' (CCW):

a) Submission of filled up Form 'A' for database (Annexure-1).
b) Copy of PF Code allocation letter.
c) Copy of ESI Code allocation letter.
d) Submission of duly filled up Form IV CL(R&A) act (In case more than or equals to 20 workers during the period of contract).
e) Submission of duly filled up Form VI A (Notice of Commencement).
f) Copy of insurance cover note under WC Act 1923 (if applicable).
g) Copy of Contract Agreement.
h) Copy of indemnity bond (if applicable).
i) Affidavit with regard to payment of wages through cheque / bank transfer only.

7.0 Requirements during execution of work:

a) Copy of receipt of application for license / license (if applicable).
b) Copy of PF Challan (latest by 26th day of every Month).
c) Copy of ESI Challan (latest by 26th day of every Month).
d) Copy of Wage disbursement sheet / Bank statement.
e) Filing / Maintenance of all statutory registers / reports / returns for inspection by Statutory/ TPNODL authorities.
f) Certification of wage disbursement by authorized representative of TPNODL.
g) Copy of 'Labour Welfare Fund' deposit certificate / Challan.
h) Insuring safe working practices at the workplace.

8.0 Requirements for 'No Objection Certificate' (NOC) for closure of work:

a) Submission of duly filled up Form VI A (Notice of Completion).
b) Copy of Half yearly / Annual return for ESI / PF / CL(R&A).
c) Consolidated copy of wage sheet of last month indicating full & final settlement of all dues like retrenchment benefit, bonus, leave encashment etc. Copy of individual declaration by employees in Form X regarding termination of employment.

d) Confirmation certificate regarding filling up of form for transfer / withdrawal of PF by the concerned workers.

In case any of the above are deviated / not complied with the Letter of Award/Order shall be liable to be withdrawn / cancelled.

Enclosure:

1) Form A
2) Form X
3) Form XI
4) Form VI A
5) Form XXIV

FORM (A)

[To be submitted by the Business Associate to the Principal Employer within a week from LoA issuance]

A. Details of the Agency

1. Name of Agency :
2. Nature of work :
3. Local Address with Ph. No. :

   (With Father's name) :
4. Permanent Address (Full) :
5. PF code no. & Place :
6. ESI Code no. & Place :
7. Name and address of :

Sub-contractor (if any)

B. Details of Work

8. Name of work (as specified in LOI/LOA) :
9. LOI/LOA Nos. & Dates :
10. Period of contract (Specify Dates) :

    [Including Extension period, if any] :
11. Work Area [Department / Location] :
12. Name / Cell no. of Officer I/c :
13. Maximum No. of workers and staff to be engaged on any day during the year.

- Supervisory Staff :
- Workers :

14. Do you have any other contract in TPNODL : Yes/No

    If yes, furnish details:

15.Details of Workmen's compensation Policy, if applicable

Name of Insurance Company ……..

……Policy No …… Number of persons covered …… Period of coverage: From …… To ……..

If no, I hereby undertake the liability arising out of Workmen's Compensation Act and Rules made there under.

C. Details of workers to be engaged

No. of Workers

No.	nskilled*	emi-skilled*	illed*	erical / Supervisory

*** Number to be indicated**

I/We shall fulfil all obligations arising from and under all relevant law in force from time to time. I/We undertake to keep the TPNODL indemnified against any loss or liability arising out of failure of my / our abiding the relevant laws.

The name of my / our representatives is …… to enter the TPNODL Premises on my behalf.

Date:

(Signature of the Business Associate

or his Authorized Representative)

This Business Associate is / will be engaged in TPNODL.

(Signature and seal of

Officer I/c of the Work)

Form G

Undertaking

I _____ hereby undertake that all the dues in respect of my employment with M/s _____ for the period of _____ to _____have been settled and final payments including retrenchment benefit have been made to me in full.

( )

_____

Date:

Form

Undertaking

With reference to the contract job awarded by M/s TP Northern Odisha Distribution Limited to M/s_____ vide work order No._____ dated_____

I _____on behalf of

M/s _____hereby undertake:

1. that the dues in respect of the workmen/ employee(s) engaged by us for the said contract, payable as per the provisions of relevant statute pertaining to

   wages/ salary

   PF & ESI, Balasore Labour Fund

   All other statutory obligation

   has been paid /settled in full and no amount/ compliance is due/ pending.

2. That in case any dispute / claim is raised by the concerned workers i.r.o. any dues / payments, M/s _____ will settle the same on its own and such liability will be borne by M/s _____

3. That M/s _____ hereby indemnify M/s TPNODL from any future liability i.r.o. any statutory obligation in respect of said contract.

Date:

_____

( )

Authorized Signatory

For M/s _____

FORM- VI A

Notice for Commencement /Completion of contract work

I/We, Sh. / M/s _____ (Name and Address of the Contractor) hereby intimate that the contract work _____ (name of work) in establishment of the _____ (name and address of the Principal Employer) for which License No._____dated_____has been issued to me/us by the Licensing Officer _____(name of the Headquarters), has been commenced / completed with effect from _____date / on date.

Signature of Contractor

With Office Seal

The Inspector

_____

_____

FORM XXIV

[See Rule 82(1)]

Return to be sent by the Contractor to the licensing Officer (in duplicate)

Half -Yearly Ending_____

1. Name and address of the Contractor
2. Name and address of the Establishment
3. Name and address of the Principal Employer
4. Duration of Contract: From _____to _____
5. No. of days during the half year on which

   (a) the establishment of the principal employer had worked

   (b) the contractor's establishment had worked
6. Maximum No. of contract labour employed on any day during the half –year:

en	omen	ildren	tal

7. (i) Daily hours of work and spread over

   (ii) (a) whether weekly holiday observed and on what day

   (b) if so, whether it was paid for

   (iii) No. of man – hours of overtime worked
8. No. of man days worked by

en	omen	ildren	tal

9. Amount of wages paid

en	omen	ildren	tal

10. Amount of deductions from wages, if any

en	omen	ildren	tal

Whether the following have been provided –

(i) Canteen : _____

(ii) Rest rooms : _____

(iii) Drinking water: _____

(iv) Crèches : _____

(v) First Aid : _____

Signature of contractor

Place _____

Date _____

ANNEXURE – G

UNDERTAKING FOR COMPETENCE OF WORKMEN

Name of Associate :

Tender No. :

Item :

With reference to the tender mentioned above, I/We _____, hereby undertake that the workmen/ employee(s) engaged by M/s _____ for the job against said tender shall be competent in all respect, commensurate to the nature of job.

Date: _____

( )

Authorized Signatory

For M/s

Seal

ANNEXURE-H

BUSINESS ASSOCIATE FEEDBACK FORM

With an objective to improve our internal processes and systems, and serve you better, we solicit your valuable feedback & suggestions. It is estimated that it will take about 10 minutes to complete this survey. We assure you that your feedback shall be kept confidential. Please send the duly filled feedback form in the "TPNODL addressed - attached envelop"

You are associated with us as

EMs		ervice ontractor		aterial ontractor		aterial & anpower Supplier	

You are associated with us for

ss than 1 Year		ore than 1 Year but less an 3 Years		ore than 3 years	

Your office is located at

alasore		ithin 200 Kms from alasore		ore than 200 Kms om Balasore	

ur nearly turnover with TPNODL

ss than 25 cs		Lacs to 1 Crore		ore than 1 Crore	

Additional information

our Name	
our Designation	
our Organization	
ontact Nos.	
mail	

We once again thank you for your participation in this survey. Please spare 10 minutes to give your feedback on following pages (Section A to E)

SECTION - A

(Please √ mark in the relevant box and give your remarks / suggestions / information for our improvement.).

S. No.	Parameters	1 Do Not Agree	2 Slightly in Agree	3 In Fair Agreeme	4 Mostly in Agree	5 Fully Agree	Remarks/ Suggesti
1	You receive all relevant que tenders from us in timely manne						
2	We provide you enough lead t respond to our queries / tenders						
3	We provide you adequate s (drawings, documents, clarifi briefing etc.) to enable you me requirements.						
4	All following elements of our co purchase order are rational:						
4.1	Scope of Work						
4.2	Delivery / Execution Schedule						
4.3	Payment Terms						
4.4	Liquidated Damages						
4.5	Performance Guarantee						
5	Our purchase orders / contra simple, specific & easy to unders						
6	TPNODL demonstrate willingnes flexible in administration of Co Purchase Order						
7	We provide timely respon clarifications to your queries						
8	TPNODL representative you int coordinate with is ade empowered to support you in n contractual obligations						
9	TPNODL provide you all ne infrastructure support for time quality completion of work (in AMC)						
10	TPNODL Engineer-in-Charge certifies the jobs executed/ n supplied						

S. No.	Parameters	1 Do Not Agree	2 Slightly in Agree	3 In Fair Agreemei	4 Mostly in Agreei	5 Fully Agree	Remarks/ Suggesti
11	TPNODL Engineer-in-Charge eff supervises the job execution for completion of job						
12	Are you satisfied with the payment release mechanism of T						
13	Our approach for Inspection and Assurance effective to expedite completion?						
14	TPNODL never defaults on cont terms						
15	In TPNODL Contracts closure i within set time limit						
16	Our material receiving procedu well defined and efficiently deplo reduce mutual inconvenience						
17	Bank Guarantees are released bound manner						
18	Our processes related to payr account settlement are effective						
19	You get payments on time						
20	TPNODL Employees follow behavior						

SECTION - B

SECTION – B (Please rate the following parameters on a scale of 1 to 5, where 1 - Minimum; 5 - Maximum)

S.No.	Parameters	1	2	3	4	5	Remarks/ Sugge
1	How do you rate courtesy/ emp attitude level and warmth of TP employees you interact with following team?						
1.1	Project Engineering						
1.2	Circle / Division						
1.3	Projects/HOG (TS &P)						
1.4	Inspection & Quality Assurance						
1.5	Stores						
1.6	Metering & Billing						
1.7	Accounts / Finance						
1.8	Administration						
1.9	IT & Automation						
2	How would you rate TPNOD comparison to your other clients in of **fairness of treatment and transpa** with its Business Associates?						
3	How would you rate TPNOD comparison to your other clients in of **processes and systems to ma partnership** with its Business Associa						
4	How would you rate TPNOD comparison to your other clients in of **building long term & mu relationship** with its Business Associ						

SECTION – C

Please √ mark in the relevant box and give your remarks / suggestions / information for our improvement.

S. No.	Parameters	Certainly NO	Probably NO	Probably YES	Certainly YES	Remarks/ Suggestio
1	Based on your experience with TPNODI you like to continue your relationsh TPNODL?					
2	If someone asks you about TPNODL, wo talk "positively" about TPNODL?					
3	Would you refer TPNODL name to other community, fraternity and society professional & dynamic organization?					

SECTION - D

If we ask you to rate us on a scale of 1 to 10, how will you rate TPNODL, that truly represents your overall satisfaction with us (please tick appropriate box) –

1	2	3	4	5	6	7	8	9	10

SECTION – E

Please √ mark in the relevant box and give your remarks / suggestions / information for our improvement.

Please spare your thoughts for TPNODL's improvement in particular areas of weaknesses, particularly relating to some great practices, attitudes that you have seen elsewhere in Indian and International Organizations, which you recommend TPNODL to adopt. Please give your valuable salient recommendations.

Please spare your thoughts for TPNODL's improvement in particular areas of major concerns for you. We also welcome your suggestions to adopt any best practices, altitudes that you have observed / experienced elsewhere in Indian/ International organization.

Recommendation	*Please tick (√) your top 5 expectations out of the following 10 points listed below -*	
(Please list down improvement you expect from TPNODL)	*Timely payment*	
1	*Flexibility in Contracts/PO*	
	Clarity in PO,s & Contracts	
2	*Timely response to quarries*	
	Timely certification of works executed	
3	*Clarity in Specs, drawings, other docs etc.*	
	Adequate information provided on website for tender notification, parties qualified etc.	
4	*Timely receipt of material at site for execution*	
	Performance Guarantee/EMD released in time	
5	*Inspection & quality assurance support for timely job completion*	

We thank you for your time and courtesy!!

ANNEXURE - I

ACCEPTANCE FORM FOR PARTICIPATION IN REVERSE AUCTION EVENT

(To be signed and stamped by the bidder prior to participation in the auction event)

In a bid to make our entire procurement process more fair and transparent, TPNODL intends to use the reverse auctions through SAP-SRM tool as an integral part of the entire tendering process. All the bidders who are found as technically qualified based on the tender requirements shall be eligible to participate in the reverse auction event.

The following terms and conditions are deemed as accepted by the bidder on participation in the bid event:

1. TPNODL shall provide the user id and password to the authorized representative of the bidder. *(Authorization Letter in lieu of the same shall be submitted along with the signed and stamped Acceptance Form).*

2. TPNODL will make every effort to make the bid process transparent. However, the award decision by TPNODL would be final and binding on the supplier.

3. The bidder agrees to non-disclosure of trade information regarding the purchase, identity of TPNODL, bid process, bid technology, bid documentation and bid details.

4. The bidder is advised to understand the auto bid process to safeguard themselves against any possibility of non-participation in the auction event.

5. In case of bidding through Internet medium, bidders are further advised to ensure availability of the entire infrastructure as required at their end to participate in the auction event. Inability to bid due to telephone line glitch, internet response issues, software or hardware hangs, power failure or any other reason shall not be the responsibility of TPNODL.

6. In case of intranet medium, TPNODL shall provide the infrastructure to bidders. Further, TPNODL has sole discretion to extend or restart the auction event in case of any glitches in infrastructure observed which has restricted the bidders to submit the bids to ensure fair & transparent competitive bidding. In case an auction event is restarted, the best bid as already available in the system shall become the start price for the new auction.

7. In case the bidder fails to participate in the auction event due any reason whatsoever, it shall be presumed that the bidder has no further discounts to offer and the initial bid as submitted by the bidder as a part of the tender shall be considered as the bidder's final no regret offer. Any offline price bids received from a bidder in lieu of non-participation in the auction event shall be outrightly rejected by TPNODL.

8. The bidder shall be prepared with competitive price quotes on the day of the bidding event.

9. The prices as quoted by the bidder during the auction event shall be inclusive of all the applicable taxes, duties and levies and shall be FOR at TPNODL site.

10. The prices submitted by a bidder during the auction event shall be binding on the bidder.

11. No requests for time extension of the auction event shall be considered by TPNODL.

12. The original price bids of the bidders shall be reduced on pro-rata basis against each line item based on the final all inclusive prices offered during conclusion of the auction event for arriving at Contract amount.

Signature & Seal of the Bidder

ANNEXURE - J

To,

Drawing & Disbursing Officer

TP Northern Odisha Distribution Limited
Balasore

Sub: **e-Payments through National Electronic Fund Transfer (NEFT) OR Real Time Gross Settlement System (RTGS)**

Dear Sir,

We request and authorize you to affect e-payment through NEFT/RTGS to our Bank Account as per the details given below: -

ɛndor Code

tle of Account in the Bank

ːcount Type

lease mention here whether account is ıvings/Current/Cash Credit)

ank Account Number

ame & Address of Bank

ank Contact Person's Names

ank Tele Numbers with STD Code

ank Branch MICR Code

lease enclose a Xerox a copy of a cheque. This ıeque should not be a payable at par cheque)

ank Branch IFSC Code

ou can obtain this from branch where you have your ːcount)

nail Address of accounts person (to send ayment information)

ame of the Authorized Signatory

ontact Person's Name

fficial Correspondence Address

We confirm that we will bear the charges, if any, levied by our bank for the credit of NEFT/RTGS amounts in our account. Any change in above furnished information shall be informed to TPNODL well in time at our own. Further, we kept TPNODL indemnified for any loss incurred due to wrong furnishing of above information.

Thanking you,

For _____

(Authorised Signatory)

(Signature with Rubber Stamp)

Certification from Bank:

We confirm that we are enabled for receiving NEFT/RTGS credits and we further confirm that the account number (specify Bank a/c no.) of (Please mention here name of the account holder), the signature of the authorised signatory and the MICR and IFSC Code of our branch mentioned above are correct.

This also is certified that the above information is correct as per Bank record

(Manager's/ Officers Signature under Bank Stamp)

ANNEXURE - K

CONTRACTOR SAFETY MANAGEMENT SYSTEM

1. **OBJECTIVE**

The objective of the Contractor Safety Management System is to lay down clear guidelines for all Business Associates (including their associates, staff and agents) which would facilitate them to observe all statutory rules and regulations, comply with applicable standards of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010 & (safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations,2011, TPNODL Safety Manual and Guidelines and thus, ensure creation of safe working environment for all stakeholders of our network.

2. **SCOPE**

All contracts (minor and major) will be subject to the provisions of this document.

Minor Contracts: Contracts which satisfy all the criteria listed under the head "Minor Contracts".

Major Contracts: Contracts which satisfy any two or more criteria listed under the head "Major Contracts"

Criteria	Minor Contracts	Major Contracts
Value of Contract	< Rs. 1500000/- (less than Rs. Fifteen Lac)	>= Rs. 1500000/- (Equal or more than Rs. Fifteen Lac)
Period	Period less than 1 year	Any period
Working on energized electrical equipment	No	Yes
Working on height (above 1.8 Mtrs from ground)	No	Yes
Work involving construction activity	No	Yes
Working with hazardous goods or chemicals	No	Yes
Work involving danger to general public	No	Yes

Note: *Exceptions for major and minor contract are – in house software development, supply of material or equipment but no direct or indirect installation of the same material, administration contracts (courier, water supply, printing, security, transport, etc.), minor civil work like plastering at ground level or flooring, etc. The facility management (housekeeping) contract will always be treated as a minor contract.*

3. INFORMATION REQUIRED AT TIME OF VENDOR REGISTRATION OR BEFORE COMMENCEMENT OF CONTRACT

3.1 Business Associate is required to fill the Safety Management System Questionnaire as per *annexure 1* and submit along with the vendor registration process / bid / tender document. The filled questionnaire will be scrutinized by Engineer In-charge / indenting group and recommend suitability of the BA with respect to safety requirements. The fulfilment of statutory requirements for vendor registration pertaining to labour laws etc. shall be done by BA Cell on being referred to it.

3.2 Business Associate is required to take suitable risk control measures mentioned against the identified Hazards and Risk document provided for all contracts as per *annexure 2*. The primary objective of this is to evaluate the understanding of the BA towards risk mitigation and employment of safe work procedures. BA is required to conduct the Hazard identification and Risk Assessment study as per the procedure and deploy more or other measures if deemed necessary.

3.3 Business Associate shall comply with **Statutory Requirements related to Safety and Occupational Health** and submit the "Safety Undertaking" as per *annexure 4*.

4. GENERAL SAFETY CONDITIONS REQUIRED TO BE FULFILLED BY BUSINESS ASSOCIATES

The requirements of the contractor safety management system applicable to the minor or major contracts related to various groups are as following –

4.1 Maintenance of Distribution Network – *Annexure 3.1*
4.2 Distribution Projects – *Annexure 3.2*
4.3 EHV Projects – *Annexure 3.3*
4.4 Maintenance of Sub transmission network – *Annexure 3.4*
4.5 Civil / Generation Projects – *Annexure 3.5*
4.6 Meter Management Group (MMG), Revenue Recovery Group (RRG), Energy Auditing Group, AMI, MRG, etc. – *Annex3.6*
4.7 Maintenance and Operation of Street Light. **–** *Annexure 3.7*

1. *Please note that hydra cranes used by any dept. should be ACE Model No. FX 150 ACE SX 150, Escorts Model No. TRX 1550 or contemporary. Use of old generation hydra cranes like ACE 14XW or ACE 12 XW, etc. are prohibited.*

(Details as per Annexure attached)

Note: *For minor contracts, the BA shall assign the duties of Safety Representative to the Work Supervisor. Work Supervisor will deliver all duties and responsibilities of Safety Supervisor as detailed in this document.*

The Business Associate (BA) having major contract will appointing Safety supervisor, engineer / manager for the TPNODL work. The BA shall make all necessary arrangements for getting their workforce safety trained and competency checked from the Safety Department of TPNODL before deployment in the field. BA Cell shall recommend the suitability after competency checked by Engineer In-charge and SAFETY group (or his representative) of TPNODL. After getting the clearance from DOSEC, BA cell and receiving temporary I-card issued by TPNODL, Business Associate shall commence the working.

Safety Representative of Business Associates will formally become the nodal point for safety concerns for TPNODL. ***BA shall not frequently transfer or terminate the services of any of the safety representatives appointed for TPNODL work site. BA needs to ensure that Safety representative is available at all points of time; failing which the work being carried out in the interim (period when Safety representative is***

not available) shall be treated as working under improper supervision and due penal provisions shall be initiated against the BA. BA will be required to provide all applicable infrastructure and power to ensure smooth working of the safety representative to maintain a sound safety management system. **In all contracts safety representative will not be assigned any other activity at site apart from the works related to safety management. The duties are detailed in clause 5.5 of this document.** TPNODL will be auditing the facilities provided to the BA`s safety team time to time.

The Safety Representative of the BA shall be required to meet and follow the instructions of the Engineer In-charge and SAFETY Group of TPNODL. He shall be responsible for providing the MIS and/or any other relevant information, as and when desired, within the stipulated time frame as per the requirements of TPNODL. Any non-conformance to safety will lead to the negative marking or issue of safety violation challan/ tokens which shall affect the monthly evaluation and performance of BA.

All contracts where BA has to depute vehicle for their staff and equipment to move from one location to other, the BA shall ensure that vehicle complies all required statutory clearances and requirement as per The Motor Vehicle Act, 1988 as well as TPNODL Road Safety Policy and are in good & safe state of working.

5. QUALIFICATION AND EXPERIENCE OF THE SAFETY AND SITE PERSONNEL

Qualification and experience required for the safety and site personnel are as following:

5.1 Safety Supervisor: It is mandatory that educational qualification of safety supervisor be ITI (of relevant trade) / Diploma (Any branch of engineering) and he has a working experience on electrical system / relevant field of work at least 5 yrs for ITI and 3 years for Diploma holder. Having formal experience of the safety systems will be an added advantage

5.2 Safety Engineer: It is mandatory that educational qualification of safety engineer be at least Diploma (relevant branch) and he has working experience on electrical system of at least 3 yrs. Having the formal experience of the safety systems will be an added advantage.

5.3 Safety Manager: The educational qualification of safety manager should be graduate engineer with working experience on electrical system / network of at least 3 yrs. OR Diploma in Industrial Safety with working experience of 05 years including at least 02 years on electrical network.

However, clause 5.1, 5.2 and 5.3 are not applicable for minor contracts. In such cases, BA shall assign the duties of Safety Representative to the Work Supervisor. Work Supervisor will deliver required duties of Safety Representative (as per clause 5.5) in addition to other duties without diluting the importance of safety.

5.4 Site Skilled Personnel: For all responsibility related to site activities and operations, the BA shall employ only qualified and skilled persons and shall comply the provisions of section 19 & 29 of Central Electricity Authority (Measures relating to safety and electric supply) Regulations, 2010. Persons holding valid approvals only by any Government approved agency or a competency assessment panel or a team set up by TPNODL shall be allowed to perform the High Risk / High Hazard activities (refer page 1). The skill / qualification required for the electrician and electrical supervisor are given in annexure 5. The contracts related to maintenance of Distribution Network, Distribution Projects, Extra High Voltage Projects, maintenance of Sub-Transmission Network, Meter Management Group & Energy Audit Group, maintenance and operation of street lights, shall preferably have at least 20 per cent of ITI qualified electricians in the first year of the contract. This figure shall preferably be incremented by 15 per cent every subsequent year.

Note: For the competency assessment may please refer the work instructions. An employee shall have to necessarily undergo the competency assessment check once in every eighteen months.

5.5 Requirements from the Safety Representative(s) of the Business Associate:

5.5.1 Safety training of 2 hrs/employee/month and one day of safety induction training to all new employees joining the BA will be conducted by the BA as per Safety training modules of TPNODL.

5.5.2 Safety Talk / toolbox talk before start of shift to BA employees.

5.5.3 Ensuring the availability & proper usage of the standard safety equipment (PPE)

5.5.4 Periodic inspection of PPE to ensure their serviceability and maintaining the 10% buffer stock of standard PPEs.

5.5.5 Ensuring the adherence to standard operating procedures of TPNODL as mentioned in TPNODL Safety standard and O & M and concerned function's manual.

5.5.6 Safety inspections / audits as per the process of TPNODL

5.5.7 Working in close coordination Safety Group of TPNODL.

5.5.8 Reporting of unsafe acts, unsafe conditions, near miss, incident or accident to Engineer In-Charge and Safety Group of TPNODL immediately after its occurrence.

5.5.9 Regular HIRA at site and comply the control measures as stated in the detailed HIRA as per the *annexure 2*. Also, deployment of JSA based checklist shall be ensured.

5.5.10 Ensuring compliance with safety and other laws as may be applicable and providing for safety assurance.

5.6 Training and Syllabus: The BA shall not deploy any person at workplace / site or send newly recruited personnel directly for competency assessment without Safety Induction Training.

5.6.1 All new BA employees have to necessarily undergo one and half days Safety training and Competency assessment at training centre of BA cell. This training will be conducted once in a week. After the completion of Safety training & Competency assessment I-card will be issued to all competent BA employees

5.6.2 BA is expected to initially train and judge the capability of the workman at his own end before further recommending the workmen for Competency assessment. If any BA workman sent for competency assessment fails in the Competency test at TPNODL (or Agency hired by TPNODL), it will be deemed that BA has not imparted sufficient training at his end and actual cost of training ₹ 7500/ BA employee/ failed attempt will be recovered.

5.6.3 The workers who have imparted Safety Training and issued I-Cards of TPNODL, are not deployed at TPNODL worksites/ voluntarily left the job by workers/ used somewhere else other than TPNODL by the BA, in that case Management reserves the rights to intervene and recover the actual cost of training i.e. ₹ 7500/BA employee. (*Exempted for attrition rate of BA workers less than or equal to 10% of total workforce deployed at TPNODL)*

5.7 It is desired that Safety representative of the BA to impart the general safety training to each employee of duration 2 hrs per month. The training will be organized at BA level and the record to be sent to engineer in-charge and SAFETY group of TPNODL every month. Please refer schedule and syllabus in *annexure 6*.

List of Personal Protective Equipment (PPE) and Maintenance schedule: BA shall commence the project or any work only when the required PPE are made available to the team of employees involved in the work. Each PPE of BA shall be checked / inspected by the safety representative / supervisor at zone before the work start or as prescribed in the list. Safety representative shall regularly check the healthiness of each PPE allocated to lineman. Suitable record shall be maintained at zone. Defective PPE shall be immediately replaced or within 24 hours by the BA. In no case linemen or any other official of BA may be allowed to work with defective PPE. It is preferred that BA ensures minimum stock of each PPE at zone for immediate replacement with defective one. The PPE shall be IS / BS / CE marked and exactly as per the standard or specification mentioned in the *annexure 7*. Working without PPE / non-standard PPE shall be treated as safety violation and penalty as stated in section 6.0 of this document. If TPNODL finds that

BA has not provided the adequate / appropriate PPE to their staff, TPNODL reserves the rights to stop the work and call the BA to provide appropriate PPEs at the risk. If the BA fails to provide the required PPEs at the risk then the same shall be provided by TPNODL at the actual cost of the PPE. The amount shall be charged to BA and same shall be first recovered from the current bill of BA or any future payment to be made to BA. In the event of any balance amount still left for recovery, the same shall be adjusted against retention amount or by invoking bank guarantee submitted by BA.

5.8 Safety Audit / Inspection & HIRA: The BA shall get the required safety inspection / audit conducted by his technical team comprising of safety representative as per the *annexure 8*. The safety representative will be required to conduct the HIRA (Hazard Identification and Risk Assessment) *as per annexure 2* of the process and work undertaken at least two times in a year or every time if a new process / activity / machine is introduced or whenever an accident take place. The risk identified to be addressed suitably with –

- Engineering Control
- Management Control, and
- Personal Protective Equipment.

The safety representative of BA shall inform and educate for the identified risk and hazard control methods to employees, supervisor and engineer as well as the engineer in-charge and SAFETY group of TPNODL.

5.9 Safety Performance and Safety MIS: The BA shall maintain good practice of safety all through the contract duration. Safety shall always be of paramount importance during the contract period. Safety performance will be monitored on yearly basis throughout the period and no relaxation will be given for bad performance. BA with good track record and excellent performance will be rewarded suitably as per clause 6.0 of this document. The BA has to provide monthly "Performance Report – Safety" to engineer in-charge and SAFETY group TPNODL this shall be part of monthly bill along with training details. Performa of the report is enclosed as *annexure 9*.

5.10 Pre – Employment Medical Check-up and Fitness of employees engaged for the critical works: The BA shall submit the health fitness certificate for all those workers involved in climbing the pole or working at height for following diseases:

5.10.2 Epilepsy
5.10.3 Colour blindness
5.10.4 Deafness
5.10.5 Vertigo & height phobia

Every year BA will give an undertaking stating that all the employees are fit to work and have not developed aforesaid diseases. The Record of such medical check-ups shall be submitted to BA Cell before issue of temporary identity card. The records shall be maintained at BA Cell. All such medical check-ups shall be repeated once in a year for all workers involved in climbing the pole or working on electrical network.

6. REWARD AND PUNITIVE MEASURES

6.1 To support the enforcement of good SHE & DM practices by the Business Associate and to eliminate repeated or continuing safety violations, use of appropriate reward and punitive measures shall be made. Each unsafe act or violation of the safety guidelines as described in the Safety Manual of the TPNODL will be audit criteria of this system. Broadly the measures identified are following:

6.1.1 Working without PPE/ Safety Gadgets
6.1.2 Working without proper tools and tackles, barricading, Poor condition of Crane / Hydra / Vehicle, using without certification / Licence, Incompetent driver/ Helper
6.1.3 Working without creation of effective safety zone
6.1.4 Improper Supervision at worksite, Lineman/ Supervisor working without competency
6.1.5 Working without adherence to PTW process or authorization/ not adherence to SOPs / W.I. of TPNODL.
6.1.6 Improper Working at height equal to or above 1.8 mtrs without taking proper fall protection measures/ Poor condition of Ladder

6.2 Measures of Reward and Punitive Measures

The Engineer In-Charge, NSO, SC, ASOs, CSI / SIs and SHE &DM group will conduct the surprise audits of the work / project and if any non-conformance is found the same will be booked and entered in the format "Safety Violation Record" *annexure 10*. The flow of the information is given below:

Safety Violation Escalation & Monitoring process	
Action	**Responsibility**
Safety Violation form has been filled and counter foil sent to SAFETY team for information. The main form is to be given to BA supervisor / Engineer in-charge. *(Automatically generated if Site audit done through Mobile App.)*	Engineer In-charge/ NSO / SC / SAFETY Group /CSI/ ASO/ Any authorised TPNODL official.
Entry of the violation in the master record and sending the information to concerned Manager, HoG, HoD, Head and Chief (O &S). *(Automatically generated if Site audit done through Mobile App.)*.	SAFETY Group
Forwarding the information Centralized Account Payable (CAPS) for amount deduction from the current bill of the BA, *if any.*	Engineer In-charge
HoG (Safety – II) & HoG (Safety & Quality – Commercial) and CAPS to generate the MIS of the violations and the amount deducted.	SAFETY Group
The pool of the amount generated after the deduction to be utilized in safety welfare of BA employees.	SAFETY Group with approval of CFO/Chief (O & S) /CEO&MD

The safety violations have been rated from 1 to 5 (figure 6.3) as per the gravity of the violation. If the same violation is repeated it may escalate into a higher penalty. If a particular Business Associate employee violates safety norms three times, he shall not be allowed to work in TPNODL for a period of one year from the date of the 3rd violation.

6.3 Safety Violation Escalation Matrix

6.3.1

Consequence of Safety Violation Observed (Not related to Incident/ Accident)		Violation				
S.No.	Safety Violation	1st	2nd	3rd	4th	Subsequent Violations
1	Working without PPE (Helmet/Gloves/Safety Harness/ Safety Shoes etc.)	A	B	C	D	Will attract the same penality as applicable in the 4th violation.
2	Improper Working at Height	A	B	C	D	
3	Working without proper tools and tackles	A	B	C	D	
4	Poor condition of Crane/Hydra/ Vehicle/Incompetent driver/ Helper	A	B	C	D	
5	Violation of SOP/ WI	B	C	D	E	
6	Working without adherence to PTW process or authorization/ Safety Zone	C	D	E		

Legend	Action to be taken	Responsibility	Penality Amount (in Rs.)	
A	Warning letter	Engineer Incharge	Nil	The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.
B	Levy of Penalty	Engineer Incharge	2,000	
C	Memo to BA & Levy of Penalty	Head of Group	4,000	
D	Memo to BA & Levy of Penalty	Head of Department	10,000	
E	Memo to BA, Levy of Penalty and termination of Contract	Head of Department	1,00,000	

Figure 6.3 (1a)-Penalty Matrix for Safety violation (Applicable for Minor Contracts)

Consequence of Safety Violation Observed (Not related to Incident/ Accident)		Violation				
S.No.	Safety Violation	1st	2nd	3rd	4th	Subsequent Violations
1	Working without PPE (Helmet/Gloves/Safety Harness/ Safety Shoes etc.)	B	C	D	D	Will attract the same penality as applicable in the 4th violation.
2	Improper Working at Height	B	C	D	D	
3	Working without proper tools and tackles	A	B	C	D	
4	Poor condition of Crane/Hydra/ Vehicle/Incompetent driver/ Helper	B	C	D	E	
5	Violation of SOP/ WI	C	D	E		
6	Working without adherence to PTW process or authorization/ Safety Zone	C	D	E		

Legend	Action to be taken	Responsibility	Penality Amount (in Rs.)	
A	Levy of Penalty	Engineer Incharge	5,000	The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.
B	Memo to BA & Levy of Penalty	Engineer Incharge	10,000	
C	Memo to BA & Levy of Penalty	Head of Group	25,000	
D	Memo to BA & Levy of Penalty	Head of Department	50,000	
E	Memo to BA, Levy of Penalty and termination of Contract	Head of Department	1,00,000	

Figure 6.3 (1b)-Penalty Matrix for Safety violation (Applicable for Major Contracts)

Once the BA reaches the "BLACK" (color – "5") category, i.e. highest level of safety violation, "Termination" notice to BA will be issued from the office of the Head of Department (equivalent to Addl GM/ GM/ Sr. GM level) and further, *if required,* continuation / extension of contract will only be initiated by Functional Head of the department (equivalent to Sr. GM / VP level) and approved by CEO / MD. Till the extension, the contract will remain suspended.

TPNODL encourages the reportage of the safety violation during the contract work by BA. Any TPNODL employee can register a safety violation against the BA in the "Safety Violation Form" *annexure 10*. Initially the observer has to fill the form and handover the counterfoil (lower portion) of the document to the supervisor of the BA, inform the site engineer of TPNODL and send the top portion of the Safety Violation Form to SAFETY group for the further necessary action against the BA. ***The cumulative nos. of Safety Violations pertaining to any particular BA shall be calculated on yearly basis.***

Safety violations resulting in incident / accident will be treated as per gravity of the injury / fatality and its impact as well as type i.e. minor or Major. Consequences of incident / accident are shown in the matrix (figure 6.3(2) for major and 6.3(3) for minor) below. In case of any accident, findings and recommendations of Accident Enquiry Committee will be final and binding and will supersede the arbitration clause of GCC.

Consequence Of an Incident / Accident (In case of MAJOR contract)		Incident / Accident				Action Required
Sl. No	Type of the injury	1st	2nd	3rd	4th	
1	Slight injury (First Aid Case)	F (Strengthening of process through continuous improvement in the work procedure)				Take risk reduction measures
2	Minor injury (No or Hospitalization less then 48 Hrs)	F	G	G	H	
3	Major injury (Bone injury or burn or Hospitalization more then 48 Hrs)	G	G	H	I	
4	Single fatality	J	K			Intolerable
5	Multiple fatalities (Two or more fatalities during one event)	K				

Legend	Action to be taken	Responsibility	Penalty (in Rs.)	
F	Memo to BA and levy of penalty	Engineer Incharge	5,000/-	*The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.*
G	Memo to BA and levy of penalty	Head of Group	20,000/-	
H	Memo to BA and levy of penalty	Head of Group	50,000/-	
I	Memo to BA and levy of penalty	Head of Department	2,00,000/-	
J	Memo to BA and levy of penalty	Head of Department	5,00,000/-.	
K	Memo to BA, levy of penalty, termination of contract and black listing of BA	Functional Head	10,00,000/-	

Figure 6.3 (2) - Penalty Matrix for Incident / Accident in Major Contracts

(*For example: In major contracts, if there is first incidence of major injury say bone injury (Cat. 3) where worker was hospitalized for more than 48 hrs then a penalty of amount Rs.20000/- will be deducted from the current bill produced for the payment. This penalty will be similar for first two incidents. However, it will increment to next higher category i.e. Rs. 50,000/- on subsequent incidents as per the above matrix)*

Consequence Of an Incident / Accident (In case of MINOR contract)		Incident / Accident				Action Required
Sl. No	Type of the injury	1st	2nd	3rd	4th	
1	Slight injury (First Aid Case)	L (Strengthening of process through continuous improvement in the work procedure)				Take risk reduction measures
2	Minor injury (No or Hospitalization less then 48 Hrs)	L	M	M	N	
3	Major injury (Bone injury or burn or Hospitalization more then 48 Hrs)	M	M	N	O	
4	Single fatality	P	Q			Intolerable
5	Multiple fatalities (Two or more fatalities during one event)	Q				

Legend	Action to be taken	Responsibility	Penalty (in Rs.)	
L	Memo to BA and levy of penalty	Engineer Incharge	5,000/-	*The number of violations are to be calculated cumulatively over the contract period and not on monthly basis.*
M	Memo to BA and levy of penalty	Engineer Incharge	10,000/-	
N	Memo to BA and levy of penalty	Head of Group	25,000/-	
O	Memo to BA and levy of penalty	Head of Department	1,00,000/-	
P	Memo to BA and levy of penalty	Head of Department	3,00,000/-.	
Q	Memo to BA, levy of penalty, termination of contract and black listing of the BA	Functional Head	5,00,000/-	

Figure 6.3 (3) - Penalty Matrix for Incident / Accident in Minor Contracts

(*For example: In minor contracts, if a worker meets with a non-fatal accident say bone injury (Cat. 3) where he was hospitalized for more than 48 hrs then a penalty of amount Rs. 10,000/-, will be charged from the current bill produced for the payment. This penalty will be similar for first two incidents. However, it will increment to next higher category i.e. Rs. 25,000/- on subsequent incidents as per the above matrix.)*

In case of single or multiple fatalities described under legends J&K of 6.3(2) and P&Q of 6.3(3), the concerned BA may be debarred from extension of contract or participate in new contract. In such event the approval of Chief (O & S) will be necessary for extension or award of new contract to concerned BA.

6.3.2 COMPENSATION FOR BA PERSONNEL

In the event of any untoward incident/ accident, the Business Associate shall ensure prompt medical assistance such as treatment, sickness benefit, etc. is provided to the victim(s) as per the Employees' Compensation Act, 1923 or Employees' State Insurance Act, 1948, as applicable. Also, the BA will be required to take adequate measures for compensating the victim(s) or his/her/their kin as follows:

I. For Death or Permanent / Total Disablement

The BA shall take an insurance coverage of at least Rs. 10 lakhs for each engaged employee, to cover any incidence of Death or Permanent / Total Disablement (Permanent/Total Disability shall be considered as defined under Employees' Compensation Act, 1923). In the event of any such unfortunate incident, the BA would ensure that adequate compensation is paid immediately to the family of the victim(s) from his own resources. This compensation shall be covered under the insurance policy subscribed by the BA mentioned earlier and the arrangement should be such that it would get reimbursed to the BA by the insurance agency subsequently.

II. For Permanent Partial Disablement and Temporary Total Disablement

The compensation in this case will be as per provisions of the Employees' Compensation Act, 1923 or Employees' State Insurance Act, 1948, as applicable.

Accordingly, the BA shall obtain a suitable Insurance Policy on award of Contract and submit documentary evidence of the policy to the BA Cell before commencement of work. The BA shall ensure that the Insurance policy is active at all times and all employees are covered in all respects till the conclusion of contract period or till working with TPNODL. The BA shall submit a copy of the policy after periodic renewals to the BA Cell.

However, on occurrence of such unfortunate incident, if it is found that the victim(s) is/are not covered under any insurance policy, the BA shall be liable to pay the entire sum of Rs. 10 lakhs from his own resources.

Further, in case of an accident resulting in Death or Permanent / Total Disablement while on duty, the appointed BA Nodal Officer will ensure that the BA complies with all statutory provisions and benefits i.e. PF, Compensation, Gratuity etc., and that all these are made available to the employees' nominee(s) as per the stipulated timelines.

6.3.3 TPNODL rewards the BA with good track record of safety management. It is proposed that BA complying with Contractors Safety Management, Safety Manual and Safety process will be rewarded suitably as per the procedure, rule and regulations of the TPNODL. In any case major accident is reported during an assessment period BA will not be eligible for this reward scheme. Assessment of contracts will be once in year. Generally, the assessment cycle is calendar year and guidelines will be declared time to time.

Abbreviations Used in the Document

TPNODL	TP Northern Odisha Distribution Limited
BA	Business Associate
HIRA	Hazard Identification & Risk Assessment
JSA	Job Safety Analysis
EHV	Extra High Voltage
SAFETY	Safety, Occupation Health, Environment & Disaster Management
MMG	Meter Management Group
EAG	Energy Audit Group
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures
CSI/SI	Circle Safety In-charge / Safety In-charge
ASO	Area Safety Officer
NSO	Nodal Safety Officer
SC	Safety Coordinator
HoG / HoD	Head of Group / Head of Department
AGM / GM / VP	Assistant General Manager / General Manager / Vice President

CFO / Chief (O & S)/ CEO & MD	Chief Finance Officer / Chief (Operating & Safety) / Chief Executive Officer & Managing Director
COS	Corporate Operation Services
CAP	Centralized Account Payable System
PTW	Permit To Work
GCC	General Conditions of Contract.

- END -

Annexure 1 (Refer Para 3.1)

Business Associate Safety Management System Questionnaire

	Certification				
	The information provided in this questionnaire is a summary of the company's occupational health and safety management system.				
	Company Name:				
Turnover and experience:			Name of top officer:		
Date:			Position		
	Contract Details				
Contract Name			Contract Number:		

Business Associates Safety Management System Questionnaire	Marks	Yes	No	Score achieved
Safety Policy and Management				
- **Is there a written company Safety policy?** - If yes provide a copy of the policy, if No please refer Note 1.	1			
- **Does the company have an Safety Management system** - If yes provide details, if No please refer Note 1.	1			
- **Is there a company Safety Management System manual or plan?** - If yes provide a copy of the content page(s), if No please refer Note 1.	2			
- **Are Safety and occupational health responsibilities clearly identified for all levels of Management and staff?** - If yes provide details, if No please refer Note 1.	2			
Safe Work Practices and Procedures				

	Certification			
- **Has the company prepared safe operating procedures or specific safety instructions relevant to its operations and relevant work as per contract?** - If yes provide a summary listing of procedures or instructions, if No please refer Note 2. - Comments	1			
- **Is there a register of injury or accident?** - If yes provide a copy (format)	1			
- **Is there a documented incident or accident investigation procedure?** - If yes provide a copy of a standard incident report form, if No please refer Note 2. - Comments	1			
Safety Training				
- **Describe how occupational health and safety training is conducted in your company** If No please refer Note 1.	2			
- **Is a record maintained of all training and induction programs undertaken for employees in your company?** - If yes provide examples of safety training records, if No please refer Note 2.	1			

	Certification			
- **Are regular safety inspections / audits are undertaken at worksites?** -If yes provide details (formats), if No please refer Note 3.	1			
- **Is there a procedure by which employees can report hazards at workplaces?** - If yes provide details if No please refer Note 1.	1			
Safety Monitoring				
- **Is there an officer / supervisor responsible for monitoring workplace / worksite safety?** - If yes provide details	1			
Safety Performance Monitoring				
- **Are employees regularly provided with information on company health and safety performance?** - If yes provide details	1			
- **Has the company ever been convicted of an occupational health and safety offence?** - If yes provide details	NO Marks *(Negative mark ONE for each case)*			
- Has there been any major accident of employee at TPNODL site in past	NO Marks *(Negative mark*			

	Certification			
	ONE for each case			
- Has there been any fatal accident of employee at TPNODL site in past. - (Note: Bid evaluation committee has to take cognizance of the incident and shall evaluate the bid only after formal approval of competent authority i.e. CTO. - In case of yes please refer Note 4.	NO Mark (Negative mark FIVE for each case)			
Minimum of 75% marks is required for qualification.		Total Marks achieved		
Company Reference				
1. Name of company *2. Name of company*				

Note

1: If company does not have formal procedure on Safety Management System than vendor may submit proposed Safety road map along with safety action plan and brief safety policy on his letter head signed by head of the organization.

2: The vendor may submit the same in the Safety Action Plan.

3: The vendor may utilize the same format of TPNODL or on request SAFETY group will assist the vendor in developing the audit system. For other points also vendor may take the assistance of SAFETY group for development of Safety management system.

4: The vendor may submit the Safety Improvement Plan and Safety Action Plan for his employees based on following points.

i. *Action plan for enhancing safety awareness*
ii. *Action plan for safety training of employee*
iii. *Action plan for increasing safety audit in field*
iv. *Action plan for provision and utilization of safety PPE.*
v. *Action plan for fatality reduction.*
vi. *Action plan for enhanced supervision at site*
vii. *Action plan for making employee more responsible and accountable for safety.*
iii. *Action plan for availability and utilization of all required tool and equipment.*
ix. *Safety Improvement done in last two years, specially highlighting those which have been taken after the fatal accident along with results.*
x. *Safety initiatives planed or started recently.*

xi. Any other point.

Based on above points and documentary evidences vendor will be required to submit a detailed report in support of his bid. The bid evaluation committee and competent authority will scrutinize the facts and the evidence submitted. If found satisfactory competent authority i.e. CTO may accord his approval for bid opening otherwise his tender shall be disqualified.

Annexure 2 (Refer Para 3.2 and 5.8)

Risk Assessment Form

ısiness Associate:
ope of the work:
A's Representative:
elephone:
gnature: ate:

Specific Task/Activity	Potential Hazards/Consequences	Class Risk	Control Measures
Working at Height	Fall from height		Mandatory usage of JSA checklist prior to start of work Use appropriate ladder Use full body safety harness having double lanyard. Use Electrical Safety Shoes if working on electrical network otherwise use safety shoes. Use Safety helmet. Use PPE as per the annexure 7 of this CSM document Refer Work instruction related to Working at Height for other details Use of metal scaffold to be ensured in height work (cup lock type) Deploy competent workforce who are medically fit
Working on electrical equipment / network	Electric flash / electrocution		Mandatory usage of JSA checklist prior to start of work Use Electrical Safety Shoes while working on electrical network. Use Electrical Safety gloves of appropriate voltage rating. Use face shield / visor attached with helmet. Use Safety helmet. Use PPE as per the annexure 7 of this CSM document Mandatory usage of Insulated tools & tackles on electrical system Mandatory compliance for Lock Out & Tag out system. Refer Work instruction related to Working on electrical equipment / network for other details

Specific Task/Activity	Potential Hazards/Consequences	Class Risk	Control Measures
Excavation / Civil work	Collapse of soil, fall in excavated pit leading to Injury		Use safety shoes. Use Safety helmet. Use PPE as per the annexure 7 of this CSM document Hard Barricading of the worksite. Refer Work instruction related to excavation / civil work for other details
Material lifting & Mechanical Erection work	Fall of material/object, Topple of crane,		Mandatory compliance of crane checklist Visual condition check of lifting tools and tackles such as wire rope sling, belt sling, chain, pulley block, D-shackles, etc. shall be ensured. The operator's physical fitness and alertness should be judged by sup. / EIC. Use PPE as per the annexure 7 of this CSM document Refer Work instruction related to Material lifting & Mechanical Erection work
Road Safety	Road Accidents		Mandatory compliance of TPNODL Road Safety policy
Note: This information for the general indication purpose. The detailed risk assessment shall be conducted before start of the work by the authorized representative of the BA. The report of same shall be submitted to engineer in-charge along with annexure 4 of the CSM document.			

Guidelines for filling the Risk Assessment Form

- *Specific Task/Activity* - The documentation of each major task associated with the contract.
- *Potential Hazards* - The identification of hazards associated with each activity or task to be carried out.
- *Class of Risk* - Each hazard should be evaluated as a level of risk, described as Risk Class 1, 2 or 3 defined above.
- *Control Measure* - The identification and documentation of actions required to eliminate or reduce the hazards that could lead to accident or injury.

Hazard / Risks shall be classified according to the following schedule:

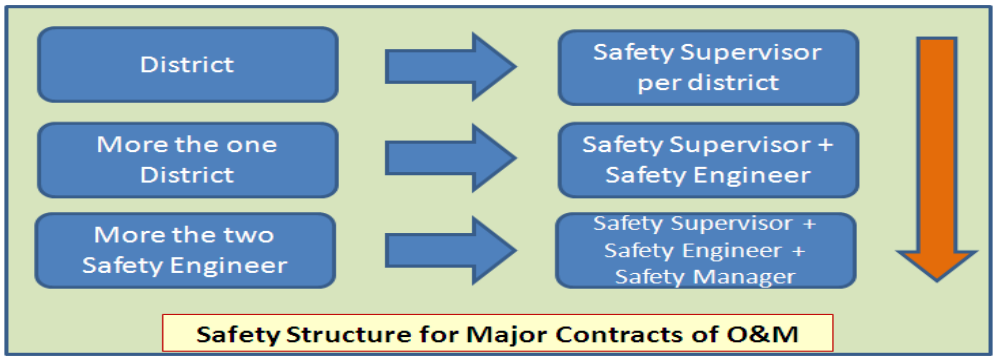
- Class 1: Potential to cause injury treatable with first aid
- Class 2: Potential to cause death or permanent injury
- Class 3: Potential to cause more than one or more lost time injuries.

Annexure 3.1 *(Refer Para 4.0)*

General Safety Conditions for the Maintenance of Distribution Network Contracts:

A BA awarded a contract (O&M) work of maintenance of distribution network will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in *annexure 7.*
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in a district. In case the BA has been awarded work in more than one district, then the following safety structure will be adopted.



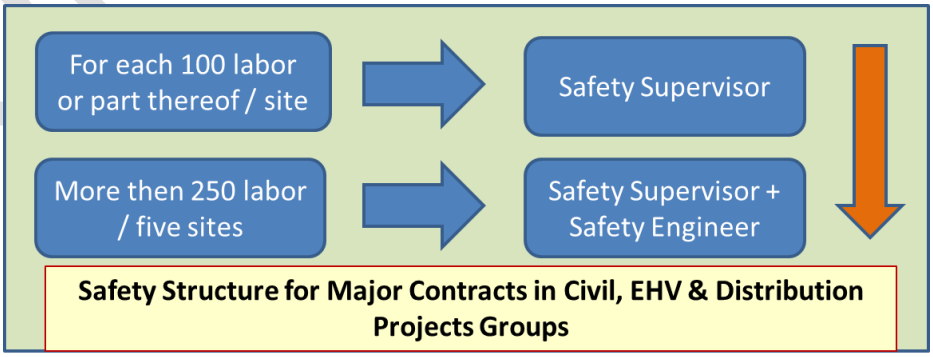
Annexure 3.2 ***(Refer Para 4.0)***

General Safety Conditions for the Distribution Projects Major Contracts:

A BA awarded a major contract work of TS&P in area of a circle will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1.

- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in the area. In case the BA has been awarded work in more than one circle, then the following safety structure will be adopted.



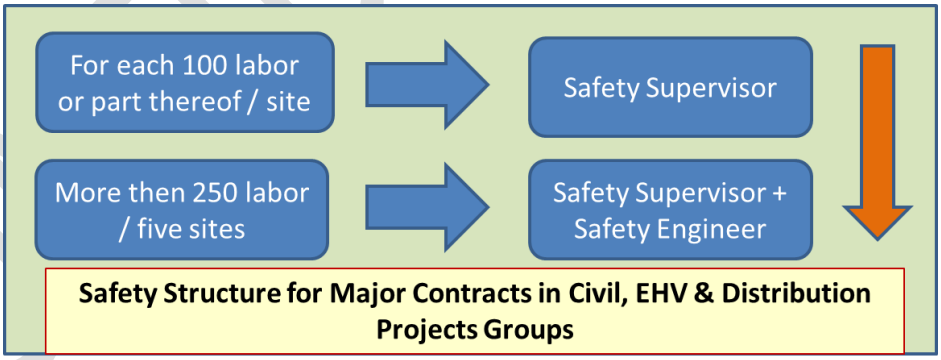
Annexure 3.3 ***(Refer Para 4.0)***

General Safety Conditions for the major EHV Projects Contracts:

A BA awarded a major contract work of EHV projects will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in annexure 7.

- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system in the area. In case the BA has been awarded work in more than one circle, then the following safety structure will be adopted.
- BA shall refer Construction Safety Manual in TPNODL Safety Manual for details.



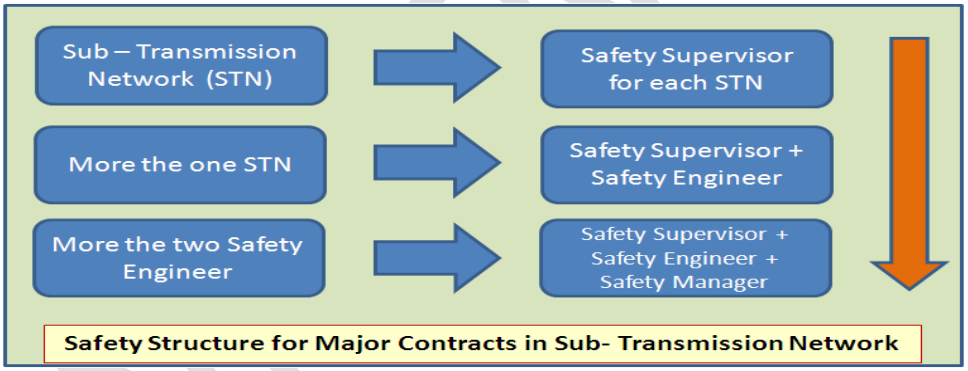
Annexure 3.4 ***(Refer Para 4.0)***

General Safety Conditions for the Maintenance of Sub – Transmission Network Contracts:

A BA awarded a major contract work of maintenance of sub – transmission network in area of a power system will be required to fulfil the following conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.

- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Coordinator for managing a complete safety management system in the area. In case the BA has been awarded work in more than one area power system, then the following safety structure will be adopted.



Annexure 3.5 ***(Refer Para 4.0)***

General Safety Conditions for the major contract work in Civil / Generation Projects:

A BA awarded a major contract work of / in civil or Generation project will be required to fulfil the following safety conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like: applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor (for workforce up to 100 at site) / a safety engineer (for workforce up to 250 at site) / safety manager (for more than two safety engineers) for managing a complete safety management system at the project site. In case the BA has been awarded more than one major contracts, then the following safety structure will be adopted.

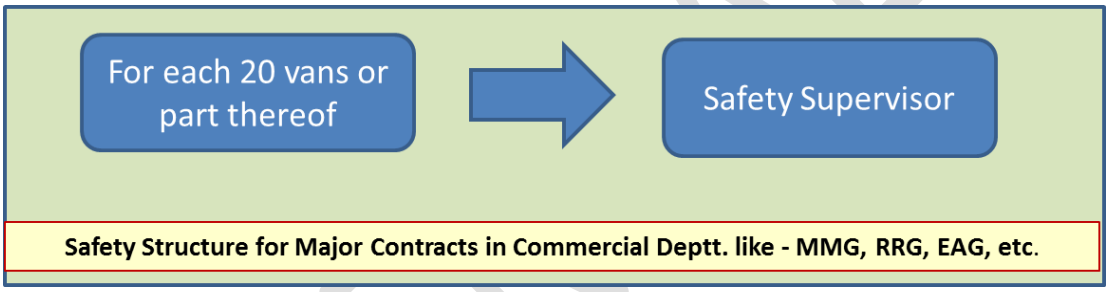
- BA shall refer Construction Safety Manual in TPNODL Safety Manual for details.

Annexure 3.6 ***(Refer Para 4.0)***

General Safety Conditions for the major contract work in Commercial Department like – Meter Reading, Billing, Collection, Disconnection, MMG, RRG, EAG, etc.:

A BA awarded a major contract work in meter management group & energy auditing group will be required to fulfil the following safety conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment (PPE) as per the TPNODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- BA shall ensure to depute a Safety Supervisor for managing a complete safety management system for the work as per the following safety structure.
- The BA for the RRG work shall depute one Safety supervisor.

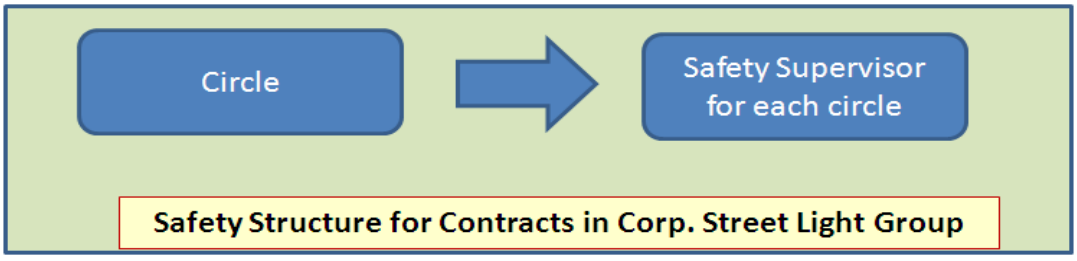


Annexure 3.7 ***(Refer Para 4.0)***

General Safety Conditions for the major contract work in O&M of street light group:

A BA awarded a major contract work in operation and maintenance of street light group will be required to fulfil the following safety conditions:

- BA shall provide Safety Policy and safety objectives of their company.
- BA shall comply with all statutory requirements like applicable acts, regulations, codes of practice, OHSAS Standards, etc.
- BA shall provide the filled safety management questionnaire as per Annexure 1
- BA shall conduct a job risk assessment and provide information as per Annexure 2
- BA shall abide by Safety manuals, guidelines of TPNODL.
- BA shall provide its organisation structure & responsibilities in terms of Safety Management to TPNODL.
- BA shall document the work practices and procedures in terms of Safety Management.
- BA shall ensure safety training and induction program for the employees
- BA shall conduct safety audits & inspections as per TPNODL procedures provided by SAFETY group.
- BA shall provide and ensure the proper usage of the safety equipment PPE as per the TPNODL approved list in annexure 7.
- BA shall ensure periodic inspection of PPE to ensure its serviceability as per the specification given by TPNODL.
- BA shall ensure the adherence to standard operating procedures or guidelines laid down by TPNODL.
- BA shall ensure reporting of any unsafe act, unsafe conditions, near miss, incident or accident to engineer in-charge and SAFETY team of TPNODL.
- BA shall provide safety performance and Safety MIS (*annexure 9)* to engineer in-charge and SAFETY group periodically. Based on any non-confirmation to the safety procedures and guidelines, BA is liable to be negatively marked for his performance and suitable penalty will be imposed.
- Each BA shall ensure to depute a Safety Supervisor for managing a complete safety management system for the work awarded as per the below structure.



Annexure 4 ***(Refer Para 3.3)***

Safety Undertaking by way of Affidavit

I_____ s/o_____R/o_____ (AUTHORIZED REPRESENTATIVE/PARTNER/DIRECTOR/PROPRIETOR) of M/S _____(name of company/firm)__ having its office at (Complete address of Company), authorized vide power of attorney dated ------/Board resolution dated----/letter of authority dated----, hereinafter referred to as **Contractor [or Business Associate (BA)]** which expression shall, unless it be repugnant to or inconsistent with the meaning or context thereof, be deemed to include its heirs, executors, administrators, and assigns do hereby affirm and undertake as under :

1. The present undertaking shall remain in force from the date of execution of contract awarded by TPNODL and shall be valid till the date of termination of the said contract by either parties. The undertaking is binding on me (contractor) as well as my sub-contractor and its employees, representatives etc.
2. That I(the contractor) will be responsible and liable to comply and abide by all the safety rules, instructions and regulations as may be specified and laid down by TP Northern Odisha Distribution Limited (TPNODL) so as enable TPNODL to achieve its goal of Zero On site incidences.
3. That the Contractor shall be fully responsible for ensuring occupational health and safety of its employees, representatives, agents as well as of its subcontractor's employees, at all times during the discharge of their respective obligations under the contract including any methods adopted for performance of their tasks / work.
4. That Contractor shall ensure ,at its own expense to arrange for and procure, implement all requisite accident prevention tools, first aid boxes, personal protective equipment, fire extinguisher, safety training, Material Safety Data Sheet, pre-employment medical test, etc. for operations & activities including as & when so specified by TPNODL specifically. , failing which TPNODL shall be entitled, but not obliged, to provide the same and recover the actual cost thereof from the Contractor's payments.
5. That the Contractor shall engage adequate and competent Safety – Supervisor / Engineer / Manager / Skilled persons at site as per the Para 5 (Qualification and experience of safety personnel) and Annexure 3 of Contract Safety Management.
6. That the Contractor shall engage the competent Site – Supervisor with each group of workers for safe and correct workmanship, proper co-ordination of material and site work as per contract.
7. That the Contractor shall immediately replace supervisor in case it is found to be not up to the level of skill and experience required as in skill and experience required in *annexure 5* of this document, but any such replacement shall be only with the prior concurrence of TPNODL .

8. That the Contractor and its subcontractors shall abide by all the safety guidelines as per Safety Manual, Contract Safety Management and other guidelines issued from time to time by TPNODL during the contract period.
9. That in case the Contractor and/or any of its Subcontractor fail to ensure the compliance as required in terms of this undertaking the Contractor shall keep and hold TPNODL / its directors / officers / employees indemnified against any / all losses / damage / expense / liability / fines / compensation / claims / action / prosecutions or the like which might be suffered by TPNODL or to which TPNODL might get exposed to as a result of any breach /wilful negligence /deliberate default on the part of the Contractor /Subcontractor in complying with the same. Contractor shall also furnish any press release, clarification etc. if sought by TPNODL for any near miss or safety violations, accidents, which are attributable to fault of Contractor.

DEPONENT

VERIFICATION

Verified at Balasore on this _Day of _____20__ that the contents of the above affidavit are true and correct and nothing material has been concealed therefrom

DEPONENT

Annexure 5 ***(Refer Para 5.4)***

SKILL / QUALIFICATION REQUIRED FOR ELECTRICIAN AND ELECTRICAL SUPERVISOR

Skill / Qualifications Required for Electrician ***(Certificate of Competency Class-II)***:

1. Formal education in ITI – Wireman/ Electrician trade.

   OR

2. Working experience of minimum three years of practical wiring.

OR

3. Have completed three years apprenticeship course through Apprenticeship Advisor, Govt. of NCT of Odisha / other state Govt. in the trade of Lineman / Wireman / Electrician.
4. A candidate must have attained the age of Eighteen years.

Skill / Qualifications Required for Electrical Supervisor (*Certificate of Competency Class-I)*:

1. Have at least five years' experience of practical wiring after passing the certificate of competency class-II i.e. electrician.
   OR
2. Recognized Degree or Diploma or equivalent qualification in Electrical Engineering from any Technical institute / College or University recognized by the Board.
   AND

   Must have completed the training/job in rectifying the common defects in electrical line and power installation for a period of one and three years after passing Degree or Diploma respectively

   OR
3. Possessing the valid certificate of certificate of competency class – 1 (Electrical Supervisor)

Annexure 6 (*Refer Para 5.6)*

Training Module for BAs Worker & Supervisor

Training for BA Supervisor **Duration – 02 Hrs / Month**

Methodology: **Lecture and Practical Demonstration of Safety Zone Creation**

Session: 1

Topic: **Electrical Safety Aspects**

Sub Topics:

1. Learning specifics of HT & LT Network of zone
2. Major type of HT / LT / service lines / street light maintenance works
3. Understanding the need of Safety
4. Understanding the safe process of maintenance:

- Planning of the maintenance job
- Availability of men, material & machine, PPEs, Safety gear and approved PTW
- Briefing of the job by the supervisor of the TPNODL
- Identification of Risks associated with the maintenance work and planning for controlling measures by TPNODL supervisor
- Creation of safety zone by TPNODL supervisor and satisfying that the network is dead – Use of Neon Tester, Shorting Chain and Safety Tagging
- Start of the work – Right person for the right job
- Alert supervision
- Completion of the job – Check points
- Energization of network
- Actions to be taken in case of some accident

Session: 2

Topic: **Use of Electrical Testing Equipment**

Methodology: **Lecture and Practical Demonstration**

Sub Topics:

1. Meggar, Hi Pot, Clamp On Meter, Neon Tester, Discharge Rod, Line tester etc.

Session: 3

Topic: **Awareness of Electrical Safety Aspects**

A. Understanding the need of this Training and Safety
B. Learning specifics of HT & LT Network
C. Major type of work to be carried out in zones
D. Switching Operations (Do's & Don'ts) including Street Light Switching
E. Working on Height *(practical demo also)*
F. Understanding the Safe Process of Maintenance / Working:

- Planning of the job
- Availability of men, material & machine, PPEs, Safety gear and approved PTW
- Briefing of the job by the supervisor

- Permit to Work
- Safety Tagging and Lock Out Tag out
- Identification of Risks associated with the work to be carried out and planning for controlling measures by proper supervision
- Concept of "***Safety Zone***"
- Identification and use of Neon Tester, Shorting Chain, Clamp On Meter, Hi Pot, Meggar etc.
- Completion of the job – Check points
- Accident Theory & Incident Reporting
- Actions to be taken in case of some accident

Session: 4

Topic: Identification, Demonstration and Usages of Tools, PPEs and other Safety Gears and demonstration of working on HT pole

Session: 5

ctical demonstration of Safety Zone creation

FREQUENCY

Regular Safety Training Program

- It will be conducted for all field & supervisor staff of BA in such a manner that all BA Personnel attend at least two hours safety training during every month.

One Day Induction Safety Training Programs:

- This training will be for the new BA's personnel, who have been cleared by the Cross Functional Panel to undergo Safety training and who are likely to be deployed at various work sites of TPNODL by the BA, as a part of AMC / Work Contract.

Duration / Periodicity:

- Duration and periodicity has been defined above. However, this is subject to change at the discretion of TPNODL.

Annexure 7 ***(Refer Para 5.7)***

LIST OF PERSONAL PROTECTIVE EQUIPMENT AND TESTING FREQUENCY

Sl. No	Name of PPE	IS / EN Standa	Testing Frequency	Remarks	Ref Brand & Mo
01	Leather Safety Sh (Color – Black) with toe cap.	IS:15298 (Part	Monthly and visual ch every day for any crac damage in the leathe sole.		BATA (Model N Endura L/C) Liberty (Model – 7198-01 Barton Black Warrior)
02	HDPE Safety helr with chin strap a ratchet type adjustment.	IS:2925-1984	Monthly and visual ch every day for any crac shell.		Karam Safetech) Joseph Leslie Accent Industrie Honeywell
03	Full body harn (Safety belt)	EN 361	Monthly and visual ch every day of the be and the harness.		Karam Safetech) Joseph Leslie Accent Industrie
04	Electrical Saf Gloves	EN: 60903 marked	Weekly and visual ch for any crack and b test before every wor	Manufactured beyond months.	Make Sparian Sumitech / CA supplied with in cotton glove w over glove of s leather.
05	Full face visor w safety helmet	EN: 166 marked (Visor	Monthly and visual ch every day for any crac shell.	Clear acrylic v attached w safety helmet.	Karam Safetech) Joseph Leslie Accent Industrie Honeywell
06	Fireproof jacket chest protection		Monthly and visual ch every day.		
07	Safety Chain shorting a earthing.	As per TPNO standard	Weekly and visual ch before every work.	Made of br Total length –	

				meters and ma of 12 SWG.	

Note:

1. *Any other Personal Protection Equipment required beyond above list will be according to BIS or EN Standards.*
2. *All Personal Protection Equipment will be checked by the engineer in-charge or SAFETY group of TPNODL.*
3. *Safety Representative of the BA has to maintain the record of the availability, condition and checking of the PPEs.*
4. *All tools required as per the contract must be according to respective IS / EN standards.*
5. *TPNODL may revise or add the above list of PPE and their specifications as and when feel necessary. The information about new specifications /models will be circulated by the Engineer In-charge (EIC), which shall adhere by the business associated in the shortest possible time. The EIC shall issue a memo / instruction to BA with timeline for implementation. Any delay will be treated as non- compliance / safety violations. Refer picture of each PPE given in next page.*

Pictures of PPE for reference purpose.

Sl. No.	Name of PPE	IS / EN Standard	Picture
01	Leather Safety Sho (Colour – Black) w PU toe cap.	IS: 15298(Part and with test rep of electri resistance.	
02	HDPE Safety helm with chin strap a ratchet type adjustment.	IS:2925-1984	
03	Full body harn (Safety belt) The straps at should and thigh shall ha full pad for comfo The back shall be designed that harn straps do not tan with each other.	EN 361:2002 EN 358 : 2000 IS: 3521:1991/200	

04	Electrical Safety Composite typ electrical gloves a of individual.	EN: 60903 CE ma	
05	Full face visor wi helmet	EN: 166 CE (Visor)	
06	Fireproof jacket protection		
07	Safety Chain for cum earthing.	As per TPNODL s	
08	Reflective jacket workman	As per TPNODL s	

Note : Picture shown are for indicative purpose only. Actual product may differ.

Annexure 8 *(Refer Para 5.8)* LIST OF AUDITS TO BE CONDUCTED

Audits	Responsibility	Freq.	Ref. Doc.
Permit to Work & Field Audit	BA Safety Representative	Weekly	F04 (COR P -12)
Tool Bag & PPE's Audit		Weekly	F06 (COR P -12)
First Aid Box Maintenance Record		Fortnightly	F08 (COR P -12)
Fire Extinguisher Record ***(Applicable for the BA involved in major construction works and have storage of flammable material at worksite)***		Monthly	F09 (COR P -12)
Safety Talk Register		Weekly	F18 (COR P -12)
Site Safety Audit		Daily	F29A (COR P -12)

Note:

1. *(BA Safety Representative has to use the formats as per Safety process COR – P – 12 of TPNODL)*

Annexure 9 (*Refer Para 5.9)*

PERFORMANCE REPORT – SAFETY

FOR THE MONTH OF……

Name of BA: ……

Name of the Project and Purchase order No: ……

Date of commencement of work: ……

Man Hour Worked in this month (No. of employees X 8 Hrs + Overtime): ……

Cumulative Man Hour worked: ……

Total Number of

Minor Injury (this month): …… Minor Injury (Total) ……

Major Injury (this month): …… Major Injury (Total): ……..

Detail of the Incident / Sub Standard Acts and Condition

Activity	This Month	Cumulative (Total)	Day Lost (this month)	ays Lost umulative)
No. of the Incident				
No. of lost time injuries				
No. of dangerous occurrences				
No. of near miss reported				
Substandard Act/Conditions observed			Attach details of observation of this month	
Safety Violation Notice received (from TPNODL) (both in numbers and in Rs.)	No.	No.	No. of violation letter received and compliance report for the TPNODL.	
	.	.		

Note: Cumulative means total from date of commencement of work according to the contract.

Detail of the Accident / Near Miss Incidents:

ate and Time	pe of the incident	ame of Employee	ief Description	rrective and Preventive tions recommended

Details of the Safety Violations:

Date and Location	Brief Description	Name of employee involved	Action Taken

Detail of the Safety Talk / Toolbox Talk / Safety Training

Date and Location	Topic (s)	Total Number of employees (Worker / Supervisor)	Number of participants (Worker / Supervisor)

Detail of the Safety Meeting

Date and Location	Number of participants	Topics discussed	Major Observations / Innovation

Detail of the Safety Inspection /Audit: (as per TPNODL site audit checklist F29A (COR-P-12)

Date	Area / Location	Major Observations	Recommendations	Action Taken

Any other Safety, Occupational Health, Environment & Disaster Management Promotional Activity (During this month):

Date	Location	Activity	Level of Participation	Number of participations

Signature of the BA Safety Representative

Name, E. No. and Date

Signature of ZM / HoG

Name, E. No. Date.

Note: The original form to be deposited with Engineer in-charge and a copy to SAFETY group on or before 5th of every month along with bill. List of training of the current month and status of PPE to be also mentioned individual wise.

BA may include additional lines if required. The TPNODL may revise the format as and when deemed required.

ANNEXURE-L

VENDOR APPRAISAL FORM

TO BE SUBMITTED BY VENDOR (To be filled as applicable)			
VENDOR:			
1.0	**DETAILS OF THE FIRM**		
	1.1	NAME (IN CAPITAL LETTERS)	:
	1.2	TYPE OF CONCERN (PROPRIETARY) Partnership, Pvt. L Public Ltd. etc.	:
	1.3	YEAR OF ESTABLISHMENT	:
	1.4	LOCATION OF OFFICE POSTAL ADDRESS TELEGRAPHIC ADDRESSES, TELEX NO. FAX NO.	:
	1.5	LOCATION OF MANUFACTURING UNITS	:
		i) UNITS 1	:
		ii) OTHER UNITS	:
2.0	**PRODUCTS MANUFACTURED**		:
3.0	**TURNOVER DURING THE LAST 3 YEARS (TO BE VERIFIED WITH LATEST PROFIT & LOSS STATEMENT).**		:
4.0	**VALUE OF FIXED ASSETS**		:
5.0	**NAME & ADDRESS OF THE BANKERS**		:
6.0	**BANK GUARANTEE LIMIT**		:
7.0	**CREDIT LIMIT**		:
8.0	**TECHNICAL**		
	8.1	NO. OF DESIGN ENGINEERS (INDICATE NO. OF YE EXPERIENCE IN RELATED FIELDS)	:
	8.2	NO. OF DRAUGHTSMAN	:
	8.3	COLLABORATION DETAILS (IF ANY)	:
		DATE OF COLLABORATION	:
		NAME OF COLLABORATOR	:
		RBI APPROVAL DETAILS	:

		EXPERIENCE LIST OF COLLABORATORS	:
		DURATION OF AGREEMENT	:
	8.4	AVAILABILITY OF STANDARDS / DESIGN PROCEDURE COLLABORA-TOR'S / DOCUMENTS (CHECK WHETHER TH ARE LATEST/CURRENT	:
	8.5	TECHNICAL SUPPORT, BACK-UP GUARANTEE, SUPERVISI QUALITY CONTROL BY COLLABORATOR (WHERE ESSENTIAL). (THIS CLAUSE IS RELEVANT WHEN VENDC EXPERIENCE IS INADEQUATE)	:
	8.6	QUALITY OF DRAWINGS	:
9.0	**MANUFACTURE**		
	9.1	SHOP SPACE, LAYOUT LIGHTING, VENTILATION, ETC.	:
	9.2	POWER (KVA)	:
		MAINS INSTALLED	:
		UTILIZED	:
		STANDBY POWER SOURCE	:
	9.3	MANUFACTURING FACILITIES (ATTACH LIST OF EQUIPMI AS APPLICABLE)	:
		9.3.1 MATERIAL HANDLING	:
		9.3.2 MACHINING	:
		9.3.3 FABRICATION	:
		9.3.4 HEAT TREATMENT	:
		9.3.5 BALANCING FACILITY	:
		SURFACE TREATMENT PRIOR TO PAINTING/ COATI POLISHING, PICKLING, PASSIVATION, PAINTING, ETC.	:
	9.4	RVISORY STAFF	:
	9.5	ADEQUACY OF SKILLED LABOURS (MACHINISTS, WELDE ETC.)	:
	9.6	NO. OF SHIFTS	:
	9.7	TYPE OF MATERIAL HANDLED (SUCH AS CS, SS, ETC.)	
	9.8	WORKMANSHIP	:
	9.9	MATERIAL IN STOCK AND VALUE	:

	9.10	TRANSPORT FACILITIES	
	9.11	CARE IN HANDLING	
10.0	**INSPECTION / QC / QA / TESTING**		
	10.1	NUMBER OF PERSONNEL (INDICATE NO. OF YEARS EXPERIENCE)	
	10.2	INDEPENDENCE FROM PRODUCTION	
	10.3	AVAILABILITY OF PROCEDURAL WRITE UP/QUALITY PLAN	
	10.4	INCOMING MATERIAL CONTROL AND DOCUMENTATION	
	10.5	RELIABILITY/REPUTATION OF SUPPLY SOURCES	
	10.6	STAGE INSPECTION AND DOCUMENTATION	
	10.7	SUB-ASSEMBLY & DOCUMENTATION	
	10.8	FINAL INSPECTION AND DOCUMENTATION	
	10.9	PREPARATION OF FINAL DOCUMENTATION PACKAGE	
	10.10	TYPE TEST FACILITIES	
	10.11	ACCEPTANCE TEST FACILITIES	
	10.12	CALIBRATION OF INSTRUMENTS AND GAUGES (V TRACEABILITY TO NATIONAL STANDARDS) (ATTACH LIST)	
	10.13	STATUTORY APPROVALS LIKE BIS, IBR, ETC. (AS APPLICABL	
	10.14	SUB-VENDOR APPROVAL SYSTEM AND QUALITY CONTROL	
	10.15	DETAILS OF TESTS CARRIED OUT AT INDEPENI RECOGNIZED LABORATORIES	
		FURNISH LIST OF TESTS CARRIED OUT AND THE NAME OF LABORATORY WHERE THE TESTS WERE CONDUCTED	
		CHECK AVAILABILITY OF CERTIFICATES AND REVIEW T WHEREVER POSSIBLE	
11.0	**EXPERIENCE (INCLUDING CONSTRUCTION / ERECTION COMMISSIONING) TO BE FURNISHED IN THE FORMAT INDICATE APPENDIX)**		
12.0	**SALES, SERVICE AND SITE ORGANIZATIONAL DETAILS**		
13.0	**CERTIFICATE FROM CUSTOMERS (ATTACH COPIES OF DOCUMENTS**		
14.0	**POWER SITUATION**		
15.0	**LABOUR SITUATION**		

16.0 *	**APPLICABILITY OF SC/ST RELAXATION (Y/N)** **IF YES, SUPPORTING DOCUMENTS TO BE ATTACHED**	
17.0	**ORGANIZATIONAL DETAILS** 1. PF NO 2. ESI NO 3. INSURANCE FOR WORK MAN COMPENSATION ACT NO 4. ELECTRICAL CONTRACT LIC NO 5. ITCC / PAN NO 6. SALES TAX NO 7. WC TAX REG. NO	
18.0	**DOCUMENTS TO BE ENCLOSED:** 1. FACTORY LICENCE 2. ANNUAL REPORT FOR LAST THREE YEARS 3. TYPE TEST REPORT FOR THE ITEM 4. PAST EXPERIENCE REPORTS 5. ISO CERTIFICATE –QMS, EMS, OHAS, SA 6. REGISTRATION OF SALES TAX 7. COPY OF TIN NO. 8. COPY OF SERVICE TAX NO. 9. REGISTRATION OF CENTRAL EXCISE 10. COPY OF INCOME TAX CLEARANCE. 11. COPY OF PF REGISTRATION 12. COPY OF ESI REGISTRATION 13. COPY OF INSURANCE FOR WORK MAN COMPENSATION ACT NO 14. COPY OF ELECTRICAL CONTRACT LIC NO 15. COPY OF PAN NO 16. COPY OF WC TAX REGISTRATION 17. DOCUMENTS IN SUPPORT OF SC/ST RELAXATION AT S.NO.16.0 18. GSTN CERTIFICATE	

*** Classification of BA s under SC/ST shall be governed under following guidelines:**

- **Proprietorship/ Single Ownership Firm:** Proprietor of the firm should be from SC/ST community. Governing document shall be Proprietorship Deed.
- **Partnership Firm:** Only such firms shall qualify which have SC/ST partners holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Partnership Deed.
- **Private Limited Company:** Only such firms shall qualify which have SC/ST directors holding equal to or more than 50% of the total ownership pattern of the firm. Governing document shall be Memorandum of Understanding (MoU) and/or Article of Association (AoA).

NOTE: Certification from SC/ST Commission shall be required for deciding upon SC/ST status of a person.

ANNEXURE XIX

SAFETY POLICY AND SAFETY TERMS AND CONDITIONS

Definitions

Order Manager: Order Manager is the TPNODL representative, who has the ownership of the given job under the signed contract.

Service Provider/Contractor/Vendor: An individual or an organization that provides services to TPNODL under a signed contract.

Site Safety Management Plan: It is the safety plan agreed between Contractor / Service provider and TPNODL. It will contain the entire job specific safety requirement and will be signed by the service provider.

High Risk Job: Any job which has significant health and safety risk associated to it. The list of high risk jobs has been identified at TPNODL level.

Emergency: A serious, unexpected, business discontinuity and often dangerous situation resulting into loss of revenue / property and requiring immediate action.

1. Safety Policy

TPNODL

HEALTH AND SAFETY POLICY

TP Northern Odisha Distribution Limited is committed to provide safe and healthy working environment for the prevention of work related injuries and ill-health. Safety is one of our core values. Westrive to be a leader in safety excellence in the global power and energy business. In pursuit of this, we are committed to the following:

- Maintain and continually improve our management systems to eliminate hazards and reduce health & safety risks to all our stakeholders.
- Incorporate appropriate health & safety criteria into business decisions for selection of plant and technology, performance appraisal of individuals and appointments in key positions.
- Comply and endeavor to exceed all applicable health & safety legal and other requirements
- Integrate health & safety procedures and best practices into every operational activity with assigned line-functional responsibilities at all levels.
- Involve our employees and business associates in maintaining a safe and healthy work environment through consultation and participation
- Inculcate safety culture by visible leadership and empowerment.
- Ensure required competency to enable our employees and business associates for working safely.
- Promptly report incidents, investigate, share crucial learnings and prevent recurrences.
- Influence our business associates in enhancing their health and safety standards and align with Tata Power's health & safety codes and practices.
- Set safety & health metrics as indicators of excellence, monitor progress and continually improve health and safety performance.

We shall ensure the availability of appropriate resources at all times to fully implement and communicate this policy to all stakeholders by suitable means and periodically review its relevance in continuously changing business environment.

(Bhaskar Sarkar)
Chief Executive Officer

Date: 01st April 2021

Lighting up Lives!

2. Safety Organization & Responsibilities

2.1 Contractor Site Management and Supervision

Each Contractor will be responsible for fulfilling all statutory and safety requirements as per the laws of the land and not limited to Factory Act, Electricity Act, Electricity Rules and Regulations, Shop and Establishment Act etc.

Each Contractor shall provide at least one competent fulltime safety supervisor for workforce of less than 100 numbers. When workforce ranges from 100 to 1000, the contractor has to provide at least one qualified safety officer and safety supervisors (reporting to the safety officer) in the ratio 1:100. For every 1000 addition in workforce, the contractor has to add 1 safety officer. The TPNODL Project Safety Manager will review and approve the appointment of all safety supervisors. Contractor/Subcontractor safety supervisors/officers will work with Tata Power Safety Managers and align themselves with Tata Power safety requirements.

Each Contractors'/Subcontractors' Site Manager is responsible, and will be held accountable, for the safety of their sub-contractors and workforce and for ensuring that all equipment, materials, tools and procedures remain in safety compliance at job site, including:

- Holding officer/supervisors accountable for safety and actively promote safe work performance.
- Participate in and cooperate with all safety program requirements to be implemented in order to meet Tata Power safety objectives.
- Ensure timely reporting of safety incidents, near misses, unsafe acts and conditions.
- Identify the training needs of its employees and maintain all safety training documents.
- Provide safety performance report at an agreed frequency.
- Stopping of unsafe work (acts and/or conditions) immediately, until corrective action be taken.

2.2 Contractor Supervisors and General Staff

Contractors' site supervisors and general staff members in charge of job site functions such as field engineering, warehousing, purchasing, cost and scheduling, etc. are responsible for the safe performance of the work of those they supervise. They must set an example for their fellow employees by being familiar with applicable sections of the Site Safety program and ensuring that all site activities are performed with SAFETY as the primary objective.

Each site supervisor is responsible and will be held accountable for identifying, analyzing and eliminating or controlling all hazards through implementation of an aggressive, pro-active Health, Safety and Environmental Program from project inception through project completion. Each supervisor will proactively participate in the SHE program by observing, correcting unsafe acts, and recording these observations.

2.3 Contractor Workforce

Contractor workforce must make safety a part of their job by following safety rules and regulations and by using all safeguards and safety equipment. They must take an active part in the Site Safety program to ensure their own safety and injury-free employment as well as being alert to unsafe practices of their fellow employees.

Every member of the workforce is expected to report for work without influence of any Drug/Alcohol. All employees are expected to report any hazardous conditions practices and behaviors in their work areas and correct where ever possible. Workforce is responsible for active participation in safety and health programs, suggestion systems, trainings and in immediate reporting of all injuries, any unsafe practices, conditions or incidents to their supervisors.

2.4 Vendor/Contractor

Vendors/Contractor shall at all times comply with, and ensure that their workforce comply with all site safety rules and regulations. Specifically, with applicable provisions of the Tata Power Site Safety Management Plan, and all statutory safety rules and regulations.

3. Site Safety Rules and Procedures

The work in the safest possible manner can only happen when it has been carefully planned and all applicable procedures are followed. The Tata Power Safety Procedures are derived from Tata Power best practices and the applicable Government acts regulations. In each case, the most stringent regulation is used.

Following is the list of Tata Power's critical Safety Rules and Procedures. Contractor shall refer to approved Rules and Procedures for detailed requirements and ensure conformance.

3.1 Lock Out and Tag Out Procedure

This procedure is intended to be used for the protection of Personnel while servicing or performing maintenance on equipment / pipeline / vessel / process systems. This is a general procedure that shall be used as the minimum requirements for isolation of equipment, pipelines, machines, system from all possible sources of hazardous energy and / or material such as Steam, Hot Water, Compressed Air, any other process fluid / chemical energy/Mechanical energy or Electrical energy. For complete procedure kindly refer Procedure Document No. TPSMS/CSP/LOTO/001 REV 01 available on official website of Tata Power (www.tatapower.com)

3.2 Excavation Safety (Shoring and Sloping) Procedure

This procedure is developed to cover the safe practices required for shoring and sloping in excavation and trenching jobs. This procedure is developed to establish mandatory requirements for practices to protect personnel, property and equipment from hazards associated with above activities. For complete procedure kindly refer Procedure Document No TPSMS/CSP/EXS/002 REV 01 available on official website of Tata Power (www.tatapower.com)

3.3 Confined Space Entry Procedure

This procedure outlines the steps required to perform the confined space entry and to protect personnel from the hazards of entering and conducting operations in confined spaces. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/CSE/003 REV 01 available on official website of Tata Power (www.tatapower.com)

3.4 Working at Height Procedure

This procedure describes the rules and procedures to protect employees from the hazards of working at heights.

This procedure is developed to cover the safe practices required for Working at Heights. This procedure is developed to establish mandatory requirements for practices to protect personnel from hazards associated in this area. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/WAH/004 REV 01 available on official website of Tata Power (www.tatapower.com)

3.5 Heavy Equipment Movement Safety Procedure

Heavy equipment lifting and movement is an activity involving loading, unloading, storage and movement from one place to another including lifting and erection or repairing of equipment with cranes or hoists. Material, machinery and equipment handling operations are being carried out by large capacity cranes and hoists, which make the job safer and faster. This procedure addresses the hazards and precautions associated with such equipment and their use. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/HEMS/005 REV 01 available on official website of Tata Power (www.tatapower.com)

3.6 Mobile Crane Safety Procedure

Mobile cranes are responsible for many incidents, injuries. Falling loads from mobile cranes pose a severe hazard to operators and nearby workers and property. Many types of cranes, hoists, and rigging devices are used for lifting and moving materials. To maintain safe, appropriate standards has to be adhered to and only qualified and licensed individuals shall operate these devices. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/MCS/006 REV 01 available on official website of Tata Power (www.tatapower.com)

3.7 Scaffold Safety Procedure

This procedure is developed to provide information on the safe erection, use, dismantling and maintenance of access scaffolding in the workplace. It is developed to establish mandatory requirements for practices to protect personnel from hazards associated with erection, use and dismantling of scaffolds. For complete procedure kindly refer Procedure Document No – TPSMS/CSP/SCAF/007 REV 01 available on official website of Tata Power (www.tatapower.com)

3.8 Electrical Safety Procedure

The objective of these standards is to specify minimum mandatory requirements and advisory guidance for identifying and controlling hazards to ensure 'Zero Harm' with regard to operation maintenance and testing of electrical equipment. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/ELEC/010 REV 01 available on official website of Tata Power (www.tatapower.com)

3.9 Job Safety Analysis (JSA) Procedure

This objective of this procedure is to have a task based risk assessment process in place that identifies, evaluates and controls the risks associated with work activities, and as a result, prevents those involved in the task or those potentially affected by the task, from being harmed. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/JSA/009 REV 01 available on official website of Tata Power (www.tatapower.com)

3.10 Fire Safety Management Procedure

Objective of this standard is to specify the minimum mandatory requirements and advisory guidelines to ensure prevention of fire related incidents and managing / controlling their impacts if they do occur. For complete procedure kindly refer Procedure Document No- TPSMS/CSP/FSM/011 REV 01 available on official website of Tata Power (www.tatapower.com)

3.11 Permit To Work Procedure

Given the inherent hazards of the power generation and distribution industry, a significant number of TATA POWER operations and installations are critical. Work Permit (WP) System is an essential element in controlling the workplace risks in an effective manner. For complete procedure kindly refer Procedure Document No –TPSMS/CSP/PTW/008 REV 01 available on official website of Tata Power (www.tatapower.com)

3.12 Lift (Elevator) Safety Procedure

To provide safe operating procedure for taking control of lift car before entering and existing the pit of OTIS make elevators. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/LIFT/001 REV 01 available on official website of Tata Power (www.tatapower.com)

3.13 Working on conveyor belt Procedure

This procedure is developed to cover the safe practices required for Working on live equipment and to protect personnel from hazards associated with it. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/CONV/002 REV 01 available on official website of Tata Power (www.tatapower.com)

3.14 Handling Hazardous Materials Procedure

This Procedure is developed to provide procedure for recycling and / or safe disposal of used / waste batteries in compliance with all legislation. For complete procedure kindly refer Procedure Document No-TPSMS/GSP/HAZM/003 REV 01 available on official website of Tata Power (www.tatapower.com)

3.15 Material Handling and Storage Procedure

The purpose of this document is to provide procedures to assist the safe handling of materials (manual handling and mechanical handling). For complete procedure kindly refer Procedure Document No – TPSMS/GSP/MATL/004 REV 01 available on official website of Tata Power (www.tatapower.com)

3.16 Contractor Safety Management Procedure

The purpose of this document is to engage with contractors in a way to create safe work environment for everyone working for Tata Power. For complete procedure kindly refer Procedure Document No – TPSMS/GSP/CSM/015 REV 01 available on official website of Tata Power (www.tatapower.com)

The above procedures will be updated periodically and the updated version of the procedures as well as any additional critical procedure will be available on official website of Tata Power (www.tatapower.com) for your reference.

4. Training and Capability Building

Safety Training and capability building of workforce is a major component of safety management program. All training required must be provided and documented as specified by Tata Power and Indian Regulations. Tata Power Safety Manager will audit contractors training and related documentation to assure its adequacy.

4.1 Tata Power Site Safety Orientation

All Tata Power contractor and subcontractor workforce is required to attend Tata Power Site Safety Orientation Training to receive a Safety Training Card, which is required to obtain a Gate Pass to the site, prior to entry.

This Safety Orientation Course will be for duration of minimum half day. The information provided during the orientation will include, but is not limited to following:

- Job rules, personal safety and conduct
- Hazards reporting
- Reporting of injuries
- Emergency procedures
- Safety Activities and Program including disciplinary measure and incentives.
- Critical safety procedure relevant to the job

4.2 Capability Building

Appropriate training such as L1, L2 & L3 is given to ensure that a jobholder, either supervisor or worker, is competent to do his/her job safely. The skill training is provided through TPSDI and other agencies authorized by Tata Power on the list of 15 procedures mentioned under safety procedure.

Contractor shall ensure that concerned workmen are provided with adequate training before he/she is allowed to execute the work.

An evaluation test will be conducted after the completion of the training. Those workmen employee who meet the minimum required competency will be provided with Gold Card which is valid for 3 years, post which the workmen has to reappear for the assessment. If the workman is not able to qualify the assessment, he/she will be given 3 additional attempts to clear in 3 month timeframe failing which he/she will not be allowed to work on high risk jobs.

5. Pre-Employment and Periodic Medical check up

Contractor shall arrange to conduct a pre-employment and periodic medical check-up for its entire workforce by Tata Power medical officer or Tata Power authorized medical officer. The contractor shall be able to produce the certificate prior to the employment. The contractor shall also organize to conduct periodical medical checkup (six monthly) for the following category of employees:

- Drivers (Check for Vision & Hearing)
- Equipment Operators (Check for Vision & Hearing)
- Workforce working at Height (Check for Vision, Hearing, Vertigo & Height Phobia)
- Workforce Handling the hazardous substances (Coal, ash and chemicals)
- Workforce in high decibel area (> 90 Decibel, Check for Hearing)
- Workforce, working in specific areas requiring specific medical attention should conduct the medical test as laid down in the respective Site Safety Management Plan.

6. Safety Performance Evaluation and Penalties

A certain percentage of the bill value will be retained against every running bill as safety performance retention. The amount will be released with the last invoice based on “Safety Performance score” attached in CSM-F-3 of CSM procedure. The amount is based on following table

ntract Value	ention Amount (%)
to 10 Lakhs	
– 50 lakhs	
to 10 Cr	
) Cr	

- Safety performance Score will be monitored by the Order Manager every month.
- For the contract value of more than Rs 1 Cr or contract duration more than 12 months, the retention amount shall be released half yearly based on safety performance. For all remaining contracts, the retention amount will be released with the final bill.
- In case of job stoppage due to safety violations/ unsafe observations at the site, no time extension shall be given to the contractor, if such delays are attributable to contractor.
- In case of fatality, limb loss or loss of property, vendor has to pay for liability, legal, statutory and additional mutually agreed settlement charges imposed by the appointed committee. This charge is over and above the retention amount.
- The committee will finalize an amount between 5 -50 lakhs based on factors such as advise by statutory authorities, contract value and impact of accident etc.
- Safety performance bonus 1% (limiting to 50 lakhs) of the invoice value will be considered at the end of the job if the contractual safety performance score is 100%.
- During the progress of the work, concerned Supervisor/Engineer will visit and inspect the work site regularly and evaluate the safety performance of the contractor based on matrix attached herewith.
- Order Manager, divisional chief and SBU head have the authority to terminate the contract in case of three consecutive serious violations.

7. Safety Performance Evaluation - CSM-F-3

S. No.	Lead Indicators	Unit Of measurement	Target	Weightage
1	% of Employee certified TPSDI/Authorized agency	%	50	10
2	CFSA score (Annexure 6.1)	Average Severity Violations	1.49	20
3	Monthly inspection completed f Critical Equipments, lifting Tools Tackles and hand tools used at si	%	80	5
4	Condition of tools, tackles ar equipments	%	100	15
	Lag Indicators			
1	Number of Fatalities	No.	0	30
2	Number of Lost work day case (LWDC)	No.	0	10
3	Man-days Lost	No.	0	10

In addition to above evaluation criteria, for specific violations penalty shall be imposed on the contractors under following circumstances:

Sr No	Description of violation	Severity	Penalty /
1.	Working without Permit	5	5000/-
2.	Untrained (TPSDI) worker on high-risk jobs.	5	5000/-
3.	Unhygienic/Bad condition of PPE	2	250/-
4.	Not following Tata Power Procedure & Standard	4	2000/-
5.	Unsafe Act/Condition of Severity 4	4	2000/-
6.	Unsafe Act/Condition of Severity 5	5	5000/-
7.	No Earthling of Electrical equipment	5	5000/-
8.	Damaged welding cable	5	5000/
9.	Violation of Positive Isolation Procedure (LOTO Not followed)	5	5000/
10.	ELCB of more than 30 mA/ELCB not working	5	5000/
11.	On/Off switch of welding m/c not working	5	5000/
12.	Electric cable tied with metal wire	5	5000/
13.	Leakage found DA hose / cylinder	5	5000/
14.	Use of LPG	5	5000/
15.	Use of Three-wheeler at the work site.	5	5000/
16.	Starting the job without Tool Box Talk	5	5000/
17.	Spatter falling on DA hose / Gas-line/ pathways / Equipment	5	5000/
18.	No safety latch in crane hook	5	5000/
19.	Load raised or swung over people or occupied areas of buildings	5	5000/
20.	Persons standing in swing area of construction equipments.	5	5000/
21.	Using damaged slings.	5	5000/
22.	Unstable scaffolding/non standard Scaffolding in use	5	5000/
23.	Handrails and mid-rails are missing	5	5000/
24.	Safety Harness not anchored with lifeline/fixed structure	5	5000/
25.	Fall arrestor not provided/ Not being used.	5	5000/
26.	Double life line not used for working at height	5	5000/
27.	No rubber mat in DB room	4	2000/-
28.	Water found accumulated in DB room/near welding machine.	4	2000/
29.	Inserting electric cables into socket, without using plug.	4	2000/
30.	Use of damaged electrical cable/two core cables.	4	2000/
31.	Inflammable material found in D.B Room./ welding areas.	4	2000/
32.	Loose material falling into excavated pit	4	2000/
33.	Water logging into excavated pit	4	2000/
34.	No / inadequate Barricade	4	2000/

Sr No	Description of violation	Severity	Penalty /
35.	Undercut / cave-in found on sides of excavated pits	4	2000/
36.	Grinding wheel/ Coupling/ Piling winch/other rotating parts without guard	4	2000/
37.	The HMV/Mobile Crane operator does not having a valid HMV driving license.	4	2000/
38.	The loading area is not leveled properly.	4	2000/
39.	Ladder not anchored at top	4	2000/
40.	Opening found in working platform of scaffolding/floor	4	2000/
41.	Inadequate illumination at the working area	4	2000/
42.	Loose material lying on Gantry ,platform	4	2000/
43.	Cleaning body with Compressed Air.	3	500/-
44.	Gas Cylinders using without cap.	3	500/
45.	Gas Cylinders stored without securing	3	500/
46.	Bringing inside any other chemicals, apart from approved by Safety dept.	3	500/
47.	Using drum for sitting or accessing height.	3	500/
48.	Misusing emergency facilities like fire hydrant line/ hose box/ spray system/ eye wash etc.	3	500/
49.	No provision of Safety net where falling materials or tools may occurs	3	500/
50.	Taking electrical supply from non designated outlet (other than socket).	3	500/
51.	Restricted gangways due to unwanted materials.	3	500/
52.	Not reporting incident.	3	500/
53.	Entering into restricted area like switch yard/ hazardous storage etc.	3	500/
54.	Work without supervision	3	500/
55.	Parking of vehicle without applying wheel choke at right front-front and left rear-rear wheels other than passengers cars.	3	500/
56.	Vehicle without helper or co-driver.	3	500/
57.	Not wearing florescent safety jacket at site.	3	500/
58.	People travelling in load body of vehicle.	3	500/
59.	Parking of vehicles at non designated area.	3	500/
60.	Shifting heavy materials without guide ropes.	3	500/
61.	Using other than 24V lamp inside the confined space/Use of other than 24V lamps.	3	500/
62.	Angular/ starch loading/ lifting with Crane or hoist.	3	500/
63.	By passing the limit switch/ Safety Interlock.	3	500/
64.	Housekeeping activities on road without proper barricade.	3	500/

Sr No	Description of violation	Severity	Penalty /
65.	Trying to board or alit from running vehicle.	3	500/
66.	Cylinder Valves of Gas cylinders not closed when not in use.	3	500/
67.	Flash-back arrester not used.	3	500/
68.	Trolley wheel found damaged.	3	500/
69.	Guy ropes of required length on both sides of object are not used during movement with load.	3	500/
70.	Scotch block/wedge not provide when the vehicle is parked.	3	500/
71.	Suitable Trolley not provided to hold the cylinders.	3	500/
72.	Locked First Aid box	3	500/
73.	Caution boards, danger signs (luminescent /red) along with emergency contact number are not found displayed.	3	500/
74.	Person found jumping barricading tape	3	500/
75.	Stacking of pipes, pile casing , drums without chock blocks/wedges	3	500/
76.	The terrain on which Heavy Equipment/Machinery moves is not reasonably hard.	3	500/
77.	Without Safety Helmet at working sites	4	250/-
78.	Without Crash Helmet (on bikes)	4	500/-
79.	Without Full body double lanyard Safety Harness (for work at height)	5	5000/-
80.	Without Hand gloves - Material Handling, Welding, Cutting,	4	100/-
81.	Without Safety goggles/ face shield - Welding/Cutting /Grinding	5	5000/-
82.	Handling Chemical without PVC Apron	5	5000/-
83.	Smoking in prohibited area (Closed Go-downs, Storage of flammable material, Storage of Gas cylinders)	5	1000/-
84.	Sleeping at Work Place	3	100/-
85.	Driving beyond speed limit	3	1000/-
86.	Seat Belt While Driving (for front seat passengers and driver)	3	500/-
87.	Driving without license	4	1000/-
88.	Heavy Commercial vehicles without reverse horn	3	500/-
89.	Non functional Head light/ tail light and side indicators	3	100/-
90.	Using Mobile Phone During Driving	5	5000/-
91.	Poor visibility of registration number/ without registration number	3	100/-
92.	Broken/ without Side view mirror	3	100/-
93.	Over speeding above specified limit	3	500/-
94.	Broken/ Without Pressure gauge on Oxygen/ LPG / Acetylene cylinder.	3	500/-

Sr No	Description of violation	Severity	Penalty /
95.	Without Flash back arrestor on Industrial Acetylene & Oxygen cylinders.	5	5000/-
96.	Spillage of hazardous material/chemicals during transportation	4	2000/-
97.	Electrical equipment without Earthing/ ELCB/ Double Insulation Cable.	5	5000/-
98.	Lifting Tools & Tackles used without/ expired Test Certificates.	5	5000/-
99.	Housekeeping repeatedly not maintained		
100.	• First Time	3	Warning
101.	• Second Time	4	1000/-
102.	• Third Time	5	5000/-
103.	Serious Violation Of House Keeping (after 1st or 2nd warning to be decided by Project Manager depending on the severity)		Rs.10000/- and above
104.	Repeat Violation of same nature	5	5X Violation

ANNEXURE XX
TATA CODE OF CONDUCT

The Owner abides by the Tata Code of Conduct in all its dealing with stake holders and the same shall be binding on the Owner and the Contractor for dealings under this Order/ Contract. A copy of the Tata Code of Conduct is available a tour website:

https://www.tatapower.com/pdf/aboutus/Tata-Code-of-Conduct.pdf

The Contractor is requested to bring any concerns regarding this to the notice of our Chief-Contracts & Material Management e-mail sunil.bhattar@tpnodl.com.

ANNEXURE XXI

ENVIRONMENT & SUSTAINABILITY POLICY

CORPORATE ENVIRONMENT POLICY

Tata Power is committed to a clean, safe and healthy environment, and we shall operate our facilities in an environmentally sensitive and responsible manner. Our commitment to environmental protection and stewardship will be achieved by:

- Complying with the requirements and spirit of applicable environmental laws and striving to exceed required levels of compliance wherever feasible
- Ensuring that our employees are trained to acquire the necessary skills to meet environmental standards
- Conserving natural resources by improving efficiency and reducing wastage
- Making business decisions that aim towards sustainable development
- Engaging with stakeholders to create awareness on sustainability

(Praveer Sinha)
CEO & Managing Director

Date: 15th June, 2018

TATA POWER
Lighting up Lives!

CORPORATE SUSTAINABILITY POLICY

At Tata Power, our Sustainability Policy integrates economic progress, social responsibility and environmental concerns with the objective of improving quality of life. We believe in integrating our business values and operations to meet the expectations of our customers, employees, partners, investors, communities and public at large

- We will uphold the values of honesty, partnership and fairness in our relationship with stakeholders
- We shall provide and maintain a clean, healthy and safe working environment for employees, customers, partners and the community
- We will strive to consistently enhance our value proposition to the customers and adhere to our promised standards of service delivery
- We will respect the universal declaration of human rights, International Labour Organization's fundamental conventions on core labour standards and operate as an equal opportunities employer
- We shall encourage and support our partners to adopt responsible business policies, Business Ethics and our Code of Conduct Standards
- We will continue to serve our communities:
  - By implementing sustainable Community Development Programmes including through public/private partnerships in and around our area of operations
  - By constantly protecting ecology, maintaining and renewing bio-diversity and wherever necessary conserving and protecting wild life, particularly endangered species
  - By encouraging our employees to serve communities by volunteering and by sharing their skills and expertise
  - By striving to deploy sustainable technologies and processes in all our operations and use scarce natural resources efficiently in our facilities
  - We will also help communities that are affected by natural calamities or untoward incidence, or that are physically challenged in line with the Tata Group's efforts

The management will commit all the necessary resources required to meet the goals of Corporate Sustainability.

(Praveer Sinha)
CEO & Managing Director

Date: 15th June, 2018

TATA POWER
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