



# Rooftop Solar Photovoltaic in Uttar Pradesh

## Policy Design & Regulatory Recommendations



# Content

- **Rationale for Promoting Rooftop Solar Photovoltaic Projects**
- **Policy Design for Rooftop Solar Photovoltaic Projects**
- **Recommendations on Net Energy Metering Regulations**
- **Status of Policy/Regulations in States**



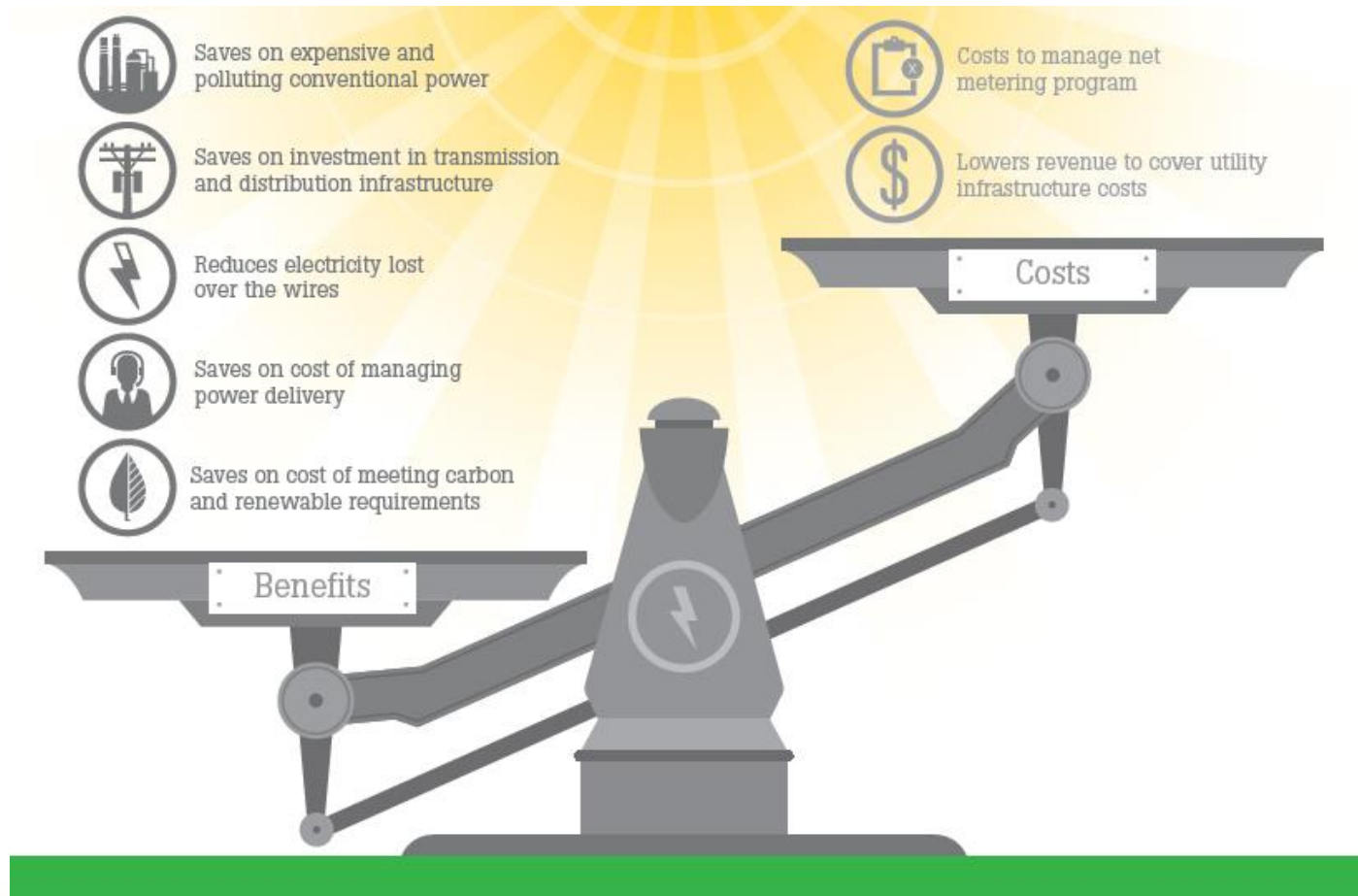
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# Benefits Vs Costs of Rooftop PV Installations

- Saves land requirement
- Better utilization of under utilized roof
- Tail end installations aims to improve voltage

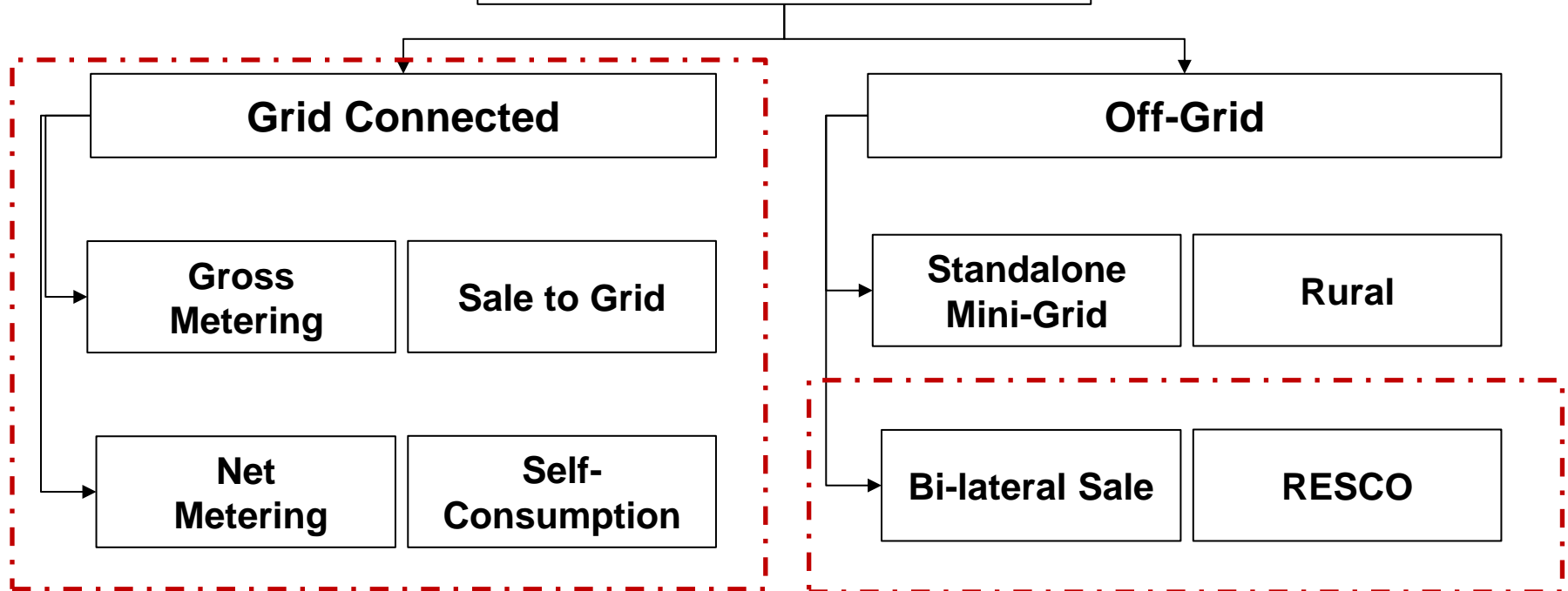


Source: The Vote Solar Initiative



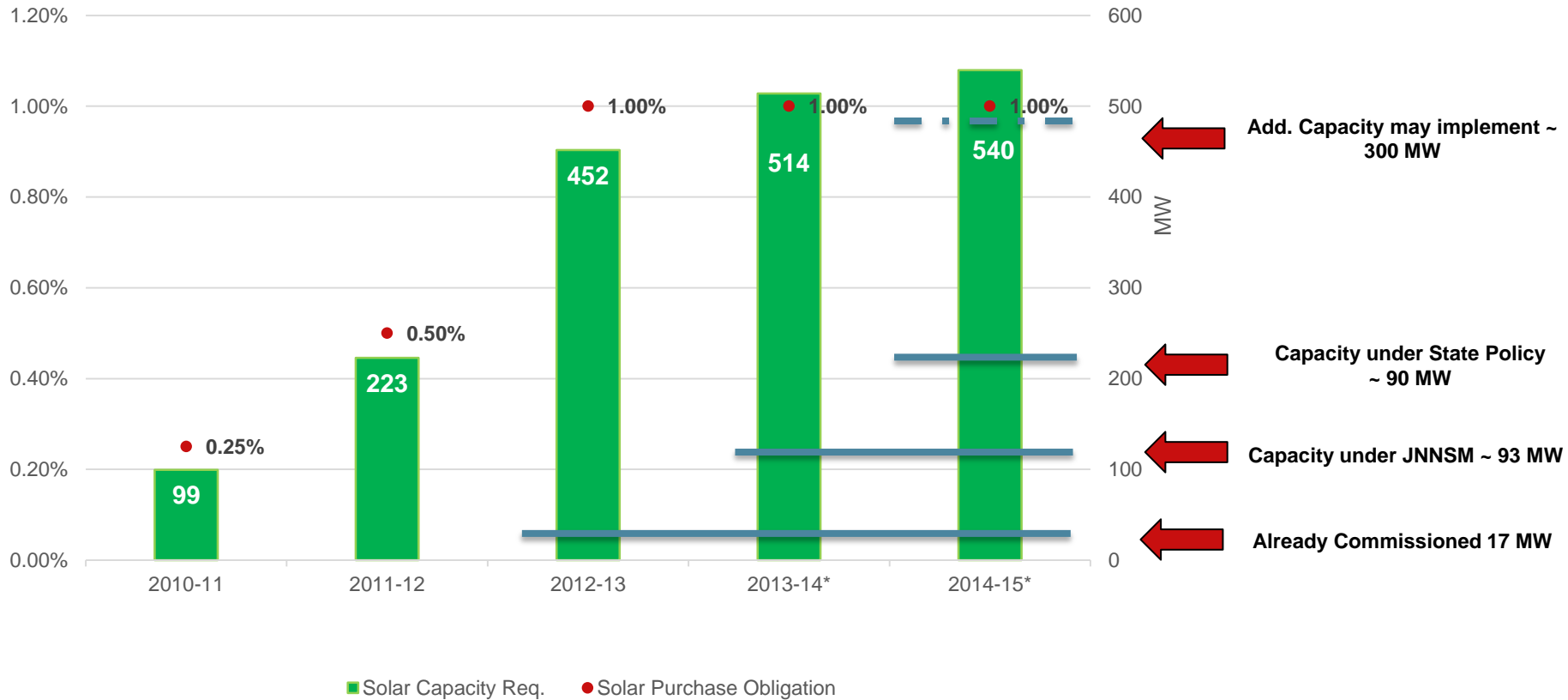
# Options for Implementing Rooftop PV Installations

## Rooftop Solar Segment





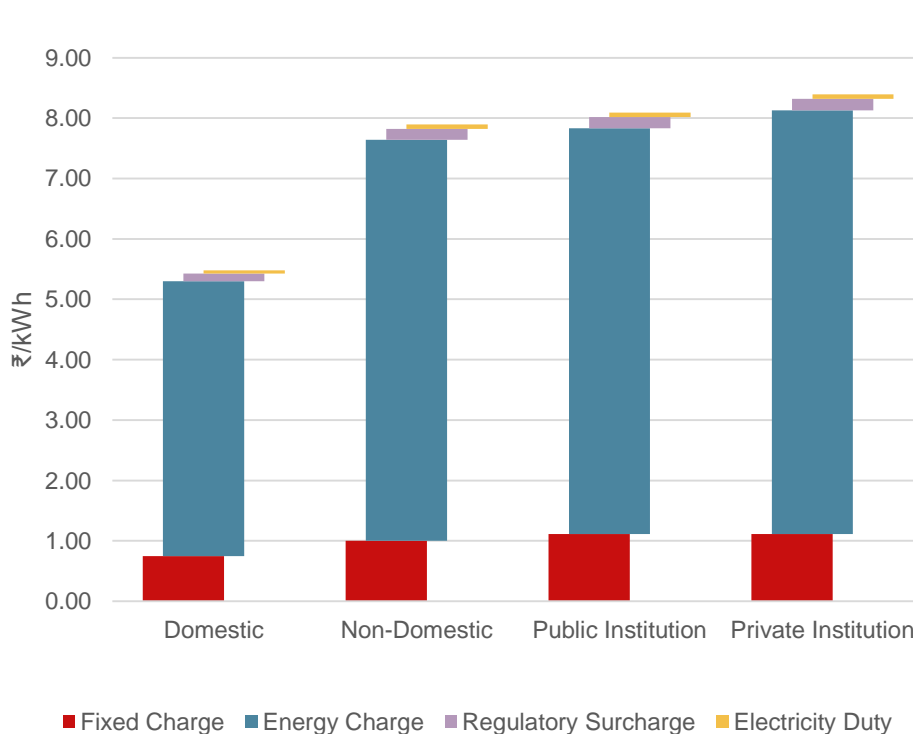
# Approach for analyzing feasibility of Gross Metering



**Solar Purchase Obligation compels DISCOMs to purchase generation from RTPV**



# Approach for analyzing feasibility of Net Metering



Description (FY 2014-15)	Domestic	Non-Domestic	Public Institution	Private Institution
Fixed Charge	0.75	1.00	1.11	1.11
Energy Charge	4.55	6.64	6.72	7.02
Regulatory Surcharge	0.13	0.18	0.19	0.19
Electricity Duty	0.05	0.08	0.08	0.08
Effective Billing Rate	<b>5.48</b>	<b>7.90</b>	<b>8.09</b>	<b>8.40</b>

Description	Without Subsidy	With 15% Subsidy
Levelling Cost of Generation (25 Years)	8.66	7.49
Accelerated Depreciation, if availed	0.94	0.80
Net Cost of Generation	<b>7.72</b>	<b>6.69</b>

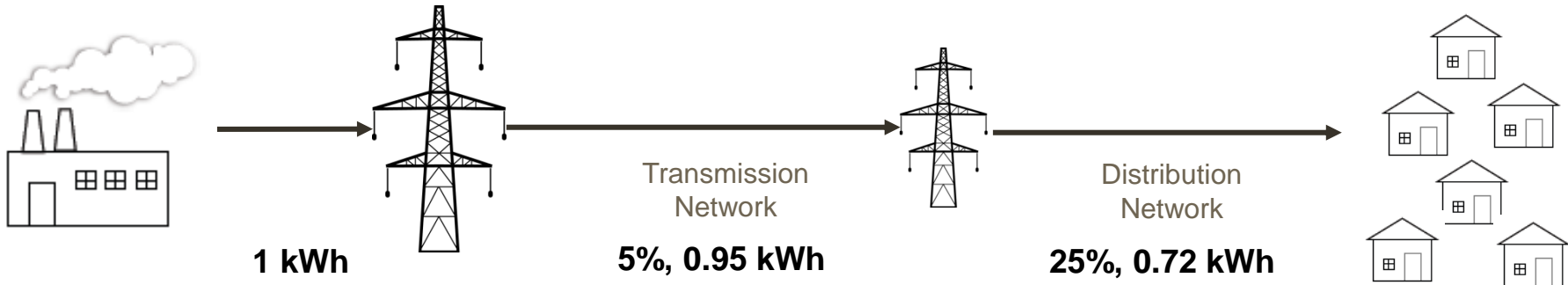
*Commercially – Yes (in some consumer segment)*

*Technically – Yes (when grid is available)*

**Parity of consumer bill with cost of generation for RTPV has formed the basis**



# Benefit of Rooftop Solar Photovoltaic to the DISCOM



1 kWh generated at load centre can save generation of 1.5 kWh by fossil fuel based plants

Parameters	Unit	FY 15
Sales	GWh	63183
D Loss	%	23.50%
Energy @ DISCOM Periphery	GWh	82952
D Loss	GWh	19409

Disallowance in Power Purchase	Unit	FY 09	FY 10	FY 11
Units Procured	GWh	2609	3675.38	1601.76
Avg. Procurement Rate	₹/kWh	7.05	5.16	7.49
Ceiling Rate	₹/kWh	4.92	5.00	5.87
Disallowance	₹ Cr	555.87	60.22	259.86



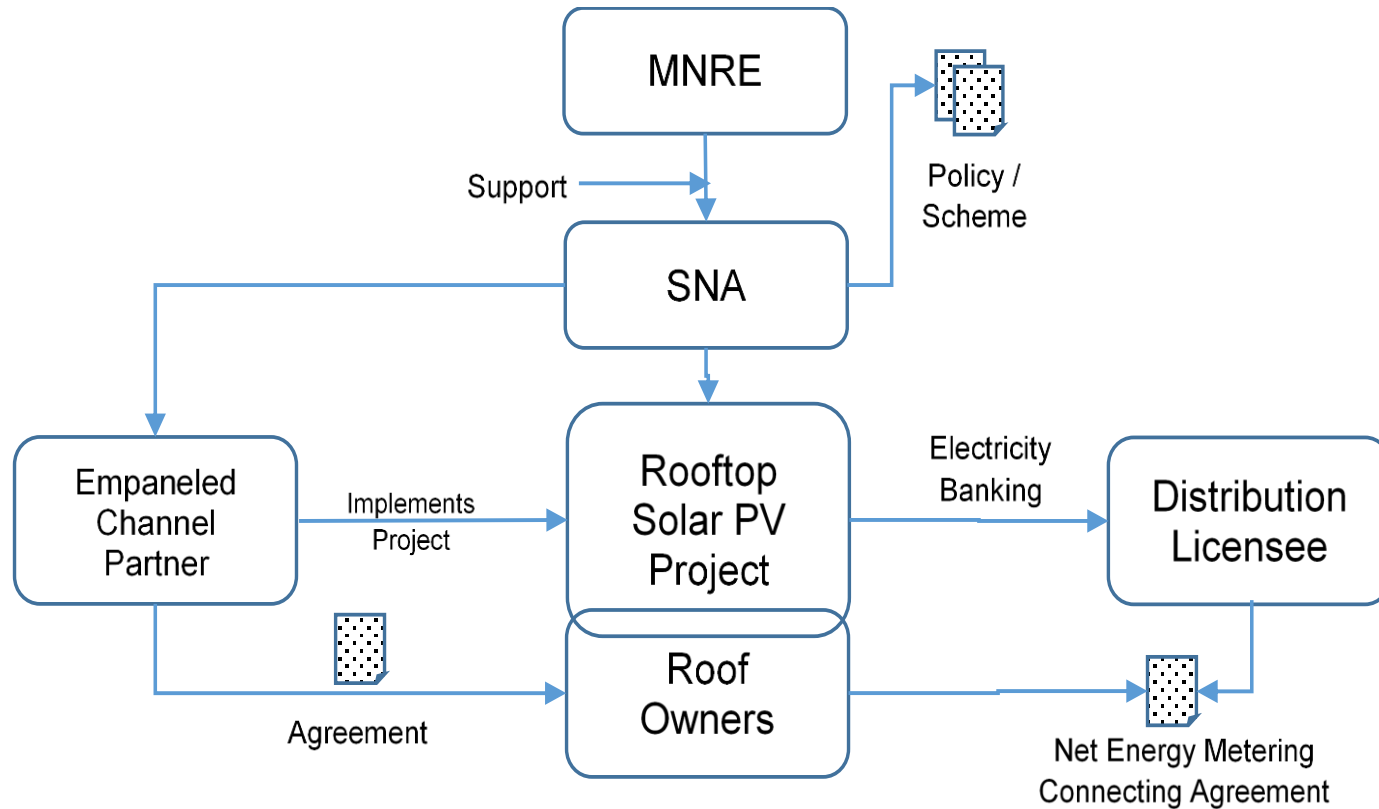


# Inputs for the Rooftop Solar Photovoltaic Policy

- State has fair solar potential (23 GW assessed by NISE) and need is to demonstrate the rooftop solar capacities
- Distribution network losses are approximately 25% (State level)
- Grid availability at lower voltages is poor
- **Electricity tariff for few consumer categories was close to levelled cost of generation for RTPV**
- Solar purchase obligation stands at around 500 MW and the State is announcing tenders for implementation of capacity under large scale solar segment
- Plans for development of capacity under Solar Park
- Power procurement from large scale solar projects shall cater towards compliance of Solar Purchase Obligation



# Transaction Framework for the Net Energy Metering





# Key enablers for Net Energy Metering Framework

**Grid  
Connected**



**Net  
Metering**

- **Policy Aspects**
  - Government to announce suitable policy framework and/or
  - Scheme for implementation of projects
- **Regulatory Aspects**
  - Enabling net metering regulations and/or Order
  - Net metering connection agreement
  - Clarity on Energy Accounting / Metering protocol and procedures
  - Clarity on Treatment of surplus energy
- **Technical Aspect**
  - **Availability of electricity grid for injection of surplus electricity**
- **Commercial Aspect**
  - **The consumer billing rate equivalent to the levellised cost of generation from rooftop solar project**



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# Key Parameters of Rooftop Solar Policy

## Parameter



## Target

## Operative Period

## Implementation Plan

## Role of Nodal Agency

### ▪ Target

- Public Institution – 10 MW
- Private Institution – 10 MW

*The State Government may regulate the target from time to time*

### ▪ Operative Period

- Targets to be implemented by March 2017

### ▪ Implementation Plan

- All State **Government owned** or **aided organisations** shall implement grid connected rooftop solar photovoltaic power plant utilising 25% of the available **plinth area for installation of solar projects**
- Plinth Area = 200 sq m
  - Available roof area or solar installation =  $25\% * 200 = 50$  sq m
  - Installable rooftop capacity = 5 kW



# Key Parameters of Rooftop Solar Policy

**Parameter**



**Target**

**Operative  
Period**

**Implementation  
Plan**

**Role of Nodal  
Agency**

## ▪ **Role of Nodal Agency (UPNEDA)**

- Facilitation in availing Subsidy/Support
- Empanelment of System Integrator(s)
- Identification of Sites for Deployment of Solar Power Capacities
- Allotment of Solar Power Capacities to Empanelled Integrator(s)
- Support in establishing Protocols for adoption of Solar
- Declaration of any Government Order
- Support in Development of Regulatory Framework
- Approval by Empowered Committee
- Recommend and Specify any Fee or Charge to operationalise the framework



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# Provisions proposed for Net Metering & Billing Mechanism

## Net Metering



### Eligible Consumer

Individual  
Capacity

Grid  
Connectivity

Energy  
Accounting

Solar Purchase  
Obligation

Metering  
Protocol

Other Charges

### Provisions proposed

- Any consumer of electricity having contracted load of not less than 1 kWp
- Plant can be **self-owned by the consumer** or **owned by any other person**
- **Eligibility shall cease** to apply, in case the eligible **consumer defaults in settling the electricity bills due for payment**





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### ■ Provisions proposed

- Entire electricity imports from the host distribution Licensee during the year shall be eligible to offset
- Capacity of the solar photovoltaic power plant shall be equivalent to the contracted load of the consumer
- Expenses of laying new electrical line and related infrastructure, up to the network of distribution licensee, for evacuation of generation due to implementation of solar photovoltaic power plant capacity in excess of contracted load to be borne by the consumer



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### Capacity Target for Distribution Licensee

- **Distribution Licensee shall submit procedure** for approval of Uttar Pradesh Electricity Regulatory Commission **within one months from the notification of the Regulations**
- **Distribution Licensee** shall provide net energy metering & billing arrangement to eligible consumers within **one month after receiving the written application** in a prescribed format and complete in all respect;
- The **cumulative capacity to be allowed** at a particular distribution transformer **shall not exceed 15% of the peak capacity** of that distribution transformer, after that the distribution licensee shall upgrade the capacity of distribution transformer;

### Grid Connectivity

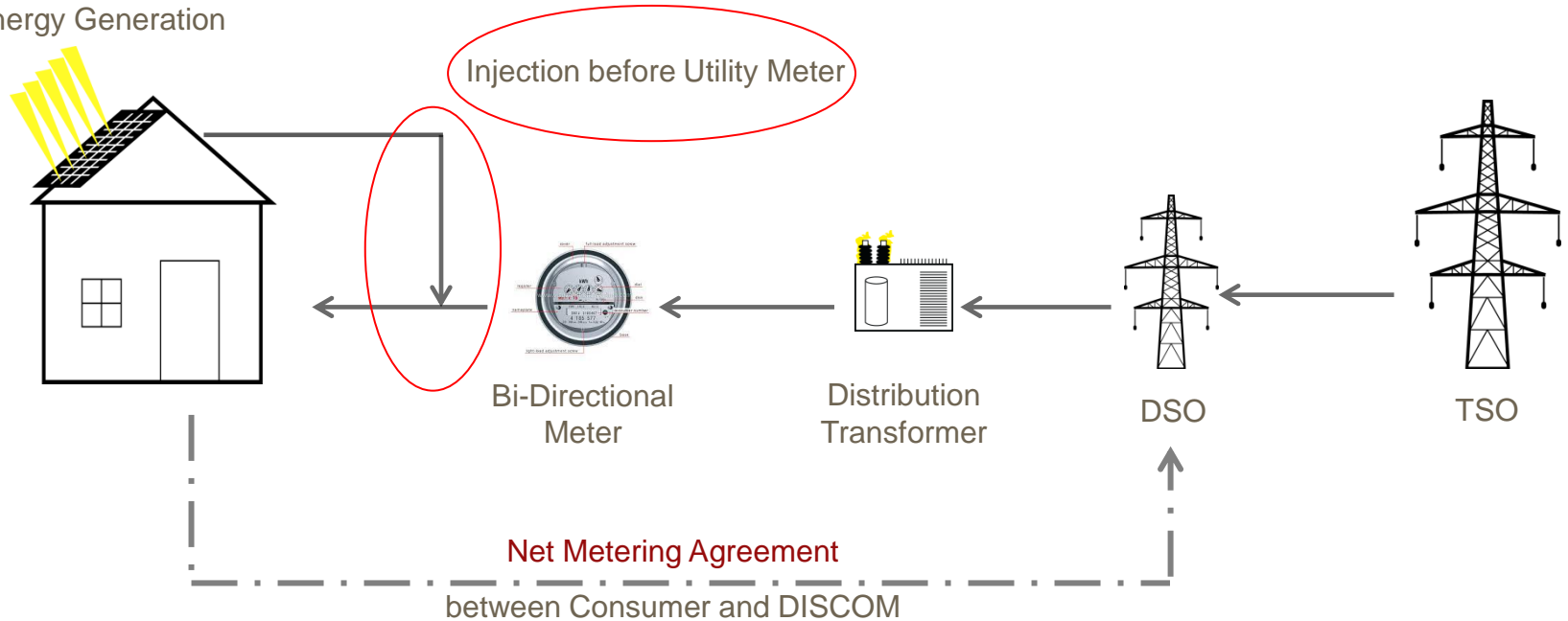
- Interconnectivity shall be as per Regulations specified by CEA or Electricity Supply Code specified by UPERC

Capacity of the System	Evacuation Voltage
Below 5 kW	Single Phase, Low Voltage
> 5 kW – 50 kW	Three Phase, 415 V
> 50 kW – 2.0 MW	6.6 kV/11 kV
> 2.0 MW – 5.0 MW	11 kV/33 kV/66 kV (as per site conditions)



# Net Metering Mechanism – Interconnection at or below 415V

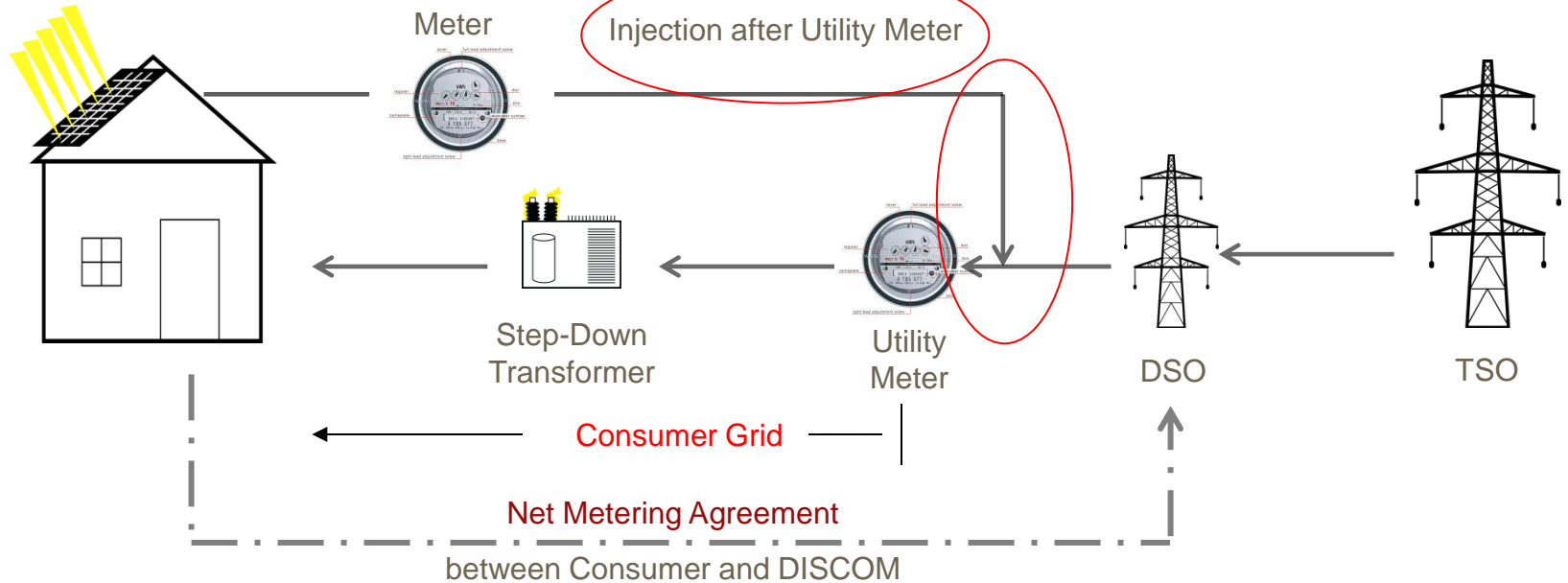
Solar Rooftop PV –  
Energy Generation





# Net Metering Mechanism – Interconnection above 415 V

Solar Rooftop PV –  
Energy Generation





# Provisions proposed for Net Metering & Billing Mechanism

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- **Net Energy Metering Arrangement –**
  - Energy accounting shall be **primarily on basis of net import/export recorded in the bi-directional meter.**
  - The distribution Licensee shall pursue energy bill on the basis of net energy metered in the bi-directional meter.
- **Net Energy Billing Arrangement -**
  - Energy accounting shall be primarily on basis of two separate meters for recording import from the distribution Licensee and export of generation from solar photovoltaic power plant, respectively.
- The electricity consumption in any time block (e.g., peak hours, off-peak hours, etc.) shall be compensated with the electricity generation in the **same time block**;



# Provisions proposed for Net Metering & Billing Mechanism

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### ■ Provisions proposed

- The quantum of electricity consumed by eligible consumer, who is not defined as obligated entity, from the solar photovoltaic power plant **shall qualify towards Renewable Purchase Obligation (RPO)** for the distribution Licensee.



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### Provisions proposed

- The type, accuracy & class, location of meters and metering arrangement shall be governed by regulations notified by Central Electricity Authority from time to time;
- **seeking connectivity with the grid above 415 V voltage level,**
  - Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 and Central Electricity Authority (Installation and Operation of Meters) Amendment Regulations, 2010 and any amendment thereof
- Power plant **seeking connectivity with the grid at 415 V and below voltage levels,**
  - Central Electricity Authority (Installation and Operation of Meters) Amendment Regulations, 2014 shall apply;
- Procurement, testing, installation of new meter and replacement of existing meter with new and/or additional meter **shall be undertaken by the host distribution Licensee** and **shall recover the charges from the eligible consumer** as approved from the Commission
- **Solar Check meters shall be mandatory** for installations having capacity **more than 10 kW**. For installations size of less than and equal to 10 kW, the solar Check meters would be optional.



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### ▪ Banking of power

- The eligible consumer shall be **allowed to bank 100%** of the **electricity** with the Distribution Licensee,
- Deduction of **2%** of the banked energy, in each month, **as banking charges payable** to the distribution Licensee **in kind**,
- The banking of energy shall be allowed during the year from the date of banking or from 1<sup>st</sup> April and ends on 31<sup>st</sup> March of the year.
- The energy generated in a month shall be adjusted against consumption in that month and the balance if any shall be considered as the banked energy for the month 'm'. Similarly, the generation in consecutive month, 'm+1', shall be first adjusted against the consumption in that month. In a situation that the consumption exceeds the generation during the month 'm+1', the energy banked in the previous month(s) 'm' shall be drawn to the extent.
- The **unutilized banked energy** on the expiry of the billing cycle/settlement period **would be treated as free energy to the Distribution Licensee**





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### ▪ Wheeling of power

- In order to promote the rooftop solar photovoltaic projects, wheeling charges and losses shall be **nil** during the first control period or when the total capacity 5 MW for rooftop solar power plant is being installed, whichever is earlier.
- However, after such period the wheeling charges and losses for the use of distribution licensee's network at respective voltage levels shall be as determined by the Commission by general or specific order

### ▪ Cross Subsidy Surcharge

- In case the solar photovoltaic power plant is owned by the eligible consumer, it shall **not** be liable to pay surcharge for consumption of the generated electricity for its own use. Provided it complies with the requirement of captive generating plant specified under Electricity Rules, 2005
- In order to promote the rooftop solar projects, cross subsidy surcharge in case the supply of power is made to the eligible consumer **by any other person** shall be nil during the first control period or when the total capacity 5 MW for rooftop solar power plant is being installed, whichever is earlier.
- After such period such consumer or person shall be liable to pay surcharge as determined the Commission, from time to time.



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## Status of Policy/Regulations in States

- **Delhi - *Surplus Generation to be accounted as if it has occurred during off-peak time block***
- **Orissa** - Regulatory Commission has announced Order for implementation of projects under Net Metering on Government and PSU Buildings only
- **Karnataka** - *Solar Rooftop PV systems connected to LT grid of a distribution company, the concept of net metering shall be adopted and the net energy pumped into the grid shall be billed*
- **Tamil Nadu** - Net Metering Mechanism has been extended to LT (as recommended in policy) and HT Consumers
- **Punjab** - Government has announced Policy on Net Metering – project size up to 1 MW;
- **Madhya Pradesh – Draft Regulations**
- **Kerala** - The quantum of electricity banked shall be settled first in the corresponding normal period and the balance in the peak period and in the off peak period in succession in subsequent billing period.
  - Excess electricity generated by the solar energy system installed in one premises and to use such excess electricity in other premises owned by the consumer is permitted within the area of supply of the licensee



# Thank you!!

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