A Model Scheme to Solarize & Ensuring Reliable Daytime Power Supply to Rural Households through Community Solarization Mechanism

In line with "PM Surya Ghar Muft Bijli Yojana"
Ensuring Reliable Power Supply without investment of Rural Residential Consumers

A Demand Side Management (DSM) Programme
by
Odisha DISCOMs

Existing Scenario of Rooftop Solar & Challenges

TPWODL

❖GOI, on 19th February 2019 approved **RTS Phase II** of 'Grid Connected Rooftop and Small Power Plants Program'

❖Distribution Companies of Odisha has received the allocation order of 20 MW (05 MW each)

CFA to Residential Individual House Holds

Project Capacity	Applicable CFA
1-3 kW	Rs. 18,000/kW
Above 3-10 kW	Rs. 9,000/kW

CFA to Resident Welfare Association /Group Housing Society (RWA/GHS)

Project Capacity	Applicable CFA
For Common facility up to 500kW	Rs. 9,000/kW

✓ **RTS Phase II:**
- A. Implementing Agency: Respective DISCOMs
- B. Domestic Electricity Consumer can avail Subsidy

✓ **Challenges in the Existing scheme :**
- **A. Rural homes are less interested** in Rooftop Solar Financial constraints, **low & subsidized** electricity tariffs.

RTS Progress till date in Odisha under Subsidy Scheme

Sr No	Discom	No of Installations	Capacity (MW)
1	TPCODL	70	0.276
2	TPNODL	35	0.104
3	TPSODL	38	0.136
4	TPWODL	18	0.086
5	Total	161	0.602

PM – Surya Ghar: Muft Bijli Yojana

Announced by the Hon'ble Prime Minister on 13.02.2024 aims to solarize one (01) crore households in India.

Subsidy for residential households

Rs. 30,000/- per kW up to 2 kW

Rs. 18,000/- per kW for additional capacity up to 3 kW

Total Subsidy for systems larger than 3 kW **capped at Rs 78,000**

State's Regulations/ Guidelines:

1. OERC Net Metering Regulation Dated :19.08.2016
2. OERC Net Metering Regulation amended : 05.05.2022 (VNM & GNM).
3. OERC Order dated 23.02.2023 regarding SoP of Solar Net Metering, Gross Metering, VNM & GNM.
4. Odisha RE Policy- 2022

MNRE allowed Subsidy to Rural Households under VNM mechanism as per RTS scheme

TPWODL

Why DISCOM

DISCOM's Difficulties & Scope in Rural Segment

Present Position of the DISCOMs in Rural Segment:

- ✓ High Distribution Loss
- ✓ Difficulties in MBC activity
- ✓ Effective Power Purchase cost is higher due to T&D Loss.
- ✓ Lower **collection efficiency** in Rural Area
- ✓ Loss of margin due to **gap between Power Purchase and Realization**

DISCOM Loss in Rural LT Segment

Particulars	TPWODL	TPCODL	TPNODL	TPSODL
Each 100 unit of Sale in Rural Segment	100	100	100	100
Distribution Loss (approved as per ARR FY-23-24)*	35%	24%	24%	26%
For each 100 unit of Sale requirement of Power	135	124	124	126
Power Purchase Cost per unit (Rs./kWh)	4.14	3.29	3.59	2.34
Ultimate Power Purchase Cost (Rs.) to serve	558	410	447	295
Avg. billing in Rs. with existing tariff	390	390	390	390
Loss due to gap between Power Purchase and Billing (A)	168	20	57	-95
Collection Efficiency of Rural Area (Assumed)	70%	75%	75%	80%
Annual Loss in Rs. due to CE (B)	117.00	97.50	97.50	78.00
Total loss (A+B)	284.69	117.02	154.34	-17.17
Loss percentage upon ultimate Power Purchase Cost	51.05%	28.58%	34.54%	-5.82%

*Actual loss is higher

RTS adoption in Rural Segment is a Challenge:

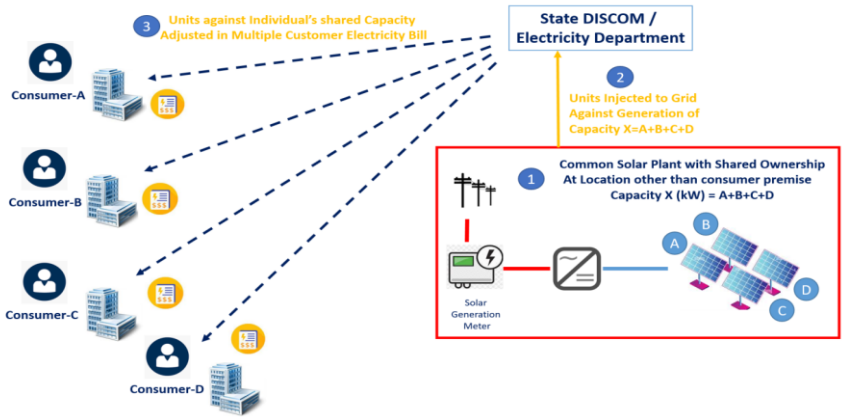
- ❖ Financial constraints
- ❖ **Low & subsidized** electricity tariffs
- ❖ **Installation & O&M Support thereof in Rural area**
- ❖ **Awareness**

Why a Scheme is required for Rural Electricity Consumer:

- ✓ Extending the Benefit of RTS in the Rural Area
- ✓ Reliable Power Supply to RHH

Embedded features in the proposed scheme:

- ✓ No investment required by Rural HH
- ✓ Free electricity up to the share of Subsidy
- ✓ DISCOM responsible for Installation & O&M thereof
- ✓ Saving in Power Purchase by DISCOM
- ✓ No Loss/Minimum Loss due to Generation at Consumer End.

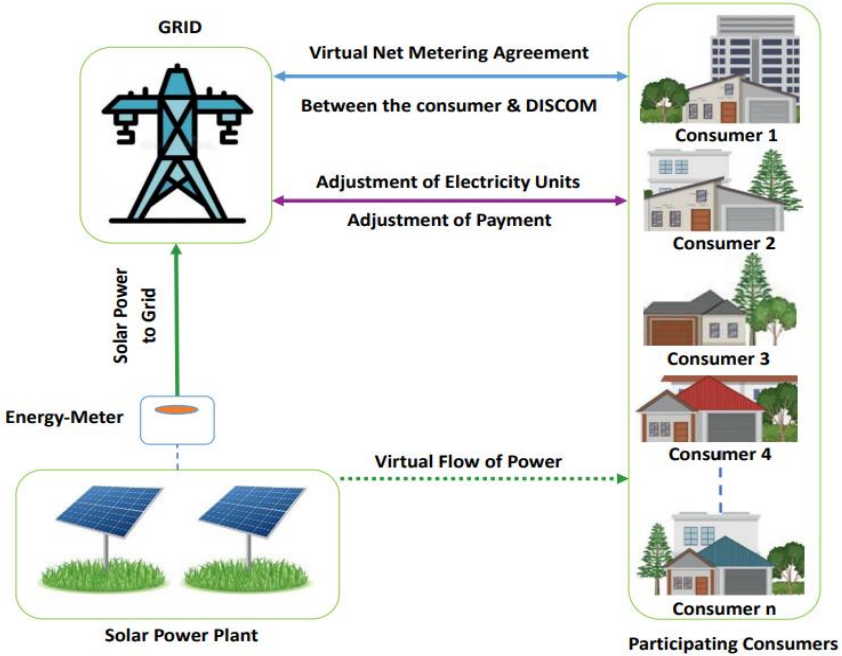


How it Works: Energy Accounting - VNM Mechanism & Pay Back

Proposed Scheme Design & How it Works

Allocation of Generated Energy:

Total Generated energy of the SPV plant will be adjusted through **"Virtual Net Metering"** VNM mechanism



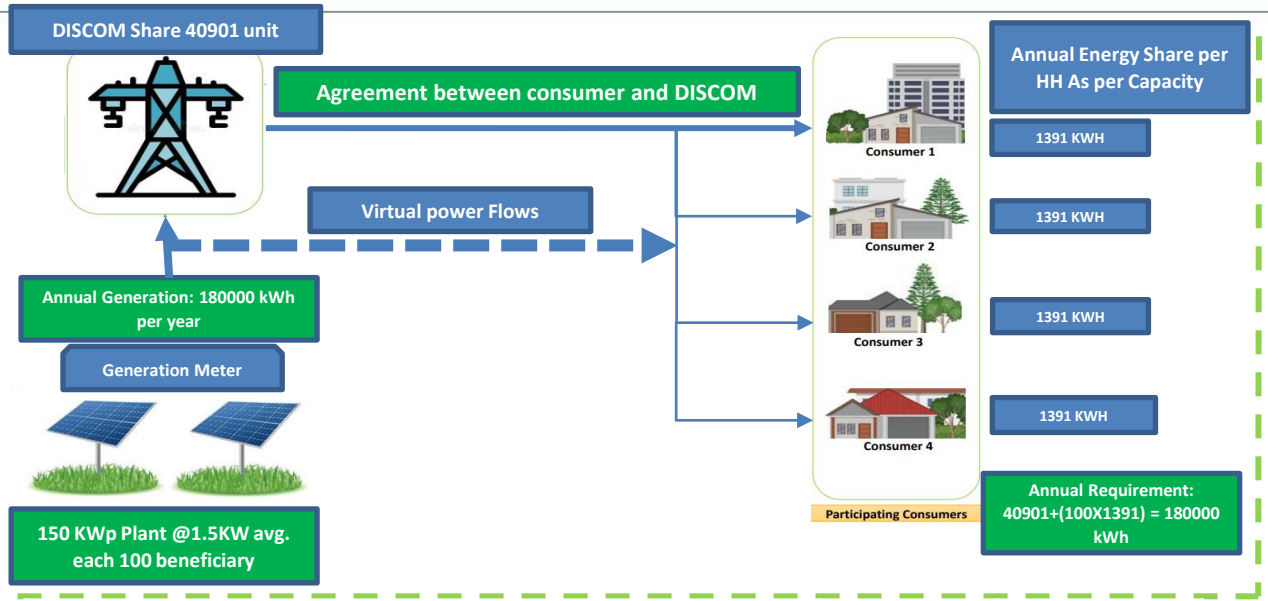
Source of Funding for 1KWp SPV:

Per kWp Cost of SPV Plant : Rs. 60,000/-			
Stakeholder wise Contribution:			
Rural Consumer	MNRE	State Govt. (proposed)	DISCOM (Proposed)
0	Rs. 30,000/- per kW	Rs. 20,000/- per kW	Rs. 10,000/- per kW

Project Cost & Quantum of Generation:

Project Capacity	kW	1
Total Annual Generation (4 unit/day/kW, Considered for 300 days)	Unit	1200
Estimated Project Cost (60000 /kW)	Rs.	₹ 60,000.00
MNRE Subsidy	Rs.	₹ 30,000.00
Proposed State Subsidy	Rs.	₹ 20,000.00
Proposed DISCOM contribution (Total Proj Cost-CFA&SFA)/Shortfall	Rs.	₹ 10,000.00
Consumer Share out of Total Project Cost		83.33%
DISCOM/RESCO Share out of Total Project Cost		16.67%
Energy Share		
Consumer Share out of Total Generation	Unit	1000
DISCOM/RESCO Share out of Total Generation	Unit	200

Proposed Model Project & Energy Accounting Mechanism



Participating Rural HH	100Nos
Avg. Load per HH	1.5 KW
Proposed Plant Capacity	150 KW
Cost per kWp	Rs. 60,000
CFA	Rs. 30,000
SFA (Proposed)	Rs. 20,000
DISCOM towards PC	Rs. 10,000
Addl. Cost for OPEX (Lum sum) *	

Project Capacity	kW	150
Total Annual Generation	Unit	180000
Estimated Project Cost	Rs. Lakh	90.00
MNRE Subsidy	Rs. Lakh	44.76
Proposed State Subsidy	Rs. Lakh	30.00
Proposed DISCOM Share: 1- towards Project Cost	Rs. Lakh	15.24
* DISCOM Share: 2 - towards OPEX (AMC, RENT, W&W & interest)	TPWODL TPCODL TPNODL TPSODL	₹ 11.31 lakhs ₹ 12.07 lakhs ₹ 12.07 lakhs ₹ 14.36 lakhs

Opex Consist of:

1. Interest on W.C.
2. Lease Rent
3. Watch & Ward (till 5th Year)
4. AMC 6th Year onwards incl. W&W

Allocation of Generated Energy

Project Capacity & Project Financing							DISCOM addl. Invesment towards OPEX					Consumer Energy Share			
							TPWODL	TPCODL	TPNODL	TPSODL		TPWODL	TPCODL	TPNODL	TPSODL
Consumer	CD/Plant Capacity in kW	Proposed SFA (Rs.)	MNRE CFA (Rs.)	Total Aid (Rs.)	Project Cost (Rs.) @Rs. 55 per Wp	DISCOM Share towards Project Cost in Rs.	DISCOM Share towards OPEX (AMC, RENT, W&W & interest) (Rs.)	DISCOM Share towards OPEX (AMC, RENT, W&W & interest) (Rs.)	DISCOM Share towards OPEX (AMC, RENT, W&W & interest) (Rs.)	DISCOM Share towards OPEX (AMC, RENT, W&W & interest) (Rs.)	Total Generation (kWh) 4unit/ day/kWp for 300 days	Individual Annual Share (kWh)	Individual Annual Share (kWh)	Individual Annual Share (kWh)	Individual Annual Share (kWh)
1	1	20000	30000	50000	60000	10000	Interest Accrued up to repayment @10% Cost of Lease Rent & watch & ward @1.5Lakh/Year up to 5Yr./ Loan repayment period **(3.81+7.5)= 11.31 Lakh)**	Interest Accrued up to repayment @10% Cost of Lease Rent & watch & ward @1.5Lakh/Year up to 5Yr./ Loan repayment period **(4.57+7.5)= 12.07 Lakh)**	Interest Accrued up to repayment @10% Cost of Lease Rent & watch & ward @1.5Lakh/Year up to 5Yr./ Loan repayment period **(4.57+7.5)= 12.07 Lakh)**	Interest Accrued up to repayment @10% Cost of Lease Rent & watch & ward @1.5Lakh/Year up to 5Yr./ Loan repayment period **(6.86+7.5)= 14.36 Lakh)**	180000	886	879	879	860
2	2	40000	60000	100000	120000	20000						1771	1758	1758	1719
3	3	60000	78000	138000	180000	42000						2657	2637	2637	2579
4	1	20000	30000	50000	60000	10000						886	879	879	860
5	2	40000	60000	100000	120000	20000						1771	1758	1758	1719
6	2	40000	60000	100000	120000	20000						1771	1758	1758	1719
7	1	20000	30000	50000	60000	10000						886	879	879	860
8	2	40000	60000	100000	120000	20000						1771	1758	1758	1719
9	3	60000	78000	138000	180000	42000						2657	2637	2637	2579
10	1	20000	30000	50000	60000	10000						886	879	879	860
11-100*	132	2640000	3960000	6600000	7920000	1320000						116889	116016	116016	113475
	150	**3000000**	**4476000**	**7476000**	**9000000**	**1524000**	**1131000**	**1207200**	**1207200**	**1435800**	**180000**	**132828**	**131836**	**131836**	**128948**
*Assumed load of Balance 90 Consumer						Total Project Cost	10131000	10207200	10207200	10435800					

DISCOM Investment 1: towards Project Cost

DISCOM Investment 2: towards OPEX (AMC, RENT, W&W & interest)

DISCOM	TPWODL	TPCODL	TPNODL	TPSODL
Consumer Share (%)	73.79%	73.24%	73.24%	71.64%
DISCOM Share (%)	26.21%	26.76%	26.76%	28.36%
DISCOM Share (kWh)	47172	48164	48164	51052

The share of energy generated will be utilized to cover Opex costs

Asset Ownership:

Solar plant is being funded through CFA, SFA and balance share (marginal cost) by DISCOMs under DSM, shall be **exclusively belonging to the community**.

To ensure the project's sustainability, the respective DISCOM will handle the O&M,W&W till lifetime of Project

Costs like lease rent, AMC, and insurance to be managed by DISCOMs for project **sustainability.**

DISCOM's Saving in Power Purchase & Payback Calculation

DISCOM	UoM	TPWODL	TPCODL	TPNODL	TPSODL
Total Annual Generation from Proposed SPV Plant 150kWP	unit	180000	180000	180000	180000
Annual Energy Share of DISCOM (residual energy)	unit	47172	48164	48164	51052
Saving in Power Purchase Cost from residual energy (in Lakhs) (A)	**Lakhs**	**1.95**	**1.59**	**1.73**	**1.20**
Saving due to sale of DISCOM share of energy @ LT average Rs.3/unit (in Lakhs) (B)	**Lakhs**	**1.42**	**1.44**	**1.44**	**1.53**
Avoidable Energy Purchase (Present Power purchase) (unit)	Unit	166035	164026	164022	162361
Cost of that Energy in Lakhs (C)	**Lakhs**	**6.88**	**5.40**	**5.89**	**3.80**
Total Annual Impact D=(A+B+C)	**Lakhs**	**10.25**	**8.43**	**9.07**	**6.53**
Less:-Existing level of Billing & Collection which will be stopped to the extent of free energy to Consumers (E)	**Lakhs**	**3.63**	**3.86**	**3.86**	**4.02**
Net Annual Savings F=D-E	**Lakhs**	**6.62**	**4.57**	**5.21**	**2.51**
Share of DISCOM's Investment	Lakhs	₹ 15.24	₹ 15.24	₹ 15.24	₹ 15.24
Opex Cost to be considered in Payback Ccalculation					
Interest Accrued up to repayment @10% on reducing balance	Lakhs	₹ 3.81	₹ 4.57	₹ 4.57	₹ 6.86
Cost of Lease Rent & watch & ward up to 5th Year @1.5 Lakh/Year after 5th year will be cover through AMC	**Lakhs**	₹ 7.50	₹ 7.50	₹ 7.50	₹ 7.50
Total cost G	**Lakhs**	**₹ 26.55**	**₹ 27.31**	**₹ 27.31**	**₹ 29.60**
Payback period	**Years**	**4.01**	**5.97**	**5.24**	**11.81**
After repayment of Principal Watch & Ward, LeaseRent & AMC shall be taken care out of Annual Saving as indicated as Annual impact					

Challenges	Mitigation plan
a) Availability of Land/roof top	a) Option of Govt land shall be exercise first. In absence of same govt land, private/beneficiary/beneficiaries land on lease rent basis.
b) Selection of beneficiary	b) Beneficiary selection will be with approval of District administration
	c) Cost of R&M including watch & ward to be met by reducing beneficiary share of power.
c) Protection of solar plant	d) Night Surveillance with CCTV integration with DISCOM Call Center

"Odisha's Rural Community Solarization Scheme"

Scheme Outline & Budgetary Plan

Scheme Outline

Title of the Scheme:	Solarisation of Rural Households through Community Solarization mechanism "Odisha Community Solarization Scheme"
Name of the Implementing Agency	TPWODL, TPCODL, TPNODL, & TPSODL
Total Cost of the Scheme	120 Cr for 20MW across the State
Source(s) of financing the Scheme	MNRE, Govt. of Odisha & DISCOM
Duration of the Scheme	**FY 24-25**
Benefits of the Scheme	1. Free (up to the share of Subsidy) & clean electricity to the Rural Households without any investment 2. Contribution towards carbon neutrality 3. More RE capacity addition to the state as per OREP-2022 4. Contribute towards RPO trajectory of Distributed RE 5. Cross Subsidy quantum will be reduced & hence cost reflective tariff. 6. DISCOM's Loss Reduction

Scheme Outline

Target Beneficiary	Rural households* having connected Load/Sanction Load of 1 to 3 kW can enjoy the benefit of free electricity of 700 to 2100 unit per annum respectively till full life of the project.
*DISCOM will prepare the priority list of rural Pockets considering the Field condition, Loss levels, Network Condition & availability of Land etc.	
Limitation of CFA & SFA	Capacity Caping up to 3 kW per rural H/H
Land identification for project	DISCOM will explore all possibilities through mutual discussion with different stakeholders like local panchayat/block office/individual farmers/any person/persons interested in leasing out their unused land block for this purpose. For this purpose, offering appropriate will enhance the availability of suitable Land.
Proposed Lease Rent	Rs. 21000/- to Rs. 25000/- per Acer
Involvement of Local Bodies & Communities	During Selection of Beneficiary & Land Selection

Scope & Budgetary Provisions

The scope of work includes the following

1. Implementation of **20MW (5MW by each DISCOM)** Distributed Renewable Energy Plants on behalf of Rural Households through community solarization mechanism
2. Distribution of Generated Energy to the Rural Households free of Cost through VNM.
3. DISCOMs to Install Operate & Maintain the Distributed SPVs till the lifetime of the project on behalf of participating Rural Households.

Financial Outlay

1. MNRE CFA: CFA for 20 MW at Rs. 30,000 per kWp

1. Proposed Funding Components for rural households:
   - A. State Funding: For 20 MW at Rs. 20,000 per kWp
   - B. By DISCOMs: For 20 MW at Rs. 10,000 per kWp

*Estimated CFA : Indicative only

Budgetary Provision DISCOM wise for 20MW in FY 24-25

DISCOM	Proposed Capacity	Central Financial Assistance (CFA)	Budgetary Provision		Total Rs. (Proposed SFA + DISCOM contribution)	Grand Total Project Cost Rs.*
	FY- 24-25 (in MW)	BY MNRE (Rs.30000/kW)	By State Govt (Rs.20000/kw)	By DISCOMs (Rs.10000/kw)		
TPWODL	5	15 Cr.	10 Cr.	05 Cr.	15 Cr.	**30 Cr.**
TPCODL	5	15 Cr.	10 Cr.	05 Cr.	15 Cr.	**30 Cr.**
TPNODL	5	15 Cr.	10 Cr.	05 Cr.	15 Cr.	**30 Cr.**
TPSODL	5	15 Cr.	10 Cr.	05 Cr.	15 Cr.	**30 Cr.**
Total	**20**	**60 Cr.**	**40 Cr.**	**20 Cr.**	**60 Cr.**	**120 Cr.***

DOE, GOO allocates a budgetary provision of Rs. 40.00 Cr. through resolution vide letter no 2695 on 12.03.2024

Implementation Plan

20 MW (5MW each DISCOM) DRE implementation in FY 25-26

TPWODL

Village Selection & Preparation of Consumer List

Selection of target villages/area and finalization of perspective list of rural consumers (for a cumulative capacity of 1MW each Circle) basing upon the loss level, Network Condition etc.

Concern SE/EE/SDO to take necessary steps towards conversion of 100% rural consumer of the target villages/area

Land Identification

liasoning with concern PD/BDO to identify Govt/Private/ Baren Land block in first phase through concern SE/EE/SDO/ESO under Supervision of concern SE.

(for a cumulative capacity of 1MW each Circle)

4-5 acre land required for 1 MW cumulative installation.

Connection Regularization and Consumer List Finalization

Survey by CMG

List of consumers and Load regularization if any

On Spot Connection regularization

Tendering & Vendor Selection

Open tendering process to be started on top priority for selection of Vendor as per tendering norms and placement of LOA

Site Clearance Project wise DPR

Land HO/TO formalities

Site Handing over

Project Specific DPR Preparation

Approval of the Project DPR

Installation and O&M

AMC & Watch and Ward by Vendor till 5th year.

Risk Assessment

Risk related to Solar PV Systems

Improper Site Assessment and Planning

Appropriate Vendor Selection to Ensure Quality of Work

Risk related to Solar PV Systems

Improper Site Assessment and Planning

Wrong structural architecture and design

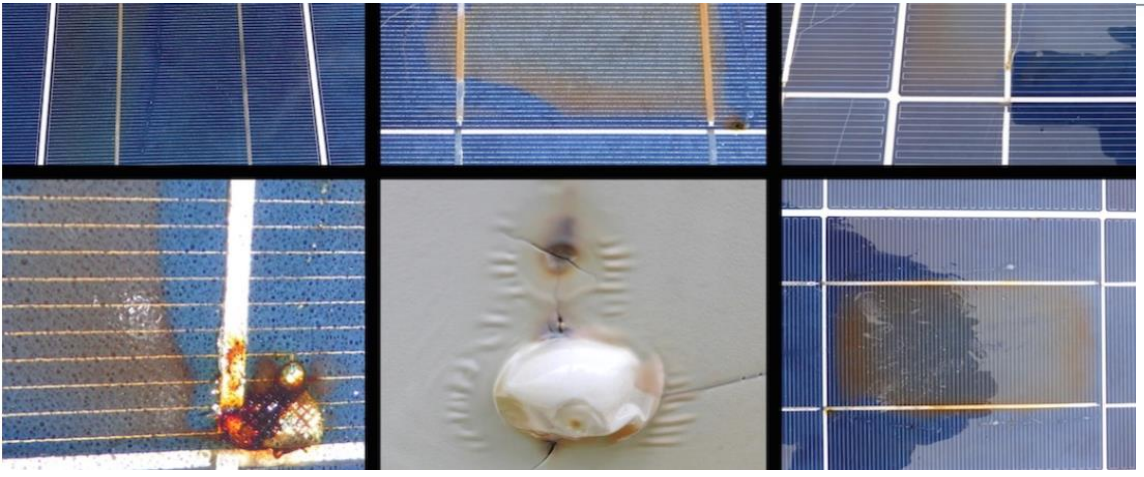
Appropriate Vendor Selection to Ensure Quality of Work

Risk related to Solar PV Systems

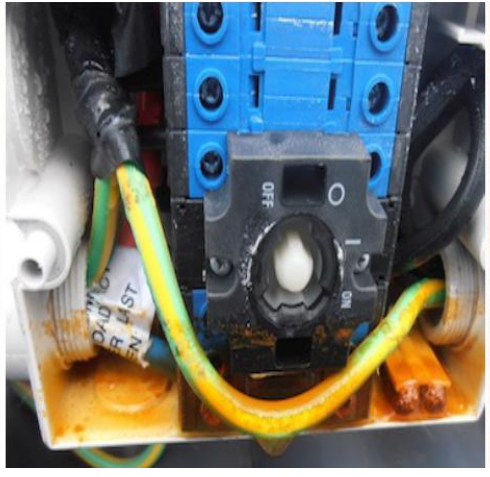
Structure failure is a major issue

Appropriate Vendor Selection to Ensure Quality of Work

Risk related to Solar PV Systems



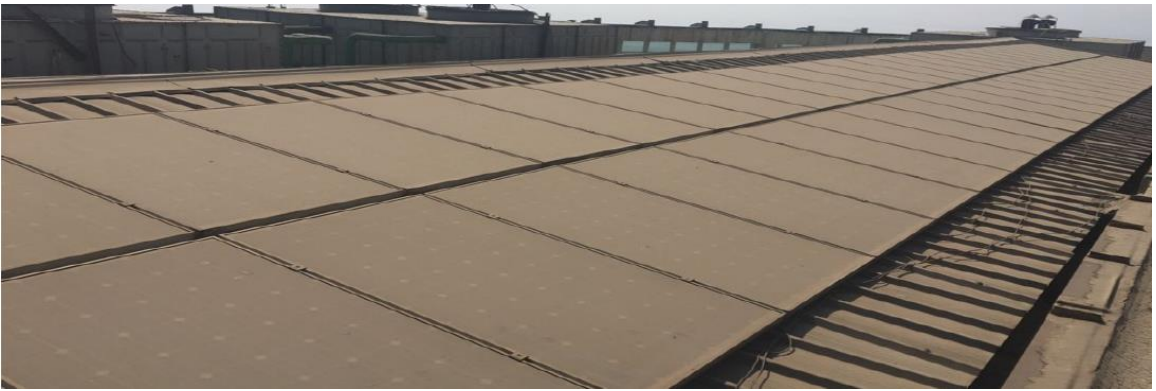
Poor quality modules



Ingression of water into switchgear

Implementation of Quality Assurance Mechanism from Scheme inception

WHY SOLAR PV SYSTEMS FAIL OR PERFORM POORLY?



Poor cleaning of modules

Regular inspection, Watch & Ward and monitoring to ensure Scheme Sustainability

Risk related to Solar PV Systems

DC Arc is CAUSES OF FIRE IN A PV SYSTEM

Appropriate IP rated quality material /BOS/Inverter
Regular inspection and monitoring to ensure Scheme Sustainability

Causes of DC arc – Summary

1. Loos Joints due to poor Quality / Workmanship
2. Breakdown of insulation system:

- Insulation degradation over time due to UV exposure
- Insulation cracking over time due to changes in temperature (hot – cold)
- Degradation of insulation due to aging
- Damage to insulation by rodents, insects, birds
- Damage to insulation during installation
- Damage to insulation by future works
- Water ingress to cables, conduits.
- Water ingress to DC isolators from poor installation
- Water ingress to DC isolators due to degradation of seals over time
- Water ingress to inverter
- Water ingress to solar module or junction box

Risk related to Solar PV Systems

TPWODL

Damaged DC cable and connector

Fire in combiner box and inverter

Regular inspection and monitoring to ensure Scheme Sustainability

Risk related to Solar PV Systems

TPWODL

Loose connection at module junction box & connector And poor workmanship

Regular inspection and monitoring to ensure Scheme Sustainability

Risks at different phases of PV project development

TPWODL

Preparation Phase	Development Phase	Engineering Procurement and Construction Phase	Operation and Maintenance Phase
• Physical site survey and assessment • Accurate planning • Analyse risks and challenges for project lifetime	• Configure system and project design based on site parameters • Select quality equipment based on site parameters	• Relevant standards are followed in design and installation including BoS and accessories, workmanship • Third party QA	• Ensure O&M is adequate and appropriate • Use of demineralised water and proper cleaning tools • **Theft** • **Insurance cover**

Regular inspection and monitoring of the Plant is essential
Engagement of Watch & Ward personnel effectively for 24X7 plant upkeeping and regular cleaning

Appropriate insurance coverage as per MNRE circular
Nighttime surveillance through common call center by Artificial Intelligence, CCTV integration & PA system

Risks at different phases of PV project development

Inverter installed in a closed space

Miscellaneous

OPEX Cost:

Interest on Loan to be taken by DISCOMs for Capital investment.

Lease Rent (if any)

Watch & Ward (till 5th Year)

AMC 6th Year onwards incl. Watch & Ward, insurance

System Augmentation Cost

Cost towards training & capacity building

Cost of Awareness Campaign

Cost towards Communication facilities, Online Portal, ERP, Mobile App Development etc.

Scheme Benefits

Benefits to Rural Consumer:-

a) No need to invest a single rupee
b) Free electricity almost more than 100 units per month (Subject to Solar plant size and no of beneficiary)
c) Benefit to Landowner/owners out of lease rent
d) Reliable power supply

Other High end Consumer:-

Cross Subsidy quantum will be reduced & hence cost reflective tariff

Benefit to Govt:

a) No direct subsidy is required
b) Beneficiaries will get free electricity up to 100 units if Govt desires to extend SFA in line with CFA (MNRE)
c) Contribution towards carbon neutrality

Benefit to other

GRIDCO :

a) Burden on power sourcing will be reduced.

b) Contribute towards RPO

Individual Mode

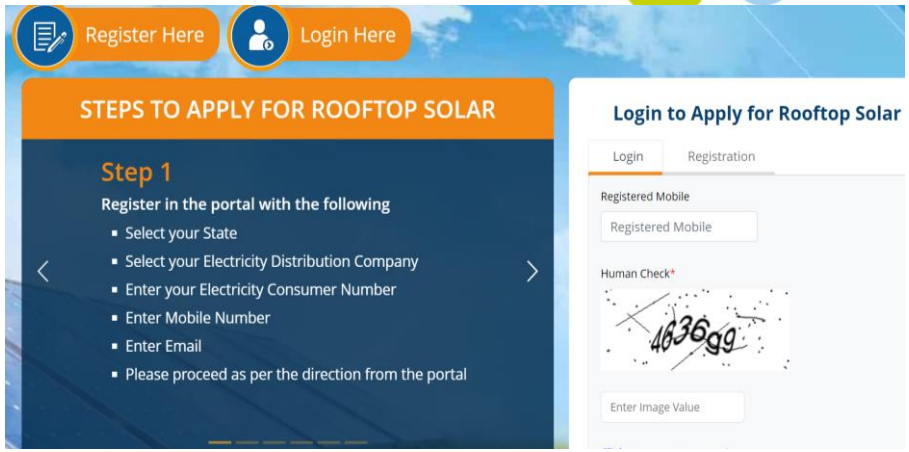
PM Surya Ghar : Important web links

National Portal for Rooftop Solar:
https://pmsuryaghar.gov.in/

Solar Rooftop Calculator:
https://pmsuryaghar.gov.in/rooftop_calculator

List of Empanelled Vendors:
https://pmsuryaghar.gov.in/VendorList/statewiseVendor

Stepwise Procedure & Registartion:
https://pmsuryaghar.gov.in/consumerRegistration



QRT PM Surya Ghar Android Application

Prayer

1. Approve the above proposed community solarisation project in rural area as per the aforesaid detailed mechanism under Demand Side Management (DSM) and recognise the cost of DISCOM share in the ARR along with Opex cost.
2. Allow DISCOM to treat the DISCOM share of Energy as input.
3. Allow DISCOMs to incur the cost of System Augmentation (if any) which shall be covered under CAPEX of the DISCOM.
4. MNRE is also requested to consider CFA in line with PM Surya Ghar scheme and remit directly to the DISCOM on behalf of the beneficiary
5. To accord any other direction the Hon’ble Commission may deems fit.

Thank You!