SMP- 25/2012

M.P. Electricity Regulatory Commission
Bhopal

Tariff Order
for
Solar Energy Based Power Generation
in Madhya Pradesh

AUGUST 2012

A1: POLICY & LEGAL CONTEXT

1.1 The Electricity Act, 2003

1.1.1 Sections 86(1) and 61(h) of the Electricity Act, 2003, provide the legal framework for the involvement of the Commission in renewable energy:

Section 86 (1) - *The State Commission shall discharge the following functions, namely: -*

(e) promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licence;

Section 61 - *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 following, namely:-*

(h) the promotion of co-generation and generation of electricity from renewable sources of energy;

1.2 National Electricity Policy, Tariff Policy & National Action Plan on Climate Change

1.2.1 The National Electricity Policy (NEP), 2005 reasserts the Government's intent to promote renewable energy. Select extracts from the NEP are presented hereunder:

5.2.20 "*Feasible potential of non-conventional energy resources, mainly small hydro, wind and bio-mass would also need to be exploited fully to create additional power generation capacity. With a view to increase the overall share of non-conventional energy sources in the electricity mix, efforts will be made to encourage private sector participation through suitable promotional measures.* "

5.12.1 "*Non-conventional sources of energy being the most environment friendly there is an urgent need to promote generation of electricity based on such sources of energy. For this purpose, efforts need to be made to reduce the capital cost of projects based on non-conventional and renewable sources of energy. Cost of energy can also be reduced by promoting competition within such projects. At the same time, adequate promotional measures would also have to be taken for development of technologies and a sustained growth of these sources.*"

5.12.2 "*... Percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies."*

1.2.2 The Tariff Policy (2006) also emphasizes the importance of the renewable energy generation and its subsequent benefits for the country. Some key extracts are presented below:

5.3 (i) " *Tariff fixation for all electricity projects (generation, transmission, and distribution) that results in lower Green House Gas emissions than the relevant base line should take into account the benefits obtained from the Clean Development Mechanism into consideration, in a manner so as to provide adequate incentive to the project developers*."

6.4 (1) "….. *The Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs*…."

6.4 (2) " *Such procurement by Distribution Licensees for future requirement shall be done as far as possible through competitive bidding process under section 63 of the Act within the suppliers offering energy from same type of non conventional sources. …."*

1.2.3 National Action Plan on Climate Change is the national strategy of India to achieve a sustainable development which simultaneously advances economic and environmental objectives. The National Action Plan hinges on the development and use of new technologies. National Solar Mission is one of the eight national missions which form the core of the National Action Plan.

The objective of National Solar Mission is to significantly increase the share of solar energy in the total energy mix while recognizing the need to expand the scope of other renewable and non-fossil options.

1.3 Policy for implementation of solar power based power Projects in Madhya Pradesh,2012

1.3.1 The Government of Madhya Pradesh has notified this policy on 20.07.2012 to encourage generation from solar based power projects in Madhya Pradesh. This policy provides various incentives such as exemption from payment of electricity duty and cess for a period of 10 years from the date of commissioning of the project, grant

of four percent in wheeling charges, banking of energy, reduction in contract demand etc. As per the provisions, the solar based power projects implemented under the above policy will have the status of industry and will be eligible for all benefits under Industrial Promotion Policy as amended from time to time.

1.4 CERC Regulation on renewable energy sources

1.4.1 CERC issued Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012 on 6th February, 2012.

1.4.2 These Regulations shall come into force w.e.f. 01.04.2012 and unless reviewed earlier or extended by the CERC, shall remain in force for a period of 5 years. The Commission has considered these Regulations as the guidelines in determination of solar tariff for the projects located in the State of Madhya Pradesh.

1.5 National Solar Mission

1.5.1 The Government of India in November, 2009 had issued a document on Jawaharlal Nehru National Solar Mission towards building SOLAR INDIA. The objective of the Solar Mission is to create conditions, through rapid scale-up of capacity and technological innovation to drive down costs so that solar generation achieves grid parity. The NTPC Vidyut Vyapar Nigam Limited (NVVN) is designated as the nodal agency by the Ministry of Power for entering into a Power Purchase Agreement with Solar Power Developers to purchase solar power fed to 33 kV and above grid in accordance with the tariff and PPA duration as fixed by the CERC. The Ministry of Power shall allocate to NVVN, equivalent megawatt capacity, from the Central unallocated quota, from NTPC power stations, at the rate notified by the CERC for bundling together with solar power. NVVN will undertake the sale of the bundled power to state utilities at the rates determined as per CERC Regulations. The above arrangement will be limited to utility scale Solar Power generated from a minimum anticipated capacity of 1000 MW in the first phase. When NVVN supplies bundled power to state utilities at the rates determined as per CERC regulations, those state utilities will be entitled to use the solar part of the bundled power for meeting their Renewable Purchase Obligations (RPO) under the Electricity Act, 2003.

1.5.2 The Ministry of New and Renewable Energy (MNRE) has launched a programme on generation based incentives hereinafter referred to as “Rooftop PV & Small Solar Power Generation Programme” (RPSSGP). The key features of the programme are as under :-

(a) There shall be two categories of projects

(i) connected at HT but below 33 kV with installed capacity of 100 kW and up to 2 MW.

(ii) connected at Low voltage up to 400 Volts with installed capacity lower than 100 kW.

(b) Projects should be designed for completion before 31.3.2013.

(c) Present guidelines are applicable to projects with installed capacity of 100 kW and up to 2 MW with grid connectivity at HT.

(d) The Local distribution company shall sign a Power Purchase Agreement with the developer at a levelised tariff determined by the Commission for 25 years.

1.6 Hence, in exercise of the powers vested in it under Section 86(1)(a), (b),(c) and (e) read with Section 62(1) of the Electricity Act, 2003 (EA, 2003) and all other powers enabling it in this behalf, the Madhya Pradesh Electricity Regulatory Commission (Commission), through this order, determines the tariff, procurement process and related dispensation for the purchase of power by licensees in Madhya Pradesh from solar based generators in the State.

A2: PROCEDURAL HISTORY AND REGULATORY PROCESS

2.1 Earlier, the Commission had issued a tariff order for procurement of power from solar based power projects on 06.07.2010 for the control period up to 31.03.2011 which was subsequently extended from time to time till further orders. The Commission had considered the reduced capital cost of the solar projects and issued an approach paper on 03.05.2012 titled "Fixation of norms for determination of Tariff for procurement of power from Solar based Power Projects" inviting comments/suggestions from various stakeholders by 25.05.2012. A public hearing was also held on 28.05.2012. In response to the above, comments from following stakeholders were received:

(a) M.P. Poorv Kshetra Vidyut Vitaran Company Limited, Jabalpur

(b) M.P. Madhya Kshetra Vidyut Vitaran Company Limited, Bhopal

(c) M/s Simplex Infrastructures Ltd., New Delhi

(d) M/s Rudraksh Energy, Jaipur

(e) M/s Moser Baer Clean Energy Limited, New Delhi

(f) M.P. Power Management Company Limited, Jabalpur

(g) M/s CPRI, Govindpura, Bhopal

2.2 The field of solar generation is in an evolutionary stage. The Commission, therefore, attempted to collate available information to come up with a sustainable tariff.

2.3 The Commission has kept in view the tariff orders issued by other State Electricity Regulatory Commissions, comments/suggestions from various stakeholders, data on solar energy based power generation from various sources, and guidelines for determination of tariff for procurement of power from renewable energy sources. The Commission has also studied the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012 issued on 6th February, 2012 and guidelines for Rooftop and other small power plants connected to distribution network (below 33 kV) as guidelines in finalization of solar tariff. Accordingly, the Commission issues the following order to meet the requirements of the Electricity Act, 2003.

A4: APPLICABILITY OF THE ORDER

4.1. The tariff determined by the Commission in this order shall be applicable to the following Projects located in the State of Madhya Pradesh and selling electricity to the distribution licensees within Madhya Pradesh only:--

(a) Solar PV Power Plants for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2015.

(b) Solar Thermal Power Plants for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2016.

(c) Rooftop and other small Solar Power Plants of capacity up to 2MW connected to distribution network (below 33 kV) for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2016.

4.2. It shall be mandatory for the licensees to submit to the Commission quarterly progress reports on the capacity addition, purchase of energy and other relevant details in respect of solar power generation projects commissioned in their licensed area, and also post the same on their websites on a regular basis.

4.3. For the purpose of this tariff order, unless the context otherwise requires;

(a) 'Control Period' means the period during which the norms for determination of tariff specified in this Order shall remain valid;

(b) 'Hybrid Solar Thermal Power Plant' means the solar thermal power plant that also uses other forms of energy sources alongwith solar thermal energy for electricity generation, and wherein not less than 75% of electricity is generated from solar energy.

(c) 'Inter-connection Point' shall mean interface point of renewable energy generating facility with the transmission system or distribution system, as the case may be, in relation to Solar Photovoltaic Projects the line isolator on outgoing feeder on HV side of the pooling sub-station and in relation to Solar Thermal Power the line isolator on outgoing feeder on HV side of generator transformer;

(d) 'MNRE' means the Ministry of New and Renewable Energy of the Government of India.

(e) 'Solar PV power' means the Solar Photo Voltaic power project that uses sunlight for direct conversion into electricity through Photo Voltaic technology.

(f) 'Solar Thermal power' means the Solar Thermal power project that uses sunlight for direct conversion into electricity through Concentrated Solar Power technology based on either line focus or point focus principle.

(g) 'Tariff period' means the period for which tariff is to be determined by the Commission on the basis of norms specified in this Order.

(h) 'Useful Life' in relation to a unit of a generating station including evacuation system shall mean the duration for which it remains functional from the date of commercial operation (COD) of such generation facility.

4.4. Save as aforesaid words and expressions used in this Order and not defined, but defined in the Act, or the Code or Regulations of MPERC shall have the meanings assigned to them respectively in the Act or the Code or the Regulations of MPERC.

A5: CONTROL PERIOD AND TARIFF PERIOD

5.1 The Control Period will start from the date of issue of this order and will end on **31.03.2014**. The tariff determined in this order shall apply to all projects as mentioned in clause 4.1 of this order and the tariff determined shall remain valid for the project life of **25 years** from the date of commissioning.

5.2 Project specific tariff, on case to case basis, shall be determined by the Commission for the project, if a project developer opts for project specific tariff:

Provided that the Commission, while determining the project specific tariff for Solar PV and Solar Thermal, shall be guided by the principles laid down in this Order and such terms and conditions as stipulated under relevant Regulations or Orders of the Commission.

A6: APPROACH FOR TARIFF DETERMINATION

6.1 Tariff determination generally requires evaluation, detailed scrutiny and determination of each cost parameter for each Project separately. It is likely that there will be considerable diversity in the value of parameters across Projects, such as in respect of plant capacity, location, project cost, financing plan etc. In the absence of availability of such extensive data in Madhya Pradesh, the Commission has decided to prescribe a generic promotional tariff.

6.2 Since solar power is not amenable to merit order dispatch principles because of its infirm nature and almost all the costs of solar power generators are fixed in nature, single part tariff appears best suited for the solar power generators and the same has been adopted.

6.3 A generalized tariff mechanism would provide an incentive to the investors for use of most efficient equipment and technology to maximize returns and for selecting the most efficient site. The process of project specific tariff fixation will be cumbersome and time consuming. It is decided to use one single part tariff for all the solar power projects using common benchmark technique, subject to provisions made in clause 5.2.

6.4 Tariff Design:

6.4.1 The working group constituted by the Forum of Regulators (FOR) for Policies on Renewables have, in their recommendations, suggested that a cost-plus tariff based on reasonable norms should be adopted for Renewable Energy. Keeping in view the above recommendations, the Commission has adopted an approach of preferential treatment on a cost-plus basis for determining tariff for Solar Power. In a cost plus approach, the key elements that influence the determination of tariffs for a project are mentioned below:

(a) Capital Cost;

(b) Debt Equity ratio;

(c) Return on equity;

(d) Interest on loan capital;

(e) Depreciation and Useful plant life;

(f) Operation and maintenance expenses;

(g) Interest on working capital;

(h) Capacity Utilization Factor(CUF);

6.5 Tariff Design for Solar Thermal Power Generation Plants

6.5.1 Capital cost:

(a) The Capital cost is the most critical element in tariff determination. This comprises cost of land, plant and machinery, civil works, erection, commissioning, cost of power evacuation and other related charges. The Commission had proposed Rs. 13.25 Crore/MW for Solar Thermal Power Plants. The views of various stakeholders regarding capital cost of solar thermal power plants are:

(i) M.P. Power Management Company Limited, Jabalpur stated that capital cost of Rs. 13 Crore per MW for Solar Thermal Power Plants should be considered by the Commission to determine the tariff.

(b) The CERC in their Regulations dated 06.02.2012 has adopted Capital Cost of Rs. 13 Crore/MW for FY 2012-13 with an escalation for future financial years as per specified formula. The norms for capital cost are inclusive of evacuation infrastructure up to inter-connection point.

(c) As per the provisions of Policy for implementation of Solar Power based projects in Madhya Pradesh, 2012 dated 20.07.2012 by the Government of Madhya Pradesh, all expenses for power evacuation facility are to be borne by the developer. However, M.P. Power Transmission Co. Ltd. and/or the concerned Distribution Company will undertake the augmentation of sub-station(s), if required.

Commission's decision:

The Commission observes that the capital cost proposed in the discussion paper is higher than that specified by CERC for FY 2012-13. The CERC has provided indexation formula for working out the capital cost for future years. However, the Commission is of the view that the capital cost of Rs. 13.25 Cr/MW including cost of power evacuation is reasonable for solar thermal power plants during the control period.

6.5.2 Useful Plant life: The Commission had proposed plant life as 25 years in its discussion paper. The CERC in its Regulations dated 06.02.2012 have also taken plant life as 25 years. Some other SERCs have also taken plant life as 25 years.

Commission's decision:

It may be mentioned that useful plant life of a coal based thermal generating station is considered as 25 years. Considering the fact that Solar Power Plants are not subject to operating conditions as demanding as thermal power plants, it is appropriate to adopt plant life at least equal to that of coal based thermal plants. The Commission has, therefore, considered the plant life as 25 years for tariff determination.

6.5.3 **Return on Equity**: The Commission had proposed return on equity as 16% pre-tax in its discussion paper. M/s Simplex Infrastructures Ltd. requested for 21% pre-tax return on equity whereas M/s Rudraksh Energy and M/s Moser Baer Clean Energy Ltd. requested for 16 % post-tax return on equity for calculation of tariff. The CERC in its Regulations dated 06.02.2012 recommended return on equity as 20% per annum for the first 10 years and 24% per annum 11th years onwards.

Commission's decision:

The Commission has allowed RoE of 15.5% pre-tax for thermal and hydro generating plants for the tariff period 2009-10 to 2011-12. This could undergo change at the time of determination of tariff for subsequent tariff periods. Keeping in view the requirements of the tariff policy for preferential tariff for renewable sources of energy and also after considering the views expressed by various stakeholders, the Commission has decided to allow RoE @ 20% pre-tax per annum during the life of the project.

6.5.4 **Capacity Utilization Factor:** The Capacity Utilization Factor (CUF) depends on several factors such as location of the project, quality and capacity and type of panels installed, technology adopted, conversion efficiency etc. The Commission in its discussion paper had proposed CUF as 23% derated at the rate of 0.5% of CUF each year from 3rd year onward. As per CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012, the CUF shall be 23 %.

Commission's decision:

As the Capacity Utilization Factor depends on various variable factors, it would be difficult to compute it specifically for each project at each site. In view of this and after duly considering the stakeholders' views during the public hearing as well as the provisions in CERC regulations, the Commission has considered adopting capacity utilization factor of 23% with derating @ 0.5% of CUF each year after two years of operation for tariff determination.

6.5.5 **Depreciation:** The Commission in its discussion paper had proposed depreciation @ 7% per annum for the first 10 years and remaining 20% to be spread over the balance life of the plant of 15 years from 11th year onwards. The CERC has specified in the Regulations notified on 06.02.2012 that depreciation rate for the first 12 years of the Tariff Period shall be @ 5.83% per annum and the remaining depreciation shall be spread over the remaining useful life of the project from 13th year onwards.

Commission's decision:

In order to facilitate repayment of debt by project developers and considering loan repayment period of 10 years (no moratorium period), the Commission decides to provide depreciation rate of 7.00% for the first ten years of plant life with the rest of the asset value being depreciated equally during the rest of the plant life of 15 years. The Salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the Capital Cost of the asset.

6.5.6 O&M expenses: The operation and maintenance expenses comprise of manpower expenses, insurance expenses, spares and repairs, consumables and other expenses (statutory fees etc.). Normally, the maintenance of Solar Power Plants results in a lower amount of manpower expenses as well as administrative and general expenses.

The Commission had proposed operation and maintenance expenses as 1% of Capital Cost for the first year and thereafter an escalation of 5.72 % per year and 0.3% of depreciated assets as insurance charges in its discussion paper. The CERC in its Regulations dated 06.02.2012 has suggested O&M expenses as 15 lacs per MW for 1st year operation with escalation @ 5.72% per annum. GERC has provided 1 % O&M expenses with 5% per annum escalation and 0.3 % insurance charges on depreciated value. RERC has provided O&M expenses as Rs. 15 lakh in first year with 5.72% escalation and 0.3 % insurance on depreciated value of assets.

Commission's decision:

Considering views of the stakeholders and recommendations of CERC and tariff orders of other ERCs, the Commission has decided that it would be appropriate to allow 1 % of the capital cost of the project as O&M expenses in the first year with an escalation of 5.72% for each year thereafter along with insurance charges of 0.3% on depreciated value of assets.

6.5.7 Interest on Debt: The Commission had proposed interest on debt @ 12.75% p.a. in its discussion paper. M/s Simplex Infrastructures Limited suggested annual rate of interest on debt @ 13.50%. The CERC in its Regulations dated 06.02.2012 have specified interest on debt at average State Bank of India Base rate prevalent during the first six months of the previous year plus 300 basis points.

Commission's decision:

The Commission considers that the interest rates for both deposit and loans are changing from time to time frequently. The Commission therefore, considers the annual interest rate on debt at 12.75 % for tariff determination purposes.

6.5.8 Debt-Equity Ratio: The Commission had proposed debt-equity ratio of 70:30 in its discussion paper. The CERC in its Regulations notified on 06.02.2012 specified debt-equity ratio of 70:30. The Clause 5.3(b) of the Tariff Policy also stipulates a debt-equity ratio of 70:30 for financing power projects.

Commission's decision:

The Commission has, therefore, considered a debt-equity ratio of 70: 30.

6.5.9 Interest on working capital: The Commission in its discussion paper has provided 13.25% towards interest on working capital. The CERC in its Regulations dated 06.02.2012 has specified interest on working capital at interest rate equivalent to the average State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points and the amount of working capital to be calculated using the following norms:

(a) O&M expenses for 1 month

(b) Receivables equivalent to 2 months of energy charges

(c) Maintenance spares @ 15% of O&M expenses.

M/s Simplex Infrastructures Limited have suggested interest on working capital @ 14%.

Commission's decision:

The Commission, after considering suggestion from the stakeholder decides that the amount of working capital shall be calculated adopting the following norms and interest thereon shall be calculated by using a simple rate of 13.25% per annum:

a) O&M expenses for one month
b) Receivables equivalent to two months of energy charges based on normative CUF.
c) Maintenance spares @ 15% of O&M expenses

6.5.10 Auxiliary Consumption: The Commission in its discussion paper has provided auxiliary consumption at the rate of 6.5%. The CERC in its Regulations dated 06.02.2012 has specified as 10%. RERC has allowed auxiliary consumption as 6.5 % since activities like coal handling, coal crushing, ash disposal etc. necessary in coal plants are not required in these plants. GERC has allowed 10% auxiliary consumption.

Commission's decision:

The Commission allows 10% of gross generation as auxiliary consumption as per the provisions of CERC regulations dated 06.02.2012.

6.5.11 Discounting Rate: The Commission in its tariff order dated 06.07.2010 as well as in the discussion paper issued in May 2010 has considered 10.01 % as the discounting factor for the purpose of tariff determination. M/s Simplex Infrastructures Limited suggested that discount rate should be changed from 10.01% to 12.68%. In pursuance of clause 5.6 (vi) of Ministry of Power Notification dated 19.01.2005 (as amended from time to time) on Guidelines for determination of tariff by bidding process, the CERC notifies every half yearly the discounting rate to be used for the purpose of bid evaluation. This discounting rate is, however, not used for payment purpose. The Commission has looked into the discounting rate notified by the CERC for last three years and has, therefore, used discounting rate of 10.20% being the average of three years for the purpose of calculation of levelised tariff.

6.6 The summary of various parameters considered by the Commission to determine tariff for solar thermal power generation are:

Parameters	Solar Thermal
Project Life	25 Years
Debt-Equity Ratio	70:30
Project Cost (Rs. Cr per MW)	13.25
Pre-tax return on equity	20% per annum
Interest on debt	12.75%
Working capital	a) Operation & Maintenance expenses for one month; b) Receivables equivalent to 2 (Two) months of energy charges for sale of electricity calculated on the normative CUF; c) Maintenance spare @ 15% of operation and maintenance expenses
Interest on working capital	13.25%
Salvage value (% of asset value)	10.00%
Depreciation (% of	7.00% (for first 10 years)

project cost per annum)	1.333% (for 11-25 years)
O&M Cost (% of project cost)	1% for 1st year of operation escalated at the rate of 5.72% p.a. from 2nd year onwards plus 0.3% of value of depreciated assets as insurance charges
Capacity Utilization Factor (CUF)	23% derated at the rate of 0.5% of CUF each year from 3rd year onwards.
Auxiliary Consumption	10 % of gross generation
Discounting rate	10.20 %

6.7 Determination of Tariff for Solar Thermal Generation Plants

6.7.1 The Commission determines the levelised tariff of **Rs. 12.65 per unit** for 25 years for sale of electricity from Solar Thermal Power Generation Plants taking discounting factor @ 10.20%.

6.7.2 The Commission has notified a separate Renewable Purchase Obligation for Solar based generation in MPERC (Cogeneration and Generation of Electricity from Renewable Sources of Energy) (Revision-I) Regulations, 2010.

6.7.3 Notwithstanding the Commission's recommendations of tariff determined in clause 6.7.1, the tariff determined by the Commission shall be applicable to the extent of minimum purchase requirement fixed by the Commission and would further be subject to provision in Clause 7.1 of this order.

6.8 Tariff Design for Solar Photovoltaic Power Generation Plants with capacity more than 2 MW

6.8.1 Capital cost:

(a) The Capital cost is the most critical element in tariff determination. This comprises cost of land, plant and machinery, civil works, erection, commissioning, cost of power evacuation and other related charges. The Commission had proposed Rs. 10.25 Crore/MW for Solar Photovoltaic Power Generating Plant.

(b) The CERC in their Regulations dated 06.02.2012 have adopted Capital Cost of Rs. 10 Crore/MW up to FY 2012-13 with escalation formula for future years. The Capital cost also includes cost of evacuation. The GERC has allowed a capital cost of Rs. 10 Crore/ MW. M/s Simplex Infrastructures Ltd. requested to consider project cost @ Rs. 10.50 Crore/MW. They have also suggested that cost of inverter replacement in the 12th year of project operation for Rs. 50 lacs/MW, cost of land @ Rs. 2.00 lacs/acre, cost of power evacuation @ Rs. 5 Crore for building a transmission line up to 20 Kms. and pre-operative expenses such as financial institution fees, independent Engineer fees etc. @ Rs. 2.5 % of the capital cost of the project may also be considered. The M.P. Power Management Company Ltd., Jabalpur stated that capital cost of Rs. 10 Crore/MW should be considered to determine the tariff.

(c) As per the provisions of Policy for implementation of Solar Power based projects in Madhya Pradesh, 2012 dated 20.07.2012 by the Government of Madhya Pradesh, all expenses for power evacuation facility are to be borne by the developer. However, M.P. Power Transmission Co. Ltd. and/or the concerned Distribution Company will undertake the augmentation of sub-station(s), if required.

Commission's decision:

The Commission observes that the capital cost proposed in the discussion paper was higher than that recommended by CERC for FY 2012-13 in its Regulations, 2012 as also that accepted by other State Electricity Regulatory Commission. The Commission, therefore, determines the tariff for solar PV Generating Projects taking the capital cost of Rs. 10.25 Crore/MW.

6.8.2 Useful Plant life: The Commission had proposed plant life as 25 years in its discussion paper. The CERC in its Regulations dated 06.02.2012 have taken plant life as 25 years. The GERC have also taken plant life as 25 years.

Commission's decision:

It may be mentioned that useful plant life of a coal based thermal generating station is considered as 25 years. Considering the fact that Solar Power Plants are not being subject to operating conditions as demanding as thermal power plants, it is, therefore, appropriate to adopt plant life at least equal to that of coal based thermal plants. The Commission has, therefore, considered the plant life as 25 years for Solar PV Generating plants for tariff determination.

6.8.3 **Return on Equity**: The Commission had proposed return on equity as 16% pre-tax in its discussion paper. M/s Simplex Infrastructures Ltd. requested for 21% pre-tax return on equity whereas M/s Rudraksh Energy and M/s Moser Baer Clean Energy Ltd. requested for 16 % post-tax return on equity for calculation of tariff. The CERC in its Regulations dated 06.02.2012 recommended return on equity as 20% per annum for the first 10 years and 24% per annum 11th years onwards. The GERC has considered Return on equity as 14% per annum.

Commission's decision:

The Commission has allowed RoE of 15.5% pre-tax for thermal and hydro generating plants for the tariff period 2009-10 to 2011-12. This could undergo change at the time of determination of tariff for subsequent tariff periods. Keeping in view the requirements of the tariff policy for preferential tariff for renewable sources of energy, the Commission has decided to allow RoE @ 20% pre-tax per annum for the life of the project.

6.8.4 **Capacity Utilization Factor:** The Capacity Utilization Factor (CUF) depends on several factors such as location of the project, quality, capacity and type of panels installed, technology adopted, conversion efficiency etc. The Commission in its discussion paper had proposed 20% with derating factor @1% per annum from 3rd years onward as CUF. As per CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012, the CUF shall be 19 %. The GERC has accepted a CUF of 18 % with 1% performance degradation annually.

Commission's decision:

As the Capacity Utilization Factor depends on various variable factors, it would be difficult to compute it specifically for each project at each site. In view of this and considering provisions made by CERC and other State Electricity Regulatory Commissions, the Commission has considered adopting capacity utilization factor of 19% with derating @ 1% of CUF per annum after two years of operations for working out tariff.

6.8.5 **Depreciation:** The Commission in its discussion paper had proposed depreciation @ 7% per annum for the first 10 years and remaining 20% to be spread over the balance life of the plant of 10 years from 11th year onwards. The CERC in its Regulations, 2012 has specified depreciation rate of 5.83% per annum for the first twelve years of plant life and the remaining depreciation shall be spread over the remaining useful life of the project from 13th year onwards after considering 10% salvage value.

Commission's decision:

In order to facilitate repayment of debt by project developers and considering loan repayment period of 10 years (no moratorium period), the Commission decides to provide depreciation rate of 7.00% for the first ten years of plant life with the rest of the asset value being depreciated equally during the rest of the plant life of fifteen years. The Salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the Capital Cost of the asset.

6.8.6 O&M expenses: The operation and maintenance expenses comprise of manpower expenses, insurance expenses, spares and repairs, consumables and other expenses (statutory fees etc.). Normally, the maintenance of Solar Power Plants results in a lower amount of manpower expenses as well as administrative and general expenses.

The Commission had proposed operation and maintenance expenses as 0.5% of Capital Cost for the first year of operation and thereafter an escalation of 5.72 % per year from 2nd year onwards plus 0.3% of depreciated assets as insurance charges in its discussion paper. M/s Simplex Infrastructures Limited suggested that O&M expenses may be considered @ 1.25% of Capital cost in the first year with an escalation @ 5.72% per year thereafter. M/s Rudraksh Energy suggested that Rs. 11 lacs/MW for 1st year may be adopted as per CERC Regulations. M/s Moser Baer Clean Energy Limited suggested that Rs. 12.71 lacs/MW for the 1st year of operation with an annual escalation of 5.72 %.

The CERC in its Regulations dated 06.02.2012 has suggested O&M expenses as 11 lacs per MW for 1st year of operation with escalation @ 5.72% per annum. The GERC has provided 0.75 % of Capital cost as O&M expenses with 5.72% per annum escalation and 0.35 % annual insurance charges on depreciated value.

Commission's decision:

Considering recommendations of CERC and provisions by other State Electricity Regulatory Commissions, the Commission has decided that it would be appropriate to allow 0.5 % of the capital cost of the project as O&M expenses in the first year with an escalation of 5.72% for each year thereafter and 0.3% of depreciated cost of assets as insurance charges.

6.8.7 Interest on Debt: The Commission had proposed interest on debt @ 12.75% p.a. in its discussion paper. M/s Simplex Infrastructures Limited suggested annual rate of interest on debt @ 13.50%. The CERC in its Regulations dated 06.02.2012 have recommended interest on debt at average State Bank of India Base rate prevalent during the first six months of the previous year plus 300 basis points.

Commission's decision:

The Commission considers that the interest rates for both deposit and loans are changing from time to time frequently. The Commission therefore, considers the annual interest rate on debt at 12.75 % for tariff determination purposes.

6.8.8 **Debt-Equity Ratio**: The Commission had proposed debt-equity ratio of 70:30 in its discussion paper. The CERC in its Regulations notified on 06.02.2012 specified debt-equity ratio of 70:30.The Clause 5.3(b) of the Tariff Policy also stipulates a debt-equity ratio of 70:30 for financing power projects.

Commission's decision:

The Commission has, therefore, considered a debt-equity ratio of 70: 30.

6.8.9 **Interest on working capital:** The Commission in its discussion paper has provided 13.75% per annum towards interest on working capital. The CERC in its Regulations dated 06.02.2012 has specified interest on working capital at interest rate equivalent to the average State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points and the amount of working capital to be calculated using the following norms:

(a) O&M expenses for 1 month
(b) Receivables equivalent to 2 months of energy charges
(c) Maintenance spares @ 15% of O&M expenses.

M/s Simplex Infrastructures Limited have suggested interest on working capital @ 14%.

Commission's decision:

The Commission, after considering suggestion from the stakeholder decides that the amount of working capital shall be calculated adopting the following norms and interest thereon shall be calculated by using a simple rate of 13.25% per annum :

(a) O&M expenses for one month
(b) Receivables equivalent to 2 months of energy charges based on normative CUF.
(c) Maintenance spares @ 15% of O&M expenses

6.8.10 **Auxiliary Consumption:** The Commission in its discussion paper has provided auxiliary consumption at the rate of 0.25%. The CERC in its Regulations dated 06.02.2012 has not specified auxiliary consumption for such projects. The GERC has also not allowed auxiliary consumption.

Commission's decision:

The Commission is of the view that some equipments in the plant shall require supply to be consumed and also to promote these technologies, an auxiliary consumption of 0.25 % of gross generation is allowed.

6.9 **Discounting Rate:** The Commission in its tariff order dated 06.07.2010 as well as in the discussion paper issued in May 2010 has considered 10.01 % as the discounting factor for the purpose of tariff determination. M/s Simplex Infrastructures Limited suggested that discount rate should be changed from 10.01% to 12.68%. In pursuance of clause 5.6 (vi) of Ministry of Power Notification dated 19.01.2005 (as amended from time to time) on Guidelines for determination of tariff by bidding process, the CERC notifies every half yearly the discounting rate to be used for the purpose of bid evaluation. This discounting rate is, however, not used for payment purpose. The Commission has looked into the discounting rate notified by the CERC for last three years and has, therefore, used discounting rate of 10.20% being the average of three years for the purpose of calculation of levelised tariff. The summary of various parameters considered by the Commission to determine tariff for Solar PV based power generation with project capacity of more than 2 MW are :

Parameters	Considered by MPERC
Project Life	25 years
Debt: Equity	70:30
Capital Cost (Rs. Crore per MW)	10.25
Pre-tax return on equity	20% per annum
Interest on debt	12.75% p.a.
Working capital	a) Operation & Maintenance expenses for one month; b) Receivables equivalent to 2 (Two) months of energy charges for sale of electricity calculated on the normative CUF; c) Maintenance spare @ 15% of operation and maintenance expenses
Interest on working capital	13.25% p.a.

Depreciation (% of project cost per annum)	7 % (for 1-10 years) 1.333% (for 11-25 years)
O&M Cost (% of project cost)	0.5% for 1st year of operation escalated at the rate of 5.72% p.a. from 2nd year onwards plus 0.3% of value of depreciated assets as insurance charges
Capacity Utilization Factor (Clear sunny days 320 days)	19% derated at the rate of 1% of CUF each year from 3rd year onwards.
Auxiliary Consumption	0.25% of gross generation
Discounting rate	10.20%

6.10 Determination of Tariff for Solar Photovoltaic Power Generation Plants

6.10.1 The Commission determines the levelised tariff of **Rs. 10.44 per unit** for 25 years for sale of electricity from Solar Photovoltaic Power Generation Plants of more than 2 MW capacity taking discounting factor @ 10.20%.

6.10.2 The Commission has notified a separate Renewable Purchase Obligation for Solar based generation in MPERC (Cogeneration and Generation of Electricity from Renewable Sources of Energy) (Revision-I) Regulations, 2009.

6.10.3 Notwithstanding the Commission's recommendations of tariff determined in clause 6.10.1, the tariff determined by the Commission shall be applicable to the extent of minimum purchase requirement fixed by the Commission and would further be subject to provision in clause 7.1.

6.11 Tariff Design and Determination of Tariff for Rooftop PV and other small Solar Power Plants with capacity up to 2 MW

Various parameters adopted by the Commission for the purpose of tariff determination are discussed below:

6.11.1 Capital cost:

(a) In case of Rooftop PV, cost of land, water facilities, land development, roads, security, illumination, civil structures, initial infrastructure for supply etc. will not be needed , which would results in lower costs in upfront investment. The modules can be installed on the public buildings and on private buildings. However, being a smaller capacity project, the overall cost is expected to be more on per MW basis.

(b) The Commission in the discussion paper had proposed Capital Cost of Rs. 10.50 Crore/MW for such projects.

Commission's decision:

The Commission has noted that none of the stakeholders have submitted the comments and also the CERC has not specified any norms for such projects in its Regulations, 2012. The Commission is of the view that it would be appropriate that the capital cost may be considered @ Rs. 10.50 Crore/MW.

6.11.2 Other parameters:

For other parameters like O&M expenses, CUF, Interest cost, depreciation etc., the Commission feels it appropriate to consider similar norms as applicable to the Solar PV Power Generation Projects.

6.12 Determination of Tariff:

6.12.1 The Commission determines the levelised tariff of **Rs. 10.70 per unit** for 25 years for sale of electricity from Rooftop PV and other small Solar Power Projects with capacity limited to 2 MW covered in MNRE's "Rooftop PV & Small Solar Power Generation Programme (RPSSGP)".

6.13 Summary of Solar Power Tariff:

The generic tariff levelised for 25 years for different technologies (Solar PV & Solar Thermal) and for Rooftop and other small Solar Power Plant is determined as under :-

S.No.	Particulars	Tariff (Rs./unit)
1.	Solar Thermal Power Plants for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2016.	12.65
2.	Solar PV Power Plants for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2015.	10.44
3.	Rooftop and other small Solar Power Plants of capacity up to 2MW connected to distribution network (below 33 kV) for which Power Purchase Agreements are signed by 31.3.2014 and the projects are commissioned by 31.3.2016.	10.70

A7: OTHER ISSUES

7.1 Bidding for Power Procurement

The tariff indicated above is the maximum tariff and the M.P. Power Management Company Ltd. on behalf of the Distribution Licensee shall invite bids from Generators/Developers. The Generators/Developers bidding lower tariff will be allowed to install the power plant within the State of Madhya Pradesh for selling the generated power to Madhya Pradesh State

7.2 The tariff rates are inclusive of all charges on account of taxes/duties/cess/octroi etc. except Electricity Duty/Cess on sale of power. The Electricity Duty/Cess, if payable by the generators on sold energy to the Licensee, shall be payable by the Licensee in addition to the above tariff charges.

7.3 The tariff rates and structure shall be firm and will not vary with fluctuation in exchange rate variations or on account of changes in law or in taxes.

7.4 Power Purchase Agreement

7.4.1. The State Government has transferred and vested the functions, properties, interest, rights and obligations of the erstwhile MPSEB relating to Bulk Purchase and Bulk Supply of Electricity along with the related agreements and arrangements in the State Government and re-transferred and re-vested these in the M.P. Power Trading Company Ltd. and subsequently to M.P. Power Management Company Limited. Therefore, the Commission directs that the energy generated by the solar based power generating units will be procured centrally by the M.P. Power Management Co. Ltd. The energy so procured will be allocated by M.P. Power Management Co. Ltd. to the three distribution licensees in the ratio of their actual energy input in each financial year. Accordingly, the Power Purchase Agreements will be signed between the developer and the M.P. Power Management Co. Ltd., Jabalpur. The M.P. Power Management Company Limited, Jabalpur in turn will have back to back power supply agreement with the Discoms. The agreements will be for exclusive sale/purchase of electricity for a period of 25 years from the date of commissioning of plant.

7.4.2. The developers are required to get all the required statutory approvals before entering into agreement with M.P. Power Management Company Limited, Jabalpur.

7.5 Scheduling:

Solar based power generation plants have been presently kept out of the purview of ‘scheduling’ and ‘merit order dispatch principles’. However, this shall be

implemented as and when the provisions are incorporated in the Indian Electricity Grid Code (IEGC)-2010 as amended from time to time.

7.6 Metering and billing:

7.6.1. The metering arrangement is to be done at site as per the provisions of the Government of M.P. policy for implementation of solar power based projects in Madhya Pradesh, 2012 notified on 20.07.2012.

7.6.2. Billing of the metered energy will be carried out on a monthly basis.

7.6.3. The meter reading will be carried out by the respective Discom where the energy is injected into the system.

7.7 Payment mechanism:

7.7.1. The Commission prescribes that a settlement period of 30 days from the date of submission of the bill to the concerned Discom where the power is injected should be followed in order to ensure that the developer has an assurance of cash inflow for the energy, which he delivers to the grid.

7.7.2. The bills favouring M.P. Power Management Company Limited, Jabalpur shall be submitted to the concerned distribution licensee in whose area the power is injected. The distribution licensee shall then verify the bills and send the same within 7 days of receipt of bills to the M.P. Power Management Company Limited, Jabalpur for making payment to the developer. The M.P. Power Management Company Limited in turn, would raise the bills on the distribution licensees on the basis of allocation.

7.7.3. In case of delay beyond the 30 days payment period, the M.P. Management Co. Ltd. will pay delayed payment surcharge on outstanding amount at the rate of 1.25% per month or part thereof.

7.7.4. In case the M.P. Management Co. Ltd. makes the payment within 15 days from the date of submission of bill by developer, an incentive of 1% of billed amount shall be allowed by the developer towards prompt payment. Alternatively, if the payment is made by the M.P. Power Management Co. Ltd. to the developer through the irrevocable letter of credit on presentation of bill, an incentive of 2% of billed amount shall be allowed by the developer.

7.7.5. The delayed payment surcharge/incentive will also be passed on to the Distribution Licensees by the M.P. Power Management Co. Limited.

7.8 Default provisions for sale to utility:

7.8.1. In case payment is not made within 60 days of presentation of bill (i.e. thirty days more than the prescribed limit of thirty days for normal payment), the developer may issue fifteen clear day's notice to the M.P. Power Management Company Limited to make the payment. This, however, will not absolve M.P. Power Management

Company Limited from payment of delayed payment surcharge as provided in clause 7.7.3 of this order. In case, M.P. Power Management Company Limited still does not make the payment, the developer shall have the liberty to approach the Commission for permitting sale of power to a third party.

7.9 Other applicable conditions:

7.9.1. All statutory clearances and necessary approvals, if any, shall be obtained by the developer, for setting up of the project through Department of Non-conventional Energy Sources. The developer is also responsible for their compliance and their renewals as may be required from time to time.

7.9.2. The developer would ensure that the proposed location of the plant is in accordance with the policy guidelines of the Union/the State Government.

7.9.3. **Transmission/Wheeling Charges**

In case of sale to the licensees, no transmission and wheeling charges shall be levied. In cases of wheeling of power to the point of own use/sale to third party, the transmission/distribution network of the licensees shall be used by the generator and hence they are liable to pay to the licensees the transmission charges/wheeling charges, as the case may be, as decided by the Commission from time to time.

7.9.4. **Sharing of CDM Benefit**

The sharing of CDM benefit shall be as under:

"The CDM benefit should be shared on a gross basis, starting from 100% to developers in the first year after commissioning and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developers and the licensees/consumers in the sixth year. Thereafter, the sharing of CDM benefits should remain equal till the time that benefits accrue. The developer shall disclose CDM benefits availed by them in the month of March each year to the concerned Distribution Licensee."

7.9.5. **Reactive Power Charges**

The Commission determines the charges for KVARh consumption from the grid as 27 paise/unit i.e. the rate which is already prevalent in the State and which may be revised by the Commission as and when necessary. Reactive energy charges would be

paid by the developer to the Distribution Licensees in whose territorial area the generator unit is located.

7.9.6. **Reduction in contract demand**

The reduction in contract demand shall be allowed in terms of the provisions made in the Government of M.P. policy for implementation of solar power based projects in Madhya Pradesh, 2012 notified on 20.07.2012.

7.9.7. **Tariff for existing projects shifted to sale to licensee from third party sale/ captive use or vice versa**

If an existing generator having arrangement for third party sale or for captive consumption desires to terminate the agreement with third party or stop using for captive use and wants to supply to the licensee, the developer is free to participate in the bidding process for power procurement initiated as per clause 7.1 by the M.P. Power Management Co. Ltd.

7.9.8. The project developer is required to obtain Short/ Long Term Open Access permission in case of captive use/ third party sale. The open access charges, as applicable, shall be levied. In case of sale of power to the distribution licensee, such permission is not applicable and is not required to be obtained. In case the points of injection and drawl fall within the jurisdiction of any Distribution Licensees involving transmission network, permission for bulk power transmission shall be obtained from M.P. Power Transmission Co. by the developer before executing the agreement with M.P. Power Management Co. and the developer shall not be required to execute a separate agreement with M.P. Power Transmission Company Limited.

7.9.9. The Distribution Company in whose area the energy is consumed (irrespective of the point of injection) shall deduct 2% of the energy injected towards wheeling charges in terms of units. The M.P. Power Management Company Limited shall also claim subsidy from the State Government towards wheeling charges @ 4% of the energy injected at the rate of prevailing energy charges for the user in terms of provisions made in the Government of M.P. Policy for implementation of solar power based projects in Madhya Pradesh, 2012 notified on 20.07.2012. This amount of subsidy shall then be passed on to the distribution licensees in whose area the energy is consumed on the basis of allocation indicated in the agreement. Wheeling charges are not applicable where generation and consumption of energy are at the same premises without involving the licensees' system network.

7.9.10. In case of inadvertent flow of energy into the system by the generator, the licensee shall pay to the developer for the energy received at the average pooled cost of purchase as per prevailing retail supply tariff order.

Ordered accordingly.

Sd/-	Sd/-
(C.S.Sharma)	**(Rakesh Sahni)**
Member	**Chairman**

Place : Bhopal

Date : 1st August, 2012