

2015

**Approach Paper for MERC (Terms and
Conditions for determination of Renewable
Energy Tariff) Regulations, 2015 for Review
Period starting from FY 2015-16**

**MAHARASHTRA ELECTRICITY REGULATORY
COMMISSION**

Prepared by



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(July 2015)**



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Abbreviations

APERC	Andhra Pradesh Electricity Regulatory Commission
AUX	Auxiliary Consumption
CERC	Central Electricity Regulatory Commission
COD	Commercial Operation Date
CUF	Capacity Utilization Factor
FY	Financial Year
GCV	Gross Calorific Value
GERC	Gujarat Electricity Regulatory Commission
DISCOM	Distribution Licensee
EPA	Energy Purchase Agreement
GoM WRD	Government of Maharashtra Water Resource Department
IREDA	Indian Renewable Energy Development Agency
JERC	Joint Electricity Regulatory Commission
kW	Kilowatt
MAT	Minimum Alternate Tax
MBEDA	Maharashtra Biomass Energy Developers Association
MEDA	Maharashtra Energy Development Agency
MERC	Maharashtra Electricity Regulatory Commission
MNRE	Ministry of New and Renewable Energy
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MT	Metric Tonne
MW	Megawatt
O&M	Operations & Maintenance
RE	Renewable Energy
PFC	Power Finance Corporation
PFS	PTC Financial Limited
PLF	Plant Load Factor
PSERC	Punjab Electricity Regulatory Commission
REC	Rural Electrification Corporation
RERC	Rajasthan Electricity Regulatory Commission
RPO	Renewable Purchase Obligation
RBI	Reserve Bank of India
RoE	Return on Equity
SERC	State Electricity Regulatory Commission
SGC	State Grid Code
SHR	Station Heat Rate
TNERC	Tamil Nadu Electricity Regulatory Commission
WACC	Weighted Average Cost of Capital
WTG	Wind Turbine Generator

1. Executive summary

The Maharashtra Electricity Regulatory Commission (MERC or the Commission) has been very proactive in promoting energy generation from Renewable Energy sources. MERC has been in the forefront of determining preferential tariffs for Renewable Energy technologies, with its first tariff Order for Non-Fossil Fuel-based Co-Generation Projects issued even before the enactment of Electricity Act, 2003 (or the Act). The Act provides for policy formulation by the Government of India and mandates State Electricity Regulatory Commissions (SERCs) to take steps to promote renewable sources of energy within their area of jurisdiction.

As per the provisions of Act and Tariff Policy, MERC has taken proactive measures for promoting Renewable Energy based generation within the State, such as determination of preferential tariff, Renewable Purchase Specification framework, grid connectivity framework, etc. The Commission has issued Tariff Orders for various types of Renewable Energy technology such as wind energy, non-fossil fuel based cogeneration, small hydel power, biomass power, etc.

MERC has framed and published the MERC (Terms and Conditions for determination of RE Tariff) Regulations in 2010 (or Principal RE Tariff Regulations, 2010) and the Review Period under these Regulations was of five (5) financial years ending in FY 2014-15. The MERC (Terms and Conditions for determination of RE Tariff) Regulations in 2010 had the provision of revising the RE Tariff Regulations for next Review Period commencing from FY 2015-16 to be notified separately.

The Commission initiated the exercise for formulating RE Tariff Regulations for the review period starting from FY 2015-16. For the purpose, the consultant, ICRA Management Consulting Private Limited (IMaCS) was entrusted with the task of developing a Discussion Paper analyzing the existing scenario across various Renewable Energy technologies and propose the RE Tariff Regulation for the next Review Period on the basis of its analysis.

The Commission has adopted the following approach for developing the discussion paper:

1. Analysis of comments received during hearing/proceedings of various Cases & related Orders in regards of Renewable Energy post implementation of Principal RE Tariff Regulations, 2010.
2. Analysis of Regulations and Orders of Central Electricity Regulatory Commission (or CERC) - Technology wise analysis of norms and parameters from Regulations and Orders issued by CERC
3. Analysis of Regulations and Orders of MERC and other SERCs - Technology wise analysis of norms and parameters from various Regulations and Orders issued by MERC and other SERCs
4. Developing data collection templates for obtaining data from MEDA, Government of Maharashtra Water Resource Department and leading financial Institutions like IREDA, REC, PFC, PFS, etc.
5. Collating & analyzing data received from the aforementioned institutions.
6. Propose the General Principles, Financial Principles and Technology-specific Principles for the next Review Period for the consideration of the Commission

The data collection templates were sent to State Nodal Agency (Maharashtra Energy Development Agency or MEDA), and other financial institutions for obtaining data on actual Projects commissioned during last 5 years which would be a basis for various financial and technical parameters to be adopted while framing the RE Tariff Regulations for the next Review Period. Regular follow up were done with MEDA and the other financial institutions requesting them to submit the data. However, only 3 institutions namely MEDA, GoMWRD, & REC have responded to the request for information sent by Commission. The data provided by REC is insufficient to create a representative sample size for analysis, where as the data provided by MEDA is inadequate whereas the data provided by GoMWRD is based on the approved DPRs which are old ones.

The Discussion Paper provides detailed description and analysis of General Principles, Financial Principles and Technology-specific Parameters for Wind Power Projects, Biomass Power Projects, Solar PV Projects, Solar Thermal Projects, Non-Fossil Fuel-based Co-Generation Projects, Small Hydro Power Projects, and Municipal Solid Waste based Projects. The Discussion paper also discusses about introducing Competitive Bidding for procurement of power generated by RE technologies in the State of Maharashtra.

The brief summary of key differences in respect of Principal RE Tariff Regulations, 2010 with proposed RE Tariff Regulations have been summarized below:

Table 1: Major changes proposed in RE Tariff Regulations

S No	Parameter	Principal RE Tariff Regulations, 2010	Proposal for next Review Period	Reason
1	Project Specific Tariff	Hybrid systems based on approved MNRE technology & Biomass Gasifier/ Biogas based Power Projects not considered	Hybrid systems based on RE technologies approved by MNRE such as Wind-Solar Hybrid, Solar-Biomass Hybrid, and Solar- Cogeneration Hybrid within same premises may approach the Commission for Project Specific Tariff. Biomass Gasifier and Biogas based Power Projects norms proposed as per the CERC	For promotion of Hybrid RE Projects the same has been proposed as more and more developers are now coming up with Projects to utilize the maximum RE potential of site. Biomass Gasifier and Biogas based Power Projects are included for Project specific tariff. So that multiple Projects of smaller capacity may come up thereby optimizing the utilisation of available potential in the State.
2	Discounting Factor	Discount factor equivalent to normative weighted	Discounting Factor is proposed as Post Tax weighted	When Post Tax WACC is used as discounting factor it would result in more realistic

S No	Parameter	Principal RE Tariff Regulations, 2010	Proposal for next Review Period	Reason
		average cost of capital has been considered	average cost of capital.	levellized tariff as compared to when Pre-Tax WACC used as discounting factor.
3	Procurement of power generated by grid connected RE technologies through Competitive Bidding	No provisions in the Principal RE Tariff Regulations, 2010	It is proposed to adopt the tariff for RE Power Projects where tariff has been determined through Competitive Bidding, as envisaged under Section 63 of the Act.	MNRE has framed the draft guidelines for Tariff Based Competitive Bidding Process for Grid Connected RE Power Projects (excluding Wind energy) under the provisions of Section 63 of the Act, but it is yet to be notified.
4	Loan Tenure	Loan Tenure of 10 years was considered for the purpose of determination of Tariff	It is proposed that Loan Tenure of 12 years to be considered.	With RE technologies achieving maturity level the lenders are now willing to provide loan for tenure up to 12 years in line with CERC norms.
5	Rate of Interest on Loan	Benchmark Prime Lending Rate (BPLR) also known as State Bank Advance Rate + some basis points.	It is proposed that Base Rate of State Bank of India + 300 basis points to be considered as the normative interest rate.	As per the guidelines issued by RBI dated 01 July, 2010, all Banks have been directed to switch over to Base Rate + some basis points. The Commission has already adopted this approach through its recent Tariff Orders.
6	Depreciation	The Depreciation rate of 7% was taken for first 10 years of the Tariff Period	It is proposed that the Depreciation rate of 5.83% to be considered for the first 12 years	Depreciation period has been made equivalent to the loan repayment requirement for first 12 years and accordingly the Depreciation rate for the first 12 years has been worked out.
7	O&M Cost	Absolute number for each technology with Annual escalation of 5.72%	Proposed as percentage of Capital Cost per MW for base year. Annual escalation of 5.72% on O&M Cost determined for base year to	In absence of actual operational data O&M Cost is expressed as percentage of Capital Cost for the base year only. Once absolute number of O&M Cost is achieved the same will be escalated by 5.72% annually.

S No	Parameter	Principal RE Tariff Regulations, 2010	Proposal for next Review Period	Reason
			continue. For Solar PV and Solar Thermal specified in Rs.Lakh/MW	
8	Capacity Utilization Factor for Wind Projects	CUF was estimated and adopted at 50 meter hub height.	Proposed that provisions of MERC Order in Case No 100 of 2014 be continued.	MEDA as directed by the Commission is still to conduct the CUF study at 80 meter hub height. CUF adopted for the 4 zones is similar with CERC zoning Principle at 80 meter hub height
9	Reactive Energy Charges	No provisions in the Principal RE Tariff Regulations, 2010.	The Reactive Energy Charges will be governed by existing or general or specific Order issued by the Commission or amendment to the Regulation for the next Review period commencing from FY 2015-16	Distribution Licensees have raised the concern over reactive power consumption and related compensation by RE Projects.
10	RoE	The value base for the equity shall be 30% of the Capital Cost or actual equity (in case of Project specific tariff determination) as determined under Regulation 13. The normative Return on Equity shall be: a) Pre-tax 19% per annum for the first 10 years. b) Pre-tax 24% per annum 11th year onwards.	The value base for the equity shall be 30% of the Capital Cost or actual equity (in case of Project specific tariff determination) as determined under Regulation 13. The Return on Equity shall be computed at the base rate of 16% to be grossed up as per applicable tax rate. The rate of return on equity shall be computed by grossing up the base rate with the tax rate	Variation is expected in the tax rates in the future considering the current Budget Speech. Focus is on providing post tax RoE @16%.

S No	Parameter	Principal RE Tariff Regulations, 2010	Proposal for next Review Period	Reason
			equivalent to Minimum Alternate Tax (MAT) for first 10 years from COD and normal tax rate for remaining years of Project life	

A summary of financial and Technology-specific Principles proposed for the purpose of tariff determination for next review period are as below:

Table 2: Summary of Financial Parameters:

Financial Parameter	Debt Equity Ratio	Return on Equity	Depreciation	Interest on loan	Interest on working capital
Technology		%	%	%	%
Wind	70:30	Return on Equity shall be computed at the base rate of 16% to be grossed up as per applicable tax rate. The rate of return on equity shall be computed by grossing up the base rate with the tax rate equivalent to Minimum Alternate Tax (MAT) for first 10 years from COD and normal tax rate for remaining years of Project life.	5.83% for 12 years and remaining spread over useful life	Base Rate of State Bank of India + 300 basis points	Base Rate of State Bank of India + 350 basis points
SHP <5MW					
SHP 5-25 MW					
Solar PV					
Solar Thermal					
Biomass					
Bagasse Cogen					
MSW					

Table 3: Summary of Technology-specific parameters

Technology-specific Parameter	Capital Cost	Capacity Utilization Factor	O&M for base year	Auxiliary Consumption	Fuel cost	GCV Fuel	SHR
Technology	Rs. Lakh / MW	%	Rs. Lakh / MW	%	Rs./MT	kcal/kg	kcal/kWh
Wind	597.79	Z1 22% Z2 25% Z3 30% Z4 32%	1.47% of Capital Cost	NA	NA	NA	NA
SHP <5MW	602.30	30%	3.60% of Capital Cost	1%	NA	NA	NA
SHP 5-25 MW	547.99	30%	2.80% of Capital Cost	1%	NA	NA	NA
Solar PV	605.85	19%	Rs. 13 Lakh	NA	NA	NA	NA

Technology-specific Parameter	Capital Cost	Capacity Utilization Factor	O&M for base year	Auxiliary Consumption	Fuel cost	GCV Fuel	SHR
Solar Thermal	1,200.00	23.0%	Rs. 15 Lakh	10%	NA	NA	NA
Biomass	491.40	During Stabilization: 60%, During remaining period of first year (after stabilization): 70% From 2nd Year onward: 80%	5.32% of Capital Cost	10%	3987	3611	3800
Bagasse Cogen	486.00	60%	3.54% of Capital Cost	8.50%	2326.84	2250	3600

2. Background

In exercise of powers conferred under Section 61, 66, 86 read with Section 181 of the Electricity Act, 2003, (herein after “the Act”), the Maharashtra State Electricity Regulatory Commission (herein after “MERC or Commission”) framed the Maharashtra Electricity Regulatory Commission (Terms and Conditions for determination of RE Tariff) Regulations, 2010 (herein after “Principal RE Tariff Regulations, 2010”). The review Period specified was of five years, ending on 31 March, 2015. Regulation 5.1 also stated that the Commission shall undertake the exercise of revision in the aforesaid Principal RE Tariff Regulations, 2010 for next Review Period. Hence, the Commission has initiated the exercise of framing RE Tariff Regulations for the next Review Period starting from 1 April, 2015.

The Tariff stream for existing Projects commissioned before these proposed Regulations would continue to apply for such Projects.

The proposed Regulations are applicable for Projects that get commissioned post Notification of revised Regulations for Review Period commencing from FY 2015-16.

3. Definitions

The Comments on Definitions received from various stakeholders during the public hearing process of various Orders issued during post implementation of Principal RE Tariff Regulations, 2010 are as follows:

Table 4: Comments received from stakeholders on definitions

Parameter	Reference	Technology	Stakeholders	Stakeholders Comments
Useful Life	Order in Case No. 20 of 2010	Wind	Indian Wind Energy Association (InWEA)	Project life of 20 years instead of 25 years may be considered for determination of tariff for Wind Projects as life of WTG is 20 years as per the Provisional Type Certification Scheme for Wind Turbine and also wind turbine manufacturers are claiming the designed life of WTG as 20 years in their product catalogue.
Useful Life	Order in Case No. 6 of 2013	Wind	Torrent Power	The useful life of Wind Power Project should be considered as 20 years instead of 25 years due to techno-commercial feasibility of such Projects and consider carrying out levellization of cost over the Tariff period of 13 years and then provide a separate levellized Tariff for balance 7 years or allow the Tariff for useful life of the Project.
Useful Life	Order in Case No. 10 of 2012	Hydro	Mahathi Hydro Power Projects	To revise the useful life of SHP Projects between 1 MW to 5 MW to 30 years instead of 35 years as these Projects are built on B.O.O.T policy of State Government, which considers hand over of Projects after 30 Years.
Line Losses Till Interconnection Point	Case No. 20 of 2010	Wind	RCF and CLP Windfarms (India) Pvt.	Line losses and transformation losses to wheel the electricity from generator level to the inter-connection

Parameter	Reference	Technology	Stakeholders	Stakeholders Comments
			Ltd (CLP)	point may be taken into account while determining tariff.

4. Scope & Extent of application Tariff Regulations

4.1 Applicability of Regulations

It is proposed that RE Tariff Regulations shall be applicable for determination of tariff for a Generating Station or a unit thereof based on renewable sources of energy for sale of electricity to Distribution Licensee. Further, in cases of wind, small hydro, biomass, non-fossil fuel based co-generation, biomass Gasifier based, Biogas based Power Projects and Solar Power Projects, the proposed Regulations shall apply subject to the fulfilment of eligibility criteria as specified below:

4.2 Eligibility Criteria

CERC and other SERCs including MERC have adopted grid connected RE technologies for the purpose of tariff determination. The eligibility criteria for RE technologies are proposed as follows:

- 4.2.1** Wind Power Project – With change in wind turbine technology and better efficiency, even the lower wind regimes have become exploitable. Considering the same, the MNRE, vide its circular dated 1 August, 2011 had issued a new guideline wherein it has been decided that hereafter, no restriction will exist for Wind energy Density criteria as far the development of Wind Power Project is concerned. Hence, Wind Power Project commissioned using new or re-powered wind turbine generators after notification of proposed Regulations shall be eligible.
- 4.2.2** Small Hydro Project – New Small Hydro Project(s) commissioned after notification of proposed Regulations and located at the sites approved by State Nodal Agency/State Government using new plant and machinery, and with installed power plant capacity lower than or equal to 25 MW at single location.
- 4.2.3** Mini Hydro Project - New Mini Hydro Project(s) commissioned after notification of proposed Regulations and located at the sites approved by State Nodal Agency/State Government using new plant and machinery, and with installed power plant capacity more than 500 kW and up to and including 1000 kW;
- 4.2.4** Micro Hydro Project – New Micro Hydro Project(s) commissioned after notification of proposed Regulations and located at the sites approved by State Nodal Agency/State Government using new plant and machinery, and with installed power plant capacity up to and including 500 kW;
- 4.2.5** Biomass based Power Project – New Biomass based Power Project(s) commissioned after notification of proposed Regulations and using new plant and machinery based on Rankine cycle technology and using biomass fuel sources. Biomass Gasifier and Biogas based Power Projects as specified by MNRE.

- 4.2.6** Non-Fossil Fuel-based Co-Generation Project: New Non-Fossil Fuel-based Co-Generation Project commissioned after notification of proposed Regulations shall qualify to be termed as a Non-Fossil Fuel-based Co-Generation Project, if it is using new plant and machinery and is in accordance with the definition and also meets the qualifying requirement outlined below. Provided that use of fossil fuel is restricted:

Topping cycle mode of Co-Generation – Any facility that uses non-fossil fuel input for power generation and also utilizes the thermal energy generated for useful heat applications in other industrial activities simultaneously.

Provided that for the Co-Generation facility to qualify under topping cycle mode, the sum of useful power output and one half the useful thermal output should be greater than 45%¹ of the facility's energy consumption, during season.

Explanation - For the purposes of this Clause 'useful power output' shall mean the gross electricity output (in kWh) from the generator. (The gross electricity is derived by adding the Auxiliary Consumption in the Co-Generation Plant (e.g. in the boiler feed pump and the FD/ID fans) to the net electricity output);

'Useful Thermal Output' is the useful heat (steam) that is provided to the process by the Co-Generation Plant;

'Energy Consumption' of the Co-Generation Plant is the useful energy input that is supplied by the fuel.

- 4.2.7** Non-fossil fuel based non-qualifying Co-Generation (NFNQC) that does not fulfill the eligibility criteria and is commissioned after notification of these Regulations.
- 4.2.8** Solar PV, Solar Thermal Power Projects, Solar Rooftop PV systems and other small Solar Power Projects – based on Technologies approved by MNRE and commissioned after notification of proposed Regulations.
- 4.2.9** Municipal waste based power plants – based on Technologies approved by MNRE and commissioned after notification of proposed Regulations.
- 4.2.10** Hybrid Renewable Energy systems based on Renewable Energy technologies approved by MNRE like Wind-Solar Hybrid, Solar-Biomass Hybrid, and Solar-Cogeneration Hybrid and commissioned after notification of proposed Regulations.
- 4.2.11** Biomass Gasifier and Biogas based Power Projects based on technologies approved by MNRE and commissioned after notification of proposed Regulations.

¹ http://powermin.nic.in/acts_notification/captive_co_gener_plants_policy.htm

General Principles

5.1 Review Period

The Review Period in Principal RE Tariff Regulations, 2010 has been considered as five (5) financial years. It is proposed that the provision regarding the Review Period is retained and the Review Period for the proposed Regulations commencing from FY 2015-16 is of Five (5) years.

The Commission may review the norms on periodic basis within the review period to take account of any changes that may significantly affect the tariff design for any RE technology in the State of Maharashtra.

5.2 Tariff Period

The tariff period as specified in Principal RE Tariff Regulations, 2010 for RE Projects as under:

- 5.2.1** The Tariff Period for Renewable Energy Power Projects except in case of Small Hydro Power Projects up to and including 5 MW, Mini/Micro Hydro Projects, Solar PV, Solar Thermal Power Projects, Solar rooftop PV and other small Solar Power Projects shall be thirteen (13) years.
- 5.2.2** In case of Small Hydro Power Projects up to and including 5 MW and Mini/Micro Hydro Projects, the Tariff Period shall be thirty five (35) years.
- 5.2.3** In case of Solar PV, Solar Thermal Power Projects, Solar rooftop PV and other small Solar Power Projects, the Tariff Period shall be twenty five years (25) years.

During the hearing process on various Orders related to RE Technologies post implementation of Principal RE Tariff Regulations, 2010, stakeholders submitted their views on the Tariff Period, & Levellization, and PPA terms considered for tariff determination. The same are compiled as follows:

Table 5: Comments received from stakeholders on Tariff Period

Parameter	Reference	Technology	Stakeholders	Stakeholders Comments
Tariff Period	Order in Case No. 6 of 2013	Wind energy	Kenersys India Private Ltd	Tariff period for wind energy should be 25 years (useful life of turbine)
		Wind energy	MSEDCL	Energy Purchase Agreement period may be extended to life of the Project.
	Order in Case No. 20 of 2010	Wind energy	InWEA	Project life of 20 years instead of 25 years may be considered.
		Wind energy	GE India Industrial Private Limited	The tariff levels to support low and medium wind speed turbines would be Rs.4.65 – 7.20 per kWh for WPD range of 400-200 W/sq.m.
Tariff Period & Levellization	Order in Case No. 100 of 2014	Wind energy	APP	To consider the PPA period for 25 years to eliminate the uncertainties.
		Wind energy	APP	The tariff period should either be equal to the life period i.e., of 25 years or levellization should be done for the tariff

Parameter	Reference	Technology	Stakeholders	Stakeholders Comments
				period i.e. 13 years.
		Wind energy	Maruti Wind Park (India) Ltd	To consider the Tariff period of minimum 20 years from Commercial Operation Date (COD) for Wind energy Plant.
		Wind energy	Welspun Renewables Energy Private Limited	To keep the tariff period valid for 25 years.
Tariff Period	Order in Case No. 100 of 2014	Non-Fossil Fuel-based Co-Generation	Cogen Association of India	Requested for determination of tariff for those Projects whose 13 years EPA tenure has been expired or in process of renewal of EPA.
Tariff Period of SHP below 5 MW	Order in Case No. 100 of 2014	Hydro Power	Mahati Hydro Power Vidarbha Pvt. Ltd	The tariff period for hydro Power Projects 1MW to 5MW is 13 years in uniformly with Projects greater than 5 MW.

Following is proposed in respect of Tariff Period for various RE technologies for the next review period commencing from FY 2015-16

- The Tariff Period for Wind Power, Biomass-based and Non-Fossil Fuel-based Co-Generation Projects shall be thirteen (13) years.
- The Tariff Period for Small Hydro Power Projects of capacity higher than 5 MW and upto & including 25 MW shall be thirteen (13) years.
- The Tariff Period for Small Hydro Power Projects of 5 MW capacity or less and for Mini/Micro Hydro Power Projects shall be thirty five (35) years.
- The Tariff Period for Solar PV, Solar Thermal, Solar Roof-top PV and other small Solar Power Projects shall be twenty five years (25) years..

5.3 Project Specific Tariff

Project Specific Tariff on case to case basis has been considered in Principal RE Tariff Regulations, 2010 for following types of Projects:

- 5.3.1 Municipal Waste based Projects
- 5.3.2 Projects based on any other new RE technologies approved by MNRE
- 5.3.3 Solar Thermal Power Projects in respect of which the Project Entities opt for a Project-specific tariff
- 5.3.4 Biomass Project other than that based on Rankine Cycle technology application with water cooled condenser.
- 5.3.5 Biomass Gasifier Project and Biogas based Projects
- 5.3.6 Hybrid RE Projects based on RE technologies approved by MNRE, such as Wind-Solar Hybrid, Solar-Biomass Hybrid, and Solar-Co-Generation Hybrid.

5.4 Tariff Structure

The Commission in Principal RE Tariff Regulation, 2010 considered the Tariff Structure for RE technologies as single-part tariff consisting of the following fixed cost components:

- (a) Return on equity;
- (b) Interest on loan capital;
- (c) Depreciation;
- (d) Interest on working capital;
- (e) Operation and maintenance expenses;

For Renewable Energy technologies having fuel cost component, like biomass Power Projects and Non-Fossil Fuel-based Co-Generation Projects, single-part tariff with two components, viz., fixed cost component and fuel cost component.

5.5 Tariff Design

In the Principal RE Tariff Regulations, 2010, it is specified that the tariff would be determined on levelized basis for all RE technologies for Tariff Period.

The levelized tariff approach is compared with various tariff determination mechanisms like front loaded tariff, back loaded tariff etc. Front loaded tariff meets the requirement of the RE Project developer at the same time it leads to significant cash flow impact for the utilities during initial period. Additionally, there is little incentive for the RE Project developer to continue with the existing energy purchase agreement with the Utility once the debt service obligations is served. The back-loaded tariff structure meets with the requirement of utility but, significant back-ending would impact Project cash flow and may not meet requirement of the Project lenders/investors.

CERC and some SERCs have adopted the levelized Tariff Design for Renewable Energy Projects. Therefore following is proposed in respect of Tariff Design for Renewable Energy for the next review period commencing from FY 2015-16:

- 5.5.1** The tariff shall be determined for the Tariff Period on levelized basis.
- 5.5.2** For Renewable Energy technologies having single-part tariff with two components, tariff shall be determined on levelized basis considering the year of commissioning of the Project for fixed cost component while the fuel cost component shall be specified on year of operation basis.
- 5.5.3** For levelized tariff computation, the discount factor equivalent to Post Tax weighted average cost of capital shall be considered.
- 5.5.4** Levelisation shall be carried out for the 'useful life' of the Renewable Energy Project while tariff shall be specified for the period equivalent to 'Tariff Period'.

5.6 Petition & proceedings for determination of Tariff:

- 5.6.1** The Commission may notify the generic preferential tariff on suo-moto basis pursuant to issuance of revised norms by Central Electricity Regulatory Commission at the beginning of each year of the Review Period for Renewable Energy technologies for which norms have been specified under the Regulations.

Further, that for the first year of Control Period, (i.e. FY 2015-16), the generic tariff on suo-moto basis may be determined within a period not exceeding three months from the date of notification of these Regulations.

- 5.6.2** A Petition for determination of Project specific tariff shall be accompanied by such fee as may be prescribed in the applicable Regulations and shall be accompanied by

- (a) Information in Forms 1.1, 1.2, 2.1 and 2.2 as the case may be, and as appended to these Regulations;
- (b) Detailed Project report outlining technical and operational details, site specific aspects, premise for Capital Cost and financing plan, etc.
- (c) A Statement of all applicable terms and conditions and expected expenditure for the period for which tariff is to be determined.
- (d) A statement containing full details of calculation of any subsidy and incentive received, due or assumed to be due from the Central Government and/or State Government. This statement shall also include the proposed tariff calculated without consideration of the subsidy and incentive.
- (e) Details of financial gain through REC or any other mechanism.
- (f) Any other information that the Commission requires the Petitioner to submit.

5.7 Despatch principles for electricity generated from Renewable Energy Sources:

In the Principal RE Tariff Regulations, 2010, it was specified that all Renewable Energy power plants except for biomass based power plants with installed capacity of 10 MW and above, and Non-Fossil Fuel-based Co-Generation plants shall be treated as ‘MUST RUN’ power plants and shall not be subjected to ‘merit order despatch’ principles. For the biomass based power Generating Station (Rankine cycle technology) with an installed capacity of 10 MW and above and Non-Fossil Fuel-based Co-Generation Projects it was specified that such Projects be subjected to scheduling and despatch code as specified under Indian Electricity Grid Code (IEGC) and CERC (Unscheduled Interchange and related matters) Regulations, 2009 including amendments thereto.

While specifying the above provision, the Commission considered that generation from RE sources such as wind, Solar, Small Hydro is non-firm in nature as they are critically affected by vagaries of nature. The Commission also considered that the use of the same needs to be maximized as and when such resources are available in order to optimally utilize the assets and maximize generation from such assets already installed.

In respect of Despatch principles for electricity generated from RE sources for the next review period commencing from FY 2015-16 is the following as proposed:

- 5.7.1 All RE power plants except for biomass based power plants and Co-Generation plants shall be treated as ‘MUST RUN’ power plants and shall not be subjected to ‘merit order despatch’ principles.**
- 5.7.2 The biomass based power Generating Station and Co-Generation Projects shall be subjected to scheduling and despatch code as specified under the State Grid Code (SGC) including amendments thereto.**
- 5.7.3 In case scheduling provisions for RE is provided by appropriate authority then the same are to be adopted for RE Projects in the state.**

5.8 General reporting requirements

It has been observed that adequate data related to RE Projects is not available with the

Nodal Agency which becomes crucial information while drafting the Regulations and limited data available in public domain has to be relied upon. Keeping this in view, it is proposed that the Distribution Licensees shall furnish the following quarterly information to MEDA, within a month of the close of the preceding quarter,

- a) details of source-wise RE capacity addition in MW;
- b) details of purchase of RE in MUs; and
- c) a statement of Energy Purchase Agreements (EPAs) entered into under these Regulations,

in addition to any other information that the Commission may stipulate from time to time. The Distribution Licensees shall also upload and update the above information on their websites on a quarterly basis, along with details of capacity addition in previous years.

Further the Commission or MEDA may from time to time stipulate any other financial, technical or other information required to be furnished by the RE Project entities, including information regarding RE Project performance parameters such as actual energy generated, monthly actual CUF and actual Auxiliary consumption, if applicable; and financial information such as Capital Cost, yearly O&M Expenses, details of loans and financing, and interest rate; etc

5. Financial principles

6.1 Debt Equity Ratio:

A debt : equity ratio of 70:30 has been generally adopted for financing RE Projects as it is considered to be in line with prudential norms for large infra Projects. The approach adopted by MERC, CERC and other SERCs for prescribing Debt Equity ratio for RE Projects is shown in the Table below:

Table 6: State wise comparative on Debt: Equity Ratio

Particulars	Reference	Debt Equity Ratio	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	70:30	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	70:30	70:30 debt equity ratio is considered to be good for long-term risk-averse investment like RE Projects which are usually covered under FIT regime.
Andhra Pradesh	APERC Wind Tariff Order in respect of "New Wind Based Power Projects, 2012 APERC Biomass Tariff Order dated 12-09-2011 APERC Order Dated 20-03-2004 / 31-03-2009	70:30	Adopted in line with CERC approach on debt equity ratio
Gujarat	GERC Wind Tariff Order (Order No.2 of 2012) GERC Order No. 4 of 2013	70:30	The Tariff Policy formulated by the Ministry of Power, Govt. of India, stipulates debt-equity ratio of 70:30 for Power Projects. GERC Multi Year Tariff (MYT) Regulations 2011 also provide that the debt-equity ratio should be kept at 70:30. CERC has also specified debt-equity ratio as 70:30 in the RE Regulations 2012. Hence, the Commission decided to retain the debt-equity ratio as 70:30.
Punjab	PSERC in the matter of Determination/Fixation of generic levlized generation tariff for various RE Technologies / Projects for the year 2014-15	70:30	Adopted in line with CERC approach on debt equity ratio
Rajasthan	RERC (RE Tariff) Regulations, 2014 on 24.02.2014 RERC Order194 & RERC Order154	70:30	The Debt-Equity ratio of 70:30 considered as per normative debt:equity ratio of 70:30 specified in the RERC Tariff Regulations 2009and also considering the normative debt:equity ratio considered by CERC and other SERCs.
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	70:30	Adopted in line with CERC approach on debt equity ratio

Some of the leading financial institutions have adopted the following approach in regards of the debt equity Ratio for RE Projects

Table 7: Approach of leading Financial Institutions on Debt: Equity Ratio

Financial Institution	Rural Electrification Corporation (REC)	Power Finance Corporation (PFC)
Approach	“The Debt Equity Ratio proposed for Private Sector borrowers is 70:30. Where Lead FI is funding on the basis of a different Debt Equity ratio, REC would follow the Debt Equity ratio being considered by the Lead FI, subject to maximum of 3:1. In case REC is the Lead FI, the Debt Equity ratio of 70:30 will be considered.” ²	To facilitate the early financial closure, implementation and commissioning of the Project, PFC will underwrite the total debt requirement of Project. PFC shall consider the Projects with Debt: Equity ratio of 70:30. However, PFC may consider higher D/E ratio in deserving cases as per extant policy of corporation applicable from time to time. ³ Further, PFC in its Guidelines for Funding Grid Connected Solar PV & Solar Thermal Private Sector Power Generation Projects has considered Debt: Equity ratio of 70:30. ^{4 5}

Analyzing the prevalent market practices, approaches of Central and others SERCs approving the financial parameters related to RE Power Projects and the approach of Financial Institutions while sanctioning loans for RE Projects, it is proposed that for the next review period starting from FY 2015-16, the normative debt equity ratio of 70:30 may be considered for the purpose of tariff determination.

6.2 Return on Equity (RoE)

The Electricity Act, 2003 under Section 61(d) mandates to fix a rate of return for equity that will not only attract investment but generate sufficient resources for further growth in the sector. The approach adopted by MERC, CERC and other SERCs for prescribing Return on Equity for RE Projects is shown in the table below:

² http://www.recindia.nic.in/download/Financing_Norms.pdf

³ <http://www.pfcindia.com/writereaddata/userfiles/file/Financial/Policy%20for%20Underwriting%20of%20Debt.pdf>

⁴

<http://www.pfcindia.com/writereaddata/userfiles/file/Services/Policy%20Guidelines%20for%20Funding%20Grid%20Connected%20Solar%20PV%20Private%20Sector%20Power%20Generation%20Projects.pdf>

⁵

[http://www.pfcindia.com/writereaddata/userfiles/file/Financial/2012-12-03%20\(31\)%20Guidelines%20for%20funding%20Grid%20Connected%20Solar%20Thermal%20Private%20Sector%20Power%20Generation%20Projects.pdf](http://www.pfcindia.com/writereaddata/userfiles/file/Financial/2012-12-03%20(31)%20Guidelines%20for%20funding%20Grid%20Connected%20Solar%20Thermal%20Private%20Sector%20Power%20Generation%20Projects.pdf)

Table 8: State wise comparative on RoE

Parameter	Reference	RoE	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Pre-tax 19% per annum for the first 10 years. Pre-tax 24% per annum 11th year onwards.	Post Tax Returns grossed up by prevailing tax rates during that year as per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	20% per annum for the first 10 years. 24% per annum 11th years onwards	Post Tax Returns grossed up by prevailing tax rates during that year
Andhra Pradesh	APERC Wind Tariff Order in respect of "New Wind Based Power Projects, 2012 APERC Biomass Tariff Order dated 12-09-2011 APERC Order Dated 20-03-2004 / 31-03-2009	16% exclusive of MAT/income tax. MAT/income tax will be a pass through over and above the tariff being fixed in the Order	To provide element of security and promote non-conventional Power Projects in State
Gujarat	GERC Solar Tariff Order (Order No.1 of 2012) GERC Wind Tariff Order (Order No.2 of 2012) GERC Order No. 4 of 2013	RoE as 14% per annum Post Tax	Commission had allowed MAT at the rate of 20.008% per annum for first 10 years and corporate tax at the rate of 32.445% per annum for the next 15 years
Punjab	PSERC in the matter of Determination/Fixation of generic levelized generation tariff for various Renewable Energy Technologies / Projects for the year 2014-15	RoE at 19% (pre-tax) per annum for the first 10 years and 24% (pre-tax) per annum from 11th year onwards	Post Tax Returns grossed up by prevailing tax rates during that year
Rajasthan	RERC (RE Tariff) Regulations, 2014 on 24.02.2014 RERC Order194 & RERC Order154	RoE as 16%	RoE has been computed by grossing up the base rate of 16% with tax rate equivalent to Minimum alternate Tax (MAT) for first 10 years from COD and normal tax rate for remaining years of the Project life.
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	19.85% pre-tax return on equity	Post Tax Returns grossed up by prevailing tax rates during that year

During the public hearing process for various Tariff Orders post implementation of Principal RE Tariff Regulations, 2010 the stakeholders have expressed their views in regards to the RoE related to RE Projects which are as follows:

Table 9: Comments received from stakeholders on RoE

Order Reference	Stakeholders	Comments
Order in Case No. 6 of 2013	Reliance Power Ltd	Developers should be ensured post-tax RoE of 16%. Considering the change in MAT rate over past years, the pre-tax Return on Equity should be 20% instead of 19%.
Order in Case No. 6 of 2013	Torrent Power and MYTRAH Energy	To consider pre tax RoE of 20% for initial 10 years and 24% from 11th year onwards to cover increasing tax rate which is

Order Reference	Stakeholders	Comments
	(India) Limited	also in line with CERC RE Tariff Regulation, 2012.
Order in Case No. 6 of 2013	Moser Baer	To consider a revised rate of return in line with CERC regulation by exercising powers of Commission under “Removal of Difficulties” as specified in regulation 77.1 of MERC RE Tariff Regulation.
Order in Case No. 6 of 2013	MSEDCL	Restore the RoE given to wind generators to 16% as per November 24, 2003 Order as investors were satisfied with the financial and economic viability at such rate of return.
Order in Case No. 10 of 2012	IWTMA	To consider the Pre-tax Return on Equity (RoE) as 20% per annum for the first 10 years on similar lines as the CERC (RE Tariff) Regulations, 2012.

In addition to RoE stakeholders have also expressed their opinion for applicable MAT rate for RE Projects which are in table below:

Table 10: Comments received from stakeholders on MAT

Order Reference	Stakeholders	Comments
Order in Case No. 20 of 2010	Rashtriya Chemicals & Fertilizers Ltd (RCF)	The MAT rate of 19.93% may be considered for determination of tariff.
Order in Case No. 20 of 2010	Welspun Renewable Energy Ltd	The MAT rate of 19.93% may be considered for determination of tariff.

In case of RE Projects the profit of the Project developers should be equal to RoE specified, as all other elements of tariff are pass through. But practically, the profit of the RE Project developer may be affected by many other factors like profits of non-core business carried out by the developer, any efficiency gains during the course of operation of Project and accordingly any incentive earned, etc. Further, for calculating pass through of income-tax to beneficiaries, it is always necessary to segregate the total income-tax paid by a company into core business and other business activities which may prove to be a difficult proposition. Another aspect of the post-tax approach is that there is no inducement for better tax planning. If tax is made pass through and a post tax RoE is allowed it leaves no room for tax management which may lead to unnecessarily overburdening the consumers.

Allowing pre-tax RoE by grossing it up with applicable income tax would incentivize the RE generators to do tax planning and will also reduce regulatory interface. Beneficiaries would be given a normative rate of return to enable them to make necessary provisions in their future cash flows. The returns for RE Projects may be specified in pre-tax terms alone and prevalent tax regime including recent and proposed revisions in MAT rate and/or corporate tax rate can be factored in while specifying pre-tax RoE.

It is proposed that the Return on Equity shall be computed at the base rate of 16% to be grossed up as per applicable tax rate. Further, the rate of return on equity shall be computed by grossing up the base rate with the tax rate equivalent to Minimum Alternate Tax (MAT) for first 10 years from COD and normal tax rate for remaining years of Project life.

6.3 Cost of Debt/Interest on long term loan & loan tenure

As per the present Regulations, 70% of the Project cost is funded through debt financing. MERC, CERC and several other SERCs also follow the same approach of allowing cost of debt at State Bank of India BPLR + 200 to 300 basis point for the purpose of tariff

calculation. The provisions by various SERCs related to cost of debt & loan tenure for RE Projects are summarized in the table below:

Table 11: State wise comparative on Interest on long term loan

Parameter	Reference	Loan tenure	Reason/ approach	Interest rates	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	10 years	Normative loan tenure in accordance to repayment schedule from the first year of COD of the Project and shall be equal to the annual Depreciation allowed	SBAR prevalent during the previous year plus 150 basis points	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	12 years	RE technologies have matured, FI/Banks are ready to lend for 12 years..	SBAR for first 6 months of preceding year + 300 basis points	Considering maturity of RE technologies and analysis of interest rates offered by leading FI/Banks on RE Projects. CERC has considered interest rates charged by IREDA &PFC for various RE Projects. Considering that the matured technologies, like: wind,co-gen and Small hydro Projects, are being financed around the normative rate
Gujarat	GERC Wind Tariff Order (Order No.2 of 2012) GERC Order No. 4 of 2013	10 years	adopted from its last tariff Order	12.86 - 13.00%	Commission has noted that banks are now following the base rate system after the RBI guidelines. While all banks have their own base rates, the Project financing interest rates are typically indicated by the SBI base rate. The Commission further noted that the SBI base rate was constant for over a year and then reduced from 20 September 2012. Therefore, to accommodate the recent changes in SBI base rate, the Commission decided to consider the weighted average base rate of FY 2012-13, which is 9.86%.
Andhra Pradesh	APERC Wind Tariff Order in respect of "New Wind Based Power Projects, 2012	10 years	Normative loan tenure	12.30% for Wind Power Projects & 12% for biomass	SBI PLR for first 6 months of preceding year + 300 basis points in lines of CERC regulation for Wind Projects & for biomass Projects APERC considered submissions of

Parameter	Reference	Loan tenure	Reason/ approach	Interest rates	Reason/approach
	APERC Biomass Tariff Order dated 12-09-2011 APERC Order Dated 20-03-2004 / 31-03-2009			Projects	BEDA and the current cost of debt
Rajasthan	RERC (RE Tariff) Regulations, 2014 on 24.02.2014 RERC Order194 & RERC Order154	12 years for wind energy 10 years for biomass energy	Normative loan tenure	300 basis points + SBI base rate of 13% for wind energy For biomass energy 12.71%	SBI PLR for first 6 months of preceding year + 300 basis points on lines of CERC regulation for Wind Power Projects. The repayment of loan has been taken equal to the Depreciation allowed for that year as stipulated at regulation 22(3) of Tariff Regulations, 2009.
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	10 years	considering loan tenure for loans generally sanctioned by Financial Institutions like IREDA stipulated this tenure hence adopted	12.25%	IREDA stipulated this rate hence adopted

The interest rates offered by the leading NBFCs which are specific lending institutions for promoting Renewable Energy Projects in India. IREDA, REC & PFC are the top NBFC providing debt at interest rate ranging between 11 to 14 percent with payment term between 8 to 12 years for RE Projects in India based on the maturity of the RE technology and the credit worthiness of the borrower.

Table 12: Approach of Leading Financial Institutions on Loan Tenure and Interest Rate

FI/NBFC	IREDA ⁶	PFC ⁷	REC ⁸
Interest rates	11.50% to 13.25%	12% to 13.70%	11.50% to 13.50%
Loan tenure	8-10	8-10	10-12

⁶ <http://www.ireda.gov.in/forms/contentpage.aspx?lid=740>

⁷ http://www.pfcindia.com/writereaddata/userfiles/file/LendingRates/PFC%20website%2007_07_2014.pdf

⁸ http://www.recindia.nic.in/download/lpc_181113_int.pdf

During the public hearing process for various Tariff Orders post implementation of Principal RE Tariff Regulations, 2010 the stakeholders have made submissions in regards of the interest cost related to RE Projects is compiled as follows:

Table 13: Comments received from stakeholders on Long Term Loan

Parameter	Reference	Stakeholders	Comments
Int. on Loan & working capital	Order in Case No. 6 of 2013	InWEA	To continue with the methodology adopted in MERC RE Tariff Regulations, 2010,
	Order in Case No. 6 of 2013	Mytrah Energy	It will only be appropriate for the Commission to invoke its power under Regulation 77 to remove difficulties and consider the normative interest on Long Term Loan at 13.73%.
	Order in Case No. 6 of 2013	IWTMA and Inox Renewable Energy Ltd	To consider Interest rate with a spread of 400 basis points to SBI average base rate Also requested the Commission to consider IREDA or PFC rate.
	Order in Case No. 6 of 2013	Orient Green Power Co. Ltd. and Kalyani Renewable Energy India Ltd	To consider the rate of interest on loan as 15% to 17%.
	Order in Case No. 6 of 2013	Maha Co-Gen Green Power Producers Association	To consider the interest rate of at least 14.5% to 15% per annum.
	Order in Case No. 6 of 2013	Maharashtra Rajya Sahakari Sakhar Karkhana Sangh Ltd	To increase interest rate in the range of 14% to 15% per annum as against 12.87% and 13.37% considered by Commission.
	Order in Case No. 6 of 2013	Yash Agro Energy Ltd. And GMT Mining & Power Pvt. Ltd	Actual interest rate from its term lenders is 14.5 – 15.25% pa
	Order in Case No. 6 of 2013	InWEA and Green Energy Pvt. Ltd	Considering the correlation between Bank Advance Rate and Base Rate, requested to continue with the existing methodology
	Order in Case No. 10 of 2012	IWTMA	To consider interest rate of 13.56% for long-term loan
	Order in Case No. 10 of 2012	ReGen Powertech	To modify the Interest on loan Capital as SBI Base Rate + 600 basis points, to account for the wide difference in rates between SBI PLR and SBI Base Rate.
	Order in Case No. 10 of 2012	Bharat Forge	To consider average interest rate for complete financial year (i.e. ,from April 1, 2011 to March 31, 2012) by assuming the latest rate for the remaining period
	Order in Case No. 39 of 2011	Celerity Power	It is difficult to obtain loans / finance from the State Bank of India for the Small Hydro Power Projects and must consider the actual interest rate applicable on the loan obtained by Celerity Power / other small hydro power developers.
Int. on loan	Order in Case No. 45 of 2012	Maharashtra Biomass Energy Developers Association	Interest rates on Long Term and Short term loans may be considered between 14-15 % per annum; as Currently Banks & Financial Institutions are lending money at an interest rate of 14 to 14.5% per annum or even higher for short Term and Long Terms Loans.

Analyzing the comments received from various stakeholders, the approach adopted by CERC, MERC in its various Orders and other SERCs and also the lending policy followed by some of the leading financial institutions it can be observed that as RE technology are achieving maturity their financing norms are converging to that of conventional Projects however there are still considerable risks associated with RE Projects and it is still difficult to get finance at lower interest rates. The maturity of technology may have prompted longer lending tenure

Following options are available for prescribing the norms related to interest cost and loan tenure

- (a) SBAR prevalent during the previous year plus basis points to cover the risks
- (b) Average rate of interest on the basis of actual loan, actual interest rate and scheduled loan repayment offered by leading NBFCs

As per the guidelines issued by the RBI dated 1 July, 2010 related to interest rates on loan advances, all banks have been directed to switch over to the system of Base Rate with effect from 1 July, 2010 by replacing the existing Benchmarking Prime Lending Rate (BPLR)⁹ [also known as Advance Rate, which is referred to in the Principal RE Tariff Regulations, 2010].

It is proposed that for the next review period starting from FY 2015-16 the normative interest rate may be considered as SBAR prevalent during the previous year plus basis points to cover the risks. The historical data for SBAR is as follows:

Table 14: computation of Weighted Average Base Rate

Period	Base Rate ¹⁰	No of days
01 April 2014 to 31 June 2014	10.00%	92
01 July 2014 to 30 September 2014	10.00%	91
Weighted Average Base Rate	10.00%	

Further, to factor in the concerns for lending to RE Projects, it is proposed that a spread of 300 basis points above the average Base Rate of State Bank of India to arrive at normative interest rate for loan financing of the RE Projects for the purpose of Tariff calculation for the for RE technologies for the next review period commencing from FY 2015-16.

⁹ http://www.rbi.org.in/scripts/BS_ViewMasCirculardetails.aspx?id=5816#a9

¹⁰ <http://rbi.org.in/rbi-sourcefiles/lendingrate/LendingRates.aspx#>

It is further proposed that the loan tenure (excluding moratorium period) the repayment of loan shall be of 12 years and to be considered from the first year of commercial operation of the Project and shall be equal to the annual Depreciation allowed.

6.4 Depreciation

In regulatory practice the Depreciation is normally considered a cash flow available for repayment of loan. The approach adopted by CERC and other SERCs for prescribing Depreciation norms for RE Projects is summarized in the following table:

Table 15: State wise comparative on Interest on Depreciation

Parameter	Reference	Depreciation	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Depreciation rate 7% per annum for first 10 years (loan tenure period) and remaining Depreciation to be spread over remaining useful life from 11th year onwards	Differential Depreciation approach using 'SLM' over two distinct periods comprising loan tenure and period beyond loan tenure over useful life Depreciation to be spread over remaining useful life as per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	Depreciation rate for first 12 years shall be 5.83% per annum & the remaining depreciation shall be spread over the remaining useful life from 13 th year onwards.	Differential Depreciation approach over useful life computed on 'SLM'. Depreciation rate in consideration to loan tenure of 12 years for matured technologies
Andhra Pradesh	APERC Wind Tariff Order in respect of "New Wind Based Power Projects, 2012 APERC Biomass Tariff Order dated 12-09-2011 APERC Order Dated 20-03-2004 / 31-03-2009	7.84% per annum for the first 8 years, shall be 7.28% in the 9th year and a further Depreciation of 20% shall be spread equally over the next 11 years in case of Biomass energy & 4.5% for 1st 10 years and 3% from 11th year onwards on straight line basis in case of Wind Power Project	To accord with the repayment of term loan and to provide adequate cash accruals for such debt service based on differential Depreciation approach over the useful life computed on 'SLM'
Gujarat	GERC Wind Tariff Order (Order No.2 of 2012) GERC Co-Generation Projects Order No. 4 of 2013	6% per annum for the first 10 years, and 3% from 11th to 20th year	As a promotional measure and to facilitate the loan repayment, the Commission has considered higher Depreciation rate at 6% per annum during the loan repayment period of 10 years.
Rajasthan	RERC (Re Tariff) Regulations, 2014 on 24.02.2014 RERC Order 194 & RERC Order 154	5.28% of the total Project cost for the first 12 years and remaining depreciable value has been spread over the balance useful life of the Power Project and transmission system	Differential Depreciation approach over useful life computed on SLM.

Parameter	Reference	Depreciation	Reason/approach
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	4.5% per annum for Depreciation on 85% (cost of plant & machinery) 85% of the Capital Cost is attributable to plant & machinery cost, 10% for civil works and 5% for land cost	Assuming a life period of 20 years and residual value of 10%

During the public hearing process for Tariff Order post implementation of Principal RE Tariff Regulations, 2010 the stakeholders have expressed their views in regards of the Depreciation rate related to RE Projects which are as follows:

Table 16: Comments received from stakeholders on Depreciation

Reference	Stakeholders	Comments
Order in Case No. 6 of 2013	Orient Green Power Company limited	To retain existing rate of Depreciation
Order in Case No. 6 of 2013	Maharashtra Rajya Sahakari Sahkar Karkhana Sangh Ltd.	To consider minimum 10% Depreciation as against 7% considered by Commission.

It has been observed that ‘Differential Depreciation Approach’ using SLM over two distinct periods comprising loan tenure and period beyond loan tenure over useful life for the purpose of tariff determination is a well accepted approach and has been adopted by CERC and other SERCs. Options of Depreciation rate in relation to the debt service coverage are as follows:

- (a) Higher Depreciation rate of 7% per annum for first 10 years and balance Depreciation to be spread during remaining useful life
- (b) Lower Depreciation rate of 5.83% per annum for first 12 and balance Depreciation to be spread during remaining useful life

Depreciation has been made equivalent to the loan repayment requirement for first 12 years considering that most of the RE technologies have achieved maturity level, and it is now possible for the developers to get loan from lenders for longer duration up to 12 years, it is proposed that Depreciation is to be allowed up to a maximum of 90% of the Capital Cost of the asset and at a lower Depreciation rate of 5.83% per annum for first 12 years and balance Depreciation to be spread during remaining useful life is adopted for the purpose of tariff determination for the next review period starting from FY 2015-16.

6.5 Interest on Working Capital

The Working Capital is determined based on fuel stock, inventory of maintenance spares, operation and maintenance cost and receivable depending on type of RE technology. The

provisions of CERC and other SERCs for allowing interest on working capital for the purpose of tariff computation for RE Projects are summarized as follows:

Table 17: State wise comparative on Interest on Interest on Working Capital

Parameter	Reference	Interest on working capital	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	13.23% for third year of the Review Period (i.e., FY 2012-13)	Based on the State Bank Advance Rate for second year of the first review Period (i.e., FY 2011-12) shall continue to be applicable for the third year of the Review Period (i.e. FY 2012-13) as per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	13.50% (Base Rate of SBI + 350 Basis Points)	Fuel costs for four months equivalent to normative PLF, O&M Cost & Maintenance spares, receivables for 2 months in line with conventional Power Projects. As regards Fuel cost, the Commission is of the view that the provision made of four months seems appropriate as not all biomass power plants procure biomass for more than six months
Andhra Pradesh	APERC Wind Tariff Order, 2012 APERC Biomass Tariff Order dated 12-09-2011 APERC Order Dt 20-03-2004 / 31-03-2009	12% - 12.8%	Working capital has been adopted on the lines of the CERC Regulations for Wind Projects & In view of submission made by BEDA and the current cost of debt for biomass Projects.
Gujarat	GERC Order No.2 of 2012 GERC Order No. 4 of 2013	11.86%- 12.00%	Commission had considered interest on working capital equal to 50 basis points lower than that of interest on Long Term Loan considering that the working capital is recurring and is required for a shorter time period.
Rajasthan	RERC (RE tariff) Regulations, 2014 RERC Order194 & RERC Order154	12.21%	Based on SBI PLR, 250 basis points higher than the average of SBI Base rate. Commission considers working capital is recurring and is required for a shorter time period.
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	12.50%	As per data available on IREDA website

During the public hearing process for various Tariff Orders post implementation of Principal RE Tariff Regulations, 2010 related to RE the stakeholders have expressed their views in regards of the interest cost related to RE Projects which is compiled as follows:

Table 18: Comments received from stakeholders on Interest on Working Capital

Parameter	Reference	Stakeholders	Comments
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Parameter	Reference	Stakeholders	Comments
Int. on Loan & working capital	Order in Case No. 6 of 2013	InWEA	To continue with the methodology adopted in MERC RE Tariff Regulations, 2010,
		IWTMA and Inox RE Ltd	Interest rate on working capital should be 50 basis points above the interest rate on loans. Also requested the Commission to consider IREDA or PFC rate.
		Orient Green Power Company Ltd and Kalyani RE India Ltd	To consider the rate of interest working capital as 15% to 17%.
		Maha Co-Gen Green Power Producers Association	To consider the interest rate of at least 14.5% to 15% per annum.
		MRSSKSL	To increase interest rate in the range of 14% to 15% per annum as against 12.87% and 13.37% considered by Commission.
		Yash Agro and GMT Mining & Power Pvt. Ltd	Actual interest rate on working capital is 14.5 – 15.00% pa which may please be considered.
	Order in Case No. 10 of 2012	InWEA and Green Energy Pvt. Ltd	Considering the correlation between Bank Advance Rate and Base Rate, the Commission may continue with the existing methodology
		IWTMA	To consider interest rate of 13.06% for working capital.
		ReGen Powertech	To modify the Interest on Working Capital as SBI Base Rate + 550 basis points, to account for the wide difference in rates between SBI PLR and SBI Base Rate.
		GAPS Power	To consider the interest on working capital as average Base Rate of SBI+450 basis points, since, the interest rate has increased considerably in the last one year.
		Bharat Forge	To consider average interest rate for complete financial year (i.e.,from April 1, 2011 to March 31, 2012) by assuming the latest rate for the remaining period
	Order in Case No. 39 of 2011	Celerity Power	It is difficult to obtain loans / finance from the State Bank of India for the Small Hydro Power Projects and must consider the actual interest rate applicable on the loan obtained by Celerity Power / other small hydro power developers.
Order in Case No. 100 of 2014	GAPS Power and Infrastructure Ltd	To revise the interest in the working capital taking into account fuel stock of 6 months and also maintenance spares to the extent of 15.00% of O & M Expenses.	
		To revise the interest in the working capital taking into account fuel stock of 6 months and also maintenance	
Order in Case No. 6 of 2013	GAPS Power and Infrastructure Ltd	To revise the interest in the working capital taking into account fuel stock of 6 months and also maintenance	

Parameter	Reference	Stakeholders	Comments
			spares to the extent of 15.00% of O & M Expenses.

It is seen that working capital is a recurring and short term requirement used to manage the day to day operational requirements of the RE Projects, and hence the interest cost attached to working capital may be lower than the long term debt. This can be observed from the interest on working capital rate allowed by CERC and other SERCs as compared to the interest rate allowed on the Long Term Loan.

It is therefore proposed that for the next review period starting from FY 2015-16 the interest rates on working capital for the purpose of tariff determination shall be considered as State Bank Base Rate, plus 350 basis points.

6.6 Calculation of Weighted Average Cost of Capital (Discount Factor):

MERC, under Regulation 10.2 of the Principal RE Tariff Regulations, 2010 has specified that discount factor equivalent to normative weighted average cost of capital (WACC) shall be considered for the purpose of levellization of tariff. However, in the Regulations for the second Control Period, CERC has specified discount factor equivalent to post-tax weighted average cost of capital for tariff levellization purpose.

Under the existing provision of normative WACC in the Principal RE Tariff Regulations, 2010 the discount rate was computed as pre-tax Weighted Average Cost of Capital (WACC). The WACC was computed as under:

$$\text{WACC} = \text{Cost of Debt} + \text{Cost of Equity}$$

Where,

$$\text{Cost of Debt} = \text{Normative Debt} \times (\text{Normative Rate of Interest})$$

$$\text{Cost of Equity} = \text{Normative Equity} \times (\text{Pre Tax Return on Equity})$$

CERC has specified to use post tax WACC for the determination of levellized tariff in the new Control Period, based on the understanding that while taking the investment decisions the developer considers post tax WACC as the discount rate to post tax incremental cash flows to arrive at Net Present Value of the Project. The RE Project developers are interested in only in the return on post tax basis. Further, in case of Pre-Tax RoE the gains or losses on account of any change in tax rate, MAT or Corporate Tax, as the case may be, have to be borne by the RE Project developer if the returns have been regulated in pre-tax terms. CERC has specified the WACC computation formula as under:

$$\text{Post Tax WACC} = \text{Cost of Debt} + \text{Cost of Equity}$$

Where,

$$\text{Cost of Debt} = \text{Normative Debt} \times (\text{Normative Rate of Interest}) \times (1 - \text{Corporate Tax rate})$$

$$\text{Cost of Equity} = \text{Normative Equity} \times (\text{Post Tax Return on Equity})$$

Use of post tax WACC as discounting factor and effect on RE tariff: Using Post Tax WACC as discounting factor would result in lower levelized tariff as compared to Pre Tax WACC as discounting factor. The following example shows how the discounting rate would change

Table 19: Calculation of WACC

Parameter for Wind Project	Unit	Value
Project cost per MW	Rs. Lakh/MW	594.6
CUF	%	22%
Equity	%	30%
Debt	%	70%
Interest rate	%	13%
Mat rate	%	20.096%
Corporate Tax rate	%	33.99%
Plant life	Years	25
RoE for 10 years	%	20.00%
RoE for Remaining life	%	24.00%
Weighted average RoE	%	22.00%

WACC (Pre-tax)	15.70%
Cost of debt	9.10%
Cost of equity	6.60%
WACC (Post Tax)	11.28%
Cost of debt	6.01%
Cost of equity	5.3%

Using Post Tax WACC as discounting rate would reflect realist approach in for tariff determination and hence, it is proposed that the Post Tax WACC is used as Discounting Factor for the purpose of Tariff determination for the RE Projects the next review period commencing from FY 2015-16.

6.7 Taxes & Duties on Sale of Power

The provisions of CERC and other SERCs in respect of taxes and duties other than income tax are as follows:

Table 20: State wise comparative on Taxes on duties

Parameter	Reference	Taxes and Duties	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Pass through on actual incurred basis	As per MERC RE Tariff Regulations 2010
CERC	CERC (RE Tariff) Regulations, 2012	Tariff determined under the Regulations is exclusive of taxes (other than corporate tax and MAT) and duties as may be levied by the appropriate Government. Tariff exclusive of taxes and duties, pass through allowed on actual basis	Taxes and duties are State subject
Andhra Pradesh	APERC Order Dated 20-03-2004	Pass through on actual incurred	Taxes and duties are

Parameter	Reference	Taxes and Duties	Reason/approach
	/ 31-03-2009 APERC Wind Tariff Order 2012 APERC Biomass Tariff Order dated 12-09-2011	basis	State subject
Gujarat	GERC Order 1 of 2012 Jan 27, 2012 GERC Order No.2 of 2012, Aug 8, 2012) GERC Order No. 4 of 2013	Pass through on actual incurred basis	Taxes and duties are State subject
Rajasthan	RERC (RE Tariff) Regulations, 2009, Draft Tariff Order on Wind Projects for FY 2012-13	Pass through on actual incurred basis	Taxes and duties are State subject
Karnataka	Order for determination of tariff for RE sources (Dec. 11,2009)	Pass through on actual incurred basis	Taxes and duties are State subject
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	Pass through on actual incurred basis	Taxes and duties are State subject

In respect of levy of taxes and duties for RE Projects, Principal RE Tariff Regulation, 2010 stipulates as follows

Tariff determined under the Regulations shall be exclusive of taxes and duties on generation and sale of electricity from RE Project as may be levied by the appropriate Government:

Provided that the taxes and duties levied by the appropriate Government on generation and sale of electricity from RE Project shall be allowed as pass through on actual incurred basis.

It is proposed that the aforesaid provisions are continued with for the next review period starting from FY 2015-16 for the purpose of tariff determination

6.8 Subsidy or incentive by Central/State Government

The provisions of CERC and other SERCs in relation to subsidy or incentive are as follows:

Table 21: State wise comparative on Interest on subsidy or incentive

Parameter	Reference	Subsidy
Maharashtra	MERC Order in Case no. 100 of 2014	To take into consideration any incentive or subsidy offered by the Central or State Government, including accelerated Depreciation benefit if availed by the generating company, for the Renewable Energy power plants
CERC	CERC (RE Tariff) Regulations, 2012	
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009 APERC Wind Tariff Order 2012 APERC Biomass Tariff Order dated 12-09-2011	
Gujarat	GERC Order 1 of 2012 Jan 27, 2012 GERC Order No.2 of 2012, Aug 8, 2012) GERC Order No. 4 of 2013	
Rajasthan	RERC (RE Tariff) Regulations, 2009, Draft Tariff Order on Wind Projects for FY 2012-13	
Karnataka	Order for determination of tariff for RE sources (Dec, 11,2009)	
Tamil Nadu	TNERC Tariff Order No. 6 of 2012, 7 of 2012 and 8 of 2012	

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related on subsidy and incentives for RE Power Projects are as follows:

Table 22: Comments received from stakeholders on subsidies & incentive

Parameter	Reference	Stakeholders	Stakeholders Comments
Accelerated Depreciation (AD)	Order in Case No. 100 of 2014	Welspun Renewables Energy Private Limited	Requested the Commission to decide whether AD should continue to be given to attract investors in the sector considering the fact that the sector is already around 4 years old.
Subsidy or incentive by Central/ State Government and sharing of CDM Benefits	Order in Case No. 100 of 2014	MSEDCL	To consider various facilities availed by investors such as capital subsidy /grants /incentives provided to non-conventional sources and Electricity Duty exemption while determining the tariffs and may adopt the policy of CDM benefits as recommended by the Forum of Regulators.

Apart from promotional Feed in Tariff, MUST RUN status, Renewable Purchase Obligation (RPO), etc., there are several other incentives that are offered for Renewable Energy developers.

For Wind Energy includes 80 per cent accelerated Depreciation on equipments in the first year, 100 per cent Tax Holiday on the earnings for 10 years, over a 15 year period to be taken consecutively (Section 80IA of Income Tax Act)¹¹, concessional customs duty on selective imported equipment and excise duty exemption. Government has also re-introduced generation based incentive (GBI)¹² till 2017 in parallel with existing fiscal incentives over and above Feed in Tariff approved by SERCs.

For Solar energy sector, incentives includes 10-year tax holiday for photovoltaic (PV) and thermal Solar plants set up by 2020, reduced customs duty and zero excise duty on specific capital equipment, critical materials and Project imports, besides loans at promotional interest rates.

¹¹ <http://indiabudget.nic.in/ub2014-15/fb/bill1.pdf>

¹² [http://ireda.gov.in/writereaddata/Revised%20Operational%20Guidelines%20for%20Grid%20Connected%20Wind%20Power%20Projects%20under%20Extension%20GBI%20Scheme%20\(2012-2017\)\(1\).pdf](http://ireda.gov.in/writereaddata/Revised%20Operational%20Guidelines%20for%20Grid%20Connected%20Wind%20Power%20Projects%20under%20Extension%20GBI%20Scheme%20(2012-2017)(1).pdf)

For Biomass and Cogeneration Projects there are provisions of capital subsidy.

In respect of subsidies and incentives the Principal RE Tariff Regulation, 2010 provides that the Commission may take into consideration any incentive or subsidy offered by the Central or State Government, including accelerated Depreciation benefit if availed by the generating company, for the Renewable Energy power plants while determining the tariff and will consider the following principles for ascertaining income tax benefit on account of accelerated Depreciation, if availed, for the purpose of tariff determination:

- (a) Assessment of benefit shall be based on normative Capital Cost, accelerated Depreciation rate as per relevant provisions under Income Tax Act and corporate income tax rate.*
- (b) Capitalisation of RE Projects during second half of the fiscal year.*
- (c) Per unit benefit shall be derived on levelled basis at discount factor equivalent to weighted average cost of capital.*

The Principal RE Tariff Regulation, 2010 further provides that in case any Notification of Central Government or State Government specifically provides any Generation based Incentive over and above tariff, the same shall not be factored in while determining Tariff.

It has been observed that while for purpose of tariff calculation the Project is assumed to be commissioned and operating for full year, however for accounting the benefits of accelerated Depreciation the Project is assumed to be have commissioned in second half of the year and hence the capitalization of the RE Project is done only during second half of the year.

It is proposed that the following provisions related to subsidy/incentives are adopted for the next review period starting from FY 2015-16 for the purpose of tariff determination.

The principles shall be considered for ascertaining income tax benefit on account of accelerated Depreciation, if availed, for the purpose of tariff determination:

- (a) Assessment of benefit shall be based on normative Capital Cost, accelerated Depreciation rate as per relevant provisions under Income Tax Act and corporate income tax rate.**
- (b) Capitalisation of RE Projects during for the full fiscal year.**
- (c) Per unit benefit shall be derived on levelised basis at discount factor equivalent to weighted average cost of capital.**

Further that in case any Notification of Central Government or State Government specifically provides for any Generation based Incentive over and above tariff, the same shall not be factored in while determining Tariff.

6.9 Rebate

The Principal RE Tariff Regulations, 2010 specified the following provisions in respect of Rebate:

- (a) For payment of bills of the generating company through letter of credit, a rebate of 2% shall be allowed.

- (b) Where payments are made other than through letter of credit within a period of one month of presentation of bills by the generating company, a rebate of 1% shall be allowed.

It is proposed that the aforesaid provisions regarding rebate on payment of bills to the generating companies may be continued with for the next review period commencing from FY 2015-16

6.10 Late payment surcharge

The Principal RE Tariff Regulations, 2010 specified the following provisions in respect of late payment surcharge:

In case the payment of any bill for charges payable under the Regulations is delayed beyond a period of 60 (sixty) days from the date of billing, a late payment surcharge at the rate of 1.25% per month shall be levied by the generating company.

It is proposed that the provisions regarding late payment surcharge to the generating companies specified in the Principal RE Tariff Regulations, 2010 may be continued with for the next review period commencing from FY 2015-16

6.11 Sharing of CDM Benefits

In consideration of the fact that the CDM related market has slowed and not many new Projects are achieving CDM status.

Principal RE Tariff Regulation, 2010 provide as follows in respect of sharing of CDM benefits:

- (a) All risks, costs and efforts associated with the availing of carbon credits shall be borne by the generating company.
- (b) Further, the entire proceeds of carbon credit from approved CDM Project, if any, shall be retained by the generating company.

It is proposed that the aforesaid provisions as specified in the Principal RE Tariff Regulations, 2010 may be continued for the Review Period commencing from 2015-16.

6.12 Reactive Energy Charges

RE generation has increased substantially during past few years and forms a significant proportion of the total generation in the grid. Reactive power is needed to compensate the reactive power requirement of the system and improve the voltage profile of the system.

Most of the wind generators, being induction type are absorbing substantial reactive power during startup and some reactive power during normal operating condition. Due to intermittent characteristic of wind, generator start up takes place multiple times during a day, resulting in huge quantum of reactive power absorption from the grid and causing voltage variation.

The source of reactive power compensation in the power system is by way of providing Capacitors or kVARh generation by power generators. Hence, if required reactive power is

not supplied by the generator, then it is to be supplied by the utility and it creates extra burden on the utility. Therefore, there should be provision for the RE generator to supply reactive power in the system for reactive power compensation of the system, so that the effect of reactive power generation will be for the system as a whole and not for specific point of location.

There have been several cases in Maharashtra, Gujarat and Tamil Nadu where stakeholders have raised concerns over reactive power consumption and related compensation to the off taker. The summary is as follows:

Table 23: Comments received from stakeholders on Reactive Energy Charges

Order No.	Name of the Party	Comment	Commission's Ruling
MERC Order in Case No. 39 of 2011,	MSEDCL	RE generators should be penalized for not maintaining the levels of reactive power and harmonics as permitted in the State Grid Code.	In case of Wind Power Projects: Reactive energy charge at the rate of Rs 0.10/RkVAh shall apply for reactive energy consumption up to 10% of the active energy delivered to the grid by the Generators. The reactive energy consumption in excess of 10% of active energy delivered to the grid shall be payable at the rate of Rs 0.25/RkVAh. In case of biomass Power Projects and Non-Fossil Fuel-based Co-Generation Projects, the Project will supply reactive power (RkVAh) equivalent to at least 36% of the active power (kWh) supplied to the grid on a monthly basis. In case of failure to do so, the STU/Licensee shall charge the shortfall at the rate of Rs 0.25/RkVAh, or such other rate as may be stipulated by the Commission from time to time. The Commission has decided to constitute a working group comprising technical experts to study the issue of harmonic distortion in power system.
MERC Order in Case No. 10 of 2012	MSEDCL	RE generators should be penalized for not maintaining the levels of reactive power and harmonics as permitted in the State Grid Code.	The Commission observes that the issue of incentive and dis-incentive mechanism for associated harmonic content and reactive power injection/drawl will have to be addressed upon detailed study taking into consideration RE Technology-specific conditions and compensation requirement of the Grid. Further, performance norms/standards will have to be developed in conformity with relevant Grid Connectivity Standards for each type of RE system to be formulated by Central Electricity Authority. The Commission opines that technical issues in the matter needs to be deliberated at forum such as Grid Co-ordination Committee and suitable action plan may be proposed within three months from issuance of this Order.

Order No.	Name of the Party	Comment	Commission's Ruling
MERC Order in Case No. 100 of 2014	MSEDCL	Commission may levy reactive power charges from renewable sources consistent with the Transmission tariff Order and reactive energy pricing should be uniform for all types of renewable sources.	Commission in its earlier Orders (Ref. Case No. 10 of 2012 & Case No. 6 of 2013) had already observed that a detailed technical study and reactive energy compensation is necessary. Accordingly, vide the said Orders, MSEDCL was directed to undertake a technical study and propose its recommendation in consultation with Grid Co-ordination Committee within a period of 4 months from issuance of the later Order. MSEDCL further submitted that the matter is complex in nature and hence is taking time. MSEDCL is yet to submit the report of the Committee to the Commission.
GERC Order No. 2 of 2012,	----	One of the objectors requested to consider the pricing of reactive energy on a net basis i.e. the reactive power import minus export. Further, in the case of third party sale of wind energy, such reactive energy charges should be added to the monthly bill of the third party purchaser, and not to the wind energy generator. One of the utilities suggested that by considering the all around price rise, the upward revision of reactive energy charges may be considered.	Export of reactive power does not always help the transmission network as it is linked with the level of voltage at the time of such export into the grid. Incremental impact of overall prices on reactive energy charges will be discussed in the Commission's transmission tariff order. "10 paisa/kVARh – For the drawl of reactive energy at 10% or less of the net energy exported. 25 paisa/kVARh – For the drawl of reactive energy at more than 10% of the net active energy exported
TNERC Order No. 8 of 2012, Page 35	Biomass Power Producers Association	Requested the Commission to ensure efficient reactive energy management by the distribution Licensees.	The Commission in its Order in 2 of 2012 dated 30-03-2012 has fixed Reactive Power Charges at 10 Ps/kVARh for 2012-13 and escalated at 0.5 paisa/kVARh annually. The Commission decides that the Reactive Power Charges shall be as per the above Orders of the Commission, as amended from time to time.
TNERC Order No 6 of 2012,	M/s.ReGen Powertech Pvt. Ltd. Tamil Nadu Generation and Distribution Corporation Ltd.	Reactive Energy charges of Rs.0.1/RkVAh may be considered. The Reactive Power Charges may be fixed equal to the Generation cost of Wind Energy. It is to be noted that the existing rate of 25 paisa and 50 paisa is cost effective to the generator instead of installing reactive power control measures.	Due to inherent characteristics, the induction type wind energy generators are prone to draw reactive power from the grid, if adequate power factor correction is not applied. During the wind season, wind energy generators contribute to about 30% of the grid demand and in such a situation grid stability will be jeopardized, if the wind energy generators are allowed to draw reactive power from the grid. Therefore, the Commission decides to retain the charges proposed in Order No.1 dated 20-03-2009. Thus, 25 paisa per kVARh will be levied on wind energy generators, who draw reactive power up to 10% of the net active energy generated. Anyone drawing in excess of 10% of the net active energy generated will be liable to pay

Order No.	Name of the Party	Comment	Commission's Ruling
			double the charge.

MERC Ruling in Case No. 100 of 2014 in regards of Reactive Energy Charges

“As regards the issue of reactive charges, the Commission in its earlier Orders (Ref. Case No. 10 of 2012 & Case No. 6 of 2013) had already observed that a detailed technical study and reactive energy compensation is necessary. Accordingly, vide the said Orders, MSEDCL was directed to undertake a technical study and propose its recommendation in consultation with Grid Co-ordination Committee within a period of 4 months from issuance of the later Order. The Commission observes that MSEDCL vide its letter dated 8 January, 2014 submitted that the technical committee has been formed under C.E. (Commercial). MSEDCL further submitted that the matter is complex in nature and hence is taking time. Thus, MSEDCL is yet to submit the report of the Committee to the Commission.”

It is therefore proposed that till the time MSEDCL submits the report of the technical study, it is proposed that the existing provisions of MERC Order in Case No 39 of 2011 in regards of Reactive Energy Charges will be continue for the next Review period commencing from FY 2015-16.

6. Technology-specific Parameters for Wind Energy

7.1 Capital Cost

The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Wind Power Projects are as follows:

Table 24: State wise comparative on Capital Cost of wind energy

Parameter	Reference	Capital Cost	Reason/approach
Maharashtra	MERC Order in Case No 100 of 2014	585 for FY 2014-15	The Capital cost considered by MERC is for 80 meter hub height. (As per MERC RE Tariff Regulations 2010)
CERC	CERC Order Suo-Moto/004/2015	619.16 for FY 2015-16	Supply in sync with demand, increased commodity prices and increased pressure due to Rupee devaluation vs other currency for import of critical component, higher land price, interconnection charges,
Andhra Pradesh	APERC Wind Tariff Order 2012	575	APERC considers it has provided over 22% hike in the Capital Cost as considered to its earlier Order thus no indexation is considered, this is flat up till 2015
Gujarat	GERC Wind Tariff Order (Order No.2 of 2012)	608	Excluding evacuation as Rs. 568 Lakh/MW, Evacuation cost as Rs. 38 Lakh/MW, Total cost as Rs. 608 Lakh/MW. GERC has arrived at the above benchmark Capital Cost by considering an appropriate escalation factor for the entire review period and has considered Capital Cost trends in the national and international markets. It does not provide indexations as considered by CERC/MERC
Karnataka	KERC RE Tariff Order dated October 10, 2013	560	Considering limited availability of land for Wind Project development, increasing cost of plant and machinery
Rajasthan	RE Tariff Regulations 2014	565	Rs. 530 Lakh including connectivity charges (of 2 Lakh/MW) and cost of evacuation network (Rs. 15 Lakh/MW) for FY 2012-13. Land is given on lease to developer for developing Wind Projects
Tamil Nadu	TNERC Order No. 6 of 2012	575	As per CERC norms on Capital Cost. Capital cost is apportioned amongst plant machinery, civil works & land at 85%, 10% and 5% respectively. Also taking into consideration to recent application made at IREDA for financing Wind Projects

The comments received from various stakeholders during the public hearing on various Orders post implementation of Principal RE Tariff Regulations, 2010 related to Capital Cost of Wind Power Projects are as follows:

Table 25: Comments received from stakeholders on Capital Cost of wind energy

Reference	Stakeholders	Stakeholders Comments
Order in Case No. 100 of 2014	Inox Renewables	The Capital Cost may be revised to Rs. 603 Lakh/MW for FY 2014-15.
Order in Case No. 100 of 2014	IWTMA and IWEA	Consider Capital Cost for Wind Power Projects as Rs. 619.52Lakh/MW due to increase in hub height.
	InWEA	Not to discontinue the indexation formula as per MERC RE Tariff Regulations, 2010 and may continue the indexation mechanism and also to consider normative Capital Cost of Rs 619 Lakh/MW
	M/s. H-Energy	To consider Capital Cost of Rs. 7 Crore/MW for CUF at 20-30% levels for Project to be commercially feasible.
	Tata Power Renewable Energy Ltd	For consideration of Capital Cost of Rs. 554.04 Lakh/MW
	Essel Infra Projects Limited	The Capital Cost of Wind Power Projects should be revised to Rs. 725 Lakh/MW
	M/s. Bothe Windfarm Development Pvt. Ltd.	To increase the Capital Cost from the proposed level to the actual industrial figure or at least equivalent to CERC norms
Order in Case No. 100 of 2014	M/s. Mytrah Energy (India) Limited	To consider the various parameters in the Capital Cost such as statutory fees paid towards various Governmental/and its undertaking Agencies, insurance cost, increase in land cost as well as Civil and Electrical cost.
	CLP	To revise the Capital Cost upwards in consonance with the MERC RE Tariff Regulations, 2010 and with due consideration to turbine prices in the market.
	APP	Capital Cost of Wind energy Plants to be revised to Rs. 7.25 Cores/MW
	IL&FS	consider the current market scenario and may consider approving a Capital Cost of Rs. 603 Lakh/MW as determined by the CERC for FY 2014-15
	Maruti Wind Park (India) Ltd	To revise the normative Capital Cost to 650 Lakh/MW.
	Welspun Renewables Energy Private Limited	The present market value for Wind Turbines, on a turnkey basis in Maharashtra is no lesser than Rs.700 Lakh/MW but the Commission has considered 575 Lakh/MW as Capital cost for Wind energy Plants.

A normative Capital Cost may be specified as part of Tariff Regulations to introduce efficiency in procurement and timely development of RE Project during the Review Period with a provision for periodical review as the cost varies over a period of time due to impact of escalation in prices of raw material, technological improvement and market competition etc.

Following approaches are available for determining the Capital Cost for Wind Power Projects.

- (a) **Comparative Capital Cost-** comparing the Capital Cost of a particular RE technology as approved by various State Commissions. Data collected from various SERCs is compiled in table below:

Table 26: Comparative of Capital Cost of Wind Energy

Parameter	CERC	Andhra Pradesh	Gujarat	Maharashtra	Tamil Nadu	Rajasthan	Karnataka
Capital Cost (Rs. Lakh/MW)	619.16 for FY 2015-16	575 for FY 2012-13	608 for FY 2012-13	585 for FY 2014-15	575 for FY 2012-13	565 for FY 2014-15	560 for FY 2013-14

(b) **Market approach:** MEDA and other financial institutions were asked to provide data regarding the Capital Cost per MW for Wind Power Projects in the year 2012 to 2014 however no sufficient data received to the Commission.

(c) **Capital cost indexation approach:**

In order to determine the normative Capital Cost for Wind Power Projects over the Review Period, the existing RE Tariff Regulations specify an indexed Capital Cost which is determined on a yearly basis pursuant to issuance of Capital Cost by CERC for Wind Power Projects.

In view of this the Capital Cost indexation has been worked out for Wind Power Projects with base year taken as 2014-15 to arrive at the normative Capital Cost of Wind Project for the base year in the next Review Period commencing from FY 2015-16.

Table 27: Capital cost indexation for wind energy

Variable	Description	Value
A	Weightage for Steel Index	0.60
B	Weightage for Electrical Machinery Index	0.40
F1	Factor for Land and Civil Work	0.08
F2	Factor for Erection and Commissioning	0.07
F3	Factor for IDC and Financing	0.10

Month/Year	Iron & Steel		Electrical & Machinery	
	2014	2010	2014	2010
Mar	138.40	134.10	155.90	153.80
Apr	138.40	134.50	154.60	155.10
May	138.60	135.50	155.20	154.50
Jun	138.60	135.60	156.10	153.30
Jul	138.80	135.60	156.10	153.40
Aug	138.40	135.70	155.70	154.00
Sep	138.60	136.30	159.10	154.30
Oct	138.70	137.10	161.10	153.00
Nov	138.70	137.50	160.70	153.90
Dec	138.50	137.80	160.80	154.10
Jan	139.00	137.40	161.00	155.10
Feb	139.10	137.80	159.20	155.40
Average	138.7	136.2	158.0	154.2

Parameter	Description	Value
CC(0)(RsL/MW)	Capital Cost for the Base Year (FY 2014-15)	585
P&M(0) (RsL/MW)	Plant & Machinery Cost for the Base Year (FY 2014-15)	468
Dn	Capital Cost Escalation Factor	2.19%

P&M(n) (RsL/MW)	Plant & Machinery Cost for the nth Year (FY 2015-16)	478.23
CC(n) (RsL/MW)	Capital Cost for the nth Year (FY2015-16)	597.79

Hence, the Capital Cost for Wind Power Projects is proposed as Rs. 597.79 Lakh/MW for the base year considering the Capital Cost indexation approach with respect to the prevailing market conditions for the base year of the next review period commencing from FY 2015-16.

7.2 Capacity Utilization Factor (CUF)

The CUF is a function of wind energy density, mean wind speed and hub height of the wind turbine that has been employed to harness the wind energy. The CUF related provisions in the Orders/Regulations of MERC, CERC and other SERCs in relation to Wind Power Projects are as follows:

Table 28: State wise comparative on CUF

Parameter	Reference	Wind energy density –CUF	Reason/approach
Maharashtra	MERC Order in Case No. 100 of 2014	<=250 = 22% 250-300 = 25% 300-400 = 30% >=400 = 32%	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	Wind zone - 1 (Upto 200 W/m ²) = 20% Wind zone - 2 (201 - 250) W/m ² = 22% Wind zone - 3 (251 - 300)W/ m ² = 25% Wind zone - 4 (301 - 400)W/ m ² = 30% Wind zone - 5 (Above 400) W/ m ² = 32%	In view of new technologies with higher hub heights that can harness wind energy.
Andhra Pradesh	APERC Wind Tariff Order in respect of "New Wind Based Power Projects, 2012	23.00%	In view of new technologies with higher hub heights.
Gujarat	GERC Wind Tariff Order (Order No.2 of 2012)	24%	Preferential tariff should encourage deployment of better technology & the CUF achieved by the commissioned Wind Power Projects in the State has increased considerably.
Karnataka	Order for determination of tariff for RE sources (Dec, 11,2009)	26.50%	No zone wise CUF defined & uniform CUF across the State for tariff determination
Rajasthan	RERC (RE Tariff) Regulations, 2014	21%- Jaisalmer, Jodhpur & Barmer districts 20% for Other districts	Due to low wind density & speed different CUF's have been provided for Wind Projects in regions of Jaisalmer, Jodhpur and Barmer as compared to other districts
Tamil Nadu	TNERC Tariff Order on Wind Energy (Order No. 6 of 2012)	27.15%	new wind machines are technically advanced, more efficient, can run even at low speed and are with higher hub heights

The comments received from various stakeholders during public hearing process on various Orders post implementation of Principal RE Tariff Regulations, 2010 in context of Capacity Utilisation Factor and Wind Zone for Wind Power Projects are as follows:

Table 29: Stakeholder comments on CUF

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Inox Renewables	To allow wind zoning based on wind density at 50 m hub height till the time adequate numbers of masts with height more than 50 m are set up and wind data from such masts for a minimum period of 2-3 years is available.
Order in Case No. 100 of 2014	IWTMA and InWEA	Till such time C-WET issues validated data regarding WPD at 80 m hub height, the Commission should continue with CUF norms at 50 m hub height as per RE Tariff Regulations, 2010 or if the Commission wishes to continue with hub height of 80 m then the CUF should not be changed.
	Wind Independent Power Producers Association (WIPPA)	With a increase in installed capacity, the availability of higher wind potential sites have been reduced and thus there is no rational to increase the CUF from a minimum level of 20% to 22% therefore study is required to be conducted in this regard prior to any such amendment.
	Tata Power Renewable Energy Ltd.	Not to change the parameters such as hub height and CUF for last year of review period and the same may be revised in the next review period only.
	M/s. Bothe Windfarm Development Pvt. Ltd.	To maintain the original terms of the RE Tariff Regulations i.e. ≤ 250 W/m ² with the CUF @ 20% at 50 meter hub height or address the lower CUF of referred Zone -1 as considered by CERC in its RE Tariff Regulations, 2012 at 80 meter hub height.
	M/s. Mytrah Energy (India) Limited	for inclusion of sites below 200 Watt/m ² as eligible sites as Wind Zone-1 which is also in line with MNRE directives /CERC Regulations.
	CLP	To continue with the wind zoning Mechanism provided under the existing MERC RE Tariff Regulations, 2010 for 50 m hub height and to specify separate tariff for Projects using the wind turbines less than 80m hub-height.
	APP	To maintain the earlier CUF as Wind Zone 1: 20%, Wind Zone 2: 23%, Wind Zone 3: 27%, Wind Zone 4: 30%
	IL&FS	May specify an additional zone for WPD less than 200 W/m ² in line with the CERC.
	Maruti Wind Park (India) Ltd	Till C-WET issues validated data regarding WPD and wind speed at 80 m hub heights. The Commission may continue the Wind energy Density measurement at 50 meter hub height for determining CUF.
	Welspun Renewables Energy Private Limited	To maintain the MERC RE Tariff Regulations, 2010 for the FY 2014-15 along with "Procedure for classification of Projects into "Wind Zones" as defined by MEDA, as the Suomoto Order of RE Tariff is already getting in the FY 2014-15 itself.
GE India Industrial Private Limited	The revised Wind energy Density (WPD) characterization, CUF norms aligned with the WPD and the hub height criteria for measurement of WPD taken by the Commission.	
Order in Case No. 6 of 2013	MSEDCL	MEDA should reassess the wind potential and RPO targets needs to be consistent with the actual scientific assessment

Reference	Stakeholder	Stakeholder Comment
		and accordingly, tariffs need to be decided Further submitted that MNRE has withdrawn the qualifying criteria of minimum wind energy density (WPD) of 200 W/m ² at 50 m above ground level for establishment of Wind Power Project. There is a need for change in procedure for classification of Wind Zones. Further requested the Commission to reconsider the zone wise tariff for Wind Projects in the State and determine a single tariff for all zones.
Order in Case No. 6 of 2013	InWEA	to consider the same CUF at a hub-height of 50 meters not at 80 meters
	Kenersys India Private Ltd	A minor correction in wind zone definition. i.e. Zone 1 <= 250, 20% CUF instead of Zone 1= 200 to 250, 20% CUF
Order in Case No. 20 of 2010	Shri Dwaraknath V Iyer, a power plant consulting engineer	A reduction of 2% in CUF may be considered across the board from Zone-1 to Zone 4.
	IWTMA	As per C-WET WPD map, there is no Class 4 WPD site available in the State of Maharashtra, hence, Zone-4 classification may be removed and CUF for other wind zones may be re-classified.

MERC in its Principal RE Tariff Regulations, 2010 had adopted the zone wise CUF philosophy considering the wind power density, mean wind speed and hub height of available wind turbines generators in the market.

The Commission in its Order dated 22 March, 2013 in Case No. 6 of 2013 has directed MEDA to review the need for modification in procedure for determination of CUF. While proposing the CUF norms for Wind Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16, the following issues are considered

1. Single CUF for State or Zone wise CUF

The present band of CUF in accordance to the WPD in the State of Maharashtra (MERC Order in Case 100 of 2014) is as follows:

Table 30: Zone wise CUF for wind energy

Wind Zone	Annual Mean Wind Power Density (W/m ²) as per Principal RE Tariff Regulation	Annual Mean Wind Power Density (W/m ²) as per MERC Order in Case No. 100 of 2014	CUF
Zone 1	200-250	<=250	22%
Zone 2	250-300	>250 - <=300	25%
Zone 3	300-400	>300 - <=400	30%
Zone 4	>400	>400	32%

It is to be noted that zone-wise CUF has also been prescribed by CERC and in the MERC (RE Tariff) Regulations, 2010. Further, Rajasthan has adopted different CUF parameters by segregating the State in to two areas for determining the wind tariff. The purpose of having a Zone wise CUF philosophy is to allow investment at sites which have lesser wind potential. It is worth noting that around 65% (3427 MW¹³) of the available wind energy potential at 50 Mtr hub heights (5439 MW¹⁴) (as estimated by CWET) has already been utilized in the State. The unutilized sites mostly fall under Zone 1 (almost all high sites with higher CUFs have been utilized already by lesser capacity turbines 250 kW to 750 kW all installed at 50mtr or less hub height) till FY 2006-07).

Table 31: wind installations during FY 1997-98 to FY 2006-07

Rated Capacity of Unit (kW)	Capacity in MW								
	FY 1997-98	FY 1998-99	FY 1999-00	FY 2000-01	FY 2001-02	FY 2003-04	FY 2004-05	FY 2005-06	FY 2006-07
225	0.23	1.35	2.70	2.93	4.50				
230	1.84	2.30	7.82	9.66	16.56				
250	3.50				0.25				
350		14.00	37.80	88.55	56.70				
500				1.00	17.50				
600				4.80	33.60			5.40	42.00
750			2.25	8.25	6.00			12.00	3.00
Total (MW)	5.57	17.65	50.57	115.19	135.11	0.00	0.00	17.40	45.00

This is corroborated with the data obtained from MEDA for Wind Project installation during FY 2011-12 to FY 2014-15 which are in following table:

Table 32: Wind Project installation during FY 2011-12 to FY 2014-15

Year	Developer	Project Capacity (MW)	Wind Zone Allotted
2011-12	M/s. Suzlon Energy Ltd. Pune	11.2	1
	M/s. Enercon (India) Ltd. Mumbai	12.8	1
	M/s. Sri Maruti Wind Park Developers, Pune	42	1
	M/s. The Tata Power Company Ltd. Mumbai	33	1
	M/s. Gamesa Wind Turbines Pvt.Ltd.Chennai	8.5	1
	Total	107.5	
2012-13	M/s.R.S. India New, Delhi	41.25	1
	M/s. Suzlon Energy Ltd. Pune	142.85	1
	M/s. Suzlon Energy Ltd. Pune	5.00	2

¹³ http://www.cwet.tn.nic.in/html/information_isw.html

¹⁴ http://www.mahaurja.com/PG_WE_Overview.html

Year	Developer	Project Capacity (MW)	Wind Zone Allotted
	M/s. Enercon (India) Ltd. Mumbai	133.6	1
	M/s. Sri Maruti Wind Park Developers, Pune	169.99	1
	M/s. Sriram Epc Ltd.Pune	3.75	1
	M/s. Gamesa Wind Turbines Pvt.Ltd.Chennai	7.55	1
	M/s. Kenersys (India) Ltd.	8	1
	M/s. Ratnagiri Wind Power Projects Ltd.	28.8	1
	M/s. Winwind energy Energy Pvt. Ltd.	10	1
	M/s. Panama Wind Energy Pvt. Ltd. Pune	16	1
	Total	566.79	
2013-14	M/s. Suzlon Energy Ltd. Pune	52.25	1
	M/s. Kenersys (India) Ltd.	30	1
	M/s. Sri Maruti Wind Park Developers, Pune	220.6	1
	M/s. Renew Power Ventures Pvt. Ltd. Gurgaon	29.4	1
	M/s. Panama Wind Energy Pvt. Ltd. Pune	48	1
	M/s. Ratnagiri Wind Power Projects Ltd.	17.6	1
	M/s. Wind World (India) Ltd. Mumbai	3.2	1
	M/s. Vestas Wind Technology India Pvt. Ltd.	34.1	1
	Total	435.15	
2014-15	M/s. Suzlon Energy Ltd. Pune	5.4	1
	M/s. Aditya Engineers, Karad	15	1
	M/s. Ratnagiri Wind Power Projects Ltd.	19.2	1
	M/s. Wind World (India) Ltd. Mumbai	10.4	1
	M/s. K P Power Pvt. Ltd. Mumbai	43.35	1
	M/s. Bothe Wind Farm Dev. Pvt. Ltd. Mumbai	38.9	1
	M/s. Sri Maruti Wind Park Developers, Pune	131.25	1
	M/s. Kenersys (India) Ltd.	30	1
	Total	293.5	

Out of the total 1409.2 MW installed since 2011-12 to 2014-15 only 5 MW has been installed in Zone 2 and the remaining (more than 99.5% or 1404.92 MW) has been installed in Zone 1 alone.

Further, analyzing the site wise installation data downloaded from MEDA presented in **table below:**

Table 33: Site wise installation wind energy

District	Capacity in MW					
	2010-11	2011-12	2012-13	2013-14	2014-15	Total
Ahmednagar		1.8	1.0	53.9	10.8	235.10
Amravati						2.00
Beed	0.5	1.0	3.0	89.1	22.0	144.80
Dhule	31.5	4.2				560.25

Kolhapur				53.3	2.0	55.25
Nandurbar	37.2	35.2				278.50
Nashik			12.6			101.00
Pune		39.2				39.20
Sangli	1.5	41.3	140.1	478.4		1,034.20
Satara	168.4	138.7	86.6	359.6	52.8	1,059.48
Solapur						19.50
Total	239.05	261.25	243.25	1,034.20	87.60	3,529.28

It can be observed that new sites like Beed, Kolhapur and Pune which were unutilized before FY 2010-11 have now been utilized by Wind Project developers.

Further, the general market trend is towards steadily growing hub heights, with most major wind turbine manufacturers now routinely offering turbines with hub heights around 80 meters and above. Data collated from EPAs regarding wind installations in the State during the years FY 2011-12, FY 2012-13 & FY 2013-14 corroborates this fact that the wind turbine installations are being made at a greater hub height than before.

Table 34: Data collected from EPA for years FY 2011-12, FY 2012-13 & FY 2013-14

Year	Total Capacity (MW)	Installation > 80m Hub Height (MW)	Installation > 60m to 80m Hub Height (MW)	Installation < 60m Hub Height (MW)
2011-12	73.25	0	73.25	0
2012-13	72.75	66.1	1.85	4.8
2013-14	479.8	349.25	93.75	36.8

2. Adopting single CUF for Maharashtra and Repowering of old sites:

MERC in its Order in Case No. 92 of 2012 has ruled as follows:

1.73 It can be observed from the above Table that smaller capacities of Wind Turbine have also been installed in FY 2011-12, therefore there appears to be no obsolescence of technology rather there happens to be technology advancement over the period. In the later years, installations of higher capacities have taken place.

1.74 It is noted that Re-powering deals with the replacement of first generation small capacity Wind Turbines with modern Mega-watt and Multi-Megawatt Wind Turbines. Some of the benefits of Re-powering is summarized as under:

- (a) More efficient use of potential land, more capacity addition per unit of land area.*
- (b) More energy generation per unit of land area and per square meter of rotor area with improved economics.*
- (c) Increase in the percentage share of wind-power in the power-generation mix*
- (d) Re-powering can be used as tool to achieve targets for RPO in Maharashtra [emphasis added]*

- (e) More social and environmental benefits such as improved landscape, a lesser number of turbines, a lesser footprint area utilization, use of new technology reducing noise-levels, reduced avian mortality resulting in better technology acceptance by communities.*
- (f) Better power-grid integration*
- (g) Reduction in risks and uncertainties for wind-energy estimation, etc.*

1.75 Though there are various benefits as indicated above, however, there are certain challenges also envisaged in the Re-powering summarised as under:

- i. Turbine ownership: Repowering will reduce the number of turbines and there may not be one-to-one replacement. Thus, the issue of ownership needs to be handled carefully.*
- ii. Land ownership: Multiple owners of wind farm land may create complications for Re-powering Projects.*
- iii. Power Purchase Agreement: PPAs were signed with Distribution Licensees for 13 years and the respective Distribution Licensees may not be interested in discontinuing or revising the PPA before its stipulated time.*
- iv. Electricity evacuation facilities: The current grid facilities are designed to support present generation capacities and may require augmentation and upgrading.*
- v. Additional costs: The additional decommissioning costs for old turbines (such as transport charges) need to be assessed.*
- vi. Disposal of old turbines: There are various options such as scrapping, buy-back by the Government or manufacturer, or export.*
- vii. Incentives: In order to compensate for the additional cost of Re-powering, appropriate incentives may be stipulated.*
- viii. Policy package: A new policy package may be developed which may include a Re-powering incentive (on the lines of the recently introduced generation-based incentive scheme by (MNRE).*

*1.76 Hence, in exercise of the powers vested in it under Section 86 (2) of the Electricity Act, 2003, advises the **Government of Maharashtra to formulate a Policy to encourage and promote Re-powering of the existing small Wind Turbines within the State** [emphasis added] which could result in higher generation and also lead to better utilisation of existing wind sites, which would help to encourage the investments in the State and also help to the meet the targets of RPO. In these circumstances, considering the infirmity of Wind Power, the Government may also consider to frame appropriate Policies for encouraging Pump-Storage Schemes and Energy Storage Schemes.*

It has already been acknowledged that most of the Zone 2, 3 & 4 sites which are having good wind potential have been utilized earlier (prior to zone wise approach) with old technology (lesser MW capacity) wind turbines operating at a lower hub height. There is a possibility that Project owners with WEG installed at lower hub heights at sites having higher CUF (Zone 2, 3 & 4 as per present classification) may decide to go for **Re-Powering** of their existing WEGs with higher MW turbines at a greater hub height.

Impact of Re-powering has further been analyzed Vis-a-Vis the option of specifying single CUF in the State. Assuming that a uniform CUF is adopted across the State, then this uniform CUF would be between the range of Highest and the Lowest CUF attainable in the State (between Zone 4 & Zone 1). With uniform CUF being adopted, a uniform tariff would be determined that would be applicable across all sites. Analyzing the case of low capacity WTGs presented in **the table below**:

Table 35: Candidate Wind Projects for Re-powering

Rated Capacity of Unit (kW)	Installed Capacity in MW								
	FY 1997-98	FY 1998-99	FY 1999-00	FY 2000-01	FY 2001-02	FY 2003-04	FY 2004-05	FY 2005-06	FY 2006-07
225	0.23	1.35	2.70	2.93	4.50				
230	1.84	2.30	7.82	9.66	16.56				
250	3.50				0.25				
350		14.00	37.80	88.55	56.70				
500				1.00	17.50				
600				4.80	33.60			5.40	42.00
750			2.25	8.25	6.00			12.00	3.00
Total (MW)	5.57	17.65	50.57	115.19	135.11	0.00	0.00	17.40	45.00

The total capacity installed during FY 1997-98 to FY 2006-07 achieved by WTGs with individual capacity between 0.225 MW to 0.750 MW was 386.42 MW. To achieve this capacity a total of 1018 WTGs were installed. These 1018 WTGs are installed at hub height of 25 to 50 meter and therefore attain much lesser CUF.

Considering that these 1018 WTGs are repowered with 2.1 MW WTGs then the expected resultant installed capacity would be 2137.8 MW which is more than 5.5 times the original installed capacity of 386.42 MW. This is just an indicative number and MEDA would be required to assess the actual number of high capacity turbines that can re-powering old turbines depending on rotor diameter and swept area and turbine to turbine distance requirements.

Re-powering would result in replacement of 1018 old WTGs with of 2.1 MW WTG installed at a higher hub height (80 meter) and thus the attainable CUF would be in the range of 30% or more and hence the resultant generation can be as much as 7 times more than the original generation.

In such a scenario adopting a uniform CUF across the State may lead to a situation where the Distribution Licensees end up paying more as uniform tariff would be applicable even to Projects in Zone 2, 3 & 4 and the policy of having a uniform CUF across the State for Wind Power Projects might not be a feasible option at this juncture. It is necessary that for establishing a uniform CUF, a comprehensive study of wind energy potential at different sites and at different hub heights is conducted in the State to ascertain the feasibility of adopting a uniform CUF policy for Maharashtra.

Further actual generation data for Projects installed in the State selling power to Distribution Licensees during the FY 2011-12 & 2012-13 has been analyzed. Following is the actual weighted average CUF of the Wind Projects:

Table 36: Actual CUF attained by Wind Projects in FY 2011-12 & FY 2012-13

Year	Capacity (MW)	Weighted Average CUF (%)
FY 2011-12	32.75	16.56%
FY 2012-13	233	19.52%

It can be clearly seen that the actual CUF attained by the Projects of most recent installations is even less than the CUF norm adopted by the Commission for Zone 1. This further corroborates the opinion that if uniform CUF is adopted the Distribution Licensee might eventually end up paying more to the Project owner.

3. Existing wind zone classification:

The existing Zone-wise classification of Wind Power Density (WPD) is based on measurements at hub-height of 50 meters due to existing practice for certification/wind zone classification by MEDA/C-WET. The norms for CUF due to higher capacity/higher hub height installation are yet to be revised to pass on benefits of higher generation to consumers through tariff, since the Capital Costs would reflect the higher capacity/rotor diameter/hub-height WTG installations. Considering the MNRE circular dated 1 August, 2011, which suggests that there should not be any restrictions for minimum WPD of 200 W/m² for development of Wind Power Projects and with change in wind turbine technology and better efficiency, even lower wind CUF zones regimes have become exploitable. Thus the existing wind zone classification has to be revised for installations at higher hub heights.

The Commission in the Order in Case No. 100 of 2014 has directed MEDA in respect of CUF for Wind Power Projects as follows:

“The Commission recognises that CUF to be specified against the revised zone-wise classification and higher hub height need to be established through study of actual CUF data for the recent years in the State.

Accordingly, the Commission directs MEDA to submit a report of Project-wise CUF of Wind Projects in the State for the latest two years (FY 2012-13 & FY 2013-14) which would be taken into consideration to arrive at the CUF norms to be specified against the revised zone-wise classification at higher hub height. Result of such analysis shall be considered by the Commission for arriving at appropriate CUF norms in the future years. Meanwhile, for the purpose of the FY 2014-15, the Commission in pursuance of its powers under “Deviation from Norms” as specified in Regulation 74.1 of RE Tariff Regulations, 2010, adopts the wind zone-wise CUFs norms as specified by CERC for the comparable wind zones specified under the CERC RE Regulations, 2012 and the Commission’s RE Tariff Regulations, 2010.”

MEDA has finalized the methodology for study and the said study as directed by the Commission is in progress. In view of the pendency of the outcome of the study, it is proposed that following CUF norms as adopted by the Commission in the Order in Case 100 of 2014 are continued for the purpose of tariff determination for the next review period:

Table 37: Proposed Wind Zones and CUF based on WPD

Wind Zone	Annual Mean Wind energy Density (W/m ²) as per Principal RE Tariff Regulations	Annual Mean Wind energy Density (W/m ²) Proposed for New control period of RE Tariff Regulations	CUF
Zone 1	200-250	<=250	22%
Zone 2	250-300	>250 - <=300	25%
Zone 3	300-400	>300 - <=400	30%
Zone 4	>400	>400	32%

The Commission may review the CUF norms after MEDA submits the outcome of the study to the Commission during the course of the Review Period of the proposed Regulations.

Further, since MEDA is still certifying the wind zones at 50 meter hub heights and while the market trend is towards installation of higher hub height machines, it is suggested that MEDA should also prepare a new certification methodology for certifying the Wind Zones at 80 meter hub height and submit its methodology to the Commission for approval.

Further, the CUF norms specified herein may be revised through general or specific Order by the Commission on the basis of adequate and appropriate data as and when available.

In case of overachievement of the actual CUF, additional electricity generation exceeding normative CUF shall attract only 70% of the applicable Feed-in Tariff Rate determined by the Commission for that year.

7.3 Operations and Maintenance (O&M) Expenses

The O&M Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Wind Power Projects are as follows:

Table 38: State wise O&M Cost for wind energy

Parameter	Reference	O & M Expenses	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	8.58 Lakh/MW, to be escalated at the rate of 5.72% per annum	As per MERC RE Tariff Regulations 2010
CERC	CERC (RE tariff) Regulations, 2012.	Rs. 10.63 Lakh/MW for FY 2015-16	escalation rate in line with the escalation factor considered for conventional Power Projects
Andhra Pradesh	APERC Wind Tariff Order, 2012	7.40 Lakh per MW with an O & M escalation of 5% every year thereon	In view the possible increases in O & M over a long period and the rates fixed by other SERC's
Gujarat	GERC Wind Tariff Order (Order No.2 of	Rs.8.00 Lakh/MW O&M escalation at the rate of 5.72%	increased cost of spares hence a escalation is allowed

Parameter	Reference	O & M Expenses	Reason/approach
	2012)		
Rajasthan	RERC (Re Tariff) Regulations, 2014 on 24.02.2014	1.25% of Capital Cost for power plant and 3% of cost of transmission line	In accordance with Regulation 83 (6)(b)(iv) of RERC Tariff Regulations, 2009.
Tamil Nadu	TNERC Tariff Order on Wind Energy (Order No. 6 of 2012)	1.1% on 85% of the capital investment and 0.22% on 15% of the capital investment escalation factor of 5% from second year onwards	NA

The comments received from various stakeholders during public hearing process on various Orders post implementation of Principal RE Tariff Regulations, 2010 in context of O&M Costs for Wind Power Projects are as follows:

Table 39: Stakeholder comments on O&M Cost for wind energy

Reference	Stakeholder	Stakeholder comment
Order in Case No. 100 of 2014	Inox Renewables and IL&FS	To consider O&M Cost as Rs. 10.50 Lakh/MW
Order in Case No. 100 of 2014	M/s. H-Energy	To link escalation in O&M to consumer price index (CPI).
	Essel Infra Projects Limited and APP	To consider O&M Costs as Rs. 14 to 14.5 Lakh /MW and insurance cost should also be considered at 1% of the Project cost for first five years.
	M/s. Bothe Wind farm Development Pvt. Ltd.	To increase the O&M Cost from current Level as the current O&M Cost taken from the various developers is varying between Rs. 10 to 12 Lakh/MW with 5-6% annual escalation.
	Maruti Wind Park (India) Ltd	O&M Cost should be considered at 20 Lakh/MW.
	Welspun Renewables Energy Private Limited	Proposed In the 1st year to be Rs.10.5 Lakh/MW i.e.1.5% of the Capital Cost.
Order in Case No. 6 of 2013	Torrent Power	To consider the one time increase of at least 20% of O&M base price in the 11th year over the O&M fees of 10th year which will then be considered as base price for determining the O&M fees during the balance life based on escalation factor of 5.72% per annum as consider by Commission and also allow an increase in the base O&M fees of first year to include service tax rate of 12.36%.
	ReGen Powertech Pvt. Ltd, Inox Renewable Energy Limited, Kenersys India Private Limited, Reliance Power limited and Surajbari Windfarm Development Pvt Ltd.	To consider O&M in between Rs 9.50 Lakh/MW to Rs 12 Lakh/MW while GE India Ltd requested to consider CERC guidelines for O&M Cost.
	MSEDCL	Taking into account the O&M norms provided by other State Regulators, MSEDCL requested the Commission to provide

Reference	Stakeholder	Stakeholder comment
		lower O&M norms.
Order in Case No. 20 of 2010	Rashtriya Chemicals & Fertilizers	Rs. 10 Lakh/MW may be considered for the first year with an annual escalation of 6%.
	Acciona Energy India Pvt. Ltd.	2% of the Capital Cost with a yearly escalation of 5.72% may be considered for Wind Power Projects.

Details of O&M Costs were requested from MEDA and other financial institution for Wind Power Projects installed during the period from 2011 to 2014. However no data was submitted by MEDA or any other Financial Institution to the Commission for analysis.

In view of the fact that actual operational data is not available, it is proposed that normative O&M Cost as a percentage of the Capital Cost may be specified.

In Principal RE Tariff Regulations, 2010 the normative O&M Cost and escalation rate for Wind energy is as follows:

- (a) Normative O&M Costs for the first year of the Review Period (i.e. FY 2010-11) shall be Rs 6.87 Lakh per MW which was 1.47% of the Capital Cost per MW for the base year FY 2010-11.
- (b) Normative O&M Costs allowed under these Regulations shall be escalated at the rate of 5.72% per annum over the tariff period to compute the levellized tariff.

Table 40: Proposed O&M Cost for wind energy

Technology	MERC RE Tariff Regulations, 2010			Proposed for next review period		
	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost
Wind	467.13	6.87	1.47%	597.79	8.82	1.47%

With this approach the O&M Cost for the base year for next review period comes out to be Rs. 8.82 Lakh/MW.

It is proposed that for the purpose of tariff determination of Wind Power Projects O&M Cost is adopted as 1.47% of the Capital Cost per MW for the base year of the review period commencing from FY 2015-16. It is also proposed that considering the increase in cost of spares the O&M Costs be allowed to escalate at a normative rate of 5.72% per annum for Wind Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16.

7. Technology-specific parameters for Small Hydro and Mini/Micro Power Projects

8.1 Capital Cost

The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Small Hydro Power Projects are as follows:

Table 41: State wise comparative of Capital Cost of Small and Mini/Micro Hydro Projects

Parameter	Reference	Capital Cost	Reason/approach
CERC	CERC Order Suo-Moto/004/2015	For SHP<5MW = Rs. 829.62 Lakh/MW for Himachal, Uttarakhand and North Eastern States Rs. 646.46 Lakh/MW for other States For SHP 5 to 25 MW = Rs. 754.20 Lakh/MW for Himachal, Uttarakhand and North Eastern States Rs. 592.59 Lakh/MW for other States	Small Hydro Power Projects cost has increased as the sites are located in remote areas
Arunachal Pradesh	Tariff Regulations (Dated 9/4/2012)	700 (<=5 MW) & 630 (5-25 MW)	Based on indexation approach
Himachal Pradesh	HPERC(RE Tariff) Regulations, 2012	780 (100kW - 2MW), 750 (2-5 MW) & 700 (5-25 MW)	Based on indexation approach
Karnataka	RE Tariff Order (Dated 11/12/2009)	475 Lakh/ MW	Based on Indexation approach
Manipur & Mizoram	Tariff Regulations (Dated 15/04/2010)	812 (<=5 MW) & 730 (5-25 MW)	Based on indexation approach
Madhya Pradesh	SHP Tariff Regulations	700 Lakh/ MW for Run of the river, 600 Lakh/ MW for canal based generation	Based on indexation approach
Maharashtra	MERC Order in Case no. 100 of 2014	589.41 (<=5 MW) & 536.26 (5-25 MW)	As per MERC RE Tariff Regulations 2010
Nagaland	Tariff Regulations (Dated 08/2011)	635 (<=5 MW) & 571 (5-25 MW)	

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to Capital Cost of Small Hydro Power Projects are as follows:

Table 42: Comments received from stakeholders on Capital Cost of Small Hydro and Micro/Mini Power Projects

Reference	Stakeholder	Stakeholder Comments
Order in Case No.	Mahati HPVPL	To revisit the Capital Cost of Small Hydro Power

Reference	Stakeholder	Stakeholder Comments
100 of 2014		Projects in Maharashtra, across the entire range from 1 MW to 24 MW and also proposed that the Capital Cost of SHP needs to be in synchronism with hydrological facts and ground the State of Maharashtra
Order in Case No. 100 of 2014	Mahati Hydro Power Vidarbha Pvt. Ltd.	The cost is reimbursed subject to a ceiling of Rs.110 Lakh by MEDA & MSEDCL/MSETCL.

Following approaches have been analysed for determining the Capital Cost for Small Hydro Energy Projects.

(a) **Comparative Capital Cost**-compare the Capital Cost of a particular Small hydro technology as approved by various State commissions. Data collected from various SERCs is as follows:

Table 43: Summary of Capital Cost for Small Hydro and Micro/Mini Power Projects

Capital Cost	CERC	Arunachal Pradesh	Himachal Pradesh	Karnataka	Manipur & Mizoram	MP	Maharashtra	Nagaland
Value (Rs Lakh/MW)	For SHP<5MW = Rs. 829.62 Lakh/MW for Himachal, Uttarakhand and North Eastern States & Rs. 646.46 Lakh/MW for other States For SHP 5MW to 25 MW = Rs. 754.20 Lakh/MW for Himachal, Uttarakhand and North Eastern States Rs. 592.59 Lakh/MW for other States	700 (<=5 MW) & 630 (5-25 MW) FY 2013-14	780 (100kW - 2MW), 750 (2-5 MW) & 700 (5-25 MW) FY 2012-13	475 Lakh/MW	812 (<=5 MW) & 730 (5-25 MW) FY 2011-12	700 Lakh /MW for Run of the river, 600 Lakh /MW for canal based generation	589.41 (<=5 MW) & 536.26 (5-25 MW) FY 2014-15	635 (<=5 MW) & 571 (5-25 MW) FY 2011-12

(b) Capital cost indexation approach:

For the purpose of specifying allowable Capital Cost, SHPs have been classified into two categories based on their installed capacities, viz.,

- a) Small Hydro Power Projects above 1 MW and up to and including 5 MW, and
- b) Small Hydro Power Projects of capacities above 5 MW and lower than or equal to 25 MW.

The Principal RE Tariff Regulations, 2010 provide for indexed Capital Cost to be notified on a yearly basis pursuant to issuance of such indexed Capital Cost by CERC for SHP in accordance with indexation mechanism stipulated under CERC RE Tariff Regulations, 2012.

Using the indexation method the indexed Capital Cost for small hydro Power Projects to be commissioned during FY 2014-15 works out to Rs.589.41 Lakh/MW for Small Hydro Power Projects with installed capacity (> 1 MW and up to and including 5 MW) and Rs 536.26 Lakh/MW for Small Hydro Power Projects with installed capacity (> 5 MW to 25 MW) as summarised in the following table:

Table 44: Capital cost indexation for Small Hydro and Micro/Mini Power Projects

Variable	Description	Value
A	Weightage for steel index	0.6
B	Weightage for Electrical Machinery Index	0.4
F1	Factor for land & Civil Works	0.16
F2	Factor for Erection & Commissioning	0.1
F3	Factor for IDC and Financing	0.14

Month/Year	Iron & Steel		Electrical & Machinery	
	2014	2010	2014	2010
Mar	138.40	134.10	155.90	153.80
Apr	138.40	134.50	154.60	155.10
May	138.60	135.50	155.20	154.50
Jun	138.60	135.60	156.10	153.30
Jul	138.80	135.60	156.10	153.40
Aug	138.40	135.70	155.70	154.00
Sep	138.60	136.30	159.10	154.30
Oct	138.70	137.10	161.10	153.00
Nov	138.70	137.50	160.70	153.90
Dec	138.50	137.80	160.80	154.10
Jan	139.00	137.40	161.00	155.10
Feb	139.10	137.80	159.20	155.40
Average	138.7	136.2	158.0	154.2

Parameter	Description	Value	Value
		<5M W	5-25MW
CC(0) (Rs. Lakh /MW)	Capital Cost for the Base Year	589.41	536.26
P&M(0) (Rs. Lakh /MW)	Plant & Machinery Cost for the Base Year	421.01	383.05
Dn	Capital Cost Escalation Factor	0.02	0.02
P&M(n) Rs. Lakh /MW)	Plant & Machinery Cost for the nth Year (FY 2015-16)	430.21	391.42
CC(n) (Rs. Lakh /MW)	Capital Cost for the nth Year (FY2015-16)	602.30	547.99

(c) **Market approach** –The Capital cost data has been received from Water Resource Department, Government of Maharashtra. The category wise list of Projects considered for analysis is as follows:

The following is the list of Projects with capacity less than 5 MW:

Table 45: Data received from GoM WRD for Capital Cost of Small Hydro and Micro/Mini Power Projects for <5MW capacity

Sr. No.	Name of the Borrower	Project Location	Sanction / Commissioning Year	Capacity	Project Cost	Project Cost
				MW	Rs. Lakh	Rs. Lakh / MW
1	M/s Shrdha const & Power Generation Pvt.Ltd. Pune	Satara	2010	4.5	2631	584.67
2	M/s Gadre Marine Exports, Ratnagiri	Sindhudurga	2010	1.5	721.16	480.77
3	M/s Mahati Electrics	Sangli	2010	4	1590	397.5
4	M/s Dodson Linbolm Hydro Power Pvt Ltd,Mumbai	Nashik	2011	4.9	2550	520.41
5	M/s Tatyasaheb Kore W.S.N.N.S Warananagar	Kolhapur	2011	2	978	489
6	M/s Vishwaj Energy Pvt. Ltd. Pune	Kolhapur	2011	2.5	1130	452
7	M/s Tatyasaheb Kore W.S.N.N.S Warananagar	Kolhapur	2011	2.5	1089.73	435.892
8	M/s Vishwaj Energy Pvt. Ltd. Pune	Satara	2011	4	1059.51	264.88
9	M/s Tatyasaheb Kore W.S.N.N.S Warananagar	Kolhapur	2012	1.5	619.03	412.69
10	M/s Mahati Electrics	Pune	2012	4.8	1950	406.25
11	M/s Samwat Systems Pvt. Ltd.	Nashik	2012	1.2	906.04	755.03
12	M/s Tatyasaheb Kore W.S.N.N.S Warananagar	Kolhapur	2013	2.5	1070	428

The following is the list of Projects with capacity more than 5 MW and less than 25 MW:

Table 46: Data received from GoM WRD for Capital Cost of Small Hydro and Micro/Mini Power Projects for 5 MW to 25 MW capacity

Sr. No.	Name of the Borrower	Project Location	Sanction / Commissioning Year	Capacity	Project Cost	Project Cost
				MW	Rs. Lakh	Rs. Lakh / MW
1	M/s Mahalaxmi	Sindhudurga	2010	10	3970.5	397.05

Sr. No.	Name of the Borrower	Project Location	Sanction / Commissioning	Capacity	Project Cost	Project Cost
	Vidyut Pvt. Ltd. Pune					
2	M/s R M Mohite Textiles Ltd.	Kolhapur	2011	10	3637.78	362.78
3	Mohite & Mohite Pvt. Ltd,	Kolhapur	2011	8	2532	316.5

Table 47: Weighted average Capital Cost per MW for the above SHP Projects

Weighted Average Capital Cost	Rs. Lakh/MW
SHP <=5MW	453.89
SHP 5-25 MW	361.80

The Capital Cost for the above Projects may be on the lower side as this is the data compiled by the GoMWRD from the Techno Economical Feasibility Report (TEFR) of the Projects and during the time frame between submission of DPR and Project implementation the actual Project cost would have changed. Therefore this data is not truly representative of the actual Project cost scenario for Small Hydro Power Projects.

Hence, considering the Capital Cost indexation approach the Capital Cost for Small Hydro Power Projects is proposed as Rs. 602.30 Lakh/MW for Projects < 5 MW and 547.99 Lakh/MW for Projects of 5-25 MW for the base year with a provision of indexation with respect to the prevailing market conditions for the next review period commencing from FY 2015-16

8.2 Capacity Utilization Factor (CUF)

The CUF related provisions in the Orders/Regulations of CERC and other SERCs in relation to Small Hydro Power Projects are as follows:

Table 48: State wise comparative for CUF for Small Hydro Power Projects

Parameter	Reference	SHP-CUF (%)	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	30%	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	45 % for Himachal, Uttarakhand and North Eastern States 30% for other states	Normative PLF as specified in the Regulation
Arunanchal Pradesh	Tariff Regulations (Dated 9/4/2012)	45%	As per CERC Regulations, 2012
Himachal Pradesh	HPERC(RE Tariff) Regulations, 2012	55%	in line with the provisions of Regulation 34 of the CERC RE Tariff Regulations, 2012
Manipur &	Tariff Regulations	40%	CUF is net of free power to

Parameter	Reference	SHP-CUF (%)	Reason/approach
Mizorum	(Dated 15/04/2010)		the home State
Nagaland	Tariff Regulations (Dated 08/2011)	30%	As per CERC Regulations, 2012

It is proposed that approach of the Principal RE Tariff Regulations, 2010 (CUF of 30%) be continued for the next review period commencing from FY 2015-16 for the purpose of tariff determination.

8.3 Operation & Maintenance Expenses (O&M)

The O&M Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Small Hydro Power Projects are as follows:

Table 49: O&M Cost for Small Hydro Power Projects

Parameter	Reference	O&M Costs	Reason/approach
CERC	CERC Order Suo-Moto/004/2015	For SHP<5MW=Rs. 29.54 Lakh/MW for Himachal, Uttarakhand and North Eastern States Rs. 23.63 Lakh/MW for other States For SHP 5-25 MW = Rs. 21.27 Lakh/MW for Himachal, Uttarakhand and North Eastern States Rs. 16.54 Lakh/MW for other States	Expressed as % of Capital Cost
Arunachal Pradesh	Tariff Regulations (Dated 9/4/2012)	25(<=5 MW) & 18 (5-25 MW) 5.72% annual escalation	As per CERC Regulations
Himachal Pradesh	HPERC(RE Tariff) Regulations, 2012	25(<=2 MW) & 22 (2-5MW) 18 (5-25 MW) 5.72% annual escalation	In line with CERC Regulations
Manipur & Mizorum	Tariff Regulations (Dated 15/04/2010)	24 (<=2 MW) & 22 (2-5MW) 17 (5-25 MW) 5.72% annual escalation	Normative O&M Cost
Maharashtra	MERC Order in Case no. 100 of 2014	22.45 (<=5 MW) & 15.86 (5-25 MW) 5.72% annual escalation	Normative O&M Cost as per MERC RE Tariff Regulations 2010

Data of operational Projects was requested from MEDA and other institutions however no such data was received by the Commission.

In view of the fact that actual operational data is not available it is proposed that normative O&M Cost is derived as a percentage of the Capital Cost for SHP Projects.

In Principal RE Tariff Regulations, 2010 the normative O&M Cost and escalation rate for Small Hydro Power Projects is as follows:

(a) Normative O&M Costs for the first year of the Review Period (i.e. FY 2010-11) shall be as follows:

Project Size	O&M Expense (Rs Lakh/ MW)
> 1 MW and upto and including 5 MW	17.97
> 5 MW to 25 MW	12.69

(b) Normative O&M Costs allowed under the Regulations was to be escalated at the rate of 5.72% per annum over the tariff period to compute the levellized tariff.

Technology	MERC RE Tariff Regulations, 2010			Proposed for next review period		
	Capital Cost Rs. Lakh / MW	O&M Cost Rs. Lakh / MW	O&M Cost as % of Capital Cost	Capital Cost Rs. Lakh / MW	O&M Cost as % of Capital Cost	O&M Cost Rs. Lakh / MW
SHP<5MW	498.88	17.97	3.60 %	602.30	3.60 %	21.67
SHP 5-25 MW	453.53	12.69	2.80 %	547.99	2.80 %	15.34

The normative O&M Cost of as percentage of Capital Cost works out to be Rs. 21.67 Lakh/MW for SHP < 5 MW and Rs. 15.34 Lakh/MW for SHP between 5 to 25 MW.

It is proposed that the same O&M Cost per MW is allowed as a percentage of Capital Cost for the purpose of tariff calculation for the base year FY 2015-16 of the next review period commencing from FY 2015-16 is as follows:

Table 50: Proposed O&M Cost for Small Hydro Power Projects

SHP Capacity	O&M Cost
SHP<5MW	3.60 % of Capital Cost per MW
SHP 5-25 MW	2.80 % of Capital Cost per MW

It is further proposed that considering the increase in cost of spares the O&M Costs be allowed to escalate at a normative rate of 5.72% per annum for Small Hydro Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16.

8.4 Auxiliary consumption (AUX)

The auxiliary consumption related provisions in the Orders/Regulations of CERC and other SERCs in relation to Small Hydro Power Projects are as follows:

Table 51: State wise comparative of auxiliary consumption for SHP Projects

Parameter	Reference	Auxiliary consumption	Reason/approach
CERC	CERC Order Suo-Moto/004/2015	1% (<=25MW)	Normative auxiliary consumption taken including transformation losses
Arunanchal Pradesh	Tariff Regulations (Dated 9/4/2012)	1% (<=25MW)	As per CERC Regulations
Himachal Pradesh	HPERC(RE Tariff) Regulations, 2012	0.5% (<=25MW)	In line with the provisions of Regulation 36 of the RE Tariff Regulations, 2012

Parameter	Reference	Auxiliary consumption	Reason/approach
Manipur & Mizorum	Tariff Regulations (Dated 15/04/2010)	1% (<=25MW)	Normative AUX as specified in the Regulation
Maharashtra	MERC Order in Case No. 100 of 2014	1% (<=25MW)	As per Principal RE Tariff Regulations, 2010
Nagaland	Tariff Regulations (Dated 08/2011)	1% (<=25MW)	Normative AUX as specified in the Regulation

It is proposed that approach of the Principal RE Tariff Regulations, 2010 (auxiliary consumption of 1% be continued for the purpose of Tariff determination for the next review period commencing from FY 2015-16.

8. Technology-specific parameters for Biomass power

9.1 Capital Cost

Capital cost in respect of Biomass Based Power Projects shall be inclusive of all capital work including plant and machinery, civil work, erection and commissioning, financing and interest during construction, and evacuation infrastructure up to inter-connection point. The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Power Projects are as follows:

Table 52: State wise comparative on Capital Cost for biomass power

Parameter	Reference	Capital Cost	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	480.43 Lakh/MW For FY 10-11	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo-Moto/004/2015	Rs. 558.70 Lakh/MW for Project [other than rice straw and juliflora (plantation) based Project] with water cooled condenser Rs. 600.09 Lakh/MW for Project [other than rice straw and Juliflora(plantation) based Project] with air cooled condenser Rs. 610.44 Lakh/MW for rice straw and juliflora (plantation) based Project with water cooled condenser Rs.651.82 Lakh/MW for rice straw and juliflora (plantation) based Project with air cooled condenser	CERC approach based on indexation
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	400 Lakh/MW	Considered on confirmation of Capital Cost received from BEDA and IREDA
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	Rs. 468 Lakh/MW and Rs. 498 Lakh/MW for biomass based	GERC examined the trends of Capital Cost of biomass based Power Projects in national and international markets

Parameter	Reference	Capital Cost	Reason/approach
		Power Projects using water-cooled and air-cooled condenser respectively	
Punjab	PSERC levellized generation tariff Order for various RE Technologies for the year 2014-15	Rs 540 - 630 Lakh/MW depending on type of biomass and technology	Adopted on the basis of Notification indexed Capital Cost for Biomass Power Projects by CERC RE Tariff Regulations 2012
Rajasthan	RERC RE Tariff Regulations, 2014	521.24 to 564.68 Lakh/MW including Rs 15 Lakh/MW towards transmission system and Rs 2 Lakh/MW as connectivity charges.	Section 83(7)(b) of Tariff Regulations 2009 provides for normative Capital Cost for biomass based power plants employing water cooled and air cooled condensers for FY 2013-14. In accordance to the above mentioned regulation, the normative Capital Cost of biomass based power plants employing the water cooled and air-cooled condenser has been taken as Rs 522 Lakh/MW and Rs 557 Lakh/MW respectively.
Tamil Nadu	TNERC Tariff Order on Biomass Energy (Order No. 8 of 2012)	445 Lakh/MW	Adopted on the basis of Notification indexed Capital Cost for Biomass Power Projects by CERC RE Tariff Regulations 2012

The comments received from various stakeholders during the public hearing process on various matters and Orders post implementation of Principal RE Tariff Regulations, 2010 related to Capital Cost of Biomass Based Power Projects are as follows:

Table 53: Comments received from stakeholders on Capital Cost for biomass power

Reference	Stakeholders	Stakeholders Comments
Case No. 100 of 2014	MBEDA and MVPNL	To consider Capital Cost Rs.6- 6.5Crores /MW as per CERC
	GMT Mining & Power Pvt. Ltd. and AA ENERGY Ltd.	To consider Capital Cost of Rs. 540 Lakh/MW as per CERC.
	M/s. Blue Gums Agro & Biotech Pvt. Ltd	The Capital Cost should be kept within provision of cost required for building supply chain management in every biomass Power Projects.
	Orient Green power Company	Requested for Capital Cost as Rs.540 Lakh/MW for Project [other than rice straw and juliflora (plantation) based Project] with water cooled condenser, Rs.580 Lakh/ MW [other than rice straw and juliflora (plantation) based Project] with air cooled condenser, Rs.590 Lakh/MW for rice straw and juliflora (plantation) based Project with water cooled condenser and Rs.630 Lakh/MW for rice straw and juliflora (plantation) based Project with air cooled condenser.
	Tata Power Company Ltd	To consider the parameters for biomass power plants in line with CERC RE Tariff Order for FY 2014-15.
Case No. 6 of 2013	Kalyani Renewable Energy India Ltd	To consider the capital expenditure norm of at least Rs. 6.5 Crore/MW.

Reference	Stakeholders	Stakeholders Comments
	GMT Mining & Power Pvt. Ltd	To consider normative cost of Rs. 600 Lakh / MW.

Following approaches are available for determining the Capital Cost for Biomass Based Power Projects.

- (a) **Comparative Capital Cost-** compare the Capital Cost of a particular RE technology as approved by various State Commissions. Data collected from various SERCs is as follows

Table 54: Summary of Capital Cost for biomass power

Parameter	CERC	Andhra Pradesh	Gujarat	Maharashtra	Punjab	Rajasthan	Tamil Nadu
Capital Cost (Rs. Lakh/MW)	Rs. 558.70 Lakh/MW for Project [other than rice straw and juliflora (plantation) based Project] with water cooled condenser Rs. 600.09 Lakh/MW for Project [other than rice straw and Juliflora(plantation) based Project] with air cooled condenser Rs. 610.44 Lakh/MW for rice straw and juliflora (plantation) based Project with water cooled condenser Rs.651.82 Lakh/MW for rice straw and juliflora (plantation) based Project with air cooled condenser	400 FY 11-12	468 & 498 FY 13-14	480.43 FY 14-15	540 - 630 FY 14-15	521.24 & 564.68 FY 14-15	445 FY 12-13

(b) Capital cost indexation approach :

The Commission in Principal RE Tariff Regulations, 2010 has specified the normative Capital Cost for the biomass Power Projects based on Rankine cycle technology as Rs. 402.54 Lakh/MW for FY 2010-11, which shall be linked to the indexation mechanism as specified in the Principal RE Tariff Regulations, 2010. In accordance with the above referred Regulations, the normative Capital Cost of biomass Power Projects based on Rankine cycle technology is derived as follows:

Table 55: Capital Cost indexation for biomass power

Variable	Description	Value
A	Weightage for steel index	0.7

Variable	Description	Value
B	Weightage for Electrical Machinery Index	0.3
F1	Factor for land & Civil Works	0.1
F2	Factor for Erection & Commissioning	0.09
F3	Factor for IDC and Financing	0.14

Month/Year	Iron & Steel		Electrical & Machinery	
	2014	2010	2014	2010
Mar	138.40	134.10	155.90	153.80
Apr	138.40	134.50	154.60	155.10
May	138.60	135.50	155.20	154.50
Jun	138.60	135.60	156.10	153.30
Jul	138.80	135.60	156.10	153.40
Aug	138.40	135.70	155.70	154.00
Sep	138.60	136.30	159.10	154.30
Oct	138.70	137.10	161.10	153.00
Nov	138.70	137.50	160.70	153.90
Dec	138.50	137.80	160.80	154.10
Jan	139.00	137.40	161.00	155.10
Feb	139.10	137.80	159.20	155.40
Average	138.7	136.2	158.0	154.2

Parameter	Description	Value
CC(0) (Rs. Lakh/MW)	Capital Cost for the Base Year	480.54
P&M(0) (Rs Lakh/MW)	Plant & Machinery Cost for the Base Year	361.31
Dn	Capital Cost Escalation Factor	0.02
P&M(n) Rs. Lakh/MW)	Plant & Machinery Cost for the nth Year (FY 2015-16)	369.46
CC(n) (Rs. Lakh/MW)	Capital Cost for the nth Year (FY2015-16)	491.40

(c) Market approach - the capital cost data has been collected from REC and State nodal agency (MEDA). The list of Projects that have been analysed to reach to the weighted average Capital Cost of Biomass Based Power Projects sanctioned is as follows:

Table 56: Capital cost data from MEDA and REC for biomass power

S.No.	Name of the Borrower	Project Location	Sanction / Commissioning Year	Capacity	Project Cost	Project Cost per MW
		State		MW	Rs. Lakh	Rs. Lakh/MW
1	Sripanchyajanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	5527.68	552.77
2	M.S.M. Energy	Maharashtra	15/11/2010	10	6008.14	600.81

S.No.	Name of the Borrower	Project Location	Sanction / Commissioning Year	Capacity	Project Cost	Project Cost per MW
		State		MW	Rs. Lakh	Rs. Lakh/MW
	Ltd.					
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	5543.30	554.33
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	8266.00	551.07
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	9239.51	923.95
6	Maharashtra Vidyut Nigam Pvt. Ltd.	Maharashtra	20.05.2013	10	7685	770
7	Bhavnagar Biomass Projects Pvt. Ltd	Gujarat	2010-11	10	4950	495.00
8	Starwire (India) Vidyut Pvt. Ltd*	Haryana	2011-12	9.9	5945	600.51
9	Starwire (India) Vidyut Pvt. Ltd.,	Haryana	2011-12	9.9	5200	525.25
10	Star Wire India Vidyut Pvt Ltd	Haryana	2012-13	9.9	7450	752.53

This weighted average Capital Cost/MW determined from the analysis of the Projects details provided by MEDA and REC is Rs. 628.60 Lakh/MW. This Capital Cost seems to be considerably on the higher side as compared to the Capital Cost determined by the CERC and other SERC's and also as compared to Capital Cost derived using indexation method.

Going by the Capital Cost indexation method and hence taking into account the factors discussed above, the Capital Cost for Biomass Based Power Projects is proposed as Rs. 491.40 Lakh/MW for the base year FY 2015-16 for the next review period commencing from FY 2015-16

9.2 Operation & Maintenance Expenses (O&M)

The O&M Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Based Power Projects are as follows:

Table 57: State wise comparative on O&M Cost for biomass power

Parameter	Reference	O&M Costs	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Rs. 26.75 Lakh/MW annual escalation by 5.72% per annum.	As per MERC RE Tariff Regulations 2010
CERC	CERC Order SM/004/2015	Rs. 44.57 Lakh/MW for FY 2015-16	Escalation rate in line with escalation factor considered for conventional Power Projects.
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	5% of Capital Cost with annual escalation at 6%	In consideration of current cost trends

Parameter	Reference	O&M Costs	Reason/approach
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	cost of 5% of the Capital Cost of biomass based Power Project allow an annual O&M cost escalation at 5.72% per annum	Approach followed by the CERC and other SERCs while fixing the O&M Cost for the purpose of biomass Power Projects
Punjab	PSERC generic tariff Order for various RE Technologies / Projects for the year 2014-15	24 Lakh/MW annual escalation 5.72%	NA
Rajasthan	RERC RE Tariff Regulations, 2014	6.50% of Capital Cost for power plant and 3% of cost of transmission	In accordance with Regulation 83 (7) (b) (vii) of Tariff Regulations, 2009
Tamil Nadu	TNERC Tariff Order on Biomass Energy (Order No. 8 of 2012)	O&M including insurance at 4.5% with annual escalation of 5% on plant and machinery by reckoning 85% of the Capital Cost as the cost of plant and machinery.	NA

The comments received from various stakeholders during the public hearing process on various matters and Orders post implementation of Principal RE Tariff Regulations, 2010 related to O&M Cost for Biomass Power Projects are as follows:

Table 58: Stakeholder comments on O&M Cost for biomass power

Reference	Stakeholder	Stakeholder Comments
Case No. 100 of 2014	MBEDA	To consider the O&M Cost as Rs. 60 Lakh/MW
	GMT MPPL, MVPNL, AA ENERGY LTD and Tata Power Company Ltd	To consider O&M Cost Rs. 42.29 Lakh/MW in line with CERC.
	Orient Green power Company Limited	To consider Rs.40 Lakh/MW as Normative O&M Costs.
Case No. 6 of 2013	GAPS power and infrastructure Limited	the fixed charges should be revised considering the O& M expenses at Rs. 35 Lakh / MW with annual escalation of 7%

The O&M data has been collected from REC & MEDA. The list of Projects that have been analysed as follows:

Table 59: O&M Cost data from MEDA and REC for biomass power

S.No.	Name of the Borrower	Project Location	Sanction / Commissioning Year	Capacity	O&M Expenses	O&M Expenses/MW
		State		MW	Rs. Lakh	Rs. Lakh/MW
1	Sripanchyjanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	NA	NA
2	M.S.M. Energy Ltd.	Maharashtra	15/11/2010	10	NA	NA
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	255.57	25.56
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	378.71	25.25
5	Sinewave	Maharashtra	27/01/2014	10	NA	NA

S.No.	Name of the Borrower	Project Location	Sanction / Commissioning	Capacity	O&M Expenses	O&M Expenses/MW
		State	Year	MW	Rs. Lakh	Rs. Lakh/MW
	Biomass Power (P) Ltd					
6	Maharashtra Vidyut Nigam Pvt.Ltd.	Maharashtra	20.05.2013	10	150	15
7	Bhavnagar Biomass Projects Pvt. Ltd	Gujarat	2010-11	10	240	24.00
8	Starwire (India) Vidyut Pvt. Ltd*	Haryana	2011-12	9.9	210	21.21
9	Starwire (India) Vidyut Pvt. Ltd.,	Haryana	2011-12	9.9	202.5	20.45
10	Star Wire India Vidyut Pvt Ltd	Haryana	2012-13	9.9	NA	NA

Based on the data received from MEDA and REC the weighted average O&M Cost/MW is Rs. 26.17 Lakh/MW.

The normative O&M Cost derived as a percentage of the Capital Cost is also considered

In Principal RE Tariff Regulations, 2010 the normative O&M Cost and escalation rate for RE technologies as follows:

- (a) Normative O&M Costs for the first year of the Review Period (i.e. FY 2010-11) shall be Rs 21.41 Lakh per MW.
- (b) Normative O&M Costs allowed under these Regulations shall be escalated at the rate of 5.72% per annum over the tariff period to compute the levelized tariff.

Table 60: Proposed O&M Cost for biomass power

Technology	MERC RE Tariff Regulations, 2010			Proposed for next review period		
	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost
Biomass	402.54	21.41	5.32%	491.40	26.12	5.32%

Normative O&M Cost derived as a percentage of Capital Cost works out to be Rs. 26.12 Lakh/MW.

It is proposed that for the purpose of tariff determination O&M Cost is adopted as 5.32% of the Capital Cost per MW for the base year of the next review period commencing from FY 2015-16.

It is also proposed that considering the increase in cost of spares the O&M Costs be allowed to be escalated at a normative rate of 5.72% per annum for Biomass Based Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16.

9.3 Fuel Cost (Rs./MT)

The Fuel Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Based Power Projects are as follows:

Table 61: State wise fuel cost data for biomass power

Parameter	Reference	Fuel Cost (Rs/ MT)	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Rs. 3730.74/MT	Based on fuel price indexation. As per MERC RE Tariff Regulations 2010
CERC	CERC Order SM/004/2015	Rs. 3422.95/MT for Maharashtra for FY 2015-16	Commission has approved fuel cost for biomass based generation considering State specific biomass demand supply situation.
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	1300 for base year 2009-10 (6%esc)	APERC found 1300/MT as reasonable cost estimate which is 30% higher than the cost fixed in 2004
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	Rs. 2726/MT (5% esc)	Absence of authentic data and reliable study on cost of biomass, Commission decides to determine the price of biomass as per equivalent heat value method.
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	2756 (5% esc)	Fuel price indexation in State of Punjab
Rajasthan	RERC RE Tariff Regulations, 2014	Rs 1830 /MT for FY 2011-12 as base with 5% escalation. For FY 2013-14, considering a normative escalation of 5%, the biomass fuel cost works out to be Rs 2017.58/MT	NA
Tamil Nadu	TNERC Tariff Order on Biomass Energy (No. 8 of 2012)	Rs 2277 with 5% escalation including the cost of transportation	NA

From the data submitted by MEDA the fuel cost for Biomass Based Power Projects in the State of Maharashtra is as follows:

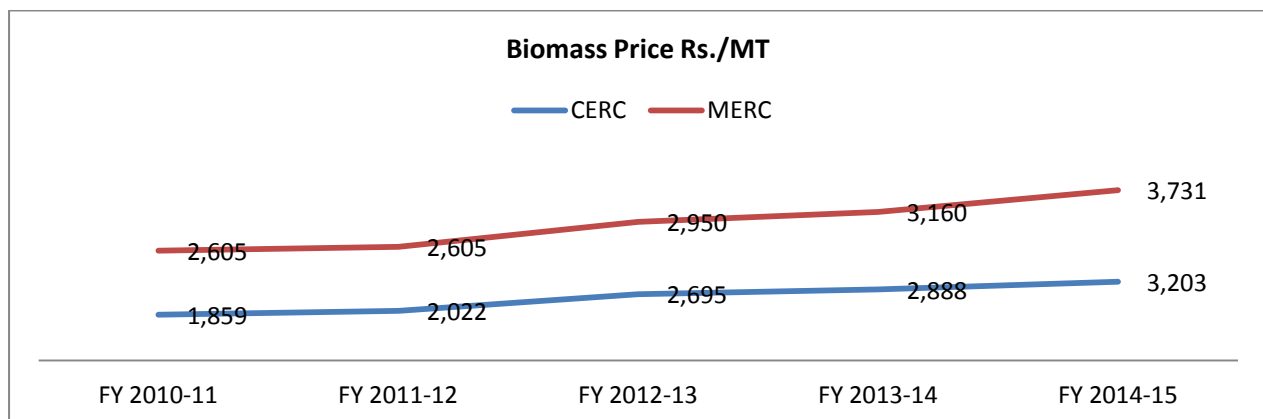
Table 62: Fuel cost data from MEDA for biomass Projects

Sr. No.	Project Name	Project Location	Sanction / Commissioning Year	Capacity	Fuel Cost FY 13-14
		State		MW	Rs /MT

Sr. No.	Project Name	Project Location	Sanction / Commissioning	Capacity	Fuel Cost FY 13-14
1	Sripanchyajanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	3000
2	M.S.M. Energy Ltd.	Maharashtra	15/11/2010	10	3000
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	4106.67
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	3500
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	3000

It can be seen that the fuel cost is in the range of Rs. 3000/MT to Rs. 4106.67/MT whereas the fuel cost as determined by the Commission in Case No. 100 of 2014 is Rs. 3730.74 /MT.

The cost of biomass as approved by MERC and CERC during last 5 years is as follows:



It can be seen that the biomass price in Maharashtra has grown at a CAGR of 7% and by 11% as specified by CERC for Biomass Based Power Projects.

In its Order dated 7 July, 2014 in Case No. 100 of 2014, the Commission determined the Biomass Price as Rs. 3730.74 per MT for FY 2014-15 based on biomass fuel price as stipulated by CERC for FY 2014-15 using equivalent heat value approach. Similarly, it is observed that CERC under its RE Tariff Order for FY 2015-16 has stipulated Biomass fuel price of Rs. 3422.95 per MT for Maharashtra and a Gross Calorific Value (GCV) of 3100 kcal per kg which translates to fuel price in equivalent heat value (in Rs/ Million kCal) terms as Rs. 1104.177 per Million kCal (i.e., Fuel Price (Rs. 3422.95 per MT) / Calorific Value (3100 kcal per kg) x 1000). Accordingly, applying the equivalent heat value approach on a GCV of 3611 kcal per kg as specified for Biomass under the MERC RE tariff Regulations, 2010, the fuel cost of Biomass for FY 2015-16 works out to Rs. 3987/MT.

Considering that the market for Biomass is unorganized and sufficient data is not available for biomass price in the state it is proposed that Fuel Cost for Biomass Based Power Projects for the purpose of tariff determination for the next control period commencing from FY 2015-16 is kept at Rs. 3987 /MT as calculated above considering

the fuel cost determined by CERC in Order 3 March 2015 in the Sou Moto Petition SM/004/2015.

Fuel Price Indexation:

In the case of both existing and new Biomass-based Power Projects, the following indexing mechanism for adjustment of fuel prices for each year of operation will be applicable for determination of the variable charge component of tariff:

Where,

P_1 = Price per ton of Biomass for the base year FY 2015-16 to be considered for tariff determination

$P_{(n)}$ = Price per ton of Biomass for the n^{th} year to be considered for tariff determination

Variable Charge for the n^{th} year shall be computed as under:

i.e. $VC_n = VC_1 \times (P_n / P_1)$

where,

VC_1 represents the Variable Charge based on Biomass Price P_1 for FY 2015-16 and shall be determined as under:

$$VC_1 = \frac{\text{Station Heat Rate (SHR)}}{\text{Gross Claorific alue (GCV)}} \times \frac{1}{(1 - \text{Aux consumption factor})} \times \frac{P_1}{1000}$$

The use of fossil fuels shall be limited to the extent of 15% in terms of calorific value on annual basis

Non-compliance with the condition of fossil fuel usage by the Project developer, during any financial year, shall render such Biomass based Power Project to be ineligible to avail preferential tariff determined as per these Regulations from the date of default and for duration of the default during such financial year when such default occurs. However, such defaulting Biomass Power Project shall continue to sell power to concerned Distribution Licensee even during the period of default at the approved Average Power Purchase Cost of the Distribution Licensee by the Commission for respective year below the applicable preferential tariff determined as per these Regulations.

Explanation. --- for the purpose of these Regulations, ‘Average Power Purchase Cost’ means the weighted average price at which the Distribution Licensee has purchased the electricity including cost of self generation, if any, approved by the Commission in the Tariff Order or Truing Up Order or any other general or specific Order. In case of absence of any such Order, last approved ‘Average Power Purchase Cost’ shall be used.

9.4 Compliance Monitoring for Biomass based Power Projects

- The Distribution Licensee procuring power from them shall be responsible for monitoring compliance by Biomass-based Projects with these Regulations.
- The concerned Distribution Licensee shall maintain all data relevant to these Regulations, including technical and commercial details, in respect of Biomass-based Projects from whom it is procuring power, and shall make the data available

in the public domain by publishing it on its website and updating it on a quarterly basis.

9.5 Plant Load Factor (PLF)

The PLF related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Power Projects are as follows:

Table 63: State wise comparative on PLF for biomass power

Parameter	Reference	Plant Load Factor	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	60% before stabilization period , 70% for remaining stabilization period of 1st year and then 80% from 2nd year onward	As per MERC RE Tariff Regulations 2010
CERC	CERC Order SM/004/2015	60% during stabilization period , 70% for remaining stabilization period of 1st year and then 80% from 2nd year onward	Different PLF is considered for the purpose of tariff calculation as the fuel consumption and plant reliability are different during stabilization and post stabilization
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	80%.	Consideration of generation data provided by AP Distribution Licensees from 2004-05 to 2009-10 & NEDCAP confirmation by an affidavit that the PLF at an average of 80% is achievable for the life-time period of the Biomass Power Projects
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	70% for 1st year & 80% from 2nd year onwards.	Commission has considered the approach followed by CERC /SERCs. The Commission has also referred to the submission under the report titled 'Operating norms of biomass Project report prepared by CEA in 2005
Punjab	PSERC Tariff Order for various RE Technologies / Projects for the year 2014-15	60% before stabilisation period , 70% for remaining stabilisation period of 1st year and then 80% from 2nd year onward	As per CERC RE Regulations 2012
Rajasthan	RERC RE Tariff Regulations, 2014	60% before stabilisation period , 70% for remaining stabilisation period of 1st year and then 75% from 2nd year onward	As per Regulation 83(7)(b)(iv) of Tariff Regulations 2009
Tamil Nadu	TNERC Tariff Order on Biomass Energy (Order No. 8 of 2012)	80%	TNERC considers that 80% PLF is physically achievable and is also in line with CERC RE Regulations 2012

The comments received from various stakeholders during the public hearing process of various Orders post implementation of Principal RE Tariff Regulations, 2010 related to PLF for Biomass Power Projects are as follows:

Table 64: stakeholder comments on PLF for biomass power

Reference	Stakeholders	Stakeholder Comments
Order in Case No. 100 of 2014	MBEDA	It is very difficult to operate a biomass power plant at the annual PLF 80% even after the stabilization period. Hence the PLF may be fixed at 70% even after stabilization.
	Tata Power Company Ltd.	To consider the parameters for biomass power plants in line with CERC RE Tariff Order dated 15 May, 2014

Following is the list of biomass based Projects along with their PLF commissioned post implementation of Principal RE Tariff Regulation, 2010 as per data received from MEDA.

Table 65: PLF data for biomass power obtained from MEDA

Sr. No.	Project Name	Project Location	Sanction / Commissioning Year	Capacity	PLF FY 13-14
		State		MW	%
1	Sripanchyajanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	80
2	M.S.M. Energy Ltd. (Parbhani)	Maharashtra	15/11/2010	10	80
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	89.76
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	90
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	64.52

It can be observed that all of the above Projects are operating within the normative range of PLF as provided by the Commission in Principal RE Tariff Regulations, 2010. Analyzing the actual data of the operational plants received from MEDA and comparing it with the provisions of CERC and other SERCs, it is proposed that the following is adopted for the next control period commencing from FY 2015-16 for the purpose of tariff determination.

- (a) 60% during stabilization period ,
- (b) 70% for remaining stabilization period of 1st year and
- (c) 80% from 2nd year onward

9.6 Station Heat Rate (SHR)

The SHR related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Based Power Projects are as follows:

Table 66: State wise comparative for SHR for biomass power

Parameter	Reference	SHR	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	3800 kCal/kWh	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	4200kCal/kWh : for Project using travelling grate boilers; 4125kCal/kWh : for Project	The norms as suggested in the report of National productivity Council as well as by MNRE.

Parameter	Reference	SHR	Reason/approach
		using AFBC boilers	
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	3,800 kCal/kWh	After examining the suggestions /reports/Orders/ from CERC expert committee, BEDA AP Distribution Licensees APERC determined the Station Heat Rate (SHR) for Biomass units
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	3800 kCal/kWh	In consideration of fact that plant operates efficiently and at the same time the consumers are not burdened with inefficient operation of plant
Punjab	PSERC tariff Order for various RE Technologies for the year 2014-15	4000 kCal/kWh	Based on CERC norms
Rajasthan	RERC in its RE Tariff Regulations, 2014	4300 kCal / kWh during stabilization and 4200 kCal / kWh after stabilization	NA
Tamil Nadu	TNERC Tariff Order on Biomass Energy (Order No. 8 of 2012)	3840 kCal/kWh	As fixed in the previous Order No. 2 of 2009 dated 27-04-2009 & considering fuel characteristics due to moisture and availability of unsized fuel.

The comments received from various stakeholders during the public hearing process of various Orders post implementation of Principal RE Tariff Regulations, 2010 related to Station Heat Rate for Biomass Based Power Projects are as follows:

Table 67: Comments received from stakeholders on SHR for biomass power

Reference	Stakeholders	Stakeholder Comments
Order in Case No. 100 of 2014	MBEDA	To consider the Station heat rate as 4125 kCal/kWh to 4200 kCal/kWh.
	GMT Mining and Power Pvt. Ltd. and Orient Green power Company Limited	To consider SHR as 4125 kCal/kWh (AFBC Boiler) and 4200 kCal/kWh (travelling grate boiler) as per CERC.
	Tata Power Company Ltd.	To consider the parameters for biomass power plants in line with CERC RE Tariff Order dated 15 May, 2014
	MBEDA	To re-compute variable charges by considering not just fuel cost but also related parameters such as GCV and SHR. MBEDA further submitted that the GCV and SHR cannot depend on year of Commissioning but are based on characteristics of fuel.
Order in Case No. 6 of 2013	GAPS Power and infrastructure Ltd	To revise the Gross Station Heat Rate to 4500 kCal/kWh for both existing and new Projects as CEA has recommended in its report.
	Maharashtra Biomass Energy Developers Association and GMT Mining & Power Pvt. Ltd	To consider SHR as 4000 kCal / kg as per CERC Draft Suomoto Order Dated 25 October 2012.
	MEDA	SHR should be around 4500 kCal / kWh instead of 3800 kCal / kWh.

The SHR achieved by the operational biomass based Projects in Maharashtra is also analysed. List of Biomass Based Power Projects along with their SHR commissioned post implementation of Principal RE Tariff Regulations, 2010 as per data received from MEDA is as follows:

Table 68: SHR data received from MEDA on biomass power

Sr. No.	Project Name	Project Location	Sanction / Commissioning Year	Capacity	SHR FY 13-14
		State		MW	kcal /kWh
1	Sripanchyajanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	3600
2	M.S.M. Energy Ltd. (Parbhani)	Maharashtra	15/11/2010	10	3600
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	4000
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	3850
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	3875

Based on the SHR related norms of CERC and other SERCs and also considering actual SHR of Biomass Based Power Projects from the data made available by MEDA, it is proposed that for the purpose of tariff determination for the next review period commencing from 2015-16, SHR of 3800 kCal/kWh is to be considered.

9.7 Auxiliary consumption (AUX)

The auxiliary consumption related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Based Power Projects are as follows:

Table 69: State wise comparative on auxiliary consumption for biomass power

Parameter	Reference	Auxiliary Consumption	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	10%	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	11% for 1st year and 10% from 2nd year for Project using water cooled condenser 13% for 1st year and 12% from 2nd year for Project using air cooled condenser	Biomass based power generation plant operates like a conventional power plan and therefore has some level of auxiliary consumption
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	9%.	Biomass plants have less number of auxiliaries compared to coal-fired stations and further there is no milling plant. Further, the amount of ash to be handled in the Biomass plants is comparatively lesser than that in coal fired stations. Having regard to the above, Commission is of the opinion that the determination of auxiliary consumption percentage in the case of Biomass plants has

Parameter	Reference	Auxiliary Consumption	Reason/approach
			to be made at comparatively lesser levels than that of coal fired stations. Accordingly, the Commission hereby fixes an auxiliary consumption of 9% for Bio Mass units
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	10%	CERC/SERCs and observed that most of the SERCs have specified 10% auxiliary consumption for biomass based Power Projects. Also, the Commission has noted that the CEA report on 'operating norm for biomass Power Projects', September 2005 has also recommended auxiliary consumption at 10%.
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	10%	As per CERC norms
Rajasthan	RERC in its RE Tariff Regulations, 2014	10.5 % during stabilization and 10% after stabilization	NA
Tamil Nadu	TNERC Tariff Order on Biomass Energy (No. 8 of 2012)	10%	NA

The comments received from various stakeholders during the public hearing process of various Orders post implementation of Principal RE Tariff Regulations, 2010 related to Auxiliary Consumption for Biomass Based Power Projects are as follows:

Table 70: Comments received from stakeholder on auxiliary consumption for biomass Power Projects

Reference	Stakeholder	Stakeholder comment
Order in Case No. 100 of 2014	Tata Power Company Ltd.	To consider the parameters for biomass power plants in line with CERC RE Tariff Order dated 15 May, 2014
	M/s. Blue Gums Agro & Biotech Pvt. Ltd.	Auxiliary consumption should be considered as 10% for developers using rice husk or similar biomass which is pre-process whereas developers using material like cotton stalks, Tur stalks, and Paddy Straws etc additional allowance of 2% should be considered.
	Tata Power Company Ltd.	To consider the parameters for biomass power plants in line with CERC RE Tariff Order dated 15 May, 2014
	Orient Green power Company Limited	Requested for changes in the Auxiliary consumption. For Project using water cooled condenser, they requested for 11% during first year of operation and 10% from second year onwards. While for Project using air cooled condenser, they requested for 13% during first year of operation and 12% from second year onwards.
Order in Case No. 6	GMT Mining & Power	Auxiliary power consumption for biomass Power Projects

Reference	Stakeholder	Stakeholder comment
of 2013	Pvt. Ltd	smaller than 12 MW should be considered at 12%.

Auxiliary consumption factor may vary according to the need of pre-processing requirement of the biomass fuel. Considering the requirement of pre-processing of the biomass fuel and typical size of the plant in the State, the auxiliary consumption data of the operational plants was requested from MEDA which is as follows:

Table 71: Data received from MEDA on auxiliary consumption for biomass Power Projects

Sr. No.	Project Name	Project Location	Sanction / Commissioning Year	Capacity	Aux Consumption
		State		MW	%
1	Sripanchyajanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	10
2	M.S.M. Energy Ltd. (Parbhani)	Maharashtra	15/11/2010	10	10
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	9.37
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	11.28
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	15

Considering the variability of auxiliary consumption based on pre-processing of the biomass fuel and typical size of the plant the Auxiliary consumption of 10% for Biomass Based Power Projects is proposed for the purpose of tariff determination for the next review period commencing from FY 2015-16.

9.8 Gross Calorific value of biomass (GCV)

The GCV related provisions in the Orders/Regulations of CERC and other SERCs in relation to Biomass Based Power Projects are as follows:

Table 72: State wise comparative for GCV of biomass

Parameter	Reference	Calorific Value	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	3611 kCal/kg	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	3100 kCal/kg for FY 2015-16	Commission considered the norms as suggested in the report of National productivity Council, CEA as well as by MNRE , the Commission has considered the GCV of biomass at 3250 kCal/kg and after taking into account, use of 15% of coal (average coal GCV at 3600 kCal/kg and 85% uses of Biomass fuel of 3150 kCal/kg), the weighted average GCV has been considered at 3300 kCal/kg.
Andhra Pradesh	APERC Biomass Tariff Order dated 12-09-2011	3275 kCal/kg	In line with CERC norms

Parameter	Reference	Calorific Value	Reason/approach
Gujarat	GERC Co-Generation Projects Order No. 4 of 2013	3400 kCal/kg	Noted that the availability of forest/waste land biomass in the State is considering Prosopis Juliflora is one of the major forest biomass available in the State and it can be used as fuel in biomass based Power Projects
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	3300 kCal/kg	In line with CERC norms
Rajasthan	RERC RE Tariff Regulations, 2014	3400 kCal/kg	NA
Tamil Nadu	TNERC Tariff Order on Biomass Energy (Order No. 8 of 2012)	3200 kCal/kg	Order No. 2 of 2009 dated 27-04-2009.

The comments received from various stakeholders during the public hearing process of various Orders post implementation of Principal RE Tariff Regulations, 2010 related to Calorific Value for Biomass Based Power Projects are as follows:

Table 73: Comments received from stakeholders on GCV for biomass

Reference	Stakeholders	Stakeholder Comments
Order in Case No. 100 of 2014	MBEDA, MVPNL, Orient Green power Company Limited, A A ENERGY Ltd., and GMT Mining and Power Pvt. Ltd.	To consider the GCV of 3100 kCal/kg as per the CREC and in line with Judgment dated 29.5.2014 of the Hon'ble APTEL.
	Tata Power Company Ltd.	To consider the parameters for biomass power plants in line with CERC RE Tariff Order dated 15 May, 2014
	MBEDA	To re-compute variable charges by considering not just fuel cost but also related parameters such as GCV and SHR. MBEDA further submitted that the GCV and SHR cannot depend on year of Commissioning but are based on characteristics of fuel.
Order in Case No. 6 of 2013	GAPS	To revise the gross calorific value to 3300 Kcal/kg.

Calorific Values (CV) of most of the biomass fuel undergo change from high moisture/low CV to low moisture/high CV. The CV is generally estimated by NABL authorized laboratories which certify the calorific value of the fuel.

The operational data of Biomass Based Power Projects (as provided by MEDA) in the State of Maharashtra which is below:

Table 74: Data received from MEDA on GCV for biomass

Sr. No.	Project Name	Project Location	Sanction / Commissioning Year	Capacity	GCV of Fuel FY 13-14
		State		MW	kcal /kg
1	Sripanchyjanya Power Pvt, Ltd.	Maharashtra	05/09/2010	10	3250
2	M.S.M. Energy Ltd. (Parbhani)	Maharashtra	15/11/2010	10	3250
3	Vayunandana Power Ltd.	Maharashtra	09/12/2010	10	3260
4	Greta Energy Pvt. Ltd.	Maharashtra	08/09/2012	15	2800
5	Sinewave Biomass Power (P) Ltd	Maharashtra	27/01/2014	10	1800-2200

The Biomass Atlas prepared and maintained by the Indian Institute of Science, Bangalore maps State-wise availability of the different types of biomass fuel and also presents the power generation potential using each of the biomass fuels:

Table 75: Biomass atlas data

Type of Biomass	GCV kCal/kg	Maha	UP	AP	TN	Kar	Raj	Pun	MP	Har
Paddy	3000	6%	46%			11%		49%	7%	34%
Wheat	3800	6%	37%				51%	28%	16%	33%
Mustard	3400						28%			
Bajra	3950	6%					9%			
Maize	3500			10%		18%				
Cotton	3636	47%		5%		18%		21%	37%	23%
Groundnut	4200			12%		9%				
Coffee	4300					9%				
Coconut	3300			6%	13%	16%				
Jowar	3500	13%				10%			9%	
Gram	3810									
Soyabean	3700	9%							19%	
Sunflower	2800									
Share in Total Biomass Surplus Available		86%	93%	90%	13%	91%	88%	98%	89%	90%
Share in Total Biomass Surplus kT/Yr		12,107	11,696	4,235	1,091	7,652	6,878	24,395	8,957	9,215
Total Biomass Surplus Available kT/Yr		14,002	12,537	4,689	8,092	8,442	7,808	24,789	10,080	10,288
Wt. Avg. Calorific Value for State kCal/kg		3,611	3,371	3,275	3,300	3,576	3,689	3,368	3,612	3,458

The data provided by MEDA is inadequate and does not form a representative sample from which conclusion on actual GCV can be derived hence it is proposed that 3611 kCal/kg will be adopted as GCV for the purpose of tariff determination for the next review period commencing from FY 2015-16.

It is to be noted that the GCV of 3611 kcal/kg has been arrived at by the Indian Institute of Science, Bangalore which has prepared a Biomass atlas mapping the cropping pattern and the available heat content that can be derived out of the major crops in the State.

In Maharashtra cotton has been the major contributor to biomass with 45% share. Thus the GCV of Cotton is most representative of the GCV of the biomass used in the state for power generation. Also taking into account the other types of biomass fuels that are used for power generation a GCV of 3611 kcal/kg has been arrived at for Maharashtra.

9. Technology-specific parameters for Non-Fossil Fuel-based Co-Generation Projects

The norms for the Capital Cost shall be inclusive of all capital work including plant and machinery, civil work, erection and commissioning, financing costs, preliminary and pre-operative expenses, and interest during construction, and evacuation infrastructure up to inter-connection point.

10.1 Capital Cost

The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 76: State wise comparison for Capital Cost for Non-Fossil Fuel-based Co-Generation Projects

Parameter	Reference	Capital Cost (Rs. Lakh/MW)	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	475.28	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	Rs. 452.48 Lakh for FY 2015-16	CERC considered Capital Cost norm developed by IREDA for financing the Project
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	325	As per CERC norms
Gujarat	Determination of Tariff for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	475	considered the appropriate growth rate based on the weighted average growth rate of WPI of steel and electrical machinery during the last review period over the base Capital Cost fixed earlier tariff Order during 2010
Punjab	PSERC tariff for various RE Technologies / Projects for the year 2014-15	544.19	After review of norms of other States
Uttar Pradesh	Tariff Regulations (Dated 22/03/2010)		Year of Operation based capital Cost
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	420	As per CERC RE Tariff Regulations 2012

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to Capital Cost of Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 77: Comments received from stakeholders on Capital Cost for Non-Fossil Fuel-based Co-Generation Power Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Cogen Association of India and Shree Chhatrapati Shahu SSK Ltd	To consider Capital Cost of Rs. 5.25 Crore/MW and Rs. 6.50 Crore/MW with modernization for bagasse based co-generation Projects.
	Shri Datta Sakhar Karkhana	To consider Capital Cost of Rs. 6.50 Crores/MW
	Orient Green power Company Limited	To consider Rs.630 Lakh/MW as the Capital Cost for Non-Fossil Fuel-based Co-Generation Projects.
	Maha Co-Gen Green Power Producers Association	To consider Rs.568 Lakh/MW as the Capital Cost for non-fossil fuel based plants.
Order in Case No. 6 of 2013	Orient Green Power Company Ltd, Maharashtra Rajya Sahakari Sakhar Karkhana Sangh ltd, Yash Agro Energy Ltd and Co Gen Association of India	To consider Capital Cost of Rs. 5.25 cr / MW to Rs. 6.50 cr /MW for Tariff determination
	Maha Co-Gen Green Power	To consider the Capital Cost of Rs. 568 Lakh per MW as against Rs. 464.39 Lakh
	MEDA	Severe drought situation in the Maharashtra may be considered while deriving the variable charge component and appropriate rise may be given.

Following approaches are considered for determining the Capital Cost for Non-Fossil Fuel-based Co-Generation Power Projects.

Comparative Capital Cost- compare the Capital Cost of a particular RE technology as approved by various State Commissions. Data collected from various SERCs is as follows

Table 78: Summary of Capital Cost for Non-Fossil Fuel-based Co-Generation Power Projects

Parameter	CERC	Andhra Pradesh	Gujarat	Maharashtra	Punjab	Tamil Nadu
Capital Cost (Rs. Lakh/MW)	Rs. 452.48 Lakh for FY 2015-16	325 FY 2009-10	475 FY 2013-14	475.28 FY 2014-15	544.19 FY 2014-15	420 FY 2012-13

(a) Capital cost indexation approach:

The Commission in Principal RE Tariff Regulations, 2010 has specified the normative Capital Cost for the Non-Fossil Fuel-based Co-Generation Projects as Rs 398.07 Lakh/MW for FY 2010-11, linked to the indexation mechanism. In accordance to the above referred

Regulation, the normative Capital Cost of Non-Fossil Fuel-based Co-Generation Projects works out to be Rs 481.8 Lakh/MW for FY 2015-16.

Table 79: Capital cost indexation for Non-Fossil Fuel-based Co-Generation Power Projects

Variable	Description	Value
A	Weightage for steel index	0.7
B	Weightage for Electrical Machinery Index	0.3
F1	Factor for land & Civil Works	0.1
F2	Factor for Erection & Commissioning	0.09
F3	Factor for IDC and Financing	0.14

Month/Year	Iron & Steel		Electrical & Machinery	
	2014	2010	2014	2010
Mar	138.40	134.10	155.90	153.80
Apr	138.40	134.50	154.60	155.10
May	138.60	135.50	155.20	154.50
Jun	138.60	135.60	156.10	153.30
Jul	138.80	135.60	156.10	153.40
Aug	138.40	135.70	155.70	154.00
Sep	138.60	136.30	159.10	154.30
Oct	138.70	137.10	161.10	153.00
Nov	138.70	137.50	160.70	153.90
Dec	138.50	137.80	160.80	154.10
Jan	139.00	137.40	161.00	155.10
Feb	139.10	137.80	159.20	155.40
Average	138.7	136.2	158.0	154.2

Parameter	Description	Value
CC(0) (Rs L/MW)	Capital Cost for the Base Year	475.28
P&M(0) (RsL/MW)	Plant & Machinery Cost for the Base Year	357.35
Dn	Capital Cost Escalation Factor	2.26%
P&M(n) RsL/MW)	Plant & Machinery Cost for the nth Year (FY 2015-16)	365.41
CC(n) (RsL/MW)	Capital Cost for the nth Year (FY2015-16)	486.00

(b) **Market approach** - the Capital Cost data has been collected from REC and MEDA. The list of Projects analysed to reach to weighted average Capital Cost of Non Fossil fuel based Cogeneration Projects sanctioned is as follows:

Table 80: Capital cost data received from MEDA for Non-Fossil Fuel-based Co-Generation Power Projects

Sr. No.	Project Developer	COD	Project Capacity (MW)	Technology	Capital Cost (Rs. Lakh)	Capital Cost Per MW (Rs. Lakh/MW)
1	Shri Ambalika	03/12/2012	10	Double Extract	5554.59	370.31

Sr. No.	Project Developer	COD	Project Capacity (MW)	Technology	Capital Cost (Rs. Lakh)	Capital Cost Per MW (Rs. Lakh/MW)
	Sugar Private Limited			Condensing		
			5	Back Pressure Type		
2	Loknete Baburao Patil Agro Industries Limited,	10/10/2014	16.5	Double Extract Condensing	4321.85	261.93
3	Majalgaon SSK Ltd, Sundarnagar	23/11/2013	16	Double Extract Condensing	11864.66	741.54
4	Utech Sugar	NA	14.9	Double Extract Condensing	6873.00	461.28
5	Manjara Shetkari SSKL	17/11/2013	6	Double Extract Condensing	9531.33	529.52
			12	Signal Extraction Back Pressure Type		
6	Samarth SSKL	07/01/2011	18	Double Extraction Condensing	7756.28	430.90

The weighted average Capital Cost derived based on above data is Rs. 466.48 Lakh/MW.

It is proposed that Capital Cost for Non Fossil Fuel based Co-Generation Projects is Rs. 486.00 Lakh/MW for the base year for the next review period commencing from FY 2015-16.

10.2 Operations & Maintenance Expenses (O&M)

The O&M Costs related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 81: State wise comparative for O&M Cost for Non-Fossil Fuel-based Co-Generation Power Projects

Parameter	Reference	O & M Cost	Reason/approach
CERC	CERC Order Suo Moto/004/2015	Rs. 18.91 Lakh/MW for FY 2015-16	Considering the current inflation trend
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	3% on Capital Cost (including insurance) with 4% annual escalation	As per CERC norms
Gujarat	Tariff for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	3% of the Capital Cost of bagasse based co-generation with annual escalation @ 5.72%	Enable the developers to operate and maintain the bagasse based co-generation

Parameter	Reference	O & M Cost	Reason/approach
			Projects in efficient way.
Maharashtra	MERC Order in Case no. 100 of 2014	Rs. 11.763 Lakh/MW with annual escalation of 5.72%	As per MERC RE Tariff Regulations 2010
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	Rs. 26.82 Lakh/MW	After review of norms of other States
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	3% with annual escalation of 5% from second year as O & M expenses on 100% of Capital Cost	in line with approach adopted by other SERCs

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to O&M Cost of Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 82: Comments received from stakeholders on O&M Cost for Non-Fossil Fuel-based Co-Generation Power Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Cogen Association of India and Shree Chhatrapati Shahu SSK Ltd	To consider it in line with CERC guided O&M Costs of Rs. 17.89 Lakh/MW
	Orient Green power Company Limited	To consider Rs.40 Lakh/MW as Normative O&M Costs.
Order in Case No. 6 of 2013	Orient Green Power Company Ltd and Yash Agro Energy Ltd.	to consider O&M Costs ranging from Rs. 40-50 Lakh /MW p.a.
	Co-Gen Association of India	to increase the O&M Costs to Rs. 25 Lakh /MW as against Rs. 16.67 Lakh /MW considered by the Commission.
	Maharashtra Rajya Sahakari Sakhar Karkhana Sangh Ltd and M/s IL&FS	Considered as Rs. 16.67 Lakh / MW whereas the average cost of O&M FY 2013-14 works out to Rs 22.35 Lakh /MW considering 5.72% escalation as per norms of the Commission.

Various stakeholders submitted that the O&M Cost has been increased. To verify the actual O&M Costs, data was sought from MEDA for actual Operational Projects. Following is the list of Projects commissioned post implementation of Principal RE Tariff Regulation.

Table 83: Data received from MEDA on O&M Cost for Non-Fossil Fuel-based Co-Generation Power Projects

S.No	Project Developer	Project Technology	Capacity	Commercial Operation Date	Cumulative O & M Expense	O&M Expense/MW/Year
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			MW	(COD)	Rs. Lakh	Rs. Lakh
				Date		
1	Majalgaon SSK Ltd, Sundarnagar	Double Extract Condensing	6	17/11/2013	800	16.67
		Single Extraction Back Pressure Type	12			
3	Samarth SSKL	Double Extraction Condensing	18	07/01/2011	838.29	11.64

This data is not sufficient to reach to a conclusion on O&M Cost/MW for Non-Fossil Fuel-based Co-Generation Power Projects.

In view of the fact that actual operational data is not adequate, it is proposed that normative O&M Cost is derived as a percentage of the Capital Cost.

In Principal RE Tariff Regulations, 2010 the normative O&M Cost and escalation rate for Non-Fossil Fuel-based Co-Generation Projects is as follows:

(a) Normative O&M Costs for the first year of the Review Period (i.e. FY 2010-11) shall be Rs 14.11 Lakh per MW.

(b) Normative O&M Costs allowed under these Regulations shall be escalated at the rate of 5.72% per annum over the tariff period to compute the levelized tariff.

Table 84: Proposed O&M Cost for Non-Fossil Fuel-based Co-Generation Power Projects

Technology	MERC RE Tariff Regulations, 2010			Proposed for next review period		
	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost
Bagasse Cogeneration	398.07	14.11	3.54%	486.00	17.20	3.54%

The normative O&M Cost as percentage of Capital Cost works out to be Rs. 17.20 Lakh/MW.

For the purpose of tariff calculation, O&M Cost is proposed as 3.54% of Capital Cost per MW for the base year of the next review period commencing from FY 2015-16.

It is also proposed that the O&M Costs be allowed to escalate at a normative rate of 5.72% per annum for the purpose of tariff determination for the next review period commencing from FY 2015-16.

10.3 Plant Load Factor (PLF)

The PLF related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 85: State wise comparative for PLF of Non-Fossil Fuel-based Co-Generation Power Projects

Parameter	Reference	PLF	Reason/approach
Maharashtra	MERC RE Tariff Regulations, 2010	60%	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	60% for Maharashtra for FY 2015-16	Based on State wise availability of fuel
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	55%	As per CERC norms
Gujarat	Tariff Order for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	60%	analysis of operating data of sugar factories in Gujarat during crushing season for the last three years
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	80%	In view of availability of fuel for cogen Projects
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	55%	Cogen Plants also use fossil fuel during off seasons

For the purpose of determining fixed charge, the PLF for Non-Fossil Fuel-based Co-Generation Projects shall be computed on the basis of plant availability for number of operating days considering operations during crushing season and off-season.

Information received from MEDA in respect of PLF of Non-Fossil Fuel-based Co-Generation Projects is as follows:

Table 86: Data received from MEDA on PLF for Non-Fossil Fuel-based Co-Generation Power Projects

S.No	Project Developer	Project Technology	Capacity	Commercial Operation Date (COD)	Plant load Factor
			MW	Date	%
1	Manjara Shetkari SSKL	Double Extract Condensing	6	17/11/2013	-
		Single Extraction Back Pressure Type	12		
3	Samarth SSKL	Double Extraction Condensing	18	07/01/2011	95.44

Since actual PLF data of the operational plants is not adequate to make any conclusion for proposing normative PLF, it is proposed that for the next review period commencing from FY 2015-16 for the purpose of tariff determination a PLF of 60% as per Principal RE Tariff regulations, 2010 be continued.

10.4 Station Heat Rate (SHR)

The SHR related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 87: State wise comparative for SHR of Non-Fossil Fuel-based Co-Generation Projects

Parameter	Reference	SHR	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	3600 kcal/kWh	As per MERC RE Tariff Regulations, 2010
CERC	CERC Order Suo Moto/004/2015	3600kcal/kWh.	SHR of 3600kcal/kg considered based on blending of coal with bagasse for power generation
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	3600kcal/kWh.	As per CERC norms
Gujarat	Tariff Order for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	3600 kCal/kWh	After review of norms of other States
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	4000 kcal/kWh	After review of norms of other States
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	3700 kcal/kWh	considering technological development in the cogen plants and the economies of scale

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to SHR are as follows:

Table 88: Comments received from stakeholders on SHR of Non-Fossil Fuel-based Co-Generation Projects

Reference	Stakeholder	Stakeholder Comments
Order in Case No. 100 of 2014	Cogen Association of India, Shree Chhatrapati Shahu SSK Ltd. and Shri Datta Sakhar Karkhana	Consider Station Heat Rate at 4000 kCal/kWh
	Maha Co-Gen GPPA	Station Heat Rate for Travelling Grate Boilers to be considered as 4200 kCal/kWh.
Order in Case No. 6 of 2013	Orient Green Power Company Ltd	Consider station heat rate at 4500 kcal/kWh.
	Maharashtra Rajya Sahakari Sakhar Karkhana Sangh Ltd.	Requested to consider Station Heat Rate as 3883 kCal /kWh as against 3600 kCal /kWh.
	Yash Agro Energy Ltd	For Projects of less than 12 MW Station Heat should be of 4000 to 4400 kCal per kWh should be considered.

Reference	Stakeholder	Stakeholder Comments
	MEDA	SHR should be revised to about 4500 kCal /kWh.

The details of SHR achieved by the operational Non-Fossil Fuel Based Cogeneration Projects in Maharashtra as submitted by MEDA

Table 89: Data received from MEDA on SHR of Non-Fossil Fuel-based Co-Generation Projects

S.No	Project Developer	Project Technology	Capacity	Commercial Operation Date (COD)	SHR
			MW	Date	kCal/kWh
1	Manjara Shetkari SSKL	Double Extract Condensing	6	17/11/2013	-
		Singal Extraction Back Pressure Type	12		
2	Samarth SSKL	Double Extraction Condensing	18	07/01/2011	4500

The actual data on SHR of Non-Fossil Fuel-based Co-Generation Projects in the State is inconclusive and does not form a representative sample. It is proposed that for the purpose of tariff determination for the next review period commencing from FY 2015-16, SHR of 3600 kCal/kWh as per Principal RE Tariff Regulations, 2010 may be continued.

10.5 Auxiliary Consumption (AUX)

Auxiliary consumption factor is one of the key performance factors and is dependent on the size of the plant. Auxiliary energy consumption is a function of plant efficiency and the energy conservation methods adopted by the developers. Auxiliary consumption factor may vary according to the need of pre-processing requirement of the biomass fuel.

Table 90: State wise comparative for auxiliary consumption for Non-Fossil Fuel-based Co-Generation Projects

Parameter	Reference	AUX	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	8.5%	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	8.5%	Non-fossil fuel based Co-Generation plants have some of the auxiliary equipment common between the sugar mill and the power generation unit. It was also considered that the bagasse requires less processing compared to the biomass and hence comprises lesser auxiliary system

Parameter	Reference	AUX	Reason/approach
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	9%	NA
Gujarat	Tariff Order Biomass based Power Projects and Bagasse based Cogeneration Projects (Order No. 4 of 2013)	8.5%	As per CERC norms
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	8.5%	As per CERC norms
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	9%	NA

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to Auxiliary Consumption are as follows:

Table 91: Comments received from stakeholder on auxiliary consumption for Non-Fossil Fuel-based Co-Generation Projects

Reference	Stakeholder	Stakeholder Comments
Order in Case No. 100 of 2014	Cogen Association of India, Shree Chhatrapati Shahu SSK Ltd., Orient Green power Company Limited and Maha Co-Gen Green Power Producers Association	To change Auxiliary consumption from 8.5% to 10%
Order in Case No. 6 of 2013	Orient Green Power Company Ltd	to fix auxiliary consumption at 10%
	Co Gen Association of India	To increase the auxiliary power consumption to 10% against 8.5% considered by the Commission.
	Maharashtra Rajya Sahakari Sakhar Karkhana Sangh Ltd.	Auxiliary power consumption of 8.5% has been considered as against 9.5 to 10% actual
	Yash Agro Energy Ltd	For Projects of less than 12 MW Auxiliary consumption at 12% should be considered.
	MEDA	Auxiliary power consumption may be increased to 11%.

It is proposed that **the Auxiliary consumption for Non Fossil Fuel based Co-Generation Projects be considered as 8.5% for the purpose of tariff determination for the next review period commencing from FY 2015-16.**

10.6 Fuel Cost

The Fuel Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 92: State wise comparative for fuel cost for Non-Fossil Fuel-based Co-Generation Projects

Parameter	Reference	Fuel Cost	Reason/approach
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Parameter	Reference	Fuel Cost	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	Rs. 2177/MT	As per MERC RE Tariff Regulations 2010. Fixed during first three years of the Review Period (i.e., FY 2010-11, FY 2011-12 and FY 2012-13) and thereafter shall be linked to indexation formulae
CERC	CERC Order Suo Moto/004/2015	Rs. 2326.84/MT for Maharashtra for FY 2015-16	In view of prevalent market rates
Andhra Pradesh	APERC Order dt 20-03-2004 / 31-03-2009	Rs. 950/MT	In view of prevalent market rates
Gujarat	Tariff Order for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	1804/ MT	50% of the price of sugarcane & Commission has decides to use the equivalent heat value approach
Punjab	PSERC tariff Order for various RE Technologies / Projects for the year 2014-15	Rs. 2801MT	As per CERC fuel cost indexation
Tamil Nadu	Tariff Order for Bagasse based Cogeneration plants (Order 7 of 2012)	Rs. 1050/MT Annual escalation of 5%	50% of cane cost in Tamil Nadu

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to Fuel Cost of Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 93: Comments received from stakeholders on fuel cost for Non-Fossil Fuel-based Co-Generation Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Cogen Association of India, Shree Chhatrapati Shahu SSK Ltd. and Shri Datta Sakhar Karkhana	To consider fuel cost for bagasse based co-generation Projects in line with CERC guided cost of Rs. 2174.34/MT.
	Maha Co-Gen GPPA	The variable charge component should be revised to Rs.5.19 from Rs.3.60 per unit.
	Maha Co-Gen GPPA	The price of Bagasse/ other fuel may be considered at least Rs.2500/MT.
Order in Case No.	Shri Datta Sakhar	To revise the uses of fossil fuel to 25% from the

Reference	Stakeholder	Stakeholder Comment
100 of 2014	Karkhana	existing 15%.

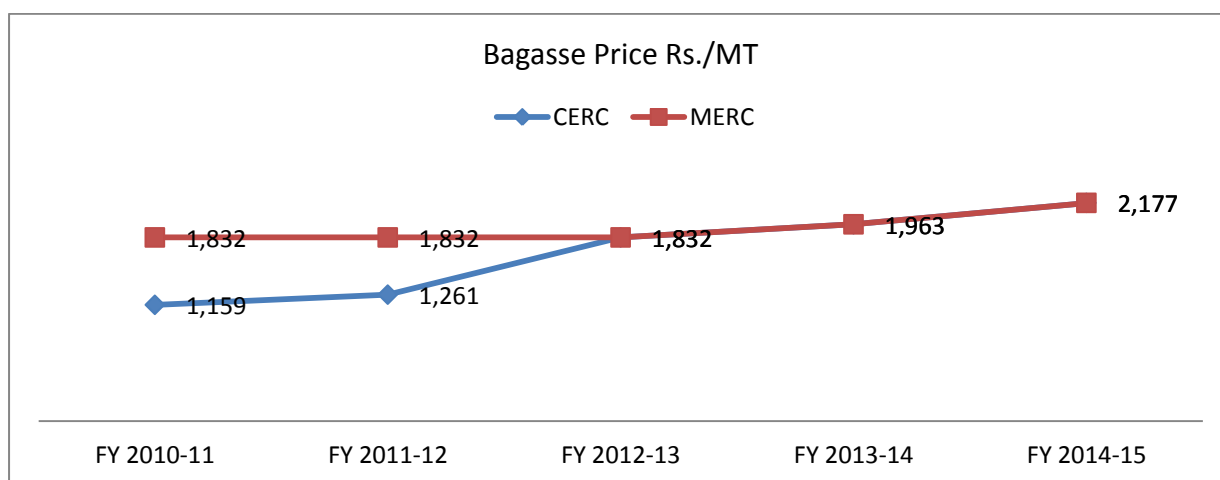
The Fuel Cost related data for bagasse based Co-Generation Projects in the State as provided by MEDA is as follows:

Table 94: Fuel cost data for Non-Fossil Fuel-based Co-Generation Projects received from MEDA

S.No	Project Developer	Project Technology	Capacity	Commercial Operation Date (COD)	Fuel Cost
			MW	Date	Rs/MT
1	Manjara Shetkari SSKL	Double Extract Condensing	6	17/11/2013	2000
		Single Extraction Back Pressure Type	12		
2	Samarth SSKL	Double Extraction Condensing	18	07/01/2011	1963

The data provided by MEDA is not adequate to reach to conclusion on Fuel Cost for Non Fossil Fuel based Co-Generation Power Projects.

The cost of bagasse as approved by MERC and CERC during last 5 years is as follows:



It can be seen that the bagasse price in Maharashtra has grown at a CAGR of 4% and by 13% as specified by CERC for Bagasse Based Power Projects.

It is proposed that the Fuel Cost of Rs. 2326.84/MT as specified in CERC Order 3 March 2015 in Sou Moto Petition SM/004/2015 for Non Fossil Fuel based Co-Generation Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16 will be considered.

The use of fossil fuels shall be limited to the extent of 15% of total fuel consumption on annual basis or as amended by MNRE from time to time.

Non-compliance with the condition of fossil fuel usage by the Project developer, during any financial year, shall render such Non-Fossil Fuel-based Co-Generation Projects to be

ineligible for preferential tariff determined as per these Regulations from the date of default and for duration of the default during such financial year when such default occurs. However, such defaulting Non-Fossil Fuel-based Co-Generation Project shall continue to sell power to concerned Distribution Licensee even during the period of default at the approved Average Power Purchase Cost of the Distribution Licensee by the Commission for respective year below the applicable preferential tariff determined as per these Regulations.

Explanation. --- for the purpose of these Regulations, 'Average Power Purchase Cost' means the weighted average price at which the Distribution Licensee has purchased the electricity including cost of self generation, if any, approved by the Commission in the Tariff Order or Truing Up Order or any other general or specific Order. In case of absence of any such Order, last approved 'Average Power Purchase Cost' shall be used.

Fuel Price Indexation:

For both existing and new Non-fossil Fuel-based Co-Generation Projects, the following indexing mechanism for adjustment of fuel prices for each year of operation will be applicable for determination of the variable charge component of tariff:

The indexed Bagasse Fuel Price (P_n) for each year (n) of the Review Period shall be notified pursuant to notification of such indexed Bagasse Fuel Price norm as applicable for Non-fossil fuel-based Co-Generation Projects within Maharashtra by Central Electricity Regulatory Commission in accordance with indexation mechanism stipulated under CERC RE Tariff Regulations.

Where,

P_1 = Price per ton of Bagasse for the base year FY 2015-16 to be considered for tariff determination

$P(n)$ = Price per ton of Bagasse for the nth year to be considered for tariff determination

Variable Charge for the nth year shall be computed as under:

$$\text{i.e. } VC_n = VC_1 \times (P_n / P_1)$$

where,

VC_1 represents the Variable Charge based on bagasse Price P_1 for FY 2015-16 and shall be determined as under:

$$VC_1 = \frac{\text{Station Heat Rate (SHR)}}{\text{Gross Claorific alue (GCV)}} \times \frac{1}{(1 - \text{Aux consumption factor})} \times \frac{P_1}{1000}$$

9.9 Compliance Monitoring for Non-Fossil Fuel-based Co-Generation Projects

- The Distribution Licensee procuring power from them shall be responsible for monitoring compliance by the Non-fossil Fuel-based Co-Generation Projects with these Regulations.
- The concerned Distribution Licensee shall maintain all data relevant to these Regulations, including technical and commercial details, in respect of Non-Fossil Fuel-based Co-Generation Projects from whom it is procuring power, and shall make the data available in the public domain by publishing it on its website and updating it on a quarterly basis.

10.7 Gross Calorific Value (GCV)

The GCV related provisions in the Orders/Regulations of CERC and other SERCs in relation to Non-Fossil Fuel-based Co-Generation Projects are as follows:

Table 95: State wise comparative for GCV for Non-Fossil Fuel-based Co-Generation Power Projects

Parameter	Reference	GCV	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	2250 kcal/kg.	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	2250 kCal/kg.	Based on comments received from stakeholders
Andhra Pradesh	APERC Order Dt 20-03-2004 / 31-03-2009	2250 kCal/kg	As per CERC norms
Gujarat	Tariff Order for Biomass based Power Projects and Bagasse based Co-Generation Projects (Order No. 4 of 2013)	2250 kCal/kg	consider the representative biomass consisting of equal proportion of surplus agro residue and Prosopis Juliflora available in the State
Punjab	PSERC tariff Order for RE Technologies / Projects for the year 2014-15	3300 kCal/kg	After review of norms of other States
Tamil Nadu	Tariff Order for Bagasse based Co-Generation plants (Order 7 of 2012)	2300 kcal / kg	Considering the views expressed by the stakeholders

Gross Calorific Values (GCV) of most of the Bagasse fuel undergo unpredictable change from high moisture/low CV to low moisture/high CV. The GCV is generally estimated by NABL authorized laboratories which certify the calorific value of the fuel.

The operational data of Non Fossil Fuel based Co-Generation Power Projects provided by is as below:

Table 96: GCV data received from MEDA for Non-Fossil Fuel-based Co-Generation Power Projects

S.No	Project Developer	Project Technology	Capacity	Commercial Operation Date (COD)	GCV of fuel
			MW	Date	Kcal/kg
1	Manjara Shetkari SSKL	Double Extract Condensing	6	17/11/2013	-
		Single Extraction Back Pressure Type	12		
2	Samarth SSKL	Double Extraction Condensing	18	07/01/2011	2250

As the data provided by MEDA is not adequate to reach to a conclusion on GCV of fuel for Non-Fossil Fuel-based Co-Generation Projects, it is proposed that GCV of 2250

kcal/kg as per Principal RE Tariff Regulations, 2010 be continued for the purpose of tariff determination for the next review period commencing from FY 2015-16.

10. Technology-specific parameters for Solar PV Power Project

11.1 Capital Cost

The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar PV Power Projects are as follows:

Table 97: State wise Capital Cost data for Solar PV Projects

Parameter	Reference	Capital Cost Rs. Lakh/MW	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	691 (FY 2014-15)	As per CERC Order for Capital Cost for FY 2014-15
CERC	CERC Suo-Moto Order No SM/005/2015 dated 03 rd March 2015	587.33 (FY 2015-16)	Taking into account degradation in the module output over a period of time as well as the auxiliary power consumption requirement, the Commission has decided to consider the additional cost towards degradation and auxiliary in the Capital Cost.
Gujarat	GERC Order No. 1 of 2012	1000 (MW scale Plants), 1200 (kW scale plants)	The Capital Costs of Solar generators are consistently falling down.
Rajasthan	Order dated 21.08.2014 applicable during FY 2014-15	673 for FY 2014-15	Based on discussion with stakeholders
Tamil Nadu	Tariff Order for Solar Power dated 12-09-2014	700	In consideration of views expressed by stakeholders

It is observed that with rapid improvement of technology, the Capital Cost related to Solar PV Projects have reduced drastically. The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to Capital Cost of Solar PV Power Projects are as follows:

Table 98: Comments received from stakeholder on Capital Cost for Solar PV Projects

Order Reference	Stakeholders	Stakeholders Comments
Order in Case No. 100 of 2014	Shri Ulhas Chaudhari	To consider land cost while determining the Capital Cost of Solar Projects.
	Association of power producers (APP)	To consider the Capital Cost of Solar PV Projects as Rs. 1132.21 Lakh/MW
	Sri Maruti Solar Power Pvt. Ltd.	To revise the Capital Cost to 900 Lakh/MW.
	Green Energy Association and Enrich Energy	To consider Capital Cost as Rs.751to Rs. 755 Lakh/MW.

Order Reference	Stakeholders	Stakeholders Comments
	Welspun Renewables Energy Private Limited	To consider the lowest tariff of the Projects which is feeding power to the grid and arrive at an optimum price also to consider the preliminary/pre-operating expenses and financing costs at the percentage of Capital Cost.
	Arbutus Consultants Pvt. Ltd.	With the kind of volatility seen on foreign exchange it is essential to have "forward cover" for import of materials. This enhances the transaction cost for imported items (almost 70% items are imported) by about 4 to 5% also module price has gone up.
	Essel Infra Projects	For pass through provision for antidumping duty, if levied in future.
Order in Case No. 6 of 2013	Reliance Power Ltd	cost of township =Rs 25 Lakh/MW, module price = \$0.75/Wp
		non module cost for thin film should be 15% higher than crystalline technology
		Land requirement should be 6 acres/ MW for crystalline PV and 7 acres/MW for thin film technology, cost of land= Rs. 10 Lakh/acre including CSR and R&R cost. Also in case of private land acquisition, the cost of relocation and rehabilitation (R&R) should be considered, along with the CSR expenditures incurred by the developer. Cost for Solar Thermal power plants should be increased to Rs. 13.50 cr/MW.

Following approaches are available for determining the Capital Cost for Solar PV Power Projects.

- (a) **Comparative Capital Cost-** compare the Capital Cost of a Solar PV technology as approved by various State Commissions. Data collected from various SERCs is as follows

Table 99: Summary of Capital Cost for Solar PV Projects

Parameter	CERC	Gujarat	Maharashtra	Rajasthan	Tamil Nadu
Capital Cost Rs. Lakh/MW	587.33 FY 2015-16	1000 (MW scale Plants), 1200 (kW scale plants) FY 2012-13	691 FY 2014-15	673 FY 2014-15	700 FY 2014-15

- (b) **Market approach** - the Capital Cost data has been collected from REC and MEDA .The list of Projects that have been analysed to reach to weighted average Capital Cost of Solar PV Power Projects sanctioned is as follows:

Table 100: Data received from MEDA & REC on Capital Cost for Solar PV power Projects

Projects	Capacity (MW)	Wght. Avg. Capital Cost (Rs Lakh/MW)	Details provided by	Project Developer
FY 2010-11	1	1708.00	REC	Raajratna Energy Holdings Pvt Ltd
FY 2010-11	5	1470.00	REC	Swisspark Vanijya Pvt Ltd
FY 2010-11	1	940.00	REC	Amrit Jal Ventures Ltd
FY 2012-13	5	1182.60	REC	Ganeshvani Merchandise Pvt Ltd., Kolkata
FY 2012-13	10	1169.10	REC	CBC Solar Technologies Pvt. Ltd.
FY 2012-13	15	1550.00	REC	Moser Baer Energy & Development Ltd
FY 2012-13	20	1182.30	REC	Hiraco Renewable Energy Pvt. Ltd.
FY 2013-14	25	835.00	REC	Acme Solar Energy Madhya Pradesh Pvt. Ltd.
FY 2013-14	25	1182.24	REC	M/S Chattel Construction Pvt Ltd
FY 2013-14	25	1321.76	REC	M/S Ganges Green Pvt Ltd
FY 2013-14	5	1704	MEDA	Videocon Industries Ltd
FY 2013-14	25	996	MEDA	Tata Power company Ltd
FY 2013-14	22	827	MEDA	Welspun Energy Maharashtra Pvt Ltd

Analysing the above data the weighted average Capital Cost of Solar PV Power Projects is as follows:

Table 101: Weighted average Capital Cost for Solar PV Projects

Wght. Avg. Capital Cost of Projects sanctioned	MEDA (Rs Lakh/MW)	REC (Rs Lakh/MW)
FY 2011-12	NA	1428.29
FY 2012-13	NA	1290
FY 2013-14	992.58	1127.59

This cost seems to be considerably higher than the Capital Cost for Solar PV Projects determined by MERC Order in Case No 100 of 2014 (based on CERC Order dated 15 May 2014) which is Rs. 691 Lakh/MW for Solar PV Power Projects and the Capital Cost for Solar PV Projects determined by CERC Order No. SM/005/2015 dated 31 March, 2015 which is **Rs. 605.85 Lakh/MW for FY 2015-16.**

Taking into consideration the data analysed from MEDA and REC and cost per MW established by CERC it is proposed that Capital Cost for Solar PV Projects for the

base year FY 2015-16 be taken as Rs. 605.85 Lakh/MW in line with the CERC Order No. SM/005/2015 dated 31 March, 2015.

11.2 Capacity Utilization Factor (CUF)

The CUF related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar PV Power Projects are as follows:

Table 102: State wise CUF for Solar PV Projects

Parameter	Reference	CUF	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	19%.	As per MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	19%.	The CERC has used NREL Projected incident Solar irradiation data, which is based on satellite modeling, of Rajasthan, Gujarat and Andhra Pradesh States used for determination of Solar field size corresponding to target CUF of 19%.
Gujarat	GERC Order No. 1 of 2012	18% with 1% annual degradation	The Commission considered views of stakeholders
Rajasthan	Order dated 21.08.2014 for FY 2014-15	20% with de-rating factor of 0.50%	CUFs are considered taking into account the efficiency factors of equipment, de-rating etc
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	19%	CUFs are considered taking into account the efficiency factors of equipment, de-rating etc

The comments received from various stakeholders during the public hearing process on various matters and Orders post implementation of Principal RE Tariff Regulations, 2010 related to CUF of Solar PV Power Projects are as follows:

Table 103: Comments received from stakeholders on CUF for Solar PV Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Essel Infra Projects Limited, Welspun Renewables Energy Private Limited and Sri Maruti Solar Power Private Limited	For consideration of zone wise CUF varying from 15% to 20% as Solar irradiation varies from 12-17% in the State.
Order in Case No. 6 of 2013	Reliance Power Ltd	The annual degradation in CUF of 3% for first year and 1% thereafter for subsequent years for Solar PV Projects.
Order in Case No. 100 of 2014	Sri Maruti Solar	To consider degradation of Solar Module at the rate of 1% every year after 2nd year
	Welspun	To consider degradation after 4th year at a rate of 0.5% p.a. and requested to factor the annual degradation for Solar PV by way of reducing the PLF every year.

Reference	Stakeholder	Stakeholder Comment
	Arbutus Consultants Pvt Ltd	The annual degradation of PV module power at the rate of 0.5% per annum may be considered.

It is been observed that with rapid improvement of technology, the CUF of Solar PV Projects has improved considerably however derating of Solar modules has been a major concern for Project developers.

The CUF data has been collected from REC and MEDA. The list of Projects that have been analysed as follows:

Table 104: CUF data received from MEDA and REC for Solar PV Projects

Project Name	Project capacity	CUF			
		2010-11	2011-12	2012-13	2013-14
Rajaratna Energy Holdings Pvt Ltd	1 MW	15.34%			
Swisspark Vanijya Pvt Ltd	5 MW	19%			
Ganeshvani Merchandise Pvt Ltd	5 MW			17.85%	
CBC Solar Technologies Pvt Ltd.	10 MW			15.78%	
Moser Baer Energy & Development Ltd	15 MW			19.14%	
Hiraco Renewable Energy Pvt Ltd	20 MW			18.2%	
ACME Solar Energy Madhya Pradesh Pvt Ltd	25 MW				10.66%
M/S Chattel Construction Pvt Ltd	25 MW				16.81%
M/S Ganges Green Pvt Ltd	25 MW				15.9%
Videocon Industries Ltd	5 MW				20%
Tata Power company Ltd	25 MW				18.56%
Welspun Energy Maharashtra Pvt Ltd	22 MW				19.1%

Analyzing the data of CUF of the various plants, it is observed that the CUF for Solar PV is in the range of 15% to 20%. However the inconsistent nature of data provided does not make it representative of the actual generation scenario for Solar PV Projects. Also CERC and other SERCs have considered a CUF of 19% for purpose of tariff determination.

In view of this it is proposed that CUF of 19% will be considered for the purpose of tariff determination for Solar PV Power Projects for the next review period commencing from FY 2015-16.

11.3 Operations & Maintenance Expenses (O&M)

The O&M Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar PV Power Projects are as follows:

Table 105: State wise O&M Cost for Solar PV Projects

Parameter	Reference	O&M Cost	Reason/approach
Maharashtra	MERC Order in Case no. 100 of 2014	11.87 Lakh/MW annual escalation 5.72% per annum	As per MERC RE Tariff Regulations 2010

Parameter	Reference	O&M Cost	Reason/approach
CERC	CERC Order Suo Moto/004/2015	Rs. 13.00 Lakh/MW for FY 2015-16	
Gujarat	GERC Order No. 1 of 2012	0.75% of Capital Cost escalated at the rate of 5.85% per annum	Considered views of stakeholders
Rajasthan	Order dated 21.08.2014	15 Lakh /MW for FY 2012-13 with an escalation of 5.72% p.a. Plus 0.3% of depreciated Project cost in each year towards insurance.	As per Regulations 28(1) of RERC RE Tariff Regulations, 2014 with annual escalation of 5.85% per annum.
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	1.4% of the capital cost with 5.72 % escalation after 1st year	Considering stakeholders' views, O&M Cost adopted by CERC and other SERCs

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to O&M Cost of Solar PV Power Projects are as follows:

Table 106: Comments received from stakeholders on O&M Cost for Solar PV Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 100 of 2014	Sri Maruti Solar Power Private Limited	To consider O&M Cost as Rs.20 Lakh/MW for Solar PV Project and annual escalation rate should be reflective of actual price due to higher WPI and increase manpower cost.
Order in Case No. 6 of 2013	Reliance Power Ltd	For Solar PV plants for FY 2013-14 should be Rs 11.63 Lakh/MW as against Rs 11.23 Lakh/MW

In Principal RE Tariff Regulations, 2010 the normative O&M Cost and escalation rate for RE technologies is as follows:

- (a) *The O&M Expenses shall be Rs.9.51 Lakh/MW for the 1st year of operation.*
- (b) *Normative O&M expenses allowed at the commencement of the Review Period under these Regulations shall be escalated at the rate of 5.72% per annum.*

The O&M data has been collected from REC and MEDA. The list of Projects that have been analysed to reach to weighted average Capital Cost of Solar PV Projects sanctioned is as follows:

Table 107: O&M Cost data received from MEDA and REC for Solar PV Projects

Year	Developer	Capacity (MW)	Actual. O&M Costs per MW as part of Capital Cost (Rs. Lakh/MW)
FY 2011-12	Raajratna Energy Holdings Pvt Ltd	1	34.28

Year	Developer	Capacity (MW)	Actual. O&M Costs per MW as part of Capital Cost (Rs. Lakh/MW)
FY 2011-12	Swisspark Vanijya Pvt Ltd	5	9.51
FY 2012-13	Ganeshvani Merchandise Pvt Ltd., Kolkata	1	9.50
FY 2012-13	CBC Solar Technologies Pvt. Ltd.	5	9.5
FY 2012-13	Moser Baer Energy & Development Ltd	10	5
FY 2013-14	Hiraco Renewable Energy Pvt. Ltd.	15	5
FY 2013-14	Acme Solar Energy Madhya Pradesh Pvt. Ltd.	20	4.17
FY 2013-14	M/S Chattel Construction Pvt Ltd	25	3
FY 2013-14	M/S Ganges Green Pvt Ltd	25	3

Based on the data provided above the weighted average O&M Cost comes out to be 4.65 Lakh/MW. This O&M Cost for the operational Solar Projects in the State is coming very less as compared to the O&M Cost as specified by CERC for for FY 2015-16.

Further, the O&M calculated as percentage of Capital Cost works out to be Rs. 3.29 Lakh/MW based on the ratio of O&M Cost to Capital cost for FY 2010-11 in the Principal RE Tariff Regulations. This O&M Cost as a percentage of Capital Cost allowed by MERC in its Principal RE Tariff Regulations, 2010 works for FY 2015-16 works out to be Rs. 3.39 Lakh which is significantly less than the O&M Cost determined by CERC for FY 2015-16.

It is proposed that for the purposed of tariff calculation normative O&M Cost of Rs. 13 Lakh of the Capital Cost per MW is adopted for the base year of the next review period commencing from FY 2015-16 as determined by CERC in Petition No. SM/004/2015(Suo-Motu).

It is further proposed that the O&M Costs be allowed to escalated at a normative rate of 5.72% per annum for Solar PV based Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16.

11. Technology-specific parameters for Solar Thermal Power Projects:

12.1 Capital Cost

The Capital Cost related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar Thermal Power Projects are as follows:

Table 108: State wise Capital Cost data for Solar Thermal Projects

Parameter	Reference	Capital Cost (Rs. Lakh/MW)	Reason/approach
Maharashtra	MERC RE Tariff Regulations, 2010	1530 for FY 2010-11.	Based on market data as per MERC RE Tariff Regulations 2010
CERC	CERC suo-moto Order No 005 dated 3 rd March 2015	1200 (FY 2015-16)	Based on the market information of EPC contracts signed by the Solar Thermal Projects developer under phase-1 of the National Solar Mission and estimated plant load factor on standalone plants, the Commission has decided to retain the total Project cost at ` 1200 Lakh/MW as benchmark Capital Cost for determination tariff for Solar Thermal Projects
Gujarat	GERC Order No. 1 of 2012	1400	The Capital Cost is derived based on global examples, no precedence to support the technology.
Rajasthan	RERC RE Tariff Regulations, 2014 RERC Order dated 21.08.2014	1195 (FY 2014-15)	As per norms prescribed in RERC RE Tariff Regulations, 2014.
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	1200	In consideration of CERC <i>suo-moto</i> Order no. 353 dated 15/5/2014.

Following approaches are available for determining the Capital Cost for Solar Thermal Projects.

- (a) **Comparative Capital Cost-** Comparing the Capital Cost data for Solar Thermal technology as approved by various State Commissions as follows

Table 109: Summary of Capital Cost data for Solar Thermal Projects

Parameter	CERC	Gujarat	Maharashtra	Rajasthan	Tamil Nadu
Capital Cost Rs. Lakh/MW	1200 FY 2015-16	1400 FY 2012-13	1530 FY 2010-11	1195 FY 2014-15	1200 FY 2014-15

Market approach - MERC sought the data from MEDA and other financial institutions to ascertain the Capital Cost per MW for Solar Thermal Projects. However there has been no response regarding the Capital Cost per MW for Solar Thermal Projects.

CERC in its Suo Moto Order No SM/005/2015 dated 3 March, 2015 has established

benchmark Capital Cost for Solar Thermal Projects as Rs. 1200 Lakh/MW for FY 2015-16 with a provision of indexing the Capital Cost with respect to the prevailing market conditions.

It is therefore proposed that the benchmark Capital Cost for Solar Thermal Projects for FY 2015-16 is considered as Rs. 1200 Lakh/MW in line with CERC RE Tariff Order for FY 2015-16.

12.2 CUF for Solar Thermal Power Projects

CUF related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar Thermal Power Projects are as follows:

Table 110: State wise comparative for CUF for Solar Thermal Projects

Parameter	Reference	CUF (%)	Reason/approach
Maharashtra	MERC RE Tariff Regulations, 2010	The Capacity Utilisation Factor shall be 23%.	As per CERC Regulations
CERC	CERC Generic RE Tariff Order for FY 2012-13; CERC (RE Tariff) Regulations, 2012	The Capacity Utilisation Factor shall be 23%.	Commission has used NREL Projected incident Solar irradiation data, based on satellite modelling, of Rajasthan, Gujarat and Andhra Pradesh States used for determination of Solar field size corresponding to target CUF of 23% and Capital cost.
Gujarat	GERC Order No. 1 of 2012	23% with 0.25% annual degradation	CUFs are considered taking into account the efficiency factors of equipment, de-ration etc
Rajasthan	Order dated 21.08.2014	23% with deration factor of 0.25%	CUFs are considered taking into account the efficiency factors of equipment, de-ration etc
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	The Capacity Utilisation Factor shall be 23%.	CUFs are considered taking into account the efficiency factors of equipment, de-ration etc

The comments received from various stakeholders during the public hearing process on various matters and Orders post implementation of Principal RE Tariff Regulations, 2010 related to CUF of Solar Thermal Power Projects are as follows:

Table 111: Comments received from stakeholder on CUF for Solar Thermal Projects

Reference	Stakeholder	Stakeholder Comment
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Reference	Stakeholder	Stakeholder Comment
Order in Case No. 6 of 2013	Reliance Power Ltd	Should be reduced to 20% as against 23% or RoE should be suitably increased in case CUF is not reduced. For Solar Thermal plants, annual degradation in CUF of 1% p.a. for the life of Project should be considered.

It is proposed that for the next review period commencing from FY 2015-16 the CUF for Solar Thermal Projects is considered as 23.00% in line with CERC Order Suo Moto 353 dated 15 May 2014 for the purpose of tariff determination.

12.3 Operations & Maintenance Expenses (O&M)

The O&M Costs related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar Thermal Power Projects are as follows:

Table 112: State wise comparative for O&M Cost for Solar Thermal Projects

Parameter	Reference	O & M Cost	Reason/approach
Maharashtra	MERC RE Tariff Regulations, 2010	Rs 13.74 Lakh/MW with 5.72 % annual escalation	As per norms stipulated under Regulation 67 and 72 of MERC RE Tariff Regulations 2010
CERC	CERC Order Suo Moto/004/2015	Rs. 17.72 Lakh/MW for FY 2015-16	Escalation rate in line with the escalation factor considered for conventional Power Projects
Gujarat	GERC Order No. 1 of 2012	1.5% of Capital Cost with 5.72 % annual escalation	After consideration of operative parameters
Rajasthan	Order dated 21.08.2014 for	Rs. 15 Lakh /MW for FY 2012-13 annual escalation of 5.72% p.a. Plus 0.3% of depreciated Project cost in each year towards insurance.	In accordance with regulation 28(1) of the RERC RE Tariff Regulations, 2014 with annual escalation of 5.85% per annum
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	1.4% of the capital cost with 5.72 % annual escalation	Considering stakeholders' views, O&M Cost adopted by CERC and other SERCs

The comments received from various stakeholders during the public hearing process on various matters post implementation of Principal RE Tariff Regulations, 2010 related to O&M Cost of Solar Thermal Power Projects are as follows:

Table 113: Comments received from stakeholders on O&M Cost for Solar Thermal Projects

Reference	Stakeholder	Stakeholder Comment
Order in Case No. 6 of 2013	Reliance Power Ltd	For the Solar Thermal Project O&M Costs should be revised to Rs 18 Lakh / MW due to high actual O&M Cost and higher escalation factors

To verify the actual O&M Costs data was sought from MEDA and other financial institution regarding actual O&M Costs for Solar Thermal Projects. However no data has been received by Commission from MEDA or any other financial Institution as there are very few Solar Thermal Projects commissioned in India.

In view of the fact that actual operational data is not received from the Project developers or MEDA, it is proposed that normative O&M Cost of is derived as a percentage of the Capital Cost.

In Principal RE Tariff Regulation, 2010 the normative O&M Cost and escalation rate for RE technologies as follows:

- (a) *The O&M Expenses shall be Rs. 13.74 Lakh/MW for the 1st year of operation.*
- (b) *Normative O&M expenses allowed at the commencement of the Review Period under these Regulations shall be escalated at the rate of 5.72% per annum.*

Technology	MERC RE Tariff Regulations, 2010			Proposed for next review period	
	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW	O&M Cost as % of Capital Cost	Capital Cost Rs. Lakh/MW	O&M Cost Rs. Lakh/MW
Solar Thermal	1,530.00	13.74	0.90%	1,200.00	10.80

With this approach the O&M Cost works out to be Rs. 10.80 Lakh/MW.

It is proposed that for the purpose of tariff determination the O&M Cost of Rs. 15 Lakh per MW is adopted for the base year for next review period commencing from FY 2015-16 as determined by CERC in Petition No. SM/004/2015(Suo-Motu).

It is also proposed that considering the increase in cost of spares the O&M Costs be allowed to escalate at a normative rate of 5.72% per annum for Wind Power Projects for the purpose of tariff determination for the next review period commencing from FY 2015-16.

12.4 Auxiliary consumption (AUX)

The auxiliary power consumption related provisions in the Orders/Regulations of CERC and other SERCs in relation to Solar Thermal Power Projects are as follows:

Table 114: State wise comparative for auxiliary consumption for Solar Thermal Projects

Parameter	Reference	Auxiliary Consumption	Reason/approach
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Parameter	Reference	Auxiliary Consumption	Reason/approach
Maharashtra	MERC RE Tariff Regulations, 2010	10%	As per MERC RE Tariff Regulations 2010
CERC	CERC (RE tariff) Regulations, 2012	10%	Based on nascent technology
Gujarat	GERC Order No. 1 of 2012	10%	In line with its last Solar tariff Order dated 29 January, 2010
Rajasthan	RERC in its RE Tariff Regulations, 2014	6.50%	
Tamil Nadu	Tariff Order on Solar Power dated 12-09-2014	10%	In line with the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012

Since there is no operational data available to verify the actual auxiliary consumption for Solar Thermal Projects, it is proposed that for the purpose of tariff determination the auxiliary consumption be considered as 10% for the next review period commencing from FY 2015-16. This is also in line with CERC and many other SERCs.

12. Competitive Bidding for procurement of power generated by RE technologies

Section 61 & 62 of the Act provide for tariff regulation and determination of tariff of generation, transmission, wheeling and retail sale of electricity by the Appropriate Commission. As per proviso of Section 61 read with Section 178(2) of the Electricity Act, 2003, the Terms and Conditions for Tariff determination from RE Sources Regulations, 2009 were framed by the CERC in September, 2009. Further, Section 63 of the Act states that – “Notwithstanding anything contained in Section 62, the Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government.”

MNRE has framed draft guidelines for Tariff Based Competitive Bidding Process for Grid Connected Power Projects Based on RE Sources¹⁵. These guidelines have been framed to cover grid connected RE Sources (excluding wind energy) under the above provisions of Section 63 of the Act. The specific objectives of these guidelines are as follows:

1. Promote competitive procurement of electricity from Renewable Energy Sources by distribution licensees;
2. Facilitate transparency and fairness in procurement processes;
3. Facilitate reduction of information asymmetries for various Bidders;

¹⁵ http://mnre.gov.in/file-manager/UserFiles/guidelines_sbd_tariff_gridconnected_res/guidelines_tariff_grid_re.pdf

4. Protect consumer interests by facilitating competitive conditions in procurement of electricity;
5. Enhance standardization and reduce ambiguity and hence time for materialization of Projects;
6. Provide flexibility to sellers on internal operations while ensuring certainty on availability of power and tariffs for buyers.

In view of the fact that MNRE has now framed draft guidelines for Tariff Based Competitive Bidding Process for Grid Connected Power Projects Based on RE Sources (excluding Wind Energy), MERC can now consider initiating power procurement by Maharashtra Distribution Licensees through competitive bidding for Grid Connected Power Projects Based on RE Sources.

It is recommended that following Regulation is introduced in the RE Tariff Regulation for the Review Period commencing from FY 2015-16

“The Commission shall adopt the tariff for RE Power Projects where tariff has been determined through the transparent process of Competitive Bidding, as envisaged under Section 63 of the Act.

Competitive bidding for RE Projects shall be introduced in the State, subsequent to Notification of competitive bidding guidelines by the Central Government including the Standard Bid Documents as applicable for RE Projects.