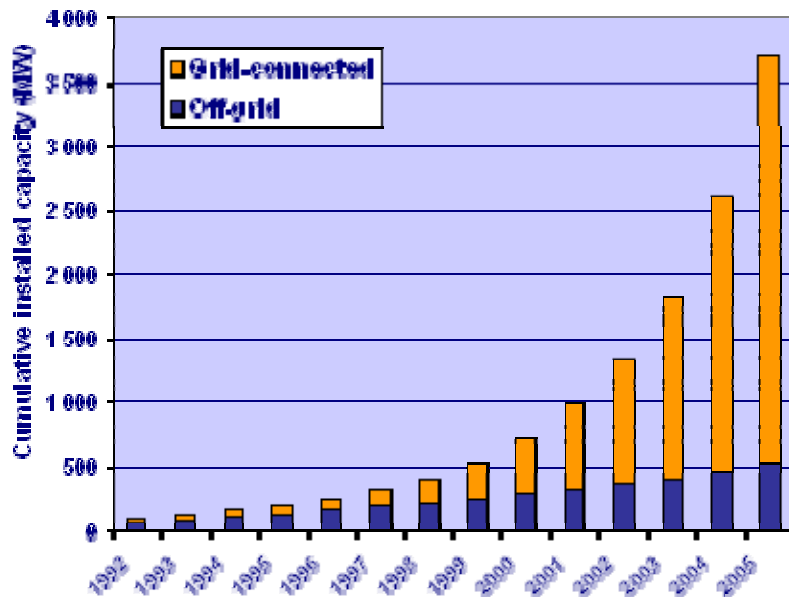


## 1 INTRODUCTION

### 1.1 Grid Connected Solar Power: International Development:

According to the International Energy Agency's factsheet "Renewables in Global Energy Supply", the solar energy sector has grown by 32 % per annum since 1971.

Solar applications can be broadly divided into grid connected applications and off-grid applications. Worldwide, grid-connected solar PV continued to be the fastest growing power generation technology. The graph alongside depicts the growth in cumulative



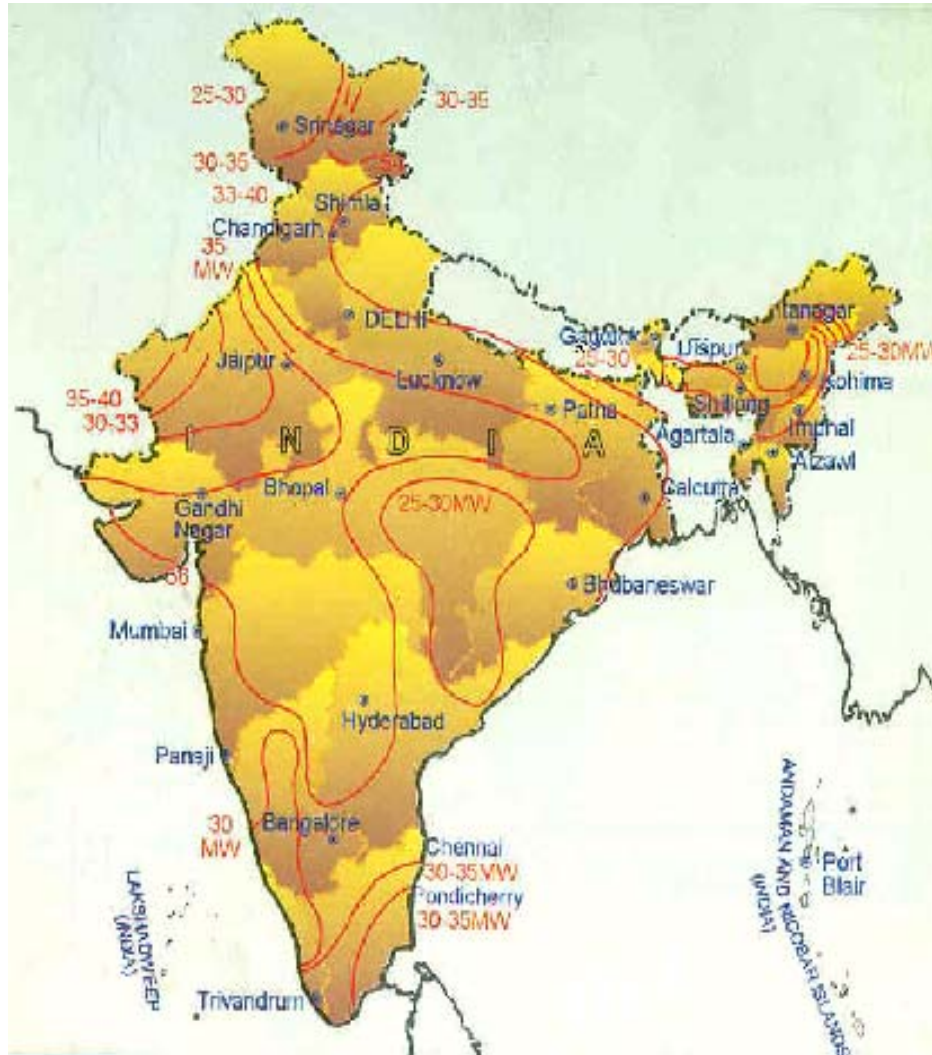
installed capacity using grid and off-grid PV technologies in IEA - PVPS countries between 1992 and 2005. It can be seen from the graph that worldwide, solar energy is being primarily used for grid connected generation and not merely for off-grid or rural energy applications.

(Source: [www.ia-pvps.org](http://www.ia-pvps.org))

### 1.2 Potential for Solar Power in India:

India, due to its geo-physical location, receives solar energy equivalent to nearly 5,000 trillion kWh/year which is equivalent to 600 GW. This is far more than the total energy consumption of the country today. But India produces a very negligible amount of solar energy - a mere 0.2 percent compared to other energy resources. Further, entire electricity generation is using Solar Photovoltaic (SPV) technology as power generation using solar thermal technology is still in the experimental stages. Currently, India has less than 3 MW of grid connected solar PV capacity.

Following graph depicts solar energy potential in the country. While India receives solar radiation of 5 to 7 kWh/m<sup>2</sup> for 300 to 330 days in a year, power generation potential using solar PV technology is estimated to be around 20MW/sq. km and using solar thermal generation is estimated to be around 35MW/sq. km.



### **1.3 Policy Initiatives:**

Announcement of Generation based incentive (GBI) scheme for grid connected Solar Power Projects by Ministry of New and Renewable Energy and emphasis of National Action Plan on Climate Change (NAPCC) for increasing share of Solar Energy have provided impetus to the Solar Power market in India.

National Solar Mission forming part of National Action Plan on Climate Change has envisaged significant increase in share of Solar Energy in total energy mix. The NAPCC

aims to promote the development and use of Solar Energy for power generation and other uses with the ultimate objective of making solar competitive with fossil-based energy options. The plan includes:

- Specific goals for increasing use of solar energy in all urban areas, industries, and commercial establishments;
- A goal of increasing production of photovoltaic to 1000 MW/year; and
- A goal of deploying at least 1000 MW of solar thermal power generation.

Other objectives include the establishment of a solar research center, increased international collaboration on technology development, strengthening of domestic manufacturing capacity, and increased government funding and international support.

#### ***1.4 Approach For Development Of Norms For Solar Power***

In view of above developments, many developers have expressed keen interest in developing power plant based on solar energy. In order to encourage and facilitate expeditious development of grid connected solar based power generation, it is critical that regulatory clarity and certainty exists for solar power projects which are at nascent stage of development. Development of suitable norms for tariff determination would ensure conducive regulatory framework much needed for growth of solar based power generation in the country. However, development of such norms is challenging task in view of diverse range of technological options, complexities of project specific requirements and limited operational experience in the country.

Based on information available about few solar power projects, it is observed that the project specific parameters vary significantly from one project to another. In order to evolve with the tariff norms for solar power projects, analysis of the project specific parameters as submitted by various project developers to the State nodal agencies or petitions filed by project developers before various State Electricity Regulatory Commissions have been undertaken as well as orders and discussion papers issued by various State Electricity Regulatory Commissions have also been scrutinised. The list of projects information considered for the purpose of development of norms is as under:

## *Explanatory Memorandum for Tariff Norms for Solar Power Projects*

Sr. No.	Name of Project Developer	Village	Location	Capacity	Technology Proposed
1	Acme Tele Power	Kolayat	Bikaner	30MW	Solar Thermal Tower
2	Entegra Ltd	Neva	Jodhpur	10MW	Solar Thermal Trough
3	Essar	Ramgarh	Jaisalmer	45MW	Solar Thermal
4	AES Solar	Osian	Jodhpur	10MW	Thin Film
5	Astonfield	Osian	Jodhpur	30MW	Thin Film
6	Moserbaer	Osian	Jodhpur	10MW	Thin Film
7	OPG Energy	Khimsar	Nagour	10MW	Thin Film
8	Vanija	Tivari	Jodhpur	10MW	Thin Film
9	Zoom	Pachpadara	Barmer	40MW	Thin Film
10	Refex	Pachpadara	Barmer	5MW	Thin Film
11	Entegra Ltd	Neva	Jodhpur	1MW	Concentrated PV
12	Moserbaer	Osian	Jodhpur	10MW	Crystalline Si PV
13	Videocon	Osian	Jodhpur	5MW	Hybrid Solar Plant
14	MSPL Limited	Narayanadevara	Bellary	10MW	
15	Ramgarh Mineral	Toranagallu	Bellary	5MW	
16	MSPL Gases	Vaddarahalli	Bellary	5MW	
17	Astonfield	Gulbarga	n.a	10MW	
18	Millenium Synergy	Gubbi	Tumkur	5MW	
19	KPCL	Yelanka	Bangalore	3MW	
20	West Bengal Green Energy Development Co	Asansol	Jemuria	2.07MW	Crystalline modules
21	Moserbaer	n.a.	n.a	5MW	Amorphous Si Thin Film
22	Refax	n.a.	n.a	5MW	Crystalline Si
23	Haryana ERC Order				photovoltaic
24	UPERC Order				photovoltaic
25	MPERC (PV)-Discussion Paper				photovoltaic
26	Kerala SERC - Regulations				photovoltaic
27	CSERC - Discussion Paper				photovoltaic
28	MPERC (Trough) - Discussion Paper				Solar trough
29	MPERC (Tower) - Discussion Paper				Solar tower

## **2 SOLAR PHOTOVOLTAIC POWER PROJECTS**

### ***2.1 Technology Aspect***

Norms for Solar Photovoltaic (PV) power under these Regulations shall be applicable for grid connected PV systems that directly convert solar energy into electricity and are based on the technologies such as crystalline silicon or thin film as may be approved by MNRE.

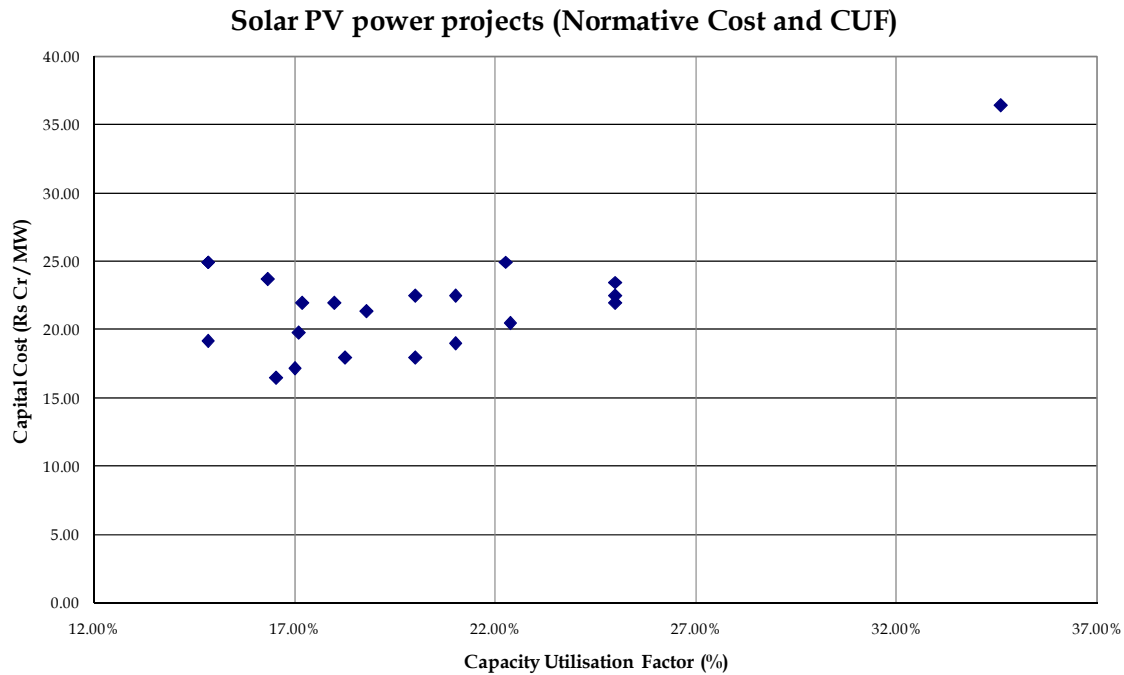
### ***2.2 Norm for Capital Cost***

In order to derive norm for capital cost for projects utilising solar photovoltaic technology the capital cost data from sources such as detailed project reports submitted to State Electricity Regulatory Commission, State Nodal Agencies and the tariff order announced by the various State Electricity Regulatory Commission for determination of tariff for Solar PV power plants has been analysed. Also, few internationally recognised literatures on the Solar Project development have been taken into consideration. It has been observed that the capital cost for projects utilising same technology varied significantly from one project to another within a State.

The Rajasthan Electricity Regulatory Commission has recently invited public comments on the petition filed by developers for determination of project specific tariff for Solar Power Plants. The capital cost requested by the developers was found to be in the range of Rs17Cr/MW to Rs21Cr/MW.

As per the details submitted by the various project developers to Karnataka Renewable Energy Development Agency the capital cost varied from Rs.18Cr/MW to Rs.25Cr/MW.

Following chart summarises the capital cost (Rs Cr / MW) and capacity utilisation factor (%) for various solar PV project installations as proposed by project developers.

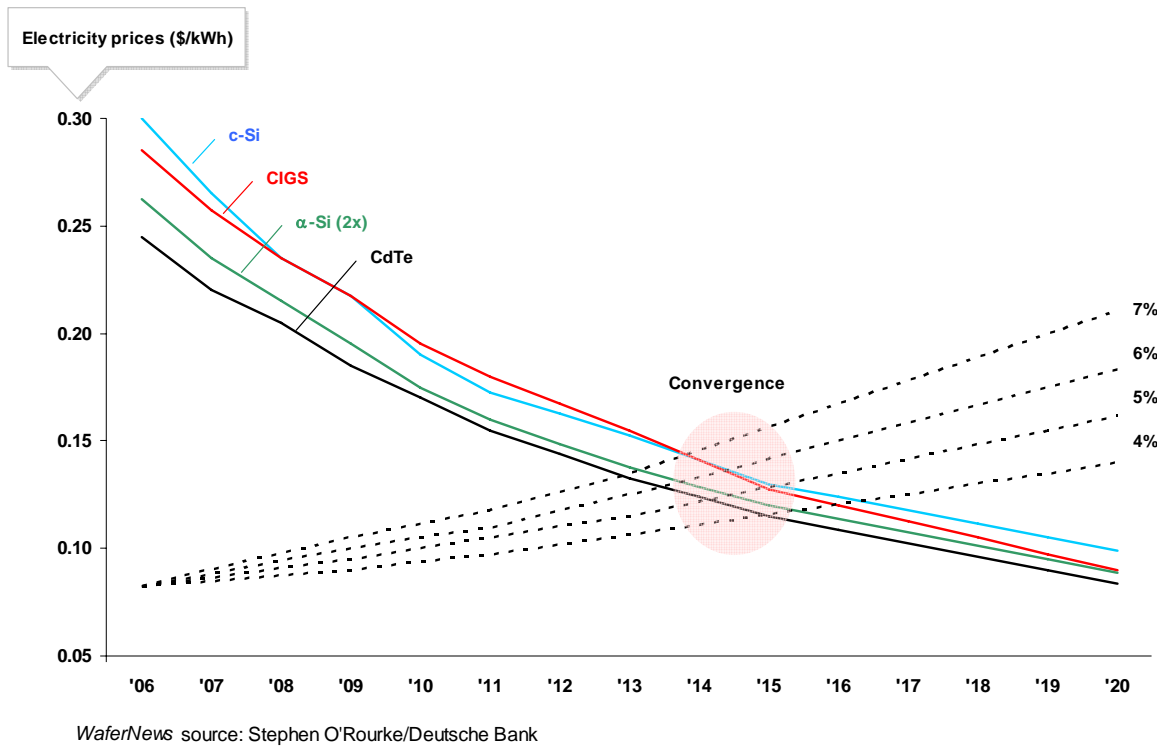


It is recognised that capital cost of the Solar PV power project shall be greatly influenced by the cost of PV modules, balance of plant and power conditioning system costs, taxes and duties, inter-connection costs etc. whereas the performance of the PV project shall depend upon the insolation, ambient conditions, conversion efficiencies etc. Based on the submissions made by various project developers as part of detailed project report or petitions filed before SERCs, it is evident that the capital cost and capacity utilisation factor has varied over wide range. However, there exists a positive co-relation between capital cost and capacity utilisation factor over this range.

Further, it is envisaged that with worldwide proliferation of the solar PV based installations, the economies of scale would ensure that the capital cost for Solar PV installations would decrease over the period. According to one the international research report<sup>1</sup>, the cost of generation for Solar PV based installations can be comparable with that of conventional power generation by 2015.

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<sup>1</sup> Wafernews : Stephen O'Rourke/Deutsche Bank



Accordingly, the **normative capital cost of Rs.18 Cr/MW** has been proposed in case of grid connected Solar PV based power project for the first year of the Control Period which shall be reviewed by the Commission for the subsequent period during the control period.

In case a developer wishes to seek 'project specific tariff' for Solar PV power project, an enabling provision has been incorporated under the Draft Regulations to enable Commission to deviate from above mentioned norm upon filing of petition by such project developer for 'project specific tariff' determination in accordance with Regulation 7 and 8 of the Regulations alongwith relevant supporting information such as detailed project report, technical and operational details of the projects, site specific considerations, premise for capital cost assumption and proposed financing plan for the project.

### **2.3 Capacity Utilisation Factor**

For a Solar Photovoltaic (SPV) project, Capacity Utilisation Factor (CUF) is the ratio of actual energy generated by SPV project over the year to the equivalent energy output at its rated capacity over the yearly period. The energy generation for SPV project depends on solar radiation, measured in kWh/sq m/day and number of clear sunny days. The output of Solar Cell is measured in terms of Wp (Watt Peak) and refers to nominal power under Standard Test Conditions (STC) (1000 W/m<sup>2</sup>, 25°C, 1.5AM).

As per report published by European Photovoltaic Industry Association (EPIA) a comparison of the cell/module efficiencies and the area required per kW installation for thin film and crystalline wafer technology respectively is presented in the table below:.

**Comparison of Module and Cell Efficiencies for Different Technologies**

Technology	Thin Film				Crystalline wafer based	
	<i>Amorphous silicon (a-si)</i>	<i>Cadmium telluride (CdTe)</i>	<i>CI(G)S</i>	<i>a-Si/m-Si</i>	<i>Monocrystalline</i>	<i>Multicrystalline</i>
<b>Cell Efficiency at STC*</b>	5-7%	8-11%	7-11%	8%	16 –19%	14 – 15%
<b>Module Efficiency</b>					13 – 15%	12 – 14%
<b>Area needed per kW** (for modules)</b>	15 m <sup>2</sup>	11 m <sup>2</sup>	10 m <sup>2</sup>	12 m <sup>2</sup>	app. 7 m <sup>2</sup>	app. 8 m <sup>2</sup>

\* Standard Testing Conditions: 25°C, light intensity of 1,000W/m<sup>2</sup>, air mass = 1.5  
 \*\* kW = kilowatt. Solar PV products and arrays are rated by the power they generate at Standard Testing Conditions

(Source: European Photovoltaic Industry Association)

(CI(G)S = Copper Indium deselenide, a-Si/m-Si = Amorphous Silicon and Multi Crystalline Silicon)

According to the Solar Radiation Handbook (2008), published by Solar Energy Centre, MNRE the daily average global radiation incident over India is in the range of 4.3 kWh/Sq m to 5.8 kWh/Sq m.

### **Mean Monthly Global Solar Radiant Exposure (kWh/sq m/day)**



## *Explanatory Memorandum for Tariff Norms for Solar Power Projects*

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Srinagar	1.33	2.71	3.96	5.07	5.63	6.18	5.60	5.21	5.06	3.86	2.57	1.94	4.28
NewDelhi	3.70	4.56	5.73	6.69	6.79	6.26	5.30	4.94	5.25	4.67	3.93	3.31	5.07
Jodhpur	4.31	5.06	6.04	6.73	6.97	6.55	5.46	5.42	5.85	5.31	4.49	4.12	5.55
Jaipur	4.25	5.01	6.11	7.08	7.25	6.65	5.13	4.89	5.45	5.05	4.28	3.74	5.39
Varanasi	3.59	4.76	5.81	6.42	6.40	5.80	4.35	4.80	4.54	4.77	4.02	3.38	4.91
Patna	3.61	4.72	5.82	6.35	6.29	5.63	4.37	4.64	4.55	4.65	4.09	3.30	4.79
Shillong	3.92	4.63	5.35	5.87	5.11	4.56	4.46	4.15	3.90	4.22	4.34	4.01	4.52
Ahmedabad	4.54	5.44	6.35	6.95	6.99	6.02	4.31	4.31	5.18	5.26	4.65	4.23	5.36
Bhopal	4.39	5.20	6.24	7.04	6.75	5.53	4.01	3.80	5.20	5.33	4.73	4.58	5.18
Ranchi	4.34	4.91	5.78	6.17	5.89	4.65	4.03	3.86	4.14	4.38	4.26	4.08	4.55
Kolkata	3.76	4.36	5.28	5.85	5.73	4.77	4.19	4.33	4.14	4.24	3.85	3.52	4.49
Bhavnagar	4.98	5.81	6.71	7.29	7.37	6.20	4.52	4.49	5.53	5.85	5.09	4.60	5.83
Nagpur	4.49	5.34	6.09	6.65	6.55	5.24	4.11	4.11	4.87	5.18	4.54	4.27	5.09
Mumbai	4.60	5.41	6.18	6.62	6.49	4.86	3.74	4.03	4.54	5.00	4.61	4.29	5.07
Pune	4.80	5.72	6.42	6.80	6.99	5.37	4.47	4.36	5.20	5.35	4.90	4.57	5.42
Hyderabad	5.46	6.12	6.73	6.91	6.63	5.59	5.14	4.88	5.49	5.19	5.02	4.99	5.65
Visakhapatnam	4.84	5.56	6.06	6.39	6.16	4.86	4.45	4.54	4.74	4.89	4.56	4.53	5.14
Panjim	5.52	6.22	6.54	6.73	6.57	4.63	4.11	4.41	5.39	5.43	5.32	5.17	5.56
Chennai	4.89	5.85	6.51	6.60	6.26	5.72	5.28	5.20	5.39	4.56	4.00	4.16	5.37
Bangalore	5.67	6.49	6.58	6.57	6.36	4.92	4.64	4.49	5.25	5.12	4.85	4.82	5.47
PortBlair	5.12	5.85	5.89	5.76	4.38	3.87	3.83	4.03	4.30	4.48	4.65	4.75	4.80
Minicoy	4.94	5.61	6.05	5.94	5.05	4.45	4.58	4.89	5.09	5.00	4.64	4.61	5.09
Thiruvananthapuram	5.54	6.13	6.50	5.94	5.45	4.83	4.96	5.28	5.70	5.05	4.60	5.02	5.40
<b>Minimum</b>	<b>1.33</b>	<b>2.71</b>	<b>3.96</b>	<b>5.07</b>	<b>4.38</b>	<b>3.87</b>	<b>3.74</b>	<b>3.80</b>	<b>3.90</b>	<b>3.86</b>	<b>2.57</b>	<b>1.94</b>	<b>4.28</b>
<b>Maximum</b>	<b>5.67</b>	<b>6.49</b>	<b>6.73</b>	<b>7.29</b>	<b>7.37</b>	<b>6.65</b>	<b>5.60</b>	<b>5.42</b>	<b>5.85</b>	<b>5.85</b>	<b>5.32</b>	<b>5.17</b>	<b>5.83</b>

(Source: Solar Radiation Handbook, 2008, MNRE, ABPS Research)

Also, it is noted that around 290 to 320 clear sunny days are prevalent across most parts of India throughout the year. Hence, considering an average clear sunny days around 300 and daily average global solar radiation to be around 5.8 kWh/Sq m/day, project developers have proposed estimate of the capacity utilisation factors for various projects under consideration. The proposed capacity utilisation factors for various Solar PV based power project installations has varied from 15% to 25 % based on SPV (thin film or crystalline) and in one case up to 35% based on concentrated PV (CPV).

Accordingly, the **normative Capacity Utilisation factor of 19%** has been proposed in case of grid connected Solar PV based power projects.

In case a developer wishes to seek 'project specific tariff' for Solar PV power project, an enabling provision has been incorporated under the Draft Regulations to enable Commission to deviate from above mentioned norm upon filing of petition by such project developer for 'project specific tariff' determination in accordance with Regulation 7 and 8 of the Regulations alongwith relevant supporting information such as detailed project report, technical and operational details of the projects, site specific considerations, premise for capital cost assumption and proposed financing plan for the project.

## **2.4 Operation and Maintenance**

There is very limited operating experience of MW scale solar PV Grid connected power plant till date in India. It is observed that none of the State Electricity Regulatory Commission has specified break up of operating expenses which comprises of employee expenses, A&G expenses, and maintenance expenses. The information available about few projects and assumptions contained in the Orders in few States indicate that O&M cost for Solar PV installations varies in the range of 0.2% to 0.8% of capital cost. In view of the limited availability of data a **normative O&M expense** of 0.5% of the capital cost, which amounts to **Rs 9 Lakh/MW** has been considered during the first year of operation which will be escalated at a rate of 5.72% per annum over tariff period.

### **3 SOLAR THERMAL POWER PROJECTS**

#### ***3.1 Technology Aspect***

Norms for Solar thermal power under these Regulations shall be applicable for Concentrated solar power (CSP) technologies viz. solar trough or solar tower, as may be approved by MNRE and uses direct sunlight, concentrating it several times to reach higher energy densities and thus higher temperatures whereby the heat generated is used to operate a conventional power cycle to generate electricity.

#### ***3.2 Capital Cost Benchmarking***

Internationally, there is very limited experience in the field of electricity generation utilising Solar Thermal technology. However, efforts are underway at various countries across globe to increase share of solar thermal based power plant installations. Examples of specific large solar thermal projects currently under construction or in advanced permitting and development stage around the world include:

- Algeria: 140-150 MW ISCC plant with 25 MW solar capacity (trough)
- Egypt: 150 MW ISCC plant with 30 MW solar capacity (trough)
- Greece: 50 MW solar capacity using steam cycle (trough)
- India: 140 MW ISCC plant with 30 MW solar capacity (trough)
- Italy: 40 MW solar capacity integrated into existing combined cycle plant (trough)
- Mexico: 291 MW ISCC plant with 30 MW solar capacity (trough)
- Morocco: 220 MW ISCC plant with 30 MW solar capacity (trough)
- Spain: over 500 MW solar capacity using steam cycle (4 x 10-20 MW solar tower and 12 x 50 MW parabolic trough)
- USA: 50 MW solar capacity with parabolic trough in Nevada using steam cycle, preceded by a 1 MW parabolic trough demonstration plant using ORC turbine in Arizona
- USA: 500 MW Solar Dish Park in California, preceded by a 1 MW (40 x 25 kW) test and demo installation

Capital cost for some of the international Solar thermal power installations have been summarised in the following table, which indicates average capital cost as US\$ 3436/kW (i.e. Rs 15.80 Cr/MW):

## Explanatory Memorandum for Tariff Norms for Solar Power Projects

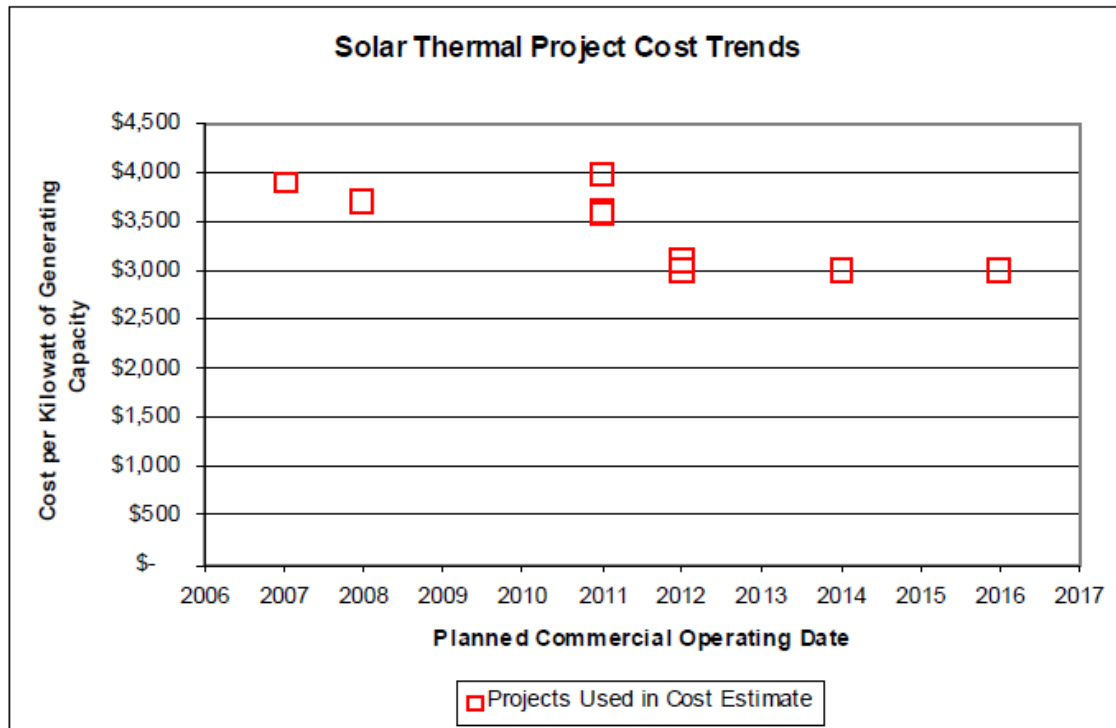
### Solar Thermal Projects Selected for Cost Estimate (Average Cost per Kw: \$3,436; Rounded Average: \$3,400)

Plant Name	State	Lead Developer	Type of Ownership	Energy Source	Technology	Net Summer Capacity (Mw)	Cost (million \$)	Cost per Kw	COD Year	Greenfield (G) or Brownfield (B)	Sources
Bethel	CA	Bethel Energy 1 and 2	IPP	Renewable	Thermal PT	99	\$368	\$3,725	2008	G	Katy Burne, "California Solar Platform Nears Stake Sales," Power, Finance and Risk, October 5, 2007; "Project Finance Deal Book," Power, Finance and Risk, January 26, 2007; California Public Utilities Commission, Resolution E-4073, March 15, 2007.
Ivanpah	CA	BrightSource Energy	IPP	Renewable	Thermal Tower	400	\$1,200	\$3,000	2012	G	Peter Maloney, "Solar Power Heats Up, Fueled by Incentives and the Prospects of Utility-Scale Projects," Platts Global Power Report, November 1, 2007; "Storage: Solar Power's Next Frontier," Platts Global Power Report, November 1, 2007; California Energy Commission, Ivanpah Solar Electric Generating System Licensing Case, Docket 07-AFC-05 [ <a href="http://www.energy.ca.gov/sitingcases/ivanpah/index.html">http://www.energy.ca.gov/sitingcases/ivanpah/index.html</a> ].
Carrizo Energy Solar Farm	CA	Ausra Inc.	IPP	Renewable	Thermal Other	177	\$550	\$3,107	2012	G	"PG&E Signs PPA for 177-MW Solar Project by Ausra in San Luis Obispo County, Calif.," Platts Global Power Report, November 8, 2007; California Energy Commission, Carrizo Energy Solar Farm Power Plant Licensing Case, Docket 07-AFC-08 [ <a href="http://www.energy.ca">http://www.energy.ca</a> ].
Nevada Solar	NV	Acciona	IPP	Renewable	Thermal	64	\$250	\$3,906	2007	G	Robert Peltier, "Renewable Top Plants,"

Plant Name	State	Lead Developer	Type of Ownership	Energy Source	Technology	Net Summer Capacity (Mw)	Cost (million \$)	Cost per Kw	COD Year	Greenfield (G) or Brownfield (B)	Sources
One		Solar Power			PT						Power Magazine, December 2007.
Mojave Solar Park	CA	Solel Solar Systems	IPP	Renewable	Thermal PT	554	\$2,000	\$3,610	2011	G	Terence Chea, "PG&E to Buy Electricity from Massive Solar Park in Mojave Desert," Associated Press, July 26, 2007; California Public Utilities Commission, Resolution E-4138, December 20, 2007.
Xcel Solar Thermal	CO	Xcel Energy	Utility	Renewable	Thermal UNK	200	\$600	\$3,000	2016	G	Steve Raabe, "Big Solar Generator Proposed by Xcel," The Denver Post, November 16, 2007.
FPL Group Florida	FL	Florida Power & Light	Utility	Renewable	Thermal Other	300	\$900	\$3,000	2014	G	"FPL Plans to Build 300-MW Solar Project in Florida and Expand California Plant by 200 MW," Platts Global Power Report, September 27, 2007
Beacon Solar Energy Project	CA	Florida Power & Light Energy, LLC	IPP	Renewable	Thermal PT	250	\$1,000	\$4,000	2011	G	"FPL Plans to Build 300-MW Solar Project in Florida and Expand California Plant by 200 MW," Platts Global Power Report, September 27, 2007; California Energy Commission Fact Sheet, Beacon Solar Energy Project (08-AFC-2).
Solana Generating Station	AZ	Arizona Public Service	Utility	Renewable	Thermal PT	280	\$1,000	\$3,571	2011	G	Ryan Randazzo, "Plant to Brighten State's Solar Future," The Arizona Republic, 2/21/2008; <a href="http://www.aps.com/Solana">http://www.aps.com/Solana</a> ; Thomas F. Armistead, "Arizona Utility Aims High for Solar Array," Engineering News-Record, 2/28/08.

(Source: CSR Report to US Congress on Power Plant characteristics & costs, Nov 2008)

Further, it is projected that with the proliferation of solar thermal installations across the world, the economies of scale shall ensure reduction in the capital cost over the period. The projected reduction in the capital cost for solar thermal installations is presented in the following chart.

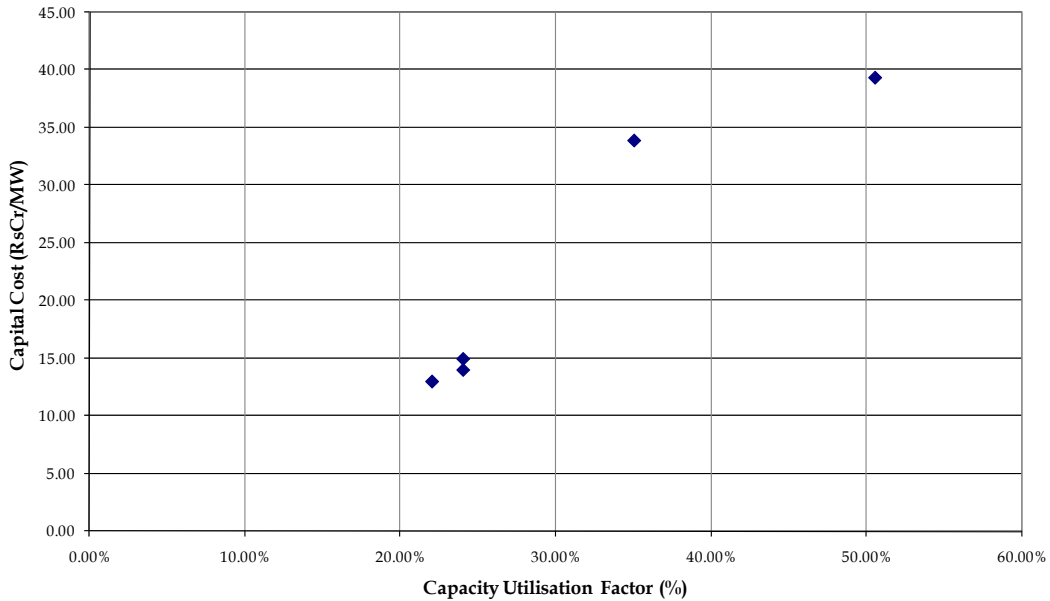


In order to derive benchmark norm in Indian context, the capital cost data from sources such as detailed project reports submitted to State Electricity Regulatory Commission, State Nodal Agencies and the tariff order announced by the various State Electricity Regulatory Commission for determination of tariff for Solar Thermal power plants has been analysed.

The Rajasthan Electricity Regulatory Commission has recently invited public comments on the petition filed by developers for determination of project specific tariff for Solar Thermal Power Plants. The capital cost requested by the developers was found to be in the range of Rs14.96Cr/MW to Rs39.35Cr/MW. The capital cost for the two projects are strictly not comparable as the capacities of two projects are significantly different as well as technologies. While one project is based on deployment of parabolic trough technology, the other is based on solar tower technology. The difference in performance parameter in terms of capacity utilisation factor is also significant.

Further, Chhattisgarh State Electricity Regulatory Commission has proposed to consider a capital cost of Rs17.5Cr/MW for Solar Thermal Projects whereas Madhya Pradesh Electricity Regulatory Commission has proposed to consider Rs13Cr/MW and Rs14Cr/MW for projects utilising Parabolic Trough and Solar Tower Technology.

**Solar Thermal Power projects (Normative Cost and CUF)**



Based on the submissions made by various project developers as part of detailed project report or petitions filed before SERCs, it is evident that the capital cost and capacity utilisation factor has varied over wide range. However, there exists a positive co-relation between capital cost and capacity utilisation factor over this range.

Accordingly, the **normative capital cost of Rs.13 Cr/MW** has been proposed in case of Solar thermal power project for the first year of the Control Period which shall be reviewed by the Commission for the subsequent period during the control period..

In case a developer wishes to seek 'project specific tariff' for Solar thermal power project, an enabling provision has been incorporated under the Draft Regulations to enable Commission to deviate from above mentioned norm upon filing of petition by such project developer for 'project specific tariff' determination in accordance with Regulation 7 and 8 of the Regulations alongwith relevant supporting information such as detailed project report, technical and operational details of the projects, site specific considerations, premise for capital cost assumption and proposed financing plan for the project.

### ***3.3 Capacity Utilisation Factor***

The capacity utilisation factor as quoted by the developers, in Rajasthan, varies from 24% to 51% for Solar Thermal Power Technologies. However, various SERCs have considered plant load factor in the range of 22%~24% while determining the tariff for Solar Thermal plants.

Accordingly, the **normative Capacity Utilisation factor of 25%** has been proposed in case of Solar thermal power projects.

In case a developer wishes to seek 'project specific tariff' for Solar thermal power project, an enabling provision has been incorporated under the Draft Regulations to enable Commission to deviate from above mentioned norm upon filing of petition by such project developer for 'project specific tariff' determination in accordance with Regulation 7 and 8 of the Regulations alongwith relevant supporting information such as detailed project report, technical and operational details of the projects, site specific considerations, premise for capital cost assumption and proposed financing plan for the project.

### ***3.4 Operation and Maintenance***

There is no operating experience of MW scale solar thermal power plant till date in India. It is observed that none of the State Electricity Regulatory Commission has specified break up of operating expenses which comprises of employee expenses, A&G expenses, and maintenance expenses. The information available about few projects and assumptions contained in the Orders in few States indicate that O&M cost for Solar thermal installations varies in the range of 0.75% to 1.5% of capital cost. In view of the limited availability of data a **normative O&M expense** of 1% of the capital cost, which amounts to **Rs 13 Lakh/MW** has been considered during the first year of operation which will be escalated at a rate of 5.72% per annum over tariff period.

### ***3.5 Auxiliary Consumption Factor***

The auxiliary consumption for solar thermal installation shall greatly vary depending on configuration and mode of operation of the power plant. The auxiliary system includes the use of auxiliary heater to ensure the salt used to store heat is maintained in a molten state during extended non-sunny days/period. Hence, an Auxiliary Consumption factor of 10% has been considered.

In case a developer wishes to seek 'project specific tariff' for Solar thermal power project, an enabling provision has been incorporated under the Draft Regulations to enable Commission to deviate from above mentioned norm upon filing of petition by such project developer for 'project specific tariff' determination in accordance with Regulation 7 and 8 of the Regulations alongwith relevant supporting information such as detailed project report, technical and operational details of the projects, site specific considerations, premise for capital cost assumption and proposed financing plan for the project.