



WORLD BANK GROUP



GOVERNMENT OF INDIA
**MINISTRY OF NEW
AND RENEWABLE ENERGY**

Policy, Regulations and Success Factors of Rooftop Solar Program in India

8th September 2020

EY

Building a better
working world



Rooftop solar has come a long way in India..

5.44 GW

Installed Rooftop Solar Capacity
(30th Dec 2019) vs. target of ~**14 GW**

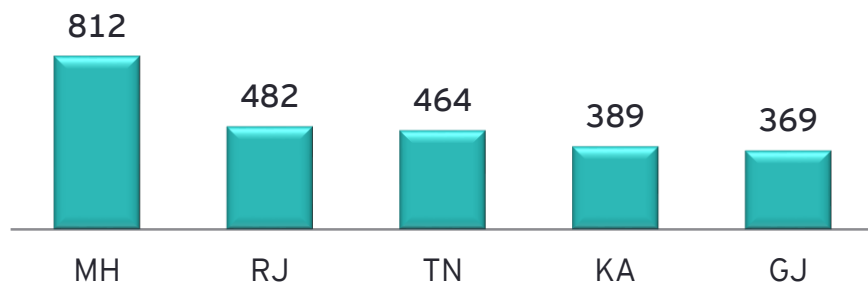
40.00 GW

Target under National Solar Mission
(By 2022)

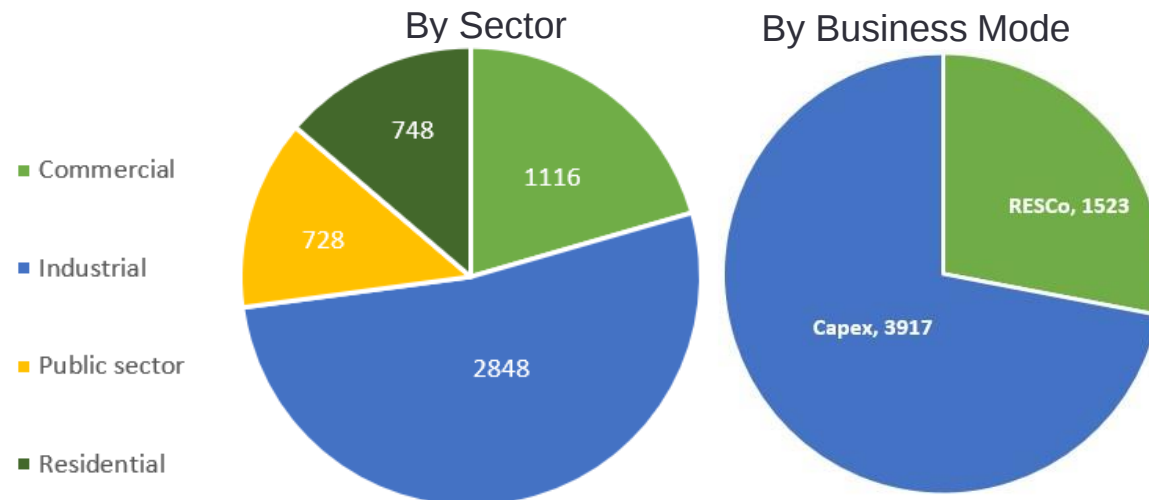
1.53 GW

Rooftop solar added vs. a target of
5.29 GW in FY 2019-20

States leading in Rooftop Solar Installations

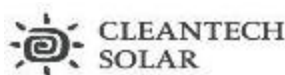


Total Rooftop Solar Installed Capacity Breakup



- ▶ CAPEX remains the most popular form of project development
- ▶ Residential sector remains relatively untapped indicating possibility of high growth

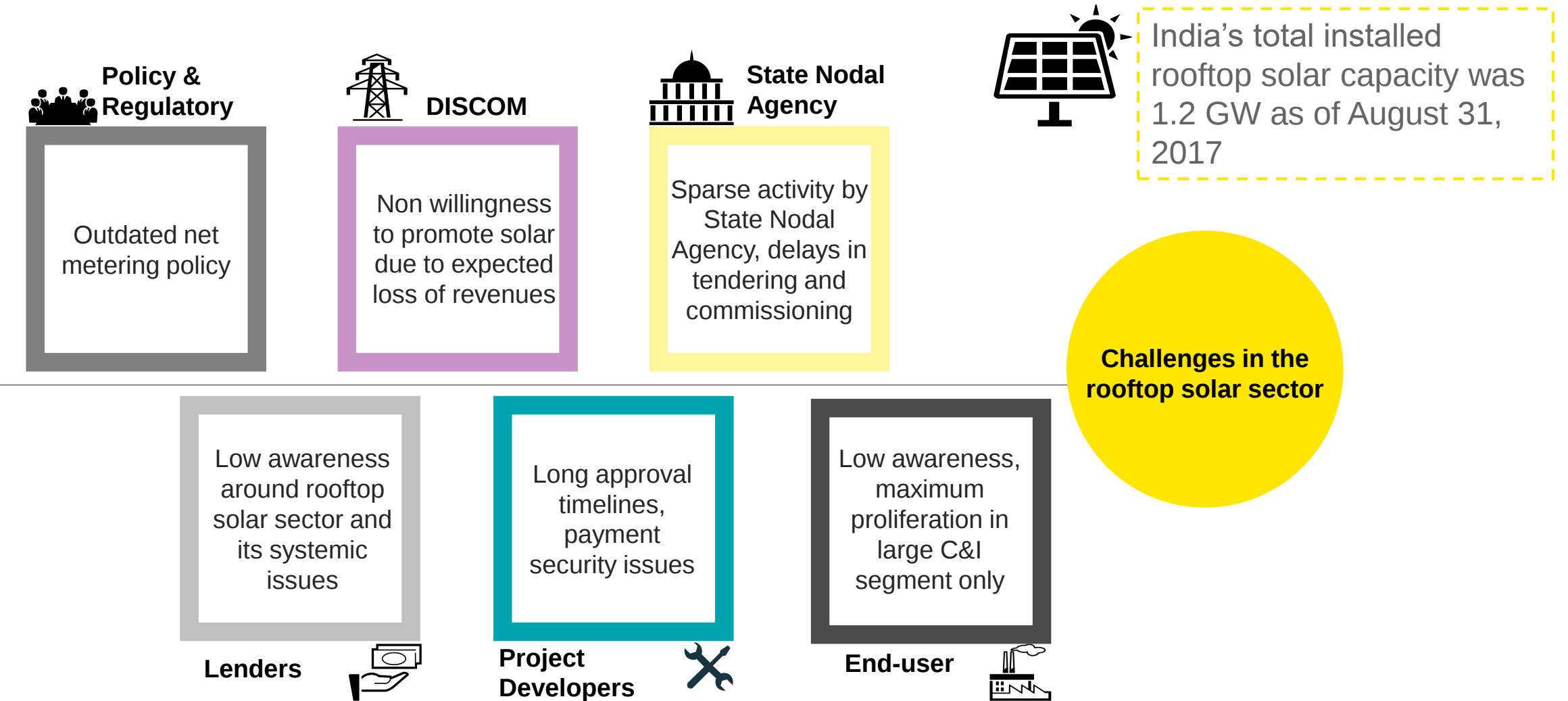
Key Developers / RESCO players



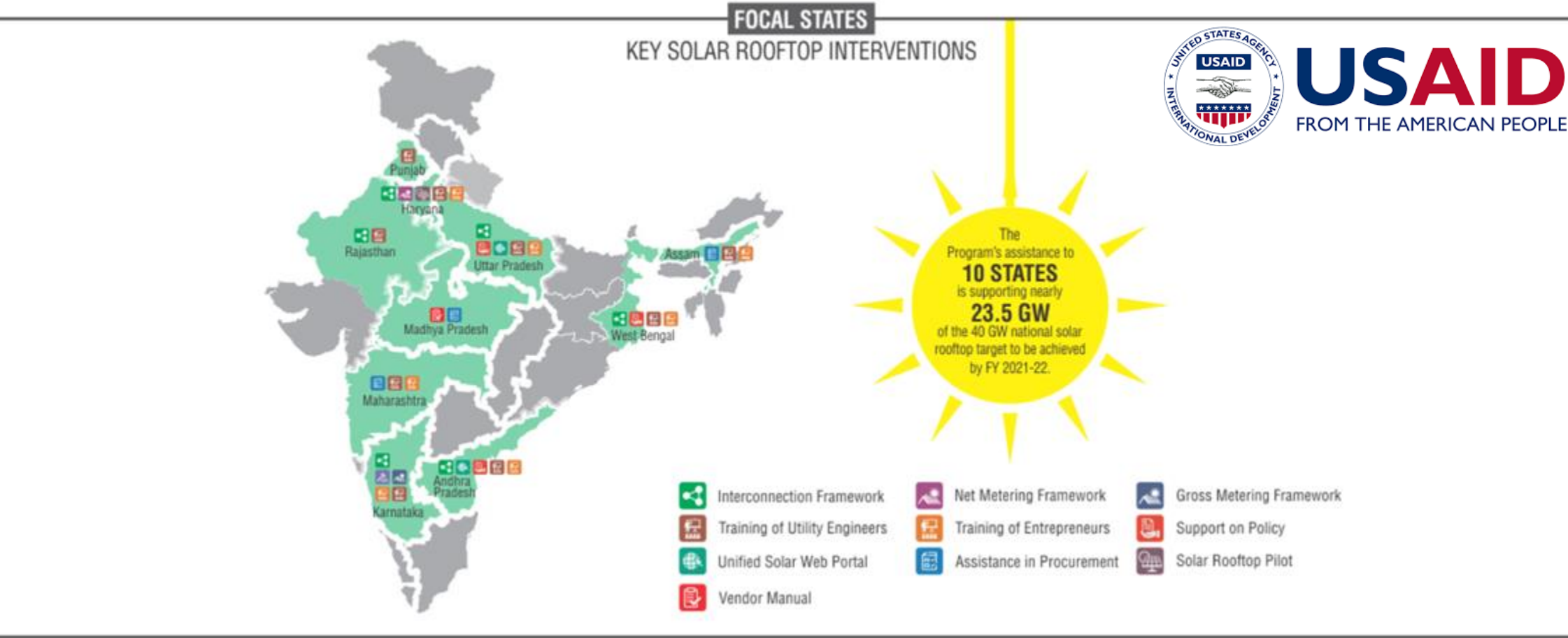
Key EPC players



In India, Rooftop Solar (RTS) market growth pace was slow due to multitude of stakeholder challenges



Early movers : USAID PACE-D was leading the RTS TA activities... since 2013...now under PACE-D 2.0



PACE-D 1.0

source:www.pace-d.com

Consolidated mapping of Donors offering Technical Assistance for RTS Sector in India ...current

World Bank

USD 13 Million TA | May, 2016 – Nov, 2021

Interventions:

- Policy & Regulatory
- Demand Aggregation
- Capacity Building
- Process Streamlining
- Media & Outreach
- SSN Knowledge Exchange

ADB

Euros 2 Million TA
(July, 2017 – January, 2022)
Interventions

- Tender Support
- Communication and Outreach
- Training and study tours
- Unified Web portal
- Utility Models

EU-India TCP

5 Mn Euros TA | Aug'14– Sept'20)
Interventions

- Discom Trainings
- IT Products
- Streamlining of RS implementation
- Tender support and Promotion

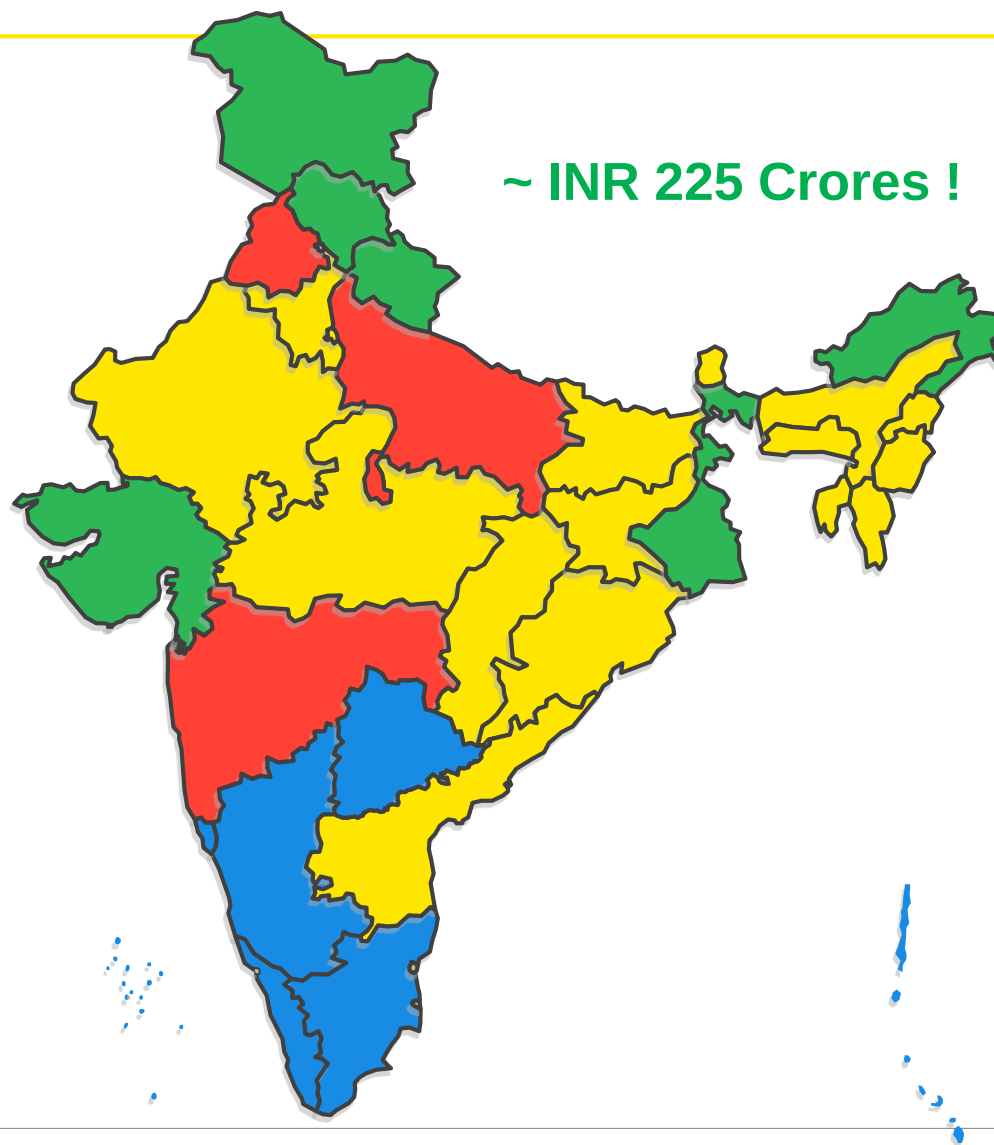
Additional assistance to Goa for rooftop solar
IT tool and Delhi for IT tool + mobile app

GIZ

Euro 12 Million TA | Oct'17–Nov'21
Interventions

- Capacity Building and study tours
- Demand Aggregation
- Unified Web Portal
- Business models

Additional support to Punjab, Uttar Pradesh
and Maharashtra for demand aggregation



SBI - The World Bank Grid Connected Rooftop Solar Photo Voltaic Technical Assistance Program



SUPRABHA
SUSTAINABLE PARTNERSHIP FOR
ROOFTOP SOLAR ACCELERATION IN BHARAT

SUPRABHA Rooftop Solar TA Program

Funding Body



Implementing
Agency



Installation
target

600 MW
GRPV

Long Term Concessional Loan: USD 625 Million

https://www.sbi.co.in/webfiles/uploads/files/SBI_WORLD_BANK.pdf

Technical Assistance : USD 13 Million

www.suprabha.org

Interventions:

1 Policy & Regulatory

4 Media & Outreach

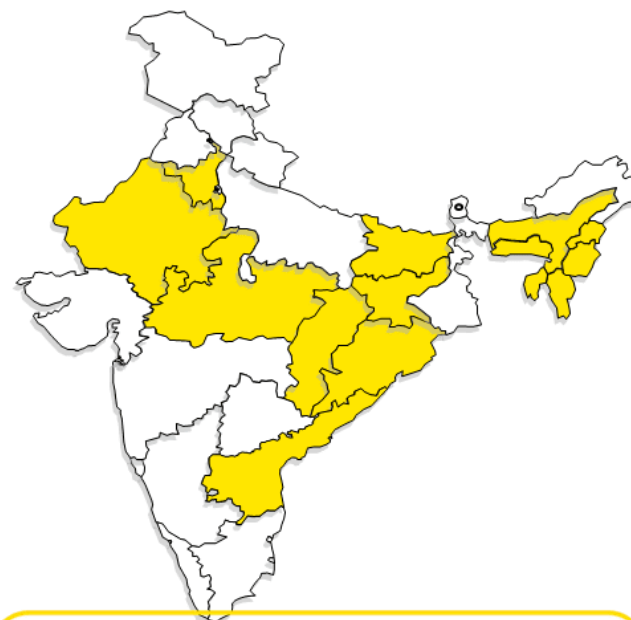
2 Capacity Building

5 Process Streamlining

3 SSN Knowledge Exchange

6 Demand Aggregation

Coverage : 17 Indian states



- ▶ Jharkhand
- ▶ Bihar
- ▶ Orissa
- ▶ Chhattisgarh
- ▶ Rajasthan
- ▶ Haryana
- ▶ Madhya Pradesh
- ▶ Delhi
- ▶ Chandigarh
- ▶ Assam
- ▶ Nagaland
- ▶ Manipur
- ▶ Mizoram
- ▶ Tripura
- ▶ Meghalaya
- ▶ Sikkim
- ▶ Andhra Pradesh

Stakeholders



Residential Consumers



Regulators & Distribution
Companies



Urban Local Bodies



C&I Consumers

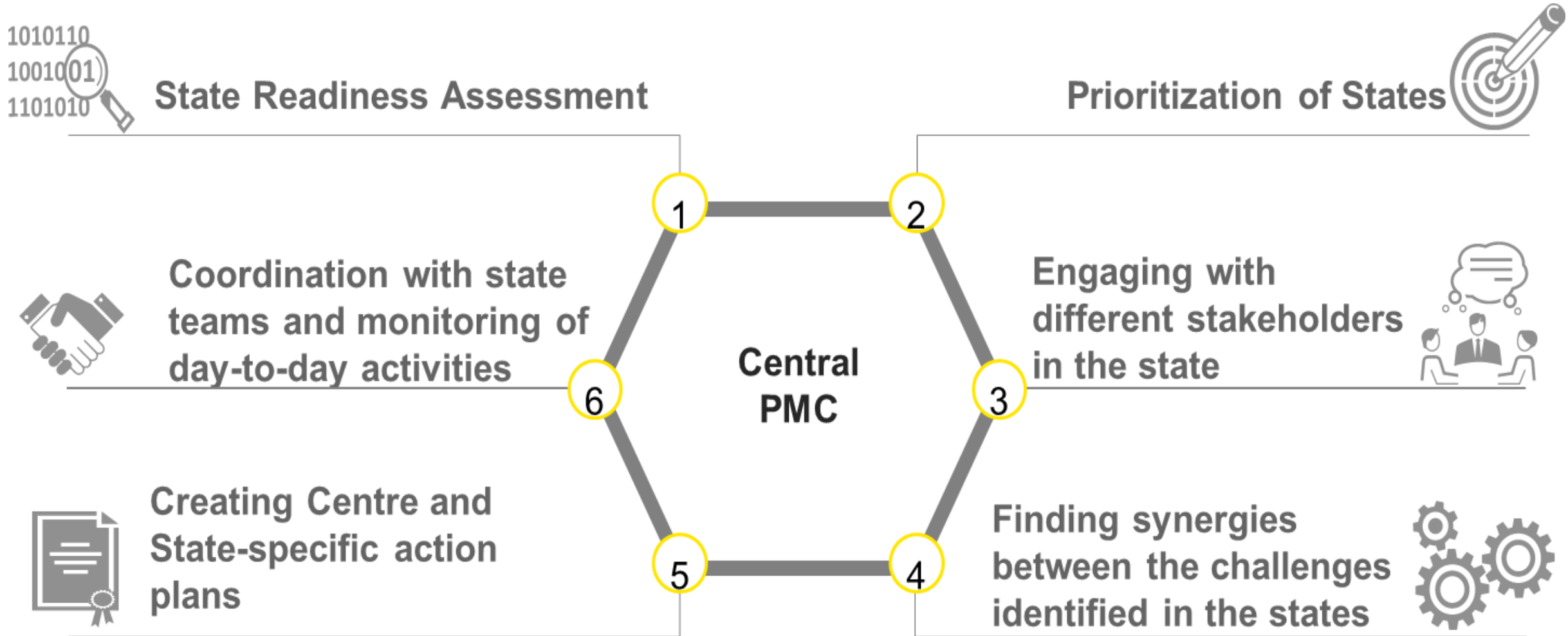


Financial Institutions

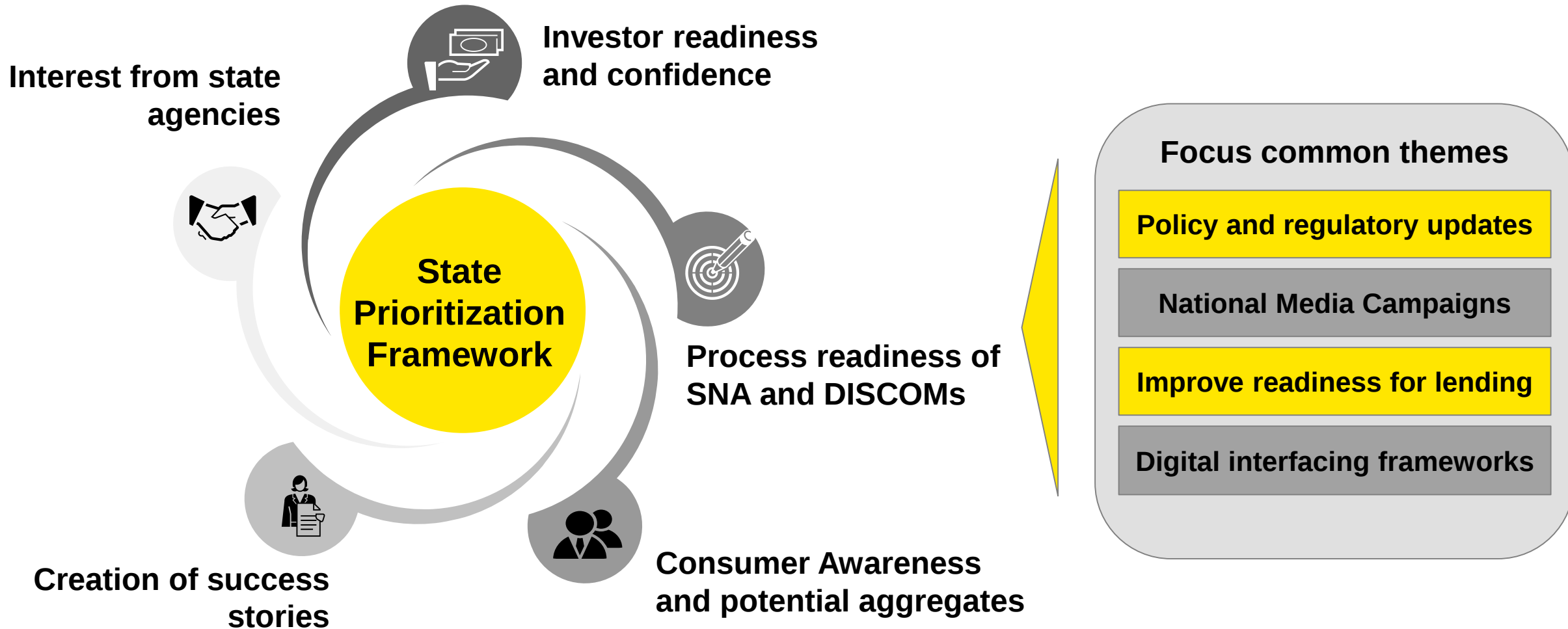


Entrepreneurs

A central PMC was established by EY to effectively deliver the TA programme in 17 states



..and EY PMC developed a state prioritization framework to identify target states and devise future course of action



SUPRABHA has achieved significant milestones in the various spheres of influence it has been working in

RTS Policy-2 States
CERC/FOR – NEM2019
(Net Metering Regulations)



Policy & Regulation

Capacity Building



1542

Stakeholders Trained
(SBI, DISCOMs, Developers,
Entrepreneurs & Trainers)

Newsletter, Advertisements,
National and State Media
Collaterals, Videos, MNRE
Website, Outreach Strategy



Media & Outreach

Unified Web Portal



States – 17
Live UWPs – 5
UWPs Developed – 4
Under Development – 6
Yet to be Initiated - 2

Residential In MW

Government In MW

State – 1
Sites – 465
Capacity – 18.23
Tendered – 18.23

States – 11
Sites – 3860
Capacity – 353.7
Tendered – 243



Demand Aggregation Program (4325 Sites & 372 MW)

MNRE DISCOM Phase II Allocation

Summary

16 States

30 DISCOMs

219.2 MW Total

Capacity Tendered



In MW

169.2

DISCOMs published tender



21

Achievements : Policies & Regulations

National

**Model
Rooftop Solar
Regulation
2019**

**Under adoption in
varying degrees
by several States**

**Published as
Gazette
Notification**

Sikkim

**Rooftop
Solar Policy**

Sikkim

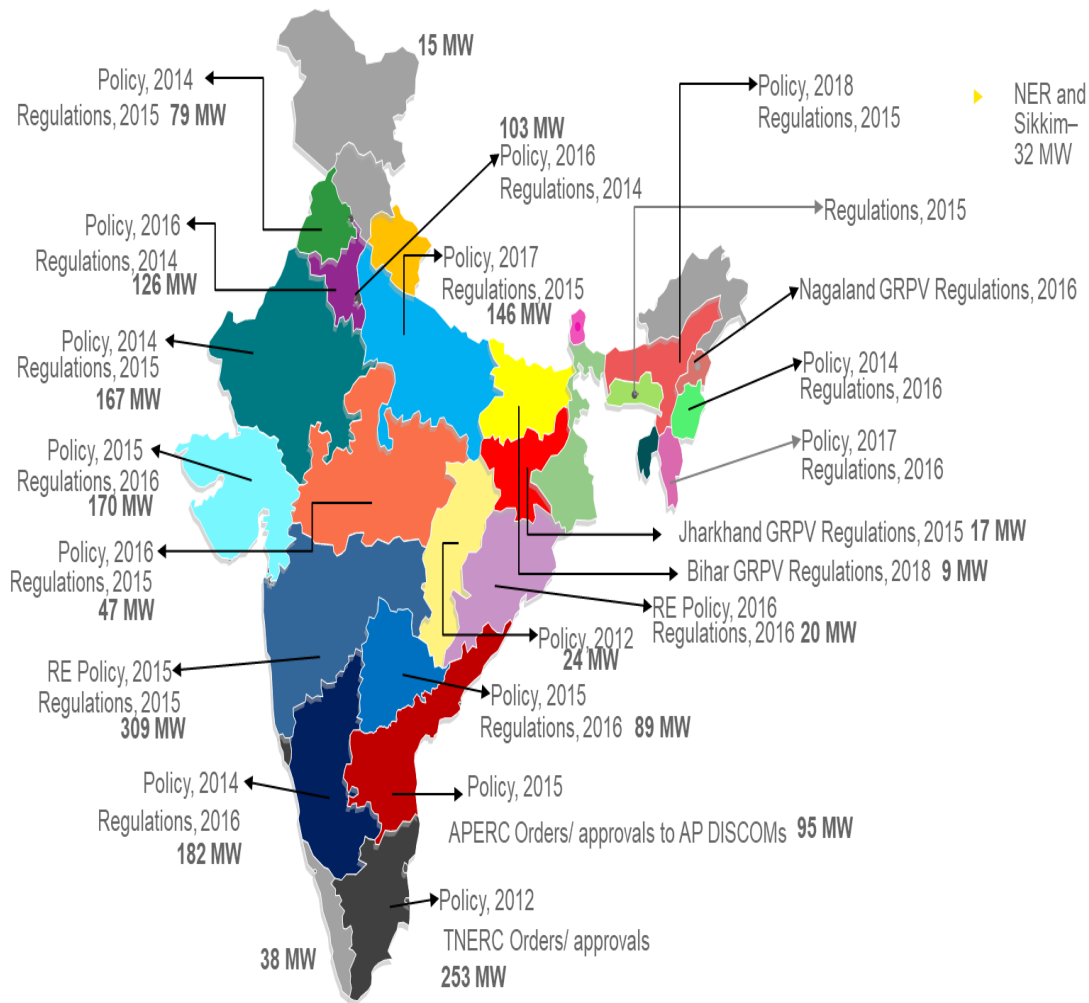
**Vendor
Empanelment
report for
Sikkim**

**Will be
replicated for
other States**

Meghalaya

**Rooftop
Solar
Policy**

**Rooftop solar
made mandatory
for Govt.
Buildings**



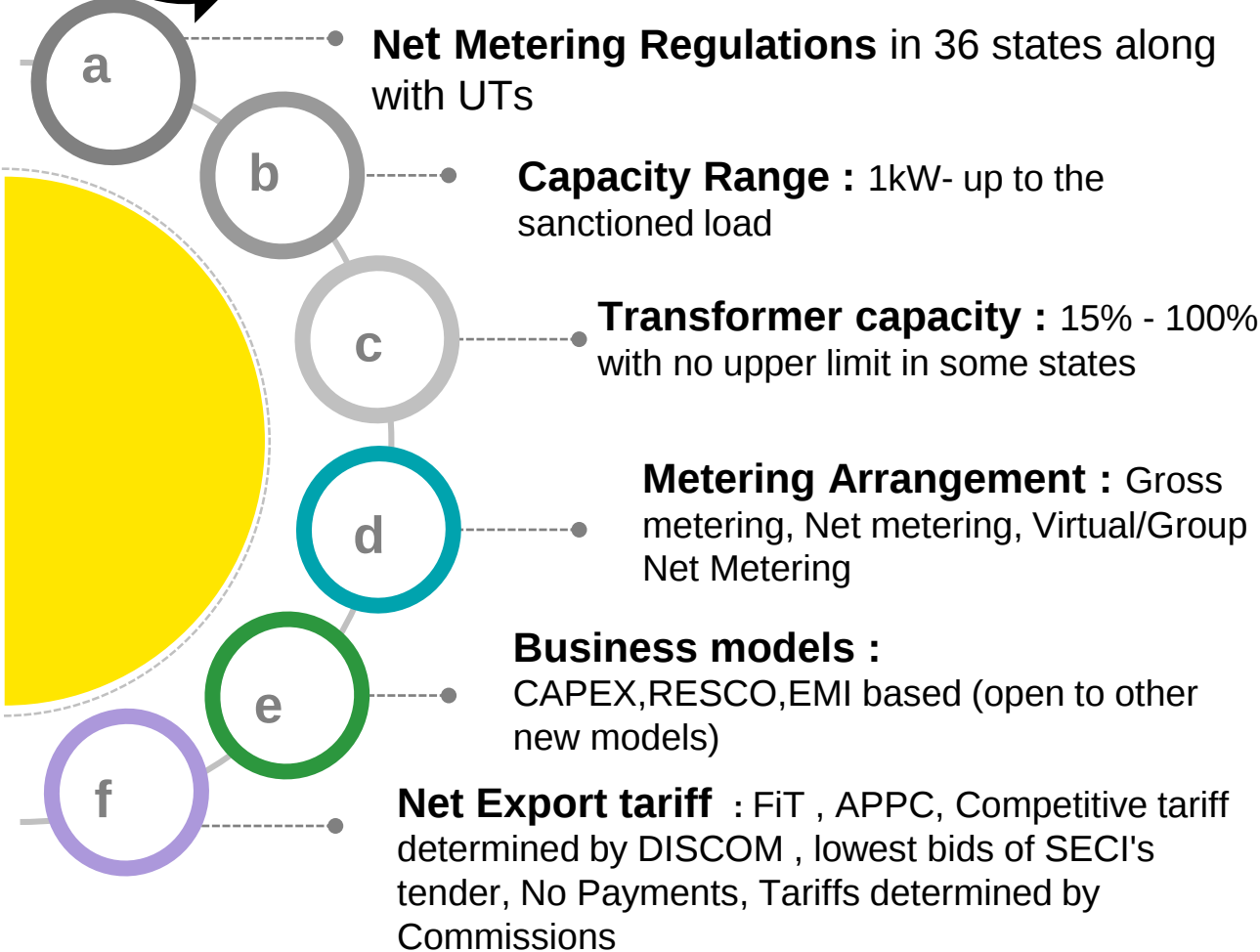
Policy & Regulations that shaped Indian RTS Sector

Net metering experience in India

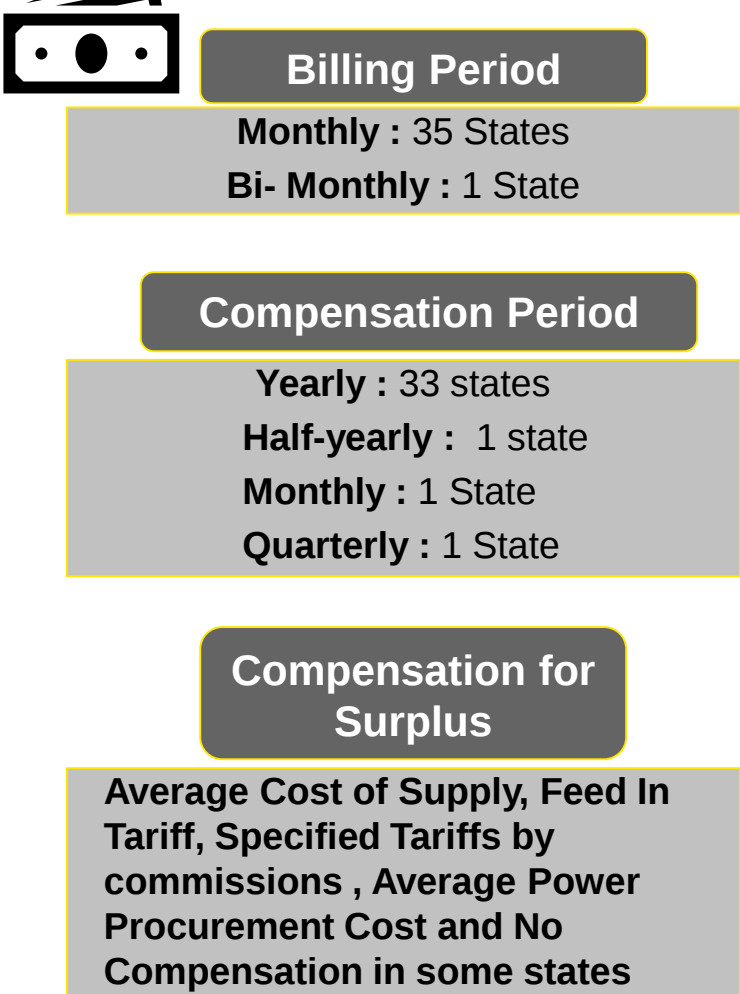
(1/2)

Almost all the Indian states have come up with a net metering regulation and a rooftop solar policy which dictates the modalities for installing grid-connected rooftop solar.

Key Features of Rooftop Solar Regulations



Billing Mechanism



Net metering experience in India

(2/2)

Energy Accounting		Incentives as per Net Metering Regulations for Vendors		Incentive Scheme by MNRE, GoI	
Excess Generation	Less Generation	Central	State	Discoms	Consumers
▶ Energy units credited in succeeding billing cycle and settled at the end of FY. ▶ No interest payable on carry forward. energy amount ▶ Banking of energy allowed within one billing cycle.	▶ Distribution Licensee shall raise invoice for the net electricity consumption after taking into account any electricity credit balance remaining from previous billing cycle till end FY.	▶ Waiver of Inter State Transmission Charge ▶ Open access surcharges	▶ Generation Based Incentive ▶ Open Access, Wheeling Charges, Banking , Cross subsidy surcharge Exemption ▶ Duties and clearances exemption	▶ Performance-linked incentives ▶ For Additional RTS capacity of : 10-15% - 5 % of RTS benchmark cost ▶ Above 15%-5 % of RTS benchmark cost upto 15% and 10% for remaining capacity	▶ Capital Incentives to residential consumers. ▶ Eligible for individual households as well as Group housing societies.

Key issues identified in the Model NEM Regulation 2013

Sr. No.	Issues identified	Type
T-1	Need for relaxing the maximum individual capacity that can be deployed based on sanctioned load	Technical
T-2	Need for clarifying the interconnection limits on GRPV capacities connected to DT	Technical
T-3	Need for provisioning for real time monitoring of solar generation and participation in system operations; required in case of large penetration of GRPV systems	Technical, grid stability & safety
C-1	Need for accommodating newer business models available to consumer and developers, limited scope to DISCOMs in present scenario	Commercial
C-2	Present PPA or connection agreement need additional aspects related to change in ownership and flexibility in existing PPA/connection agreement	Commercial
C-3	Need for compensating for excess generation in present energy accounting and commercial settlement principles	Commercial
O-1	Definition of premises and Solar roof-top PV systems needs review owing to future possibility of different scenarios	General definition & others
O-2	Metering and communication requirements needs review to provide greater visibility on solar generation to DISCOMs and system operations	Communication, metering & safety

Developing Comprehensive Metering Regulations & Accounting Framework for Grid Connected – updation of NEM Regulations 2013

New Features, April 2019

1

Six new business models

Utilities might act as various type of facilitators such as RESCO, EPC contractor, demand aggregator, resulting in promotion of innovative business models

2

Operational improvements

Consumer application to final system commissioning – the entire consumer interface with DISCOMs will be online through interactive portals

3

Metering Arrangements

Net Metering , **Net Billing** for Prosumer based system and Independent Distributed Renewable Energy (DRE) system

4

Government structure and institutional framework

DRE cell at DISCOMs, formation of DRE advisory committee, clarity in their role and responsibilities

5

Promotion of distributed generation

Provisions related to RPO targets, incentive to DISCOMs to procure power from distributed generation

6

Relaxation & Incentives

- No restrictions on individual capacity
- Distribution Transformer limit increased
- Remuneration introduced for excess generation

Utility led business models along with private sector initiatives are emerging to increase the uptake and enable financing



Utility Led

Aggregation

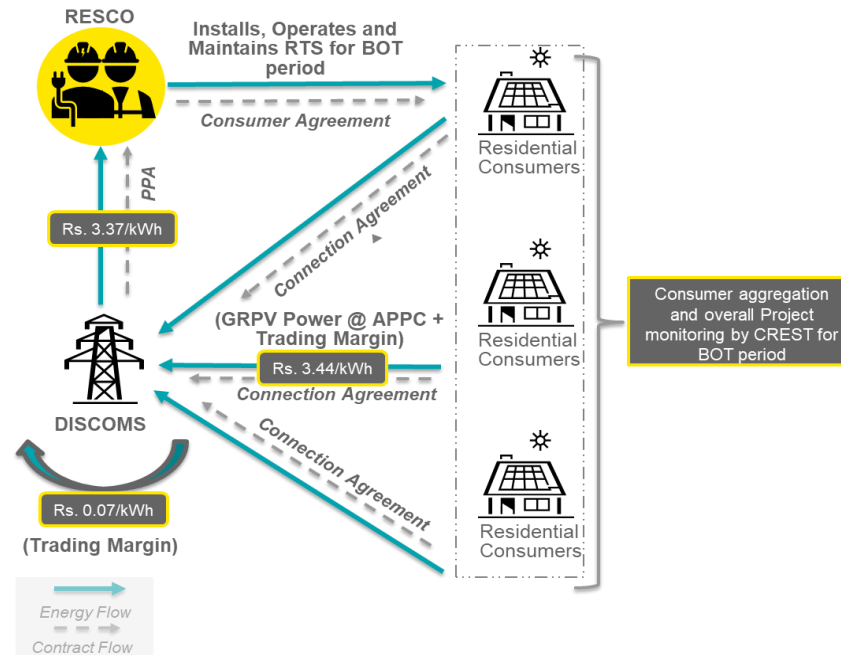
EPC

RESCO

EMI

Hybrid

Community Solar



RESCO Built Own Transfer Model –
Chandigarh (under finalization)



Market Players
(Developers, SNAs,
Super RESCOs, NBFCs)



Buy-back guarantee
Developer-Flex Pay
Annuity Model
NBFC Financing
NBFC - onlending

Case Study : Maharashtra RTS regulations – Challenging yet Leading

MERC, Grid Interactive Rooftop Renewable Energy Generating Systems Regulations, 2019

- Net Metering or
- Net Billing;
- Behind the meter with prior intimation

Net metering allowed upto 1MWp capacity. No max limit for Net Billing

Capacity Cap: shall not exceed the sanctioned load/ contracted load or contract demand

Distribution Transformer : shall not exceed 70% of its rated capacity

Introduced **Grid Support Charges to be levied** on the generated energy under **Net Metering systems** which shall cover balancing, banking and wheeling cost after adjusting RPO benefits, avoided distribution losses and any other benefits accruing to the Distribution Licensee.

Consumers with sanctioned load up to 10 kW shall be exempted from payment of Grid Support Charges for Net Metering systems

Third Party Owned System Allowed

Rolled-over credits will be treated as off-peak power irrespective of their time of generation

Unadjusted net credited units at the end of FY settled at Generic Tariff for that year

Under Net Billing, Consumers shall enter into PPA with discom at APPC approved for the respective period constant throughout PPA period

Net Billing and Third Party Owned Systems encourage new business models

Grid Support Charges (GSC) – too early to implement?

Grid Support Charges will help to partly recover the cost of network, banking facility, standby arrangement, and distribution grid balancing after adjusting RPO benefits, avoided distribution losses and any other benefits accruing to DISCOM

Grid support charges **NOT LEVIED** on rooftop solar projects under net-metering arrangement till cumulative installed capacity in the state reaches **2000 MW**.

Grid Support Charges shall be levied on the **quantum of gross generation** from RE sources during the billing period.

Grid support charges **NOT LEVIED** on rooftop solar projects upto 10 kW

MERC while accepting the GSC as a legitimate charge under EA 2003, delayed its implementation by linking to a threshold capacity installation (2 GW)

Need for dedicated Rooftop Solar Policy

Terrain

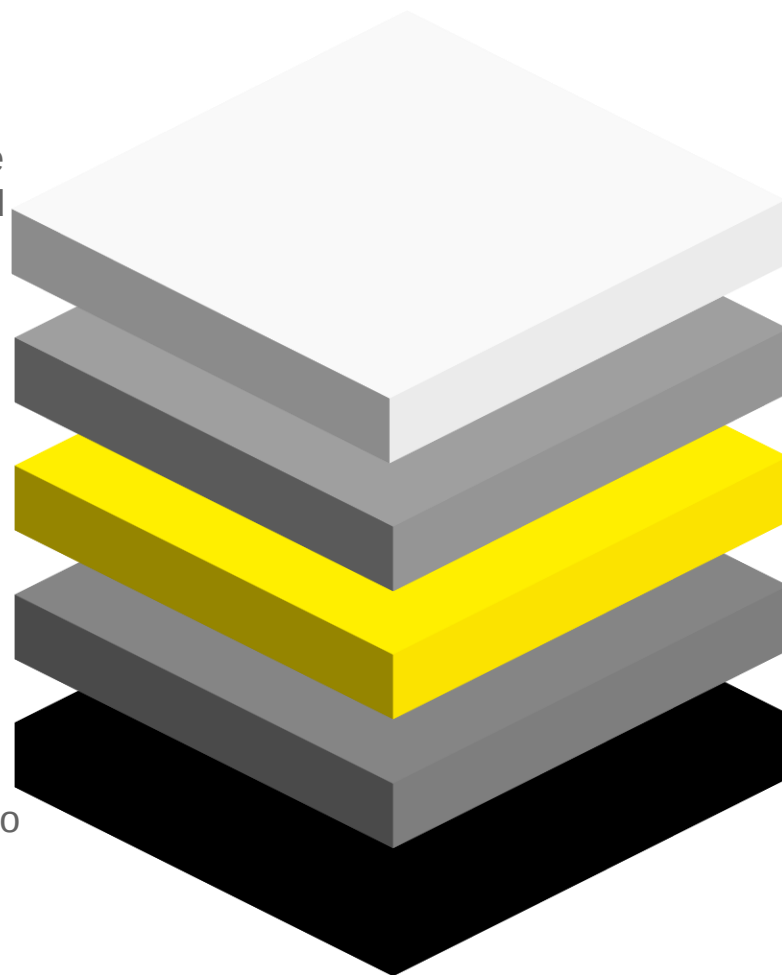
Nagaland being a hilly state with large forest cover need focused approach towards GRPV as against Utility Scale Solar which need large land tracts and investments.

Climate

With lesser sunny days, lower solar irradiance and heavy rainfall, promotion of solar technology would require special measures and incentives.

Off-Grid to GRPV

To clearly provide guidance on converting existing Off-grid systems to GRPV with storage subject to appropriate safety measures.



Target Setting

Setting of target capacity to be installed in the State, taking into consideration the present scenario. Setting of Category-wise, Sector-wise, year-wise targets along with guidance on facilitative eco-system.

Supply Chain Management / Local Employment

To successfully install GRPV in the State, the policy is required to establish a robust supply chain system management system to make it reach to the far flung areas of the State. Policy to further provide guidance on promotional measures for localized start-ups, employment opportunities.

Clarity on Role

To bring in the clarity on Roles and responsibilities of various Government Institutions in accelerating GRPV deployment. Also, provide guidance towards time bound action plan for achieving the Policy Objective.

Rooftop Solar Policy - Key Decision Variables / Discussion Points

Objectives

What should be the Key Objective of the Policy?

- Local Employment generation
- R&D and Manufacturing
- Capacity Building

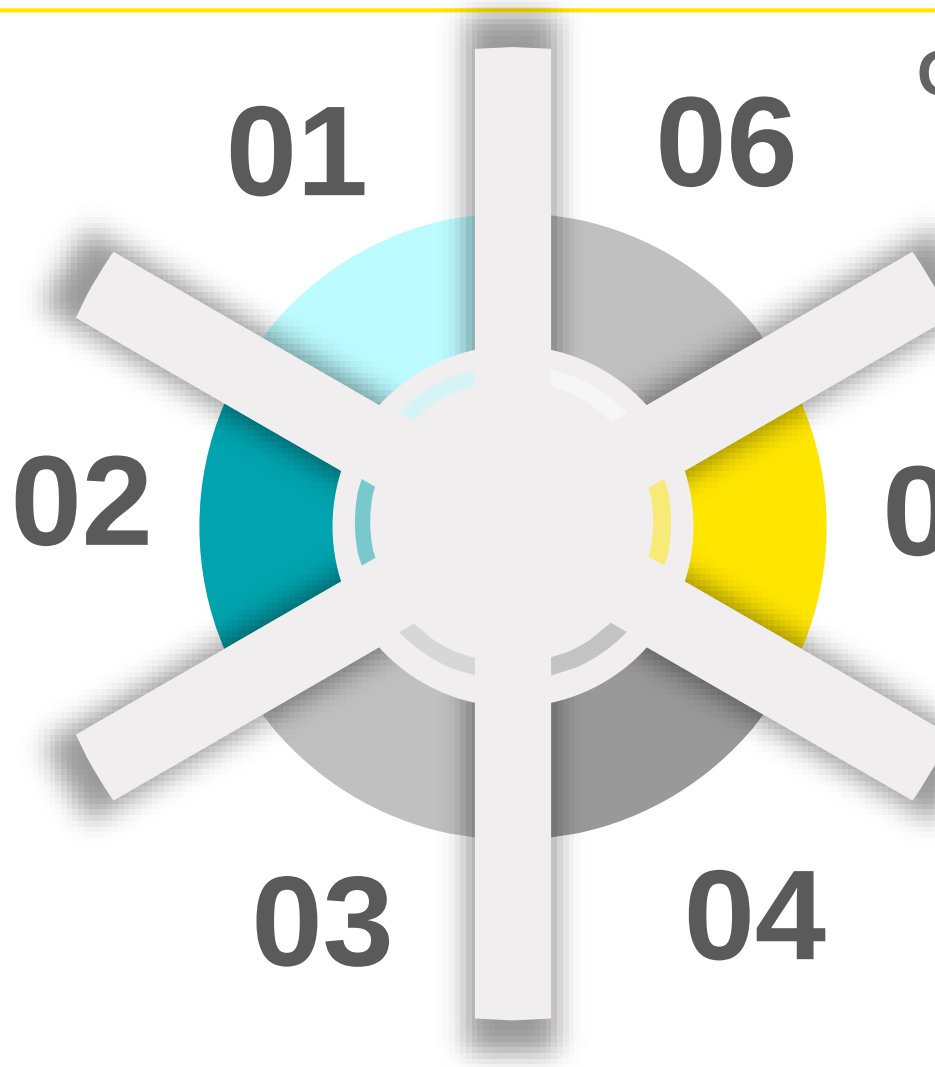
Target Setting

- State's overall Target till 2022
- Category wise, Sector wise, Year wise Trajectory for - Domestic, Commercial, Industry, Institutions, Government Departments

Incentives

What state specific incentives should be adopt?

- State Level Fund
- Generation based Incentives
- Subsidy for Batteries



Operation Modes

- With / Without Battery back-up
- ToD Tariff design for promoting Peak Demand Management
- Converting Off-grid systems to GRPV

Metering Arrangements

Should the state go beyond net metering?

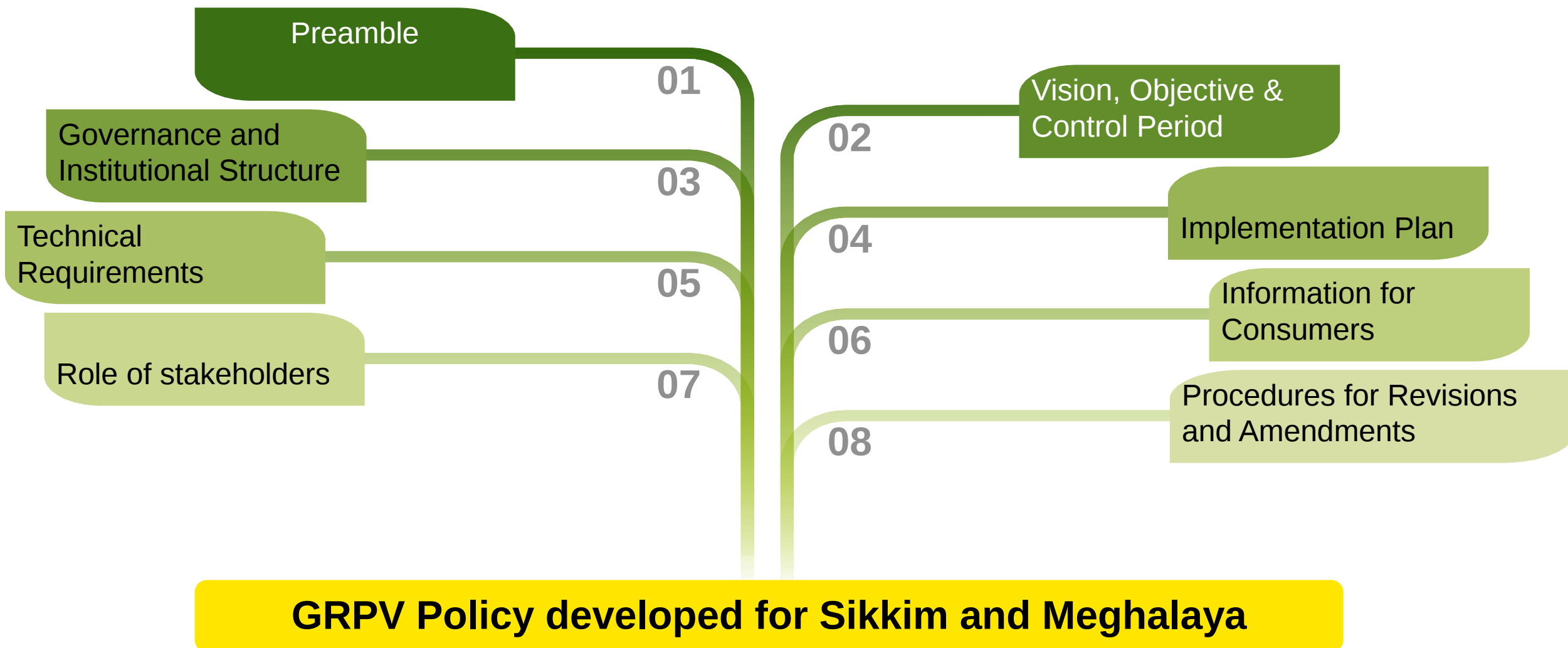
- Gross metering
- Net Metering
- Virtual Net Metering

Best practices

Which all innovative ideas/ best practices should the policy adopt?

- Utility based Business Models
- Aggregator
- Facilitator
- Super RESCO
- Online Unified Portal

Key Elements of Proposed Solar Rooftop Policy



Way to Scale-up GRPV deployment in the State

01

Policy and Regulatory

- Develop Solar Rooftop Policy
- Update Metering Regulations

- Helps in developing market
- Approach to business models
- Implementation support
- Incentive mechanisms

02

Standardized Processes

- Empanelment of Vendors
- Interconnection Procedure

- Well defined technical standards
- Robust interconnection process
- Consumer-friendly Interconnection process
- Execution in timely manner

03

Monitoring & Verification Framework

- Unified Web Portal
- Database creation

- Web based procedures
- Online monitoring
- Error reduction
- Save of time and money

04

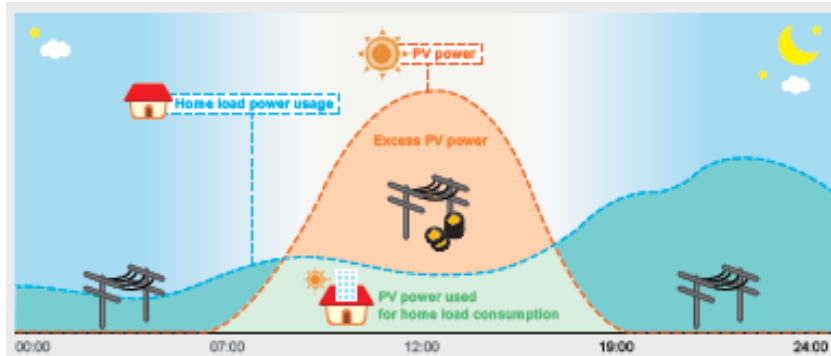
Capacity Building & Outreach

- Training Program
- Media Outreach Programs

- Technical knowledge to developers and DISCOMs
- Awareness to consumers
- Strengthening the state government

It is important to adopt & implement Progressive policies, Standardized procedures, and robust frameworks, to enable Rooftop Solar sector.

Net Metering with/without Storage



Net Metering: without battery

Excess Generation is fed into grid.
Grid is used as Storage
Works well in areas with Day time Peak

Benefits

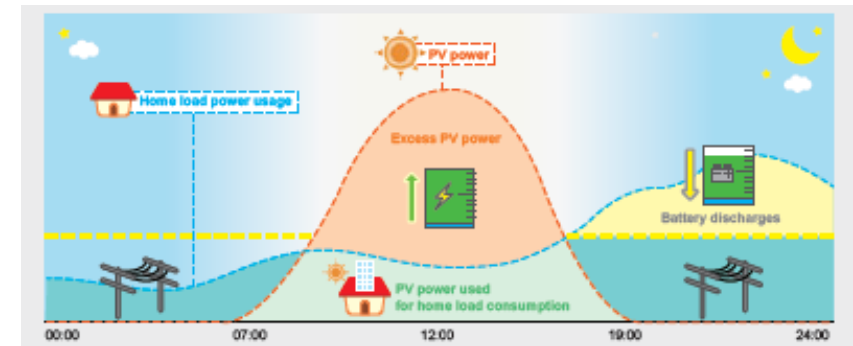
- ▶ Supplementary generation when Peaking Plants Shutdown mid-day
- ▶ Replace thermal power in the Energy Basket

Net Metering : with battery

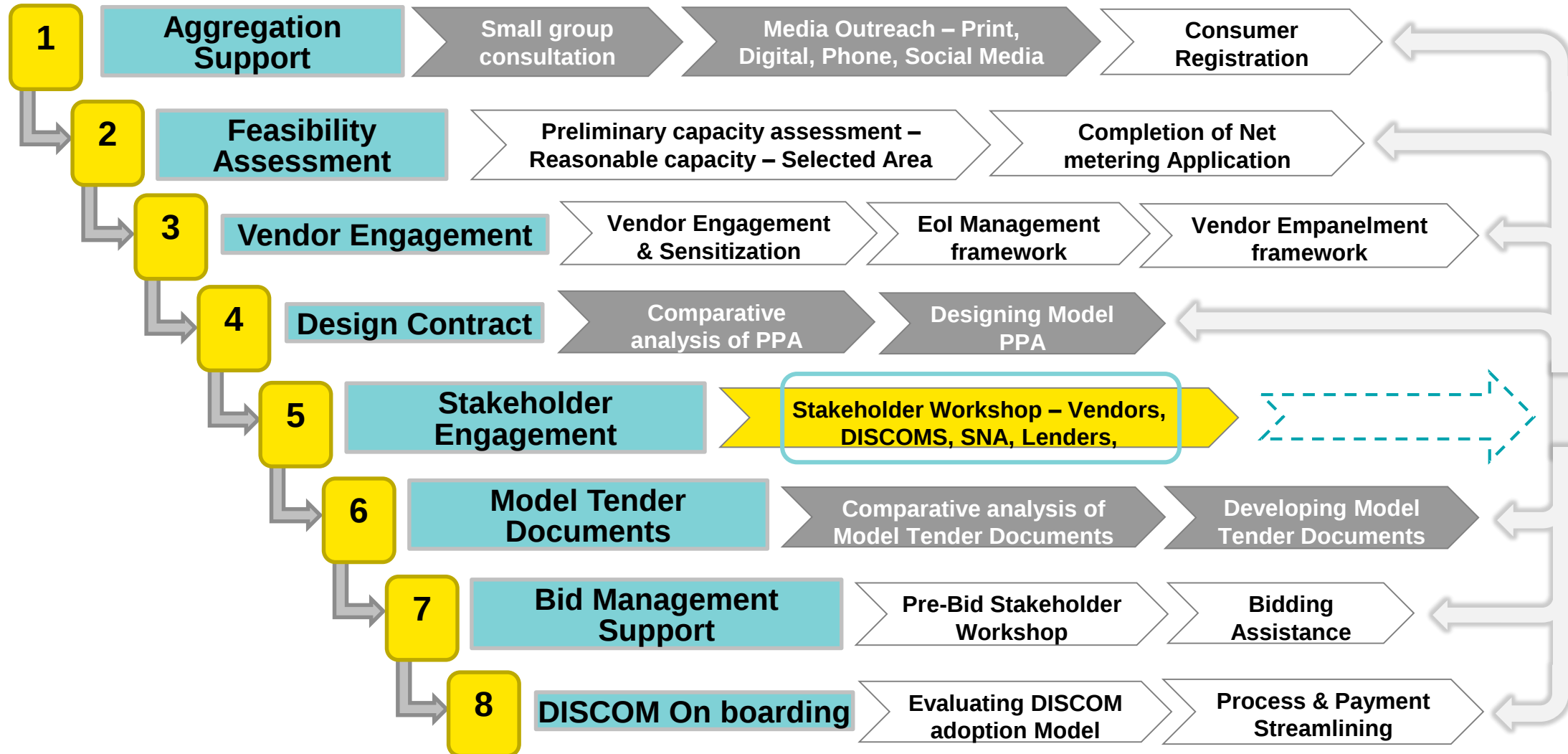
Excess Generation is stored in batteries first and later fed to grid when batteries are full

Benefits

- ▶ Reduce Peak Demand at the consumer end
- ▶ Additionally serves as Back Up Supply source



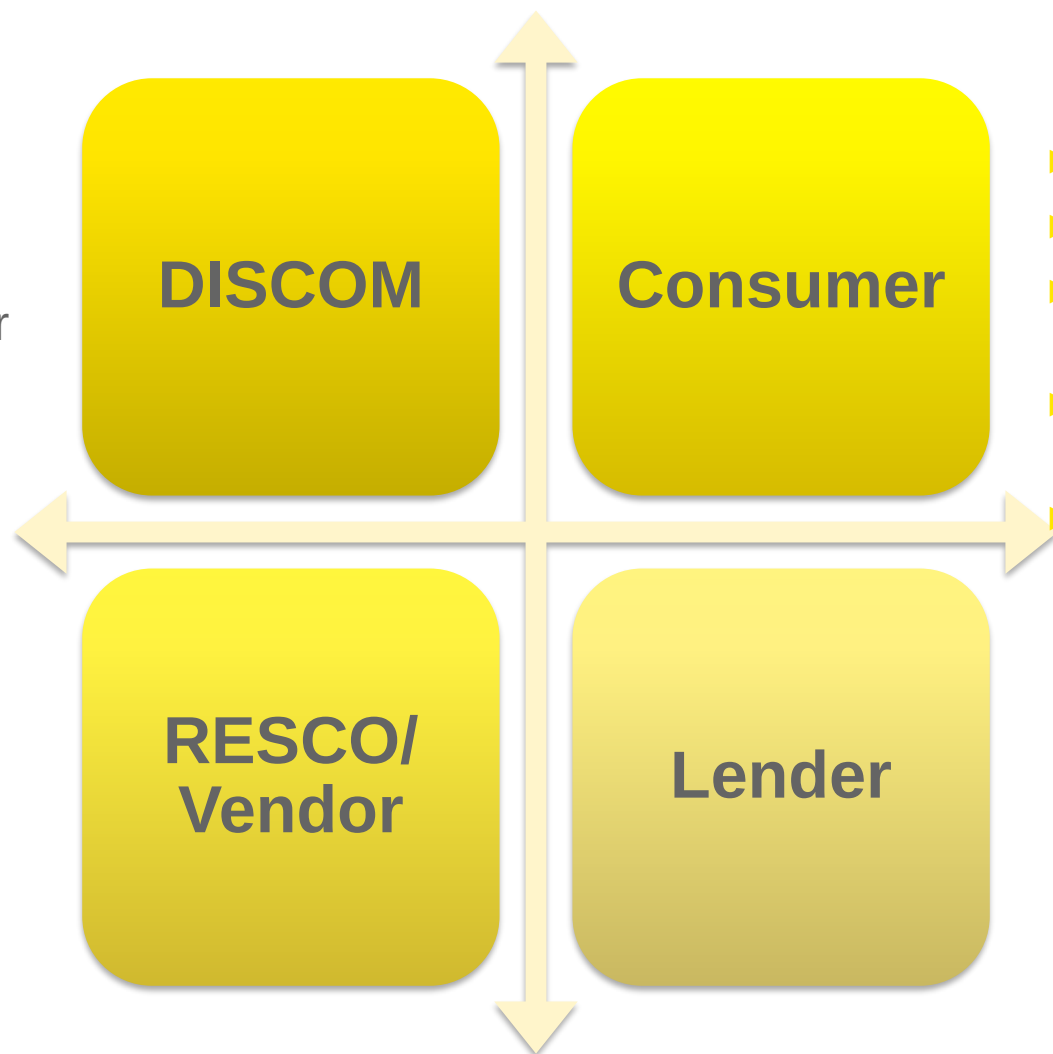
Demand Aggregation - Approach



Benefits to various stakeholders

- ▶ Faster Scale up
- ▶ Faster processes
- ▶ Online information on Generation/ Performance for ease of planning

- ▶ Access to scaled demand
- ▶ IT enabled tools to access potential sites
- ▶ Significant reduction in customer acquisition costs
- ▶ Payment Assurance



- ▶ Facilitates Onboarding
- ▶ Assured Quality
- ▶ Significant improvement in Cost (due to aggregation)
- ▶ Robust and time-defined approvals
- ▶ Fair contracts

- ▶ Stapled loans to Tenders
- ▶ Access to Scaled demand
- ▶ Reduced risks

Step by Step....for Data Room

Methodology Adopted

1. Site Visit and Survey
2. Capacity Estimation
3. Annual Energy Yield Estimation
4. Creation of Data Room



Site visit and survey:

- Extracting geographical coordinates of site
- Identification of shadow free area
- Measurement of roof and obstacles



Capacity estimation:

- Array layout based on shadow free area after survey
- Select suitable module and inverter
- Determine DC capacity and AC capacity of plant

System Metrics



Module DC Nameplate
19.09 kWp

Load Ratio
0.95

AC Nameplate
20.00 kW

Weather Dataset
Meteonorm

Annual energy yield estimation:

- Select site conditions
- Select weather parameters
- Use The Solar Labs Simulation tool

Heat Map

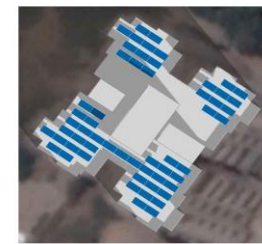


Solar Access



Shadow Analysis

December 22 10:00 AM



December 22 03:00 PM



Conclusion: Panels are shadow free for 98.14% of solar time throughout the year.

Elevated Structure Configuration
(3m height from roof)



Non-Elevated Structure Configuration
(0.5m height from roof)

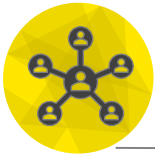


Digital Interventions by SUPRABHA TA program



Unified Web Portal

- Interconnection Module and Subsidy Module
- Vendor Management Module
- Consumer Grievance Redressal Module
- Bank Guarantee Monitoring, Performance Ratio based penalty assessment



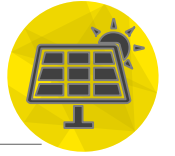
Vendor Mgmt. Portal

- Project management including milestone tracking, status updates and performance reports
- Power Purchase Agreement automation
- Grievance redressal through time based escalation features



NORS-DMC @ NISE

- Framework for national level data monitoring of RTS plants through Advance Metering Infrastructure (AMI) and Smart Meters / Inverters / Data Logger



Data Room

- Solar capacity assessment of site
- Annual solar power generation estimation
- Estimation of solar power losses incurred due to various factors (e.g shadow analysis)
- Generation of site feasibility assessment and shadow analysis report



FOR NEM Regulation

- Updated FOR Model NEM Regulation includes stipulation of installation of Advanced Metering Infrastructure (AMI) facility with RS 485 (or higher) communication port

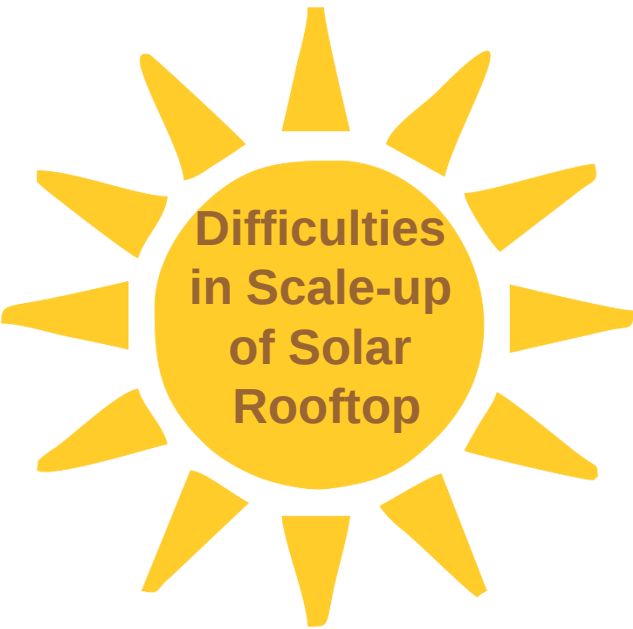


RE Data Analytics Centre

- Integrated Renewable Energy Data Analytics Centre with central data repository for intelligent monitoring and verification of RE systems installed across states in India

**Digital
Interventions
by TA**

Process Streamlining : Need for Unified Web Portal



Consumer requirements

Utility/DISCOM perspective

State Nodal Agency's considerations

Chief Electrical Inspector/Protection & Safety

Developer/Channel partners considerations

Lenders/ Banks requirements

Awareness and Outreach

Key Features

Streamlines process

Increases accountability

Brings transparency and efficiency

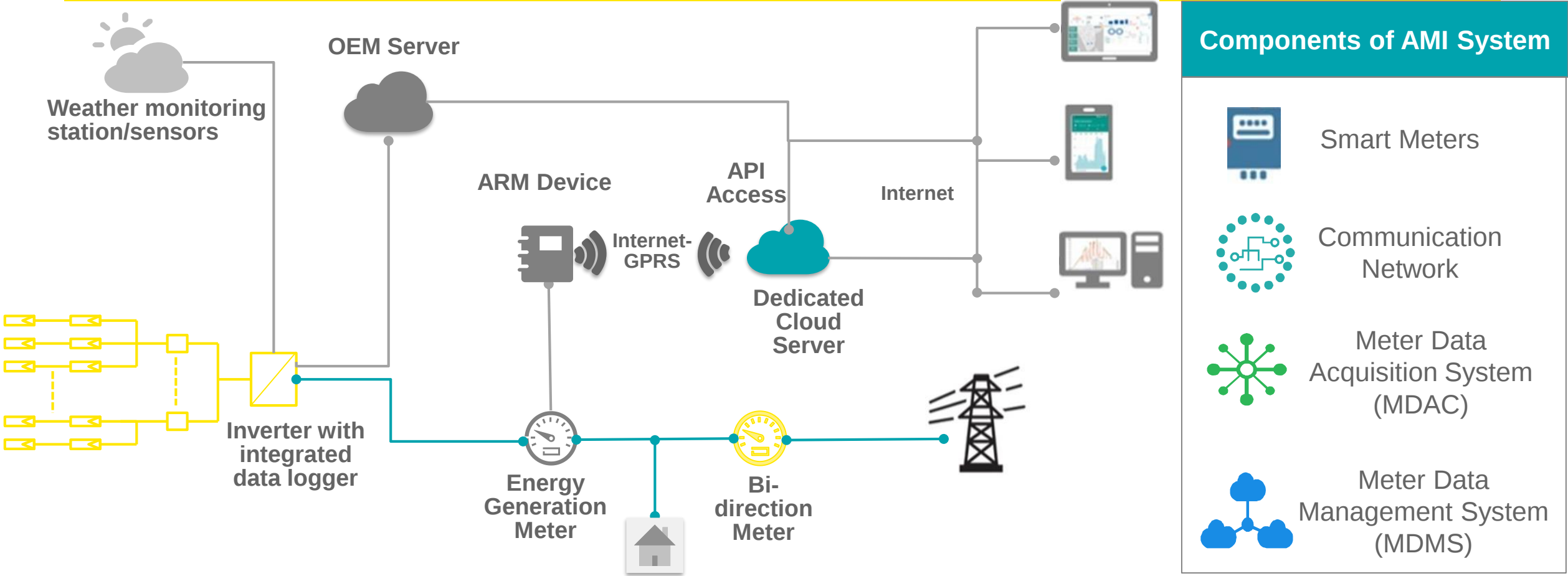
Efficient monitoring

Ease of doing business

Portal provides information at **One Single Point** and **allows interaction with multiple stakeholders**

National Online Data Monitoring Centre at NISE

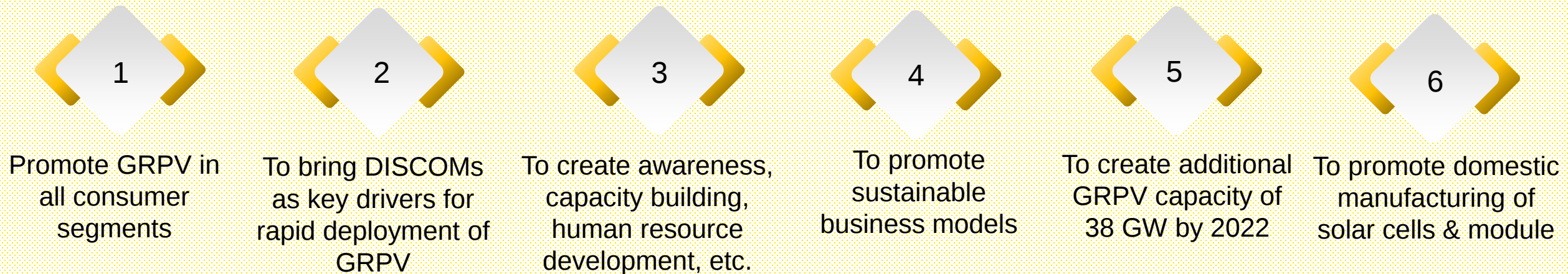
Framework for monitoring the performance of the Rooftop Solar installation through Advance Metering Infrastructure (AMI) using Smart Meters at Solar generation side. MRV protocol for generating Emission Reductions of Climate Assets



MNRE guidelines on Implementation of GRPV Phase – II program – Residential Sector - 0.85 GW already allocated to 27 States/UTs

Approved by MNRE on 19th February, 2019 for achieving cumulative capacity of 40 GW RTS plants by 2022

Aim and Objectives of Phase-II Grid Connected Rooftop Solar Programme



DISCOMs will be the nodal points for implementation of the Phase II GRPV Program. DISCOMs will play a key role in expansion of GRPV as they have direct contact with consumer, manage distribution network & billing and accord approval for GRPV installation

Marching forward with DISCOMs

01 Demand Aggregation : Finalize the capacities and target consumer segments for rooftop solar installation in the DISCOMs areas for CY2020 (vendor empanelment / common tender)

02

Sensitization Workshop on Implementing Grid-connected Rooftop Solar Programme Phase II for DISCOM(s)

03

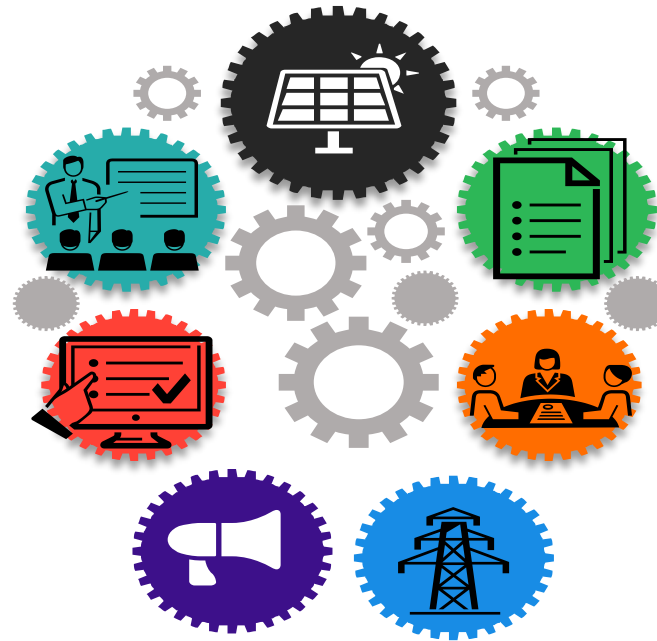
Unified Web Portal (UWP): Subsidy module development for DISCOMs. Updation of UWP with features of MNRE RTS Phase II Program.

04

Utility-led business model/s for deploying the finalized capacities.

05

Capacity building of designated DISCOM officials on various aspects of rooftop solar.



07

Media and Outreach campaigns for awareness creation.

06

Support setting up of a dedicated **Distributed Renewable Energy (DRE) Cell** at the DISCOMs

Rooftop solar ecosystem in India: 2022



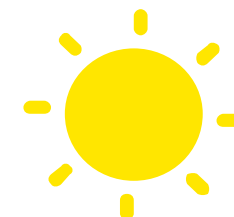
POLICY MAKERS AND REGULATORS

Robust policy and regulations bolstering GRPV uptake amongst all consumer categories and stakeholders



SKILL DEVELOPMENT ORGANIZATIONS

Standardized, scalable and sustainable training modules ensuring upskilling and employability of various stakeholders



BANKS

Banks offering long term, low cost and innovative financing instruments for GRPV



DEVELOPERS



Skilled developers offering high quality, affordable installations with various business models

PROSUMERS



Commercial



Residential/
Institutional



Industrial

Increased uptake of GRPV amongst all consumer categories

DISCOMS

Forerunner in implementing innovative, leading and sustainable business models with strong emphasis on consumer engagement and prosumer empowerment



URBAN LOCAL BODIES

Enabling and scaling the market by acting as a hub for demand aggregation besides execution of transparent policies and practices



Nithyanandam Yuvaraj Dinesh Babu
Team Leader, EY Consortium / Executive Director
Email: Yuvaraj.Dinesh@in.ey.com
www.suprabha.org
Contact: 9560719349

Thank You

Solar Policy and Regulation in States

1/2

States/Features	Metering	Max. System Capacity	Business Models	DT loading Limit	Settlement Cycle
Rajasthan	Net	1000 kW	CAPEX/RESCO	30%	Yearly
Delhi	Net, Gross and Virtual	System capacity limited only by the Distribution Transformer (DT) Ratio	CAPEX/RESCO	DT capacity shall not be less than the limit set by Commission	Yearly
Andhra Pradesh	Net, Gross and EMI based	1000 kW	CAPEX/RESCO/E MI based model	No limit	Yearly
Haryana	Net	1000 kW	CAPEX/RESCO	50% and 30% of the rated DT capacity	Yearly
Bihar	Net and Gross	1000 kW	CAPEX/RESCO	80%	Yearly
Chhattisgarh	Net	Capacity allowed is up to Sanctioned load	CAPEX/RESCO	100%	Yearly
Meghalaya	Net	1000 kW	CAPEX/RESCO	5%	Yearly

States/Features	Metering	Max. System Capacity	Business Models	DT loading Limit	Settlement Cycle
Maharashtra	Net	1000 kW	CAPEX/RESCO	40%	Yearly
Gujarat	Net	1000 kW	CAPEX/RESCO	65%	Billing period or monthly cycle
Uttar Pradesh	Net and Gross	2000 kW	CAPEX/RESCO/E MI based model	25%	Yearly
Karnataka	Net and Gross	1000 kW	CAPEX/RESCO	80%	Yearly
Jharkhand	Net and Gross	2000 kW	CAPEX/RESCO	100%	Monthly
Kerala	Net	1000 kW	CAPEX/RESCO	15%	Yearly
Madhya Pradesh	Net	1 MW	CAPEX/RESCO	30%	Yearly
Odisha	Net	Maximum system capacity allowed	CAPEX/RESCO	30%	Yearly