

Before

# UTTARAKHAND ELECTRICITY REGULATORY COMMISSION

Misc. Application No. 35 of 2017 (Suo-Motu)

## Draft Order

### **In the matter of:**

Review of the Benchmark Capital Cost for Solar PV, Solar Thermal and Grid Interactive Rooftop & Small Solar PV Plants to be applicable for FY 2017-18 and onwards till reviewed/revised by the Commission.

### **CORAM**

**Shri Subhash Kumar      Chairman**

**Date of Order: May 17, 2017**

1. The Commission in exercise of powers vested in it under Section 61(h), 86(1)(e) read with Section 181(2)(zd) of the Electricity Act, 2003, notified the UERC (Tariff and Other Terms for Supply of Electricity from Renewable Energy Sources and non-fossil fuel based Co-generating Stations) Regulations, 2013 (hereinafter referred to as "RE Regulations, 2013") on 15.04.2013.
2. Regulation 11 of the RE Regulations, 2013 specifies as under:

***"11. Control Period or Review Period***  
*(1) The Control Period or Review Period under these Regulations shall be of five years, of which the first year shall be the financial year 2013-14.*  
*Provided that the benchmark capital cost for Solar PV, Canal Bank & Canal Top Solar PV, Solar thermal, Municipal solid waste based power projects, Refused Derived Fuel based power projects and Grid interactive Roof Top and Small Solar PV projects may be reviewed annually annually by the Commission.*  
*Provided further that the tariff determined as per these Regulations for the RE projects commissioned during the Control Period, shall continue to be applicable for the entire Tariff Period (Useful life of the plant) as specified under Regulation 3(1)(nn)."*
3. In exercise of power under Regulation 11 of aforesaid Regulations, the Commission, vide order dated June 16<sup>th</sup>, 2016 in Suo-Motu Petition no. 12 of 2016, determined the Benchmark Capital cost norms for the Financial Year 2016-17 for Solar PV, Solar Thermal and Grid connected Rooftop

Solar PV Plants & Small Solar PV projects as Rs. 635.52 Lakh/MW, Rs. 1200 Lakh/MW and Rs. 587.94 Lakh/MW respectively. Accordingly, the generic tariff for Solar PV projects notified vide the aforesaid order and applicable for the financial year 2016-17 was Rs. 7.40/kWh and Rs. 6.80/kWh with Accelerated Depreciation benefit. For Solar Thermal projects, levellised tariff for FY 2016-17 is Rs. 12.30/kWh, and Rs. 11.20/kWh with AD benefit. Further, levellised tariff determined for Grid connected Rooftop Solar PV Plants & Small Solar PV projects for FY 2016-17 was Rs. 5.70/kWh and Rs. 5.10/kWh with AD benefit.

6. Having due consideration of the fact that with the passage of time and up-gradation of technologies in respect of the aforesaid solar projects, the declining trend of capital cost has been observed. Moreover, in discharge of the requirement of Regulation 11 of the RE Regulations, 2013, the Commission has decided to determine the benchmark capital cost norm for the Solar PV, Solar Thermal and Grid connected Rooftop Solar PV Plants & Small Solar PV projects and in turn the generic tariffs for the projects to be commissioned during FY 2017-18 as elaborated in Annexure- A enclosed herewith.
7. Comments/suggestions of the stakeholders on the draft proposal are invited latest by 15<sup>th</sup> June, 2017.

**(Subhash Kumar)**  
**Chairman**

**A. Normative benchmark capital cost for Solar PV, Solar Thermal technologies and Grid Interactive Rooftop & Small Solar PV Plants commissioned during FY 2017-18**

1. In accordance with Regulation 33, 34 & 35 of the RE Regulations, 2013 the normative capital cost for Solar PV, Solar Thermal and Grid Interactive Rooftop & Small Solar PV Plants is inclusive of all capital works including plant and machinery, civil works, erection and commissioning, financing and interest during construction etc., and evacuation infrastructure upto the interconnection point.
2. Regulation 11 of the RE Regulations, 2013 specifies that the benchmark capital cost for Solar PV and Solar Thermal Power Plants and Grid Interactive Rooftop & Small Solar PV Plants may be reviewed annually by the Commission.
3. The proposed benchmark capital cost for the above referred solar technologies for FY 2017-18 and onwards are discussed below:

**I. Solar PV Power Plants**

4. With the increasing demand for power from highly diversified generation sources, there is rapid development in solar power sector in terms of investments, technology and innovations. The benign policies of the Central Government and the State Governments have made it possible for local, national and international players to participate in the Indian power markets. This trend is largely visible in the last five years both in manufacturing of solar cells/panels and commissioning of solar power plants. Such positive developments in Solar power market have resulted in healthy competition resulting in drastic reduction in the cost of solar power generation. Thereby the end consumers of electricity stand to benefit by cheaper and environmentally friendly source of power generation.
5. As per Section 61 of the Electricity Act, 2003, the appropriate Commission shall, subject to the provisions of this Act, specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by the principles and methodologies specified by the Central Commission for determination of the tariff. Accordingly, based on the principles followed by the CERC for fixing the benchmark capital cost and determination of tariff based on such capital cost, this Commission, in its Order dated 16.06.2016 had considered the capital cost of Rs. 635.52 Lakh/MW for the purpose of determination of tariff of Solar PV power plants. CERC vide its Order dated 18.04.2017 in Petition no. 05/SM/2017 has mentioned that for Solar

PV, Solar Thermal, Wind (onshore and offshore), MSW/RDF and other emerging renewable energy technologies, the tariff will be project specific, and not generic. However, in the State there is potential of Solar Power Plant growth, in accordance with the Section 61 of the Act, the Commission has followed the similar principles as had been considered in previous Orders for determination of benchmark capital cost.

### Capital Cost

6. The Commission, in its Tariff Order dated 16.06.2016, had considered the capital cost of Rs. 635.52 Lakh/MW for solar PV plants. The CERC in its Order dated 23.03.2016, in the matter of determination of benchmark capital cost norm for Solar PV power projects, had determined benchmark capital cost for FY 2016-17 at Rs. 530.02 Lakh/MW as against Rs.605.85 Lakh/MW determined for 2015-16.
7. The CERC in the above Order, had considered the average module cost of 0.48 US\$/Wp for determination of benchmark capital cost for FY 2016-17 and considering an average rate of Rs. 66.59/US\$ of past six months, CERC had arrived at module cost of Rs. 319.62 Lakh/MW for FY 2016-17. Further, the CERC in the above mentioned Order had considered a degradation of 0.5% had been assumed on a yearly basis, which was then applied to module cost to arrive at yearly degradation cost, followed by discounting to arrive at the net present value of that degradation cost at Rs. 8.77 Lakh/MW. Thus, the total cost of module worked out to Rs. 328.39 Lakh per MW for FY 2016-17.

The breakup of benchmark capital cost considered by CERC for FY 2016-17 for Solar PV project is as under:

**Table 1: Benchmark Capital Cost of Solar PV Project Approved by CERC for FY 2016-17**

SI. No.	Particular	Capital cost Norm for Solar PV project (Rs. Lakh/MW)
1	PV Modules (@ \$0.48/W and exchange rate @ Rs. 66.59/US \$)	328.39
2	Land Cost	25.00
3	Civil and General works	35.00
4	Mounting Structures	35.00
5	Power Conditioning Unit	35.00
6	Cables and Transformers	44.00
7	Preliminary and Pre-operative expenses IDC etc.	27.63
	<b>Total</b>	<b>530.02</b>

As per the PV Insight Report dated 19.04.2017, the following are the module prices:

**Table 2: Module prices as per PV Insight Report**

Item	High USD/Watt	Low USD/Watt	Average USD/Watt
Silicon Solar Module	0.41	0.30	0.339
Thin Film Solar Module	0.42	0.30	0.351

The Commission notes that the cost of module has come down from 0.48 USD/Wp obtained during March, 2016 to 0.35 USD/Wp in 1<sup>st</sup> month of FY 2017-18. Considering the average cost at 0.345 USD/Wp and an exchange rate of Rs. 67.233/USD based on the average of last six months i.e. from October, 2016 to March, 2017), the cost of Solar PV modules works out to Rs. 231.95 Lakh/MW and compensation on account of degradation works out to Rs. 8.59 Lakh/MW based on the methodology adopted by the CERC. Accordingly, cost of Module works out to Rs. 240.55 Lakh/MW.

8. The Commission had considered Rs. 125.00 Lakh/MW as cost of land for arriving at the capital cost of Solar PV projects for FY 2015-16 and FY 2016-17. The Commission proposes the same land cost, i.e. Rs. 125.00 Lakh/MW for FY 2017-18. The costs of other components have been adopted in the same proportion in which the respective costs were considered at the time of finalization of capital cost for Solar PV power projects for FY 2016-17.
9. In light of the above discussion, the Commission proposes the capital cost of Rs. 512.39 Lakh/MW for Solar PV projects to be commissioned on or after 01.04.2017. Detailed breakup of the capital cost approved by the Commission for FY 2016-17 and that proposed for FY 2017-18 is as follows:

**Table 3: Benchmark Capital Cost of Solar PV Project Approved for FY 2016-17 and proposed for FY 2017-18**

S. No.	Particulars	Approved Capital Cost for FY 2016-17 (Rs. Lakh/MW)	% of Total Cost	Proposed Capital Cost for FY 2017-18 (Rs. Lakh/MW)	% of Total Cost
1	PV Modules	328.39	51.67%	240.55	46.95%
2	Land Cost	125.00	19.67%	125.00	24.40%
3	Civil and General Works	35.00	5.51%	28.22	5.51%
4	Mounting Structures	35.00	5.51%	28.22	5.51%
5	Power Conditioning Unit	35.00	5.51%	28.22	5.51%
6	Evacuation cost upto interconnection point (Cables and Transformers)	44.00	6.92%	35.48	6.92%
7	Preliminary & Pre-operative expenses including IDC & contingency etc.	33.13	5.21%	26.71	5.21%
	<b>Total Capital Cost</b>	<b>635.52</b>	<b>100.00%</b>	<b>512.39</b>	<b>100.00%</b>

## II. Solar Thermal Power Plants

10. The Commission proposes to adopt the benchmark Capital Cost as Rs. 1200.00 Lakh/MW for Solar Thermal Projects to be commissioned on or after 01.04.2017.

## III. Grid Interactive Rooftop & Small Solar PV Plants

11. CERC has not proposed the Cost of Grid Interactive Rooftop & Small Solar PV Plant in its draft order dated 18.04.2017 in Petition No. 05/SM/2017.
12. The Commission in its Order dated 16.06.2016 was of the view that so far as cost of module was concerned there was no difference between Solar PV Plants & Solar Rooftop PV Plants. Hence, in line with the same, module cost of Rooftop Solar Plant has been kept same as that proposed for Solar PV Plants. In case of Land cost, civil and general work cost, capital cost as approved in the Commission's above referred Order has been considered for determination of benchmark capital cost of the Grid Interactive Rooftop & Small solar PV Plants for FY 2016-17. Further, with respect to the cost of power conditioning equipment including inverter, mounting structure and evacuation facility, the Commission had earlier decided to allow higher cost for such components. Accordingly, as considered in the Commission's Order dated 16.06.2016, the Commission proposes to allow 35% higher cost of above mentioned components for Rooftop Solar Plants as compared to the Solar PV Plants. In view of the above, details of the capital cost approved for FY 2016-17 and details of the capital cost proposed for FY 2017-18 for Grid-Connected Rooftop Solar PV based Plant are as follows:

**Table 4: Benchmark Capital Cost of Grid Interactive Rooftop & Small Solar PV Plants Approved for FY 2016-17 and proposed for FY 2017-18**

S. No.	Particulars	Approved Capital Cost for FY 2016-17 (Rs. Lakh/MW)	Proposed Capital Cost for FY 2017-18 (Rs. Lakh/MW)
1	PV Module inc. degradation	328.39	240.55
2	Land Cost, Civil and General Works	75.00	75.00
3	Mounting Structures	47.25	38.10
4	Power Conditioning Units	47.25	38.10
5	Evacuation cost upto interconnection point (Cables and Transformers)	59.40	47.89
6	Preliminary & Pre-operative expenses including IDC & contingency etc.	30.65	24.18
	<b>Total Capital Cost</b>	<b>587.94</b>	<b>463.81</b>

## IV. Revised Tariff

13. Based on the benchmark capital cost, as proposed above, the Commission has determined the generic tariff to be applicable for projects to be commissioned in FY 2017-18. Proposed tariffs

for FY 2017-18 along with the applicable generic tariff for FY 2016-17 for Solar PV and Solar Thermal Plants are as follows:

**Table 5: Existing and Proposed Generic Tariffs for Solar PV Plants and Solar Thermal Plants**

Particulars	Solar PV Plant (Rs./kWh)		Solar Thermal Plant (Rs./kWh)	
	FY 2016-17	FY 2017-18	FY 2016-17	FY 2017-18
Gross Tariff	7.40	6.10	12.30	12.20
Less : Acc Dep Benefit	0.60	0.50	1.10	1.10
Net Tariff	6.80	5.60	11.20	11.10

14. The Commission had vide its Order dated 11.02.2016 also determined the tariffs for Grid connected Rooftop & Small Solar PV Plants corresponding to various level of subsidies such as 0%, 70% & 90% respectively. Accordingly, the Commission has also worked out the tariffs for Grid connected Rooftop & Small Solar PV Plants considering the level of subsidy ranging from 0% to 90%. Proposed tariffs for FY 2017-18 along with the applicable generic tariff for FY 2016-17 are as follows:

**Table 6: Existing and Proposed Generic Tariffs for Grid connected Rooftop & Small Solar PV Plants (Rs./kWh)**

Level of Subsidy	0%		30%		70%		90%	
	FY 2016-17	FY 2017-18	FY 2016-17	FY 2017-18	FY 2016-17	FY 2017-18	FY 2016-17	FY 2017-18
Gross Tariff	6.90	5.65	5.70	4.70	4.35	3.65	3.95	3.30
Less : Acc Dep Benefit	0.55	0.45	0.60	0.50	0.60	0.50	0.60	0.50
Net Tariff	6.35	5.20	5.10	4.20	3.75	3.15	3.35	2.80

The proposed tariffs as mentioned above at Tables 5 & 6 shall be applicable on the projects commissioned on or after 01.04.2017 and shall continue to be applicable till further reviewed by the Commission. Furthermore, the tariffs determined shall be the ceiling tariffs and procurement of power shall be done through competitive bidding route by distribution licensee.