Before

UTTARAKHAND ELECTRICITY REGULATORY COMMISSION

Petition No. 12 of 2016 (Suo-Motu)

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 2016-17 and onwards till reviewed/revised by the Commission.

CORAM

Shri Subhash Kumar Chairman

Shri K.P. Singh Member

Date of Order: June 16, 2016

1. The Commission in exercise of powers vested in it under Section 61(h) and Section 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 15th April, 2013.
2. In accordance with the first proviso of Regulation 11 of the aforesaid Regulations, the Commission issued a draft order dated 4th March, 2016 on a Suo-Motu Petition no. 12 of 2016 in the matter of review of benchmark capital cost for Solar PV, Solar Thermal and Grid Interactive Rooftop & Small Solar PV Plants to be applicable for the projects commissioned on or after 1st April, 2016 but on or before 31st March, 2017.
3. The draft order was also posted on the Commission's website and comments were sought from the stakeholders on the same latest by 28th March, 2016. In response, total five stakeholders have submitted comments on the draft order as listed in **enclosure-1.** In order to have participation of all the stakeholders by way of direct interaction with the Commission, a public hearing was also held on 19th April, 2016 and the stakeholders present during the hearing is listed in **enclosure-2.**

4. The Commission through this order has determined the generic tariff for solar power plants on Suo-Motu basis based on the norms specified in the Regulations duly taking into account the suggestions/comments made by the stakeholders on the draft Order. The present regulatory exercise is limited to the determination of benchmark capital cost and determination of generic tariff for Solar PV Power Plants, Solar Thermal Power Plants and Grid Interactive Rooftop & Small Solar PV Power Plants. The comments/suggestions of the stakeholders on the parameters, such as Interest on Loan, CUF, which have already been specified in the said Regulations, are beyond the scope of the present proceedings as tariff determined herein is based on the Regulations presently in force.

5. Issue-wise submissions/comments of stakeholders and the Commission's view, analysis & decision on the same have been discussed in the following paragraphs. As far as possible, the Commission has given due consideration to the issues raised by the stakeholders/ developers in deciding the project cost & corresponding tariff.

6. Solar PV Based Projects

6.1 Capital Cost

The Commission, vide its draft Order dated 4th March, 2016 proposed to revise the capital cost of Solar PV based Projects and while doing so, the Commission had relied on the cost specified by CERC in its draft Order dated 23rd December, 2015.

6.1.1 Comments of the Stakeholders

UPCL, the State distribution licensee, has submitted that the rate of PV module with other accessories has been taken at an average national level and the rate of land is as per the prevailing land rates in Uttarakhand and expressed its acceptance on the cost of PV module and land proposed by the Commission. However, UPCL submitted that the cost of land considered was on a very high side and does not appear to be collaborated with the market price as the cost of land is playing an important role in the determination of tariff. Actual Cost of land purchased by the generator should be considered and the price of land should be lower of the cost of purchase of land as reflected in the sale deed or the rate determined through the applicable circle rate. UPCL further added that there are no available data to sustain that cost of land in Uttarakhand is 5 times more i.e. Rs. 125 Lakh/MW than the land cost as proposed by the CERC i.e. Rs. 25 Lakh/MW. UPCL

requested the Commission to consider the fact that the land value is escalating each year and the generator would be the owner of the land having very high market price after the expiry of the useful life of plant. Therefore, it requested that appreciation of the land as appropriately determined by the Commission should be the discount offered in the cost of the land determined for the purpose of tariff.

UREDA has submitted that the cost of each civil & general works, mounting structures, power conditioning units and evacuation cost up to the interconnection point has been proposed lower by Rs. 15.00 Lakh/MW and Solar PV module cost has also been reduced by Rs. 26.87 Lakh/MW. UREDA accepted the reduction in the PV module cost. However, on the reduction in the cost of civil & general works, mounting structures, power conditioning units and evacuation infrastructure, UREDA has submitted that the cost of these components are increasing. UREDA has requested the Commission not to reduce the cost of civil & general works, mounting structures, power conditioning units, evacuation cost up to interconnection point (Cables and Transformers) and preliminary expenses of solar PV Power Plants and consider their costs same as approved in FY 2015-16 vide Order dated 23rd July, 2015. UREDA has requested the Commission to consider the capital cost of Rs. 692.76 Lakh/MW for FY 2016-17.

Sh. Manu Bishnoi, one of the stakeholder, submitted that the module cost considered is low and at present the best rates one could get from Tier-1 modules was around $0.49 (including freight & custom clearance). Considering the INR/$ rate, the cost comes out to Rs. 33/watt. He further submitted that the BOS cost has been taken in the Evacuation cost but the transmission line and Bay extension cost is not considered anywhere. ROW cost should also be considered.

M/s Mittal Machines (P) Ltd., has submitted that the Indian made Modules cost and String Inverter cost is around 38/Wp and 9/WP respectively. He submitted the copies of quotations of vendors in support of his statement. He further added that cement & labour prices have increased and cost of transformers as per new IS released are also on a higher side.

6.1.2 Commission's Views and Decision

A) Cost of Solar PV Module

The Commission in its draft order dated 4th March, 2016 had considered the cost of

Solar PV Module as Rs. 310.19 Lakh/MW as provided by CERC in its draft Order dated 23rd December, 2015 in the absence of any details on the module cost. UPCL and UREDA have also submitted that the PV module cost is showing a reducing trend. Sh. Manu Bishnoi has submitted that the module cost should be Rs. 33/watt considering rate of $ 0.49 per module (including freight & custom clearance). However, no documentary evidence has been provided by the stakeholder in support of his claim. Further, M/s Mittal Machines (P) Ltd. has submitted that Indian made Module cost is around Rs. 38/Wp. So far as comment of M/s Mittal Machines (P) Ltd. is concerned, stakeholder has considered the price of domestic modules and only price of one supplier has been provided whereas in the international market, prices are much lower.

CERC in its final order observed that quality of module be ensured for life of the project and has considered Tier-1 module prices. In addition, considering the variation in average exchange rate of US Dollar for the past six months, CERC vide its final Order dated 23rd March, 2016 has revised the Solar PV module cost from Rs. 310.19 Lakh/MW to Rs. 328.39 Lakh/MW. Accordingly, based on CERC order, the Commission has considered the PV module cost of Rs. 328.39 Lakh/MW for FY 2016-17.

B) Land Cost

The Commission in the draft order has retained the land cost as considered in the previous Order dated 23rd July, 2015. CERC has also not made any change in the land cost while determining the capital cost for Solar PV Plants for FY 2016-17. Further, so far as UPCL's comment regarding considering the land cost 5 times than cost considered by the CERC is concerned, the Commission has already dealt with the same in its previous Order dated 23rd July, 2015 where the Commission opined that the land requirement of 5 Acre/MW for setting up solar crystalline PV project would be reasonable which translates into 25 Bighas and considering the land cost of Rs. 5 Lakh/Bigha, the Commission had considered the land cost of Rs. 125 Lakh/MW. Further, it would be relevant to mention that the land appreciates in the value and does not depreciate as is the case with other fixed assets.

Further, UPCL has requested the Commission to consider that the land value is escalating each year and the generator would be the owner of the land having very high market value after the expiry of the useful life. Here, it must be noted that land deployed

for these projects is typically barren in nature. Further, project developers have to bear the cost of land at the time of implementation of such plants which is being considered for determination of capital cost and fixation of corresponding tariff in accordance with the existing RE Regulations, 2013. These regulations do not provide for treatment of anticipated benefits of land ownership post life-cycle of the plant. Additionally, land cost has been stagnant over the last financial year. Thus, the Commission has decided to retain the land cost at Rs. 125/MW.

C) Civil & General Works and Mounting Structure Cost

The Commission, based on the CERC draft Order dated 23rd December, 2015 had proposed the cost of Rs. 35 Lakh/MW for 'Civil & General Works and Mounting Structure'. UREDA has requested the Commission not to reduce the cost of civil & general works and mounting structures of solar PV Projects and consider their costs same as approved in FY 2015-16. In this context, UREDA has not submitted any justification for considering the costs as approved in FY 2015-16. Further, CERC in its Order dated 23rd March, 2016 has fixed the cost of civil & general works and mounting structure as Rs. 35 Lakh/MW.

Civil works include preparation of terrain for digging, levelling and mounting, construction of control room to house inverter and other BoS components, building approach roads, fencing or boundary wall, cable trenching, arranging water supply, lighting etc. General works include security, setting up of power back-up generator, yard lighting, earthing kits, etc. However, it should be noted that this cost is on a per MW basis, and as plant size increases to 5-10 MW, the higher costs of control/inverter room, boundary wall, approach road, lighting, etc. gets distributed over a larger base.

Accordingly, as proposed in the draft order Rs. 35 Lakh/MW the same has been considered for each 'Civil & General work' and 'Mounting Structure' for the purpose of finalization of capital cost of Solar PV Power Plants.

D) Power Conditioning Units

The Commission in its draft Order considered the Power Conditioning Unit cost of Rs. 30 Lakh/MW based on the CERC draft Order dated 23rd December, 2015. UREDA has requested the Commission to consider the cost of Power Conditioning Unit equal to

the cost approved in the Order dated 23rd July 2015 without submitting any justification for the same. Considering the additional cost of replacement of inverter parts or upgradation of inverter after 12-14 years, CERC vide its Order dated 23rd March, 2016 has revised the cost of Power Conditioning Unit from Rs. 30 Lakh/MW to Rs. 35 Lakh/MW. Accordingly, based on CERC Order, the Commission has considered the Power Conditioning Unit cost of Rs. 35 Lakh/MW for FY 2016-17.

E) Cable & Transformers

This expenditure includes costs towards DC cabling between Solar PV panels & Inverters including junction boxes, AC cabling between Inverter & sub-station, LT panels, HT panels, earthing arrangements, step up outdoor type transformer, breaker, current transformers, potential transformers, auxiliary transformers control cables, isolators, lightning arrestors, protection relays and Time of Day (ToD) meters / tariff meters, peripheral lighting, telemetry system for real time monitoring etc.

The Commission, vide its draft order dated 4th March, 2016, proposed the Cable and Transformers cost, i.e. evacuation cost upto interconnection point of Rs. 40 Lakh/MW based on the CERC draft order dated 23rd December, 2015. UREDA has requested the Commission to keep the cost equal to the amount allowed in the previous Order dated 23rd July, 2015 without giving any justification. Mr. Manu Bishnoi has submitted that the BoS cost has been taken in the Evacuation cost but the transmission line and Bay extension cost is not considered anywhere.

CERC, considering the additional cost for telemetry and SCADA system vide its final Order dated 23rd March, 2016 has revised the cost of evacuation upto interconnection point from Rs. 40 Lakh/MW to Rs. 44 Lakh/MW.

So far as transmission line and bay extension cost is concerned, Regulation 15 (1)(a) of RE Regulations, 2013 specifies as under:

> *"…*
>
> *The capital cost shall also include the expenditure incurred or projected to be incurred towards the evacuation infrastructure upto point of interconnection (i.e. it does not include cost of dedicated line and associated equipment from point of interconnection up-to the nearest sub-station of transmission or distribution licensee to which generating station is connected)…"*

Hence, capital cost of plants does not include transmission line and Bay extension cost as proposed by stakeholder. Accordingly, based on the CERC order dated 23rd March, 2016, the Commission has considered the cost of Cable and Transformer as Rs. 44 Lakh/MW.

F) Preliminary and Pre-operative expenses

The Commission had proposed Rs. 31.64 Lakh/MW, i.e. 5.50% of the hard cost as the preliminary and pre-operative expenses in its draft Order dated 4th March, 2016. UREDA has requested to consider preliminary and pre-operative expenses cost same as approved in FY 2015-16. Sh. Manu Bishnoi, stakeholder submitted that RoW cost should also be considered.

In this regard, the Commission is of the view that any expenditure on Right of Way are applicable only if transmission lines are laid beyond the inter-connection point and such costs are beyond the scope of generic tariff calculations.

The breakup of Preliminary and Pre-operative expenses and financing cost, as percentage of total capital cost is proposed as under:

i. Insurance Cost and Contingency: 0.5%
ii. Interest during Construction (IDC) & Financing Cost: 4%
iii. Project management cost: 0.5%
iv. Pre-operative Cost: 0.5%

Further, the Commission is of the view that since the construction of solar PV projects is carried out on turn-key basis and involves short construction period (less than a year), IDC and financing cost of 4% is commensurate specifically keeping in view the fact that highest capital cost in solar projects is of panels which are installed towards the end of project lifecycle and moreover, keeping in view the falling interest rates. Accordingly, the Commission has decided to retain the rate of 5.50% of the hard cost under this head which works out to Rs. 33.13 Lakh/MW.

In view of the above discussions & analysis, the Commission has approved the cost of Solar PV based Plant for FY 2016-17 as follows:

Table: Capital Cost of Solar PV Plants for FY 2016-17

S. No.	Particulars	Proposed Capital Cost Norm		Approved Capital Cost Norm	
		Rs. Lakh/MW	%	Rs. Lakh/MW	%
1	PV Modules	310.19	51.12	328.39	51.67
2	Land Cost	125.00	20.60	125.00	19.67
3	Civil and General Works	35.00	5.77	35.00	5.51
4	Mounting Structures	35.00	5.77	35.00	5.51
5	Power Conditioning Units	30.00	4.94	35.00	5.51
6	Evacuation Cost upto interconnection point (Cables and Transformer)	40.00	6.59	44.00	6.92
7	Preliminary and Pre-operative expenses	31.64	5.21	33.13	5.21
	Total Capital Cost	**606.83**	**100**	**635.52**	**100**

6.2 Tariff for Solar PV Plants

Based on the proposed benchmark capital cost for Solar PV Plants, the Commission in its draft Order dated 4th March, 2016 had proposed a gross tariff of Rs. 7.10/kWh and accelerated depreciation of Rs. 0.60/kWh. The comments of the stakeholders/developers on the draft Order are being discussed herein below:

6.2.1 Comments of the Stakeholders

A) Tariff in other States

UPCL submitted that the rates quoted for solar power in Rajasthan, Andhra Pradesh and Telangana is Rs. 4.34/kWh, Rs. 4.63/kWh and Rs. 5.49/kWh respectively. UPCL further submitted that GoI had introduced a scheme for setting up of over 2000 MW grid connected Solar PV power plants with a benchmark cost of Rs. 4.50/kWh and proposal of the same has been forwarded to Uttarakhand for its consent in purchasing the power. In addition, UPCL submitted that in the tender for a 500 MW issued by MNRE wherein M/s Sun Addision won the bidding by quoting Rs. 4.63/kWh.

B) Ceiling of Tariff

UPCL submitted that bidding conducted by UREDA in FY 2015-16 for cumulative capacity of 181 MW, the minimum allotted tariff is Rs. 5.57/kWh and maximum allotted tariff is Rs. 5.99/kWh which is much lower than the rate derived in the draft Order so the rate proposed in the draft Order should be lower than that.

6.2.2 Commission's Views and Analysis

A) Tariff in other States

The Commission is of the view that the present exercise has been initiated under the mandate of RE Regulations, 2013 which requires the Commission to review the

benchmark capital cost in each financial year. In compliance with the same, the Commission has approved the benchmark capital cost of Solar PV Plants to be commissioned during FY 2016-17. Based on the revised capital cost, tariff has strictly been worked out in accordance with the tariff principals stipulated in RE Regulations, 2013.

Further, in respect of UPCL's submission regarding tariff quoted in Telangana, Andhra Pradesh and Rajasthan, it is pertinent to mention that these rates are derived through competitive bidding and are not the tariffs (whether generic or project specific) determined by any of the State Commission. So far as GoI's scheme for setting up of over 2000 MW grid connected Solar PV Power Plants with a tariff of Rs. 4.50/kWh is concerned, the Commission is of the view that the rate is based on an average of the country geography and financial cost. However, the Commission has considered the capital cost based on the present development in the field of solar power plants scenarios of the Uttarakhand State.

B) Ceiling of Tariff

On the issue of Ceiling of Tariff, the tariff rates determined in the order shall be the ceiling/maximum tariff in accordance with the provisions of Regulation 2(3) of RE Regulations, 2013. Further, on the contention of UREDA, rates derived out for cumulative capacity of 181 MW are based on competitive bidding.

In view of the above discussion, the Commission has determined the gross tariff of Rs. 7.40/kWh for Solar PV sources and accelerated depreciation of Rs. 0.60/kWh commissioned on or after 1st April, 2016 as depicted in Annexure-I. This tariff shall continue to be the maximum tariff and the distribution licensee shall invite bids from generators/developers for procurement of power from these generators/developers.

7. Grid Interactive Rooftop & Small Solar PV based Projects

7.1 Capital Cost

So far as cost of module was concerned there is no difference between Solar PV Plants and Solar Rooftop PV Plants. Hence, module cost of Rooftop Solar Plant had been kept same in the draft order. In case of Land, civil and general work, the cost as approved in the Commission's Order dated 23rd July, 2015 had been proposed in the draft order. Further, in respect of cost of power conditioning equipment including inverter, mounting

structure and evacuation facility, the Commission had proposed to allow 35% higher cost of the above mentioned components for the Rooftop Solar Plants as compared to the Solar PV Plants. Accordingly, the Commission had proposed the capital cost of Rs. 555.92 Lakh/MW in the draft Order dated 4th March, 2016.

7.1.1 Comments of Stakeholders

UREDA and Sh. Sanjay P. Garg submitted that as per the scheme of GoUK formulated in consequence with MNRE scheme, Grid Interactive Rooftop & Small Solar PV Plants capacities are only upto 500 kW and the Commission has reduced the cost of Grid Interactive Rooftop & Small Solar PV Plants by considering the cost in Rs. Lakh/MW. As per the economies of scale the cost per unit of output generally decrease with increasing scale as fixed costs are spread out over more units of output. Large capacity solar PV power plants would be expected to have a lower cost per unit of electricity than a smaller capacity of solar PV power plant.

UREDA has submitted that cost of civil and general works, mounting structure, power conditioning unit and evacuation cost upto interconnection point (Cables and Transformers) are increasing. UREDA has requested the Commission to consider the capital cost of Rs. 641.13 Lakh/MW for Grid Connected Rooftop Solar PV & Small Solar PV based Projects.

UPCL has submitted that in the draft order, land cost has been considered for evaluating the tariff but in the Rooftop Category the land or the roof is already of the consumer and should be excluded in the total capital cost of Grid Interactive Rooftop and even if the land cost in terms of lease is included for the Third Party Model, the cost proposed is on a very higher side. UPCL further submitted that CERC in case of Solar PV Power Projects itself has considered the rate of land at Rs. 25 Lakh/MW and there are no reasons for considering land cost for Rooftop Solar PV plants even more than the rates for Grid Connected Solar PV Plants. In addition to the above, UPCL submitted that MNRE has advised banks to include capital cost of Solar Rooftop PV plants as part of home loan. Many banks have already initiated action and such loans are available at lower interest rates. UPCL requested the Commission to consider the probable effect in the possible reduction of interest rate.

Sh. Sanjay P. Garg, Stakeholder, submitted that the Commission may opt for an

inclusive exercise involving all stakeholders, UREDA, UPCL, EPCs, Developers etc. in the process of what it takes to erect a good and workable Solar PV Plant with quality material and all the infrastructural and logistical support required to run the plant optimally. In respect of PV module cost, the stakeholder submitted that use of Indian made PV module is mandatory in case of Roof-top and Small Solar PV Plant and the current capacity of module manufacturers in the country is much less than that of the total demand and as the developers of the "Rooftop and Small Solar PV Plant" are small buyers, they are not in a better position to bargain with the good manufactures which leads indigenous module cost much higher than the imported modules and the highly efficient modules is of Rs. 37,000/- per kW excluding freight and other applicable levies. Stakeholder further submitted that Land cost, Civil and general work cost for 0.5 MW is Rs. 90 Lakh approx. against the cost of Rs. 160 Lakh for one MW for Solar PV Plants. Besides this, stakeholder has also submitted that the cost of land, i.e. Rs 125 Lakh taken for MW scale seems realistic, however, the civil construction and plant facilities cost for 500 kW should be Rs. 64 Lakh. Further, Stakeholder requested to consider the Power Conditioning Unit cost of Rs. 53.20 Lakh in case of String Inverter and Rs. 50.20 Lakh for Central Inverter case. Stakeholder suggested capital cost of Rs 435 Lakh/0.5MW.

M/s Mittal Machines (P) Ltd. has submitted that as per the scheme of Roof-top and small power launched by UREDA there is a constraint of installing Indian make Modules for which quotations has also been attached from different vendors, wherein module cost is Rs. 380 Lakh/MW.

7.1.2 Commission's View and Analysis

A) Solar PV Module Cost

The Commission in its draft Order had proposed the Solar PV module cost equivalent to the cost proposed for Solar PV power plants which is Rs. 310.19 Lakh/MW. UREDA has expressed its acceptance on the PV module cost for Grid Interactive Rooftop & Small Solar PV Plants. One of the stakeholders has submitted that Indian made PV module is mandatory in case of "Roof-top and small Solar PV Plants" and the cost of indigenous module is relatively higher than the imported module cost. With regard to cost of indigenous modules, the Commission is of the view that with spurt in the demand of Solar PV modules across the country due to GoI/MNRE policy initiatives on

development of 100 GW solar power capacity by 2022 in the country, the manufacturer in the country are bound to operate at their maximum production capacity levels resulting in reduction of per unit (piece) cost of PV module on the basis of cost volume profit economic principle. Hence, the Commission does not find any valid reasons to differentiate between the cost of Solar PV Plants and Roof-top Solar PV Plants.

Accordingly, the revised PV module cost @ Rs. 328.39 Lakh/MW considered in case of Solar PV Plants has also been considered for Roof-top Solar plants.

B) Land Cost and Civil & general works

The Commission in the draft order has retained the land cost and cost of Civil & General works as considered in the Order dated 23rd July, 2015. So far as comment of UREDA is concerned regarding Land Cost, it is pertinent to mention that Rs. 75 Lakh/MW does not include only cost of land lease charges but it also includes civil & general works. One of the stakeholder suggested that total cost of Land and Civil & General works should be considered as Rs. 90 Lakh and Rs. 64 Lakh respectively for 0.5 MW. In support of the cost of Civil & General work, he has submitted the breakup of the cost. It appears that the stakeholder has considered cost of Rs. 31.10 Lakh for land leveling, flood protection wall, fencing and bore-well which appears to be on a higher side. Moreover, heads of expenditures mentioned by the stakeholder, like land leveling, flood protection wall, fencing etc. have already been included under Civil & General works. Some of the works proposed by Shri Garg like CCTV, various types of covered rooms etc. may be avoided as the cost appears to be exorbitant and may be unnecessary considering the scale of operations.

In respect of UPCL's submission regarding higher land cost for such plants, it may be noted that no separate cost of purchase of land has been specified for such plants, however, the cost of land lease alongwith cost on Civil & General works has been provided to the developer to maintain occupancy of the land during the life of the plant. Further, regarding the rate of interest equivalent to the interest rate applicable on home loans for such plants, as proposed by UPCL, amendment in the Regulations would be required and the same cannot be carried out in current proceedings. Further, the tariff being normative, is determined in accordance with the principles specified in the Regulations. The Commission may take a necessary view on the same separately, if

required.

Accordingly, the Commission is of the view that no change is required in the Land and Civil & General works cost from the FY 2015-16. Hence, The Commission has retained the cost as proposed in the draft order.

C) Mounting Structures cost

UREDA has requested the Commission to consider the cost of Mounting Structure as considered in the Order dated 23rd July, 2015. Sh. Sanjay P. Garg, stakeholder, submitted that a different kind of mounting structure is required to achieve a higher CUF which will cost Rs. 15 Lakh additionally for 0.5 MW plant. The Commission, based on the view taken in Order dated 23rd July, 2015, has considered the cost of mounting structure as 35% higher than that considered for the Solar PV plants. Hence, Rs. 47.25 Lakh/MW has been retained in the final order.

D) Power Conditioning Units

The Commission had proposed Power Conditioning Units cost of Rs. 40.50 Lakh/MW in the draft order. UREDA requested the Commission to consider the cost of Power conditioning as considered in the Order dated 23rd July, 2015. Shri Sanjay P. Garg submitted that cost of string inverter of Rs. 53.20 Lakh/0.5 MW should be considered. The Commission, based on the views taken in the Order dated 23rd July, 2015, has considered the cost of Power Conditioning Units as 35% higher than the cost considered above in this Order w.r.t. Power Conditioning Units for Solar PV Plants. Accordingly, Rs. 47.25 Lakh/MW has been considered in the final order.

E) Evacuation Cost upto interconnection point (Cables and Transformer)

The Commission had proposed Rs. 54 Lakh/MW in the draft order. UREDA has requested the Commission to consider cost of Cable and Transformers as considered in the Order dated 23rd July, 2015. Shri. Sanjay P. Garg has proposed the cost of Rs. 35 Lakh for a 500 kW small Solar PV Plant. The Commission, based on the view taken in the Order dated 23rd July, 2015, has considered the cost of Power Conditioning Units as 35% higher than the cost considered above in this Order w.r.t. Cables & Transformers for Solar PV plants. Accordingly, Rs. 59.40 Lakh/MW i.e. 35% higher cost of Rs. 44 Lakh has been considered in the final Order.

F) Preliminary & Pre-operative expenses including IDC & contingency etc.

The Commission, in line with the CERC Order dated 23rd March, 2016, has proposed 5.50% of the hard cost as preliminary & Pre-operative expenses in the draft Order. UREDA has requested the Commission to consider the cost as considered in the Order dated 23rd July, 2015. Shri Sanjay P. Garg has proposed that the interest itself should not be less than Rs. 30 Lakh for 500 kW power plants. The Commission is of the view that 5.50% of the hard cost would be reasonable even assuming the interest rate 12% p.a. since gestation period for erection and commissioning of such plants is even less than 6 months and based on the phasing of expenditure, bulk of the amount would be required at the latter stage when solar panels are required. The same has already been deliberated in the above Paras. Accordingly, the Commission has retained the proposed percentage of 5.50% for the preliminary & pre-operative expense which works out to Rs. 30.65 Lakh/MW.

G) Capital Cost Differentiation for 1 MW & 0.5 MW

In respect of stakeholders submission for considering higher cost of 500 kW plants as against per MW cost derived for 1 MW, the Commission is of the view that the cost of mounting structure, power conditioning unit and evacuation cost for such plants have already been considered on higher side as discussed above. Hence, average cost of such equipment for plants upto 500 kW capacity would be higher than the corresponding per MW cost derived for solar PV plants.

In view of the above discussions & analysis, the Commission has approved the cost of Roof-top & Small Solar PV based Plant for FY 2016-17 as follows:

Table: Capital Cost of Roof-top & Small Solar PV Plants for FY 2016-17

S. No.	Particulars	Proposed Capital Cost Norm		Approved Capital Cost Norm	
		Rs. Lakh/ MW	%	Rs. Lakh/MW	%
1	PV Modules	310.19	55.80	328.39	55.85
2	Land Cost and Civil & General Works	75.00	13.49	75.00	12.76
3	Mounting Structures	47.25	8.50	47.25	8.04
4	Power Conditioning Units	40.50	7.29	47.25	8.04
5	Evacuation Cost upto interconnection point (Cables and Transformer)	54.00	9.71	59.40	10.10
6	Preliminary and Pre-operative expenses	28.98	5.21	30.65	5.21
	Total Capital Cost	**555.92**	**100**	**587.94**	**100**

7.2 Tariff for Roof-top & Small Solar PV Plants

Based on the proposed benchmark capital cost for Solar PV Plants, the Commission in its draft Order dated 4th March, 2016 had proposed a gross tariff of Rs. 7.10/kWh and accelerated depreciation of Rs. 0.60/kWh. The comments of the stakeholders/developers on the draft Order are being discussed herein below:

7.2.1 Comments of the Stakeholders

A) Interest Rate for Roof-top Solar PV Plants

UPCL submitted that MNRE has advised banks to include capital cost of Solar Rooftop PV plants as part of Home Loan. Many banks already initiated action and such loans are available at lower interest rates. UPCL requested the Commission to consider the probable effect in the possible reduction of interest.

B) Capacity Utilization Factor (CUF)

Sh. Sanjay P. Garg submitted that currently CUF is not more than 16% in the entire State and CUF of 19% seems virtually impossible to achieve in Uttarakhand's climatic conditions.

7.2.2 Commission's View and Analysis

A) Interest Rate for Roof-top Solar PV Plants

Regulation 16 of the RE Regulations, 2013 specifies as under:

"**16. Interest on loan capital**

(1) The loans arrived at in the manner indicated in Regulation 15(2) shall be considered as gross normative loan for calculation of interest on loan. The normative loan outstanding as on 1st April of every year shall be worked out by deducting the cumulative repayment up to 31st March of previous year from the gross normative loan.

(2) For the purpose of computation of generic tariff, the normative interest rate shall be considered as average State Bank of India (SBI) Base Rate prevalent during the first six months of the previous year plus 300 basis points. For the purpose of computation of project specific tariff, interest rate shall be considered as lower of the actual interest payable to the financial institutions or the average State Bank of India (SBI) Base Rate prevalent during the first six months of the previous year plus 300 basis points

(3) Notwithstanding any moratorium period availed by the generating company, the repayment of loan is being considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed. While calculating project specific tariff, notwithstanding any moratorium period availed by the generating company,

the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed or actual repayment made, whichever is higher.

(4) Normative period of loan repayment shall be taken as 12 years."

The Commission is bound by its own regulations which specifies that for the computation of the generic tariff, the normative interest rate shall be considered as average State Bank of India (SBI) Base Rate prevalent during the first six months of the previous year plus 300 basis points, i.e. for FY 2016-17 it would be the average SBI Base Rate prevalent during the period 1st April, 2015 to 30th September, 2015 plus 300 basis points, and, accordingly, the same works out to 12.76%. Similarly, the rate of interest on working capital has been considered as 13.26%. The suggestion made by UPCL would require amendment in the Regulations and cannot be undertaken in the current proceedings.

B) Capacity Utilization Factor (CUF)

The instant regulatory process has been initiated in accordance with the provisions of RE Regulations, 2013 with a limited purpose of reviewing the benchmark capital cost and corresponding tariffs of Solar based projects in accordance with the norms specified in RE Regulations, 2013. These Regulations provide for computation of generic tariff based on a normative CUF of 19% in respect of both Solar PV Plants and Grid-connected Rooftop & Small Solar PV Plants. The normative CUF specified in the regulations has to be adopted as such till the same is amended following due regulatory/public process for amendment of Regulations. Hence, the Commission does not find any merit in the comments of the stakeholders/ project developers for reduction in CUF for the purpose of computation of tariffs. Accordingly, the Commission is continuing with the CUF of 19% for tariff purposes.

The Commission had vide its Order dated 11.02.2016 also determined 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 tariffs for Grid connected Rooftop & Small Solar PV Plants considering level of subsidy ranging from 0% to 90%.

Accordingly, as discussed above, the Commission has determined the gross tariff

of such plants as Rs. 6.90/kWh, Rs. 5.70/kWh, Rs. 4.35/kWh & Rs. 3.95/kWh, considering the capital subsidy as 0%, 30%, 70% & 90% respectively as depicted in Annexure II-A , Annexure II-B, Annexure II-C & Annexure II-D.

8. Solar Thermal Projects

8.1 Capital Cost

In line with RE Regulations, 2013, the Commission had proposed benchmark cost of Solar Thermal Plants of Rs. 1200.00 Lakh/MW as proposed by the CERC in its draft Order dated 23rd December, 2015. Further, CERC vide its final Order dated 23rd March, 2016 has retained the capital cost for Solar Thermal Projects as proposed in the draft order.

The Commission has observed that no comments/objections on the proposed capital cost have been submitted by any of the developers or stakeholders. Further, CERC has also vide its Order dated 23rd March, 2016 has continued with benchmark capital cost of Rs. 1200.00 Lakh/MW, hence, the same has been considered by the Commission for the FY 2016-17.

8.2 Tariff

The Commission had proposed the tariff in respect of Solar Thermal Plants as Rs. 12.55/ kWh in its draft Order dated 4th March, 2016.

Based on the approved capital cost and in accordance with the norms specified in RE Regulations, 2013, the applicable gross tariff for FY 2016-17 has been determined as Rs. 12.30/kWh as depicted in Annexure-III enclosed.

9. Other Comments

One of the stakeholder has raised issues regarding delay in laying of transmission lines by UPCL and lower additional tariff in case of construction of such line by project developers. In this regard, the Commission is of the view that additional tariff has been specified in the Regulations in case the developer opts to construct the evacuation line on its own expense, hence, no dispensation can be carried out for the same under the current proceedings. Delay in laying of transmission lines, tripping in lines etc. attributable to UPCL, if any, may be represented before the Commission separately in accordance with the provisions of the Act/Regulations.

Stakeholder has also submitted some issues related to execution of PPA and role of UREDA in the matter of implementation of project. As the same are not related to the current proceedings, hence, the Commission does not delve on these issues. However, the stakeholder may bring this matter separately before the Commission in accordance with the provisions of the Act/Regulations.

10. Generic Tariffs

Based on the revised capital cost, as proposed above, the Commission has determined the generic tariff to be applicable for projects to be commissioned in FY 2016-17 which is as follows:

Generic Tariff for Solar PV Plants and Solar Thermal Plants

Particulars	Solar PV Plant (Rs./kWh)		Solar Thermal Plants (Rs./kWh)	
	Approved for FY 2015-16	Approved for FY 2016-17	Approved for FY 2015-16	Approved for FY 2016-17
Gross Tariff	8.25	7.40	12.55	12.30
Less: Acc. Dep Benefit	0.65	0.60	1.05	1.10
Net Tariff	7.60	6.80	11.50	11.20

Generic Tariffs for Grid Interactive Rooftop & Small Solar PV Plants

Level of Subsidy	0%		30%		70%		90%	
Particular	Approved for FY 2015-16	Approved for FY 2016-17	Approved for FY 2015-16	Approved for FY 2016-17	Approved for FY 2015-16	Approved for FY 2016-17	Approved for FY 2015-16	Approved for FY 2016-17
Gross Tariff	7.75	6.90	6.35	5.70	4.80	4.35	4.35	3.95
Less: Acc. Dep Benefit	0.60	0.55	0.65	0.60	0.65	0.60	0.65	0.60
Net Tariff	7.15	6.35	5.70	5.10	4.15	3.75	3.70	3.35

The above ceiling tariff shall be applicable on the projects commissioned or to be commissioned on or after 1st April, 2016 and will remain applicable till further reviewed by the Commission.

(K.P. Singh)
Member

(Subhash Kumar)
Chairman

Enclosure-1

List of Stakeholders

Sr. No.	Name	Designation	Organisation	Address
1.	Sh. Manu Bishnoi	Director	M/s JLTM Energy India Pvt. Ltd.	C/o Altios India, H-2, 3rd Floor, Hauz Khas Village, New Delhi-110016
2.	Sh. A.K. Tyagi	Chief Project Officer	Uttarakhand Renewable Energy Development Agency	Urja Park Campus, Industrial Area, Patel Nagar, Dehradun
3.	Sh. A.K. Singh	Chief Engineer (Commercial & Projects)	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
4.	Sh. Sanjay P. Garg	-	-	L-106, Doon South Park Apartments, Sewla Kalan (Majra), Dehradun-248171
5.	Sh. Sachin Mittal	Director	M/s Mittal Machines (P) Ltd.	Near Prince Chowk, 1, Haridwar Road, Dehradun

Enclosure-2

List of Participants

Sr. No.	Name	Designation	Organisation	Address
1.	Sh. M.A. Khan	Director (Finance)	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
2.	Sh. A.K. Singh	Chief Engineer (Commercial & Projects)	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
3.	Sh. Gaurav Sharma	Executive Engineer	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
4.	Sh. Munir Alam	Executive Engineer	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
5.	Sh. Pravesh Kumar	Executive Engineer	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
6.	Sh. Anurag Sharma	Advocate	Uttarakhand Power Corporation Ltd.	Victoria Cross Vijeta Gabar Singh Bhawan, Kanwali Road, Dehradun.
7.	Sh. Santosh Vashistha	Executive Engineer	Power Transmission Corporation of Uttarakhand Ltd.	Vidyut Bhawan, Near I.S.B.T. Crossing, Saharanpur Road, Majra, Dehradun-248002
8.	Sh. Ashok Kumar	Executive Engineer	Power Transmission Corporation of Uttarakhand Ltd.	Vidyut Bhawan, Near I.S.B.T. Crossing, Saharanpur Road, Majra, Dehradun-248002
9.	Sh. Sandeep Kr. Ravi	Executive Engineer	Power Transmission Corporation of Uttarakhand Ltd.	Vidyut Bhawan, Near I.S.B.T. Crossing, Saharanpur Road, Majra, Dehradun-248002
10.	Sh. Sunil Dutt Sharma	Assistant Engineer	Power Transmission Corporation of Uttarakhand Ltd.	Vidyut Bhawan, Near I.S.B.T. Crossing, Saharanpur Road, Majra, Dehradun-248002
11.	Sh. A.K. Tyagi	Chief Project Officer	Uttarakhand Renewable Energy Development Agency	Urja Park Campus, Industrial Area, Patel Nagar, Dehradun
12.	Sh. Ishant Choudhary	Project Engineer	Uttarakhand Renewable Energy Development Agency	Urja Park Campus, Industrial Area, Patel Nagar, Dehradun
13.	Sh. Sanjaj K. Garg	Developer	-	-
14.	Sh. Manish Gupta	Developer	-	-

Annexure-I

TARIFF DETERMINATION FOR SOLAR PV POWER PLANTS OF UTTARAKHAND FOR FY 206-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32
Aux Consumption	**%**		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Saleable Energy	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.58	0.61	0.65	0.69	0.73	0.77	0.81	0.86	0.91	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.42	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21
Depreciation	Rs. Crore		1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Interest on term loan	Rs. Crore		2.72	2.48	2.25	2.01	1.77	1.54	1.30	1.06	0.83	0.59	0.35	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.16	0.15	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.17	0.18	0.18
Return on Equity	Rs. Crore		1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29
Total Cost of generation	Rs. Crore		**7.24**	**7.03**	**6.83**	**6.63**	**6.42**	**6.23**	**6.03**	**5.84**	**5.65**	**5.46**	**5.67**	**5.49**	**4.03**	**4.10**	**4.18**	**4.25**	**4.33**	**4.42**	**4.51**	**4.60**	**4.70**	**4.81**	**4.92**	**5.04**	**5.17**
Per unit Cost of generation	**Rs. /kWh**		8.70	8.45	8.20	7.96	7.72	7.48	7.25	7.02	6.79	6.56	6.81	6.59	4.85	4.93	5.02	5.11	5.21	5.31	5.42	5.53	5.65	5.78	5.92	6.06	6.21

Levelised Tariff	**7.40**
Accelerated Depreciation	0.60
Net Tariff	**6.80**

Annexure-II (A)

TARIFF DETERMINATION FOR ROOFTOP SOLAR PV PLANTS OF UTTARAKHAND FOR FY 2016-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32
Aux Consumption	**%**		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Saleable Energy	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.58	0.61	0.65	0.69	0.73	0.77	0.81	0.86	0.91	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.42	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21
Depreciation	Rs. Crore		1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Interest on term loan	Rs. Crore		2.52	2.30	2.08	1.86	1.64	1.42	1.20	0.98	0.77	0.55	0.33	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.15	0.15	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.17	0.17	0.18
Return on Equity	Rs. Crore		1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12
Total Cost of generation	Rs. Crore		**6.74**	**6.55**	**6.37**	**6.18**	**6.00**	**5.82**	**5.64**	**5.47**	**5.30**	**5.13**	**5.32**	**5.16**	**3.82**	**3.89**	**3.96**	**4.04**	**4.12**	**4.21**	**4.30**	**4.39**	**4.49**	**4.60**	**4.71**	**4.83**	**4.96**
Per unit Cost of generation	**Rs./kWh**		8.10	7.88	7.65	7.43	7.21	7.00	6.78	6.57	6.37	6.16	6.40	6.20	4.59	4.67	4.76	4.85	4.95	5.05	5.16	5.28	5.40	5.53	5.66	5.80	5.96

Levelised Tariff	**6.90**
Accelerated Depreciation	0.55
Net Tariff	**6.35**

Annexure-II (B)

TARIFF DETERMINATION FOR ROOFTOP SOLAR PV PLANTS OF UTTARAKHAND FOR FY 2016-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32
Aux Consumption	**%**		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Saleable Energy	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.58	0.61	0.65	0.69	0.73	0.77	0.81	0.86	0.91	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.42	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21
Depreciation	Rs. Crore		1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Interest on term loan	Rs. Crore		1.67	1.45	1.23	1.02	0.80	0.58	0.36	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.13	0.14	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.17	0.18
Return on Equity	Rs. Crore		1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12
Total Cost of generation	Rs. Crore		**5.49**	**5.30**	**5.11**	**4.93**	**4.74**	**4.56**	**4.39**	**4.21**	**4.14**	**4.17**	**4.59**	**4.65**	**3.72**	**3.79**	**3.86**	**3.93**	**4.02**	**4.10**	**4.19**	**4.29**	**4.39**	**4.49**	**4.61**	**4.73**	**4.85**
Per unit Cost of generation	**Rs. /kWh**		6.59	6.37	6.14	5.92	5.70	5.48	5.27	5.06	4.97	5.02	5.52	5.59	4.47	4.55	4.64	4.73	4.83	4.93	5.04	5.15	5.27	5.40	5.54	5.68	5.83

Levelised Tariff	**5.70**
Accelerated Depreciation	0.60
Net Tariff	**5.10**

Annexure-II (C)

TARIFF DETERMINATION FOR ROOFTOP SOLAR PV PLANTS OF UTTARAKHAND FOR FY 2016-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32
Aux Consumption	**%**		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Saleable Energy	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.58	0.61	0.65	0.69	0.73	0.77	0.81	0.86	0.91	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.42	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21
Depreciation	Rs. Crore		0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Interest on term loan	Rs. Crore		0.55	0.33	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.12	0.12	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.17	0.17
Return on Equity	Rs. Crore		1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12
Total Cost of generation	Rs. Crore		**3.81**	**3.62**	**3.43**	**3.36**	**3.40**	**3.45**	**3.49**	**3.54**	**3.59**	**3.65**	**4.07**	**4.13**	**3.58**	**3.65**	**3.72**	**3.80**	**3.88**	**3.96**	**4.05**	**4.15**	**4.25**	**4.36**	**4.47**	**4.59**	**4.71**
Per unit Cost of generation	**Rs. /kWh**		4.58	4.35	4.13	4.04	4.09	4.14	4.20	4.26	4.32	4.38	4.89	4.96	4.30	4.38	4.47	4.56	4.66	4.76	4.87	4.98	5.11	5.23	5.37	5.51	5.66

Levelised Tariff	**4.35**
Accelerated Depreciation	0.60
Net Tariff	**3.75**

Annexure-II (D)

TARIFF DETERMINATION FOR ROOFTOP SOLAR PV PLANTS OF UTTARAKHAND FOR FY 2016-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32
Aux Consumption	**%**		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Saleable Energy	**MU**		8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32	8.32

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.58	0.61	0.65	0.69	0.73	0.77	0.81	0.86	0.91	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.42	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21
Depreciation	Rs. Crore		0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Interest on term loan	Rs. Crore		0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.12	0.12	0.11	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.17
Return on Equity	Rs. Crore		1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12
Total Cost of generation	Rs. Crore		**3.03**	**3.02**	**3.06**	**3.10**	**3.14**	**3.18**	**3.23**	**3.28**	**3.33**	**3.38**	**3.80**	**3.86**	**3.51**	**3.58**	**3.65**	**3.73**	**3.81**	**3.89**	**3.98**	**4.08**	**4.18**	**4.29**	**4.40**	**4.52**	**4.64**
Per unit Cost of generation	**Rs. /kWh**		3.65	3.63	3.68	3.72	3.77	3.83	3.88	3.94	4.00	4.07	4.57	4.64	4.22	4.30	4.39	4.48	4.58	4.68	4.79	4.90	5.02	5.15	5.29	5.43	5.58

Levelised Tariff	**3.95**
Accelerated Depreciation	0.60
Net Tariff	**3.35**

Annexure-III

TARIFF DETERMINATION FOR SOLAR THERMAL POWER PLANTS OF UTTARAKHAND FOR FY 2016-17

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Generation	**MU**		10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07	10.07
Aux Consumption	**%**		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Saleable Energy	**MU**		9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07	9.07

Cost of Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Expenses	Rs. Crore		0.79	0.84	0.89	0.94	0.99	1.05	1.11	1.17	1.24	1.31	1.38	1.46	1.55	1.63	1.73	1.83	1.93	2.04	2.16	2.28	2.41	2.55	2.70	2.85	3.01
Depreciation	Rs. Crore		3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Interest on term loan	Rs. Crore		5.14	4.69	4.24	3.80	3.35	2.90	2.46	2.01	1.56	1.12	0.67	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs. Crore		0.32	0.31	0.30	0.30	0.29	0.28	0.28	0.27	0.26	0.26	0.27	0.26	0.20	0.21	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.26	0.26	0.27	0.28
Return on Equity	Rs. Crore		3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32	4.32
Total Cost of generation	Rs. Crore		**13.35**	**12.94**	**12.53**	**12.13**	**11.73**	**11.33**	**10.94**	**10.55**	**10.16**	**9.78**	**10.14**	**9.77**	**6.99**	**7.08**	**7.18**	**7.29**	**7.40**	**7.51**	**7.64**	**7.77**	**7.90**	**8.05**	**8.20**	**8.37**	**8.54**
Per unit Cost of generation	**Rs. /kWh**		14.72	14.27	13.82	13.38	12.94	12.50	12.07	11.64	11.21	10.79	11.18	10.77	7.71	7.81	7.92	8.04	8.16	8.29	8.42	8.57	8.72	8.88	9.05	9.23	9.42

Levelised Tariff	**12.30**
Accelerated Depreciation	1.10
Net Tariff	**11.20**