



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 5      Issue: VIII      Month of publication: August 2017**

**DOI: <http://doi.org/10.22214/ijraset.2017.8330>**

**[www.ijraset.com](http://www.ijraset.com)**

**Call: ☎ 08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**



# An Overview of Solar Roof Top Program In India with Specific Reference of Madhya Pradesh Policy for Decentralized Renewable Energy, 2016

Surendra Bajpai<sup>1</sup>, Dr. V. K. Sethi<sup>2</sup>

<sup>1</sup>Energy Expert-Mpuvn, <sup>2</sup>VC– RKDF University Bhopal MP

**Abstract:** *To harness the abundantly available solar energy potential in the country, the Government of India makes plan to encourage the development of roof top solar projects and applications in a big way. In 2015-2016 the National targets of solar energy based power plants have been increased from 40GW to 100GW out of which 40GW is set to achieve from Roof top solar applications, further to achieve these marathon targets Government had announced National Tariff Policy (NTP), in January 2016, which lays down Solar RPO of 8% by 2022.*

*Amongst RE sources of generation, solar energy has by far the most suitable technology in the market today and Solar PV rooftop has the largest potential for mass replication amongst consumers and small independent power producers because of its very nature of replicable and scalable. With recent technological advances in the sector and achievements in the space of large scale solar based power generation, solar energy has emerged as a viable and sustainable alternative to electricity produced from fossil fuel.*

*In this research work, a detailed study is done on the policies of Government of India to promote solar Roof-top systems, opportunities available, government initiatives and the challenges to be faced in achieving the targets. In this research work, specific analysis of Madhya Pradesh policy for decentralized renewable Energy, 2016 has been carried out. Most of the states have issued Net Metering or Gross metering policy whereas MP policy suggests various options for roof top or decentralized applications with fair consideration for utility concerns.*

**Key Words:** *Renewable Energy, Solar Energy, Roof-top power plant, Net Metering, Gross Metering.*

## I. INTRODUCTION

To popularize the renewable energy sources across the technology, Government of India, had carved a separate department called DNES in 1982, (Department of non-conventional energy sources) later, which was expended in separate full-length ministry MNRE (Ministry of New and Renewable Energy sources). Further to harness the abundantly available solar Energy potential in the country, Government of India had launched Jawaharlal Nehru National Solar Mission during 2010-11, which is a major initiative of the Government to promote ecologically sustainable growth while addressing India's energy security challenges. It also constitutes a major contribution by India to the global effort to meet the challenges of climate change. The aim of the Mission is to focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level. Based on the experience gained during the 1<sup>st</sup> phase of the Mission, the programme is being expanded with a focus on energy access and substituting fossil fuels.

There is a large potential available for generating solar power using unutilized space on rooftops and wastelands around buildings. Small quantities of power generated by each individual household, industrial building, commercial building or any other type of building can be used to partly fulfil the requirement of the building occupants and surplus, if any, can be fed into the grid. The roof-top SPV systems on building's roof space can be installed to replace DG gen sets for operation during load shedding.

The National Solar Mission (NSM) envisaging development of 40 GW of grid connected solar rooftop systems by 2022, about 30 times what India has achieved till March 2016. Solar Roof top program also has high synergies with another key focus area of the Government of India, viz., the "Smart City" program, which envisages a minimum of 10% of the energy consumption in a "Smart City" coming from solar energy. Further this program would help to achieve Renewable purchase obligation targets set under National Tariff Policy (NTP) in January 2016, which lays down Solar RPO of 8% by 2022.

Government of India has shown his commitment for clean and green energy promotion during climate change summit COP 21 in Paris, where Prime Minister of India has proposed a new initiative of forming a group of countries falling between tropic of cancer and tropic of Capricorn either completely or partially, named International Solar alliance (ISA) for efficient exploitation of solar energy to reduce dependence on fossil fuel.

#### A. Objectives of Program and Overview

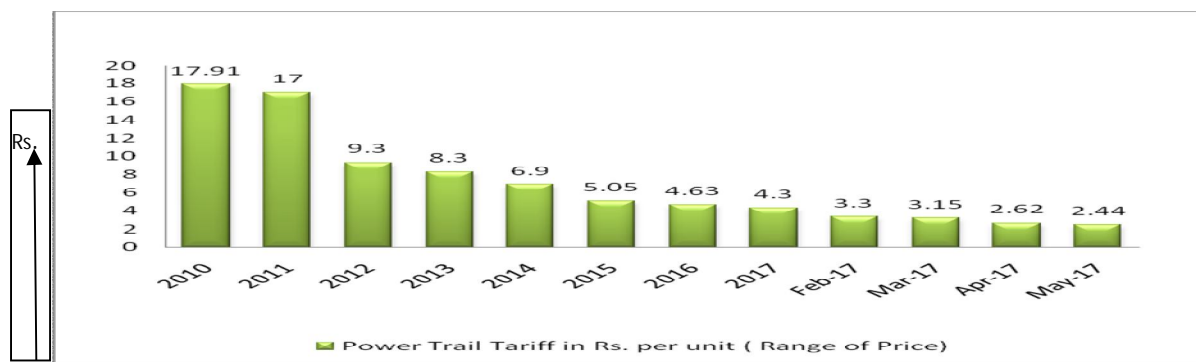
Broad objectives of the program are as under

- 1) Growth of decentralized RE Systems.
- 2) To reduce dependence on conventional sources of energy.
- 3) To provide impetus to growth of clean technology.
- 4) To reduce carbon emissions.
- 5) To develop sustainable energy solution for future, and help in achieving energy security of the nation.

With recent technological advances in the sector and achievements in the space of large scale solar based power generation, solar energy has emerged as a viable and sustainable alternative to electricity produced from fossil fuel. The solar PV power tariff has seen a sharp decline in just seven years

Table-1: Solar PV power tariff decline trend in India

Year	Tariff (Rs. Per unit)	Project
2010	17.91	Under RPSSGP scheme of MNRE (Roof top photovoltaic small scale generation plant)
2011	17	Under JNNSM Gujarat issues large Scale projects
2012	9.3	State level bidding
2013	8.3	State level bidding
2014	6.9	State level bidding
2015	5.05	State level bidding
2016	4.63	AP solar park
2017	4.3	Rajasthan solar park phase-I
Feb-17	3.3	RUMS (MP) solar park at REWA
Mar-17	3.15	Kadappa Solar Park in AP
Apr-17	2.62	Bhadla Solar Park in Rajasthan (Phase-I)
May-17	2.44	Bhadla Solar Park in Rajasthan (Phase-II)



Decline trend of solar power generation cost

With Central financial assistance (about 30% of Benchmark price) the price of power generated from roof top solar plants installed today is at par with or lower than the DISCOM / Distributed Licensees tariff for consumers and it is on the decline trend while the cost of fossil fuel based electricity is increasing day by day. The basic objective of providing the CFA is to popularize the use of solar energy so that people gain confidence and can increase its use. For general awareness, Government has also launched a mobile app named "ARUN" (Atal rooftop solar user Navigator) which can be used to calculate the size, tentative cost and subsidies of the system.

Solar PV rooftop has the largest potential for mass replication amongst consumers and small independent power producers for the following reasons – 1) Solar roof top systems are already meeting grid parity for commercial and industrial applications, and will also meet grid parity with residential consumer tariffs soon; 2) solar PV rooftop technology is robust and modular in nature with an established supply chain; 3) banks and financial institutions are familiar with solar technology; 4) solar technology has no fuel requirement, and is a plug and play technology with no substantial operation and maintenance requirements; and 5) solar technology is easily replicable and scalable.

In pursuit of the targets set by Central Government, States have developed their policies / regulations majorly focussed on Net Metering and Gross metering approach for Solar Roof top system deployment. A statement showing the important regulatory boundaries for eligible consumers in different States of India, are as below

Table-2: Regulatory boundaries for eligible consumers in different States of India

Sr. No.	State	Eligible Consumers	Transformer Loading / Max. System size	Target
1	Madhya Pradesh**	upto 1MW	30% of Peak capacity of DT	-
2	Karnataka	All Consumers	No Limit	-
3	Tamil Nadu	Domestic and Commercial	No Limit	-
4	West Bengal	All Consumers	No Limit	-
5	Assam	All Consumers	The feasibility of interconnection with the grid	-
6	Kerala	All Consumers	Less than 80% of Avg min load	-
7	Maharashtra	All Consumers	40%	-
8	Himachal Pradesh	All Consumers	30%	-
9	Orissa	All Consumers	30%	-
10	Punjab	All Consumers	30%	-
11	Rajasthan	All Consumers	30%	-
12	Andaman and Nicobar	All Consumers	30%	Up to the limit to meet RPO Requirements
13	Chandigarh	All Consumers	30%	---''---
14	Dadar and Nagar Haveli	All Consumers	30%	---''---
15	Daman and Diu	All Consumers	30%	---''---
16	Lakshadweep	All Consumers	30%	---''---
17	Pondicherry	All Consumers	30%	---''---
18	Goa	All Consumers	30%	---''---
19	Delhi	All Consumers	20%	-
20	Bihar	All Consumers	15%	10 MW on yearly basis
21	Meghalaya	All Consumers	15%	1 MW on yearly basis
22	Uttar Pradesh**	All Consumers	25%	-
23	Haryana	All Consumers	15% of Peak capacity of DT	200 MW

Information is based on the regulations issued by respective state governments till September 2016.

\*\* based on the updated information till March 2017.

## II. MP POLICY ANALYSIS

“Madhya Pradesh Policy for Decentralized Renewable Energy Systems, 2016” (visit [www.mprenewable.nic.in](http://www.mprenewable.nic.in) for detailed policy) has a difference from other roof top or net metering based policies in the country, MP policy has broaden the boundaries to capture all possible methods to promote decentralized Renewable Energy systems. The state of Madhya Pradesh is endowed with more than 320 clear sunny days with average solar irradiation of ~5.5 kWh/m<sup>2</sup>/day. The state intends to take forward the ambitious and forward looking vision adopted by it under the “Madhya Pradesh Solar Policy, 2012”, which has provided a major thrust to the installation of grid-connected solar projects in the state. Out of the National target of 40 GW of solar rooftop development by 2022



set by Ministry of New and Renewable Energy, Government of India, the state of Madhya Pradesh has been allotted a target of 2.2 GW.

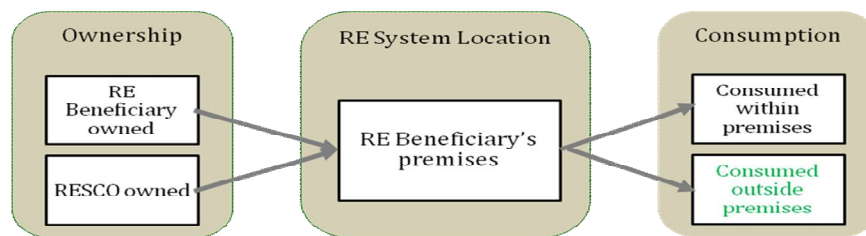
The MP policy intends to promote captive consumption through energy generation, and third party sale of energy generated from RE resources at decentralized locations. This would reduce the burden on conventional sources of energy. The policy also intends to help in reduction of distribution losses, which are a bane for distribution licensees. In the said policy, State intends to promote decentralized RE Systems in following operational modes.

#### A. Grid Connected RE Systems

- 1) Category I : On Net Metered basis
- 2) Category II : Gross Metering with wheeling & banking
- 3) Category III : For consumption within Premises with no export of power (Base load reduction)

#### B. Off - Grid RE Systems

Figure-1: Working of the MP policy can be explained with following flow chart



✱ This mode is applicable only under Category -II ✱

The essence of the policy is that varied combination of Stakeholders can work together under the policy framework:

Table-3 : MP policy enables innovative modes of operation, enabling new business models through RE projects

Sr No	Owner of RE System	RE System Location (premise)	Consumer of RE power	Remarks
1	A	A	A	Net metering mechanism
2	A	B	B	RESCO arrangement
3	A	A	B	Open Access sale of RE power outside the premises
4	A	A	B1, B2, B3...	Open Access sale of RE power to multiple consumers outside the premises
5	A	B	A	RE power generation for captive consumption outside the premises
6	A	B1, B2, B3..	A	Multi-location RE power generation for captive consumption outside the premises
7	A	B	C	Open Access sale of RE power to a consumer outside the premises
8	A	B1, B2, B3..	C	Multi-location RE power generation for Open Access sale outside the premises
9	A	B	C1, C2, C3,...	Open Access sale of RE power to multiple consumers outside the premises

The policy aims to promote all decentralized and distributed RE technologies and is technology neutral, for the purposes of discussion and application, the focus is mostly on decentralized and distributed Solar Roof top systems. Since the policy is focused on Solar PV roof top majorly, all key provisions, like interconnection framework, technical specifications, etc., have been adopted keeping solar PV system in view.

### C. Other Salient Features of MP Policy

- 1) RE systems can be installed on roof or open area of the premises.
- 2) Energy sale to 3<sup>rd</sup> party is allowed.
- 3) Wheeling and banking allowed. Wheeling & banking charges exempted under Net metering mode and only 4% shall be applicable under gross metering with wheeling and banking mode.
- 4) System size: up to 2 MW RE systems eligible under the Policy
- 5) Pooling of power from multiple locations for sale to single consumer is allowed
- 6) Enables OA transaction at 1 kW level for RE
- 7) Lifetime Electricity Duty exemption for systems installed by RE Beneficiary connected at LT level and 10 years exemption for HT consumers
- 8) DISCOM's to get RPO compliance benefits if the RE Beneficiary is not an obligated entity
- 9) Exemption from FAR (Floor Area Ratio) calculation, and incentives for additional FAR is proposed.
- 10) Exemption from height limit under building permission.

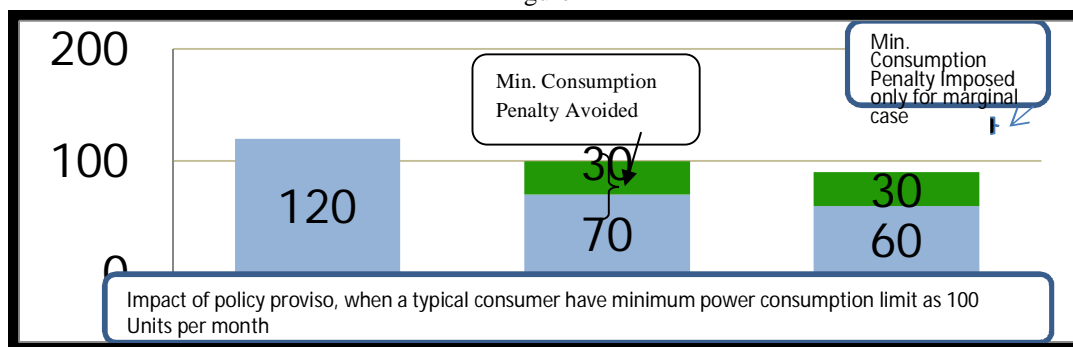
## III. UNIQUENESS OF THE MP POLICY

### A. Addressing Minimum Consumption Issue Proviso14.3

“ In the cases where the Distribution licensee is getting the benefit of RPO on account of consumption of renewable energy from RE system by a consumer, the Distribution Licensee shall add energy generated by the RE System to the net imported energy, while determining such consumer's adherence to the minimum consumption required in accordance with MPERC's orders.”

This shows that lot of brain storming has been done in formulating the policy and also keeping the interest of DISCOM intact. A typical study for Minimum consumption impact for both the stakeholders is as under:

Figure-2



### 1) Impact to Stakeholders:

- a) No direct revenue loss to DISCOM. Sale of energy and consequent energy charges are reduced.
  - b) On account of Policy, only probable penalties are avoided
  - c) DISCOM's are safeguarded due to Capacity limitation on very low consuming user
  - d) Consumer is safeguarded from possible adverse implication on reduced import of energy from DISCOM
- B. Policy has also provided the single line diagrams (SLD's) for interconnection along with the standards of Meters at different voltages, technical standards of SPV and details of technical interconnection parameters. Which makes the policy absolutely user friendly and gives a clear idea of total system with all security features.
- C. Renewable Energy based hybrid systems are also allowed under this policy.
- D. The various operational / working mode (for installation of decentralized RE power plants) are also explained very thoroughly in the policy document and even a beginner can understand the options available.



#### IV. CHALLENGES AND WAY FORWARD

Till recent past supply of electricity was in the domain of utility companies, and with the development in Renewable energy sector this matrix is changing and utility companies have to gear up to accommodate this change.

- A. The present trend of installing grid-tied solar photovoltaic system in residential sector (mainly under Net metering arrangement) offer challenges to DISCOM, as their network is basically designed for unidirectional flow of power i.e. from DISCOM network to residence.
- B. The generation from solar roof top or decentralized solar plants is not firm and purely intermittent, secondly day time generation meets the day time load and which leads to scheduling & power management issues for utilities apart from efficiency decline of distribution network and some time increase in distribution feeder voltages.

As per MNRE reports only 9235.24 MW capacity solar power projects are commissioned till 31/01/2017, which includes big ground mounted solar plants and all other grid tied solar systems in the country. In light of this fact it is estimated that the target of 40GW through grid tied solar rooftop till 2022 is over ambitious and with present pace of progress it seems very difficult to achieve. However some enabling provision in policy can help in achieving them, are as:

- 1) Take utility companies on the board when planning for large scale decentralized RE based power systems.
- 2) Solar technology has almost achieve grid parity, utility company should also be encouraged to set up solar based power plant for remote locations for day time loads, like agriculture water pumping etc.
- 3) Day time energy uses/applications should be encouraged.
- 4) Support to upgrade and strengthen the distribution infrastructure.
- 5) Decentralized solar plants can be considered for high loss areas / region of DISCOM's
- 6) At all decentralized location use of solar power plant should be encouraged.
- 7) Evolving attractive time of day tariff.

#### V. CONCLUSION

Government is planning to develop a growing share of renewable energy in country's electricity mix, and in this context Government has set an ambitious target to insure uninterrupted power to all by 2022. It aims to make "solar revolution" by installing 100GW of solar power by 2022 which includes installation of 40GW of grid connected rooftop solar PV (GRPV). The policies developed by the States to meet this National Target are majorly focussed for Net meter or Gross metering arrangement. In India, mostly we get electricity through DISCOM, run by State, and financial health of most of the DISCOM's is in distressed state due to heavy accumulated losses and liabilities on account of T&D Losses and AT&C Losses.

Looking to recent trend in declining the solar power generation cost, the loyal consumers of the DISCOM, who is / was making timely payments to DISCOM has started switching over to decentralized / roof top solar systems. This move further deepens the DISCOM problem and it has become increasingly difficult to service their debts. This is serious issue and become bane for DISCOM. Until this matter is not addressed properly, the success of the program would be in question.

MP policy for Decentralized Renewable Energy systems, 2016 is one of the best policy document available in the country to promote decentralized and roof top solar applications, still more safeguarding of utility / DISCOM need to be incorporated in the policies for growing together. Now time has come when Government of India also has to reframe the Electricity act 2003 in light of recent developments and design proper place for Decentralized and distributed power management system.

#### REFERENCES

- [1] "MP Policy for Decentralized Renewable Energy Systems, 2016" of New and Renewable Energy Dept. Government of Madhya Pradesh, India.
- [2] Ministry of new and Renewable Energy Govt. of India's scheme, reports, publications and literature.
- [3] Executive summary - P & R for Grid Connected Rooftop Solar Photo Voltaic Program - Environment and Social Systems Assessment-2016
- [4] "Evaluating Renewable Energy policies: A Review of Criteria and Indicators for Assessment" published by IRENA UKERC policy paper publishes in 2014.
- [5] Renewable Energy, An International Journal, ISSN: 0960-1481
- [6] International Journal of Renewable Energy Research (IJRER), ISSN: 1309-0127.





10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)