

CENTRAL ELECTRICITY REGULATORY COMMISSION

NEW DELHI

No.: 1/21/2017-Reg.Aff./(RE-Tariff - 2017-20)/CERC

Dated: 17th April 2017

NOTIFICATION

In exercise of powers conferred under Section 61 read with Section 178 (2)(s) of the Electricity Act, 2003 (36 of 2003), and all other powers enabling it in this behalf, and after previous publication, the Central Electricity Regulatory Commission hereby makes the following regulations, namely:

1. Short title and commencement

- 1) These regulations may be called the Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2017.
- 2) These regulations shall come into force on 1.4.2017, and unless reviewed earlier or extended by the Commission, shall remain in force for a period of 3 years from the date of commencement.

2. Definitions and Interpretation

- 1) In these regulations, unless the context otherwise requires,
 - a) **'Act'** means the Electricity Act, 2003 (36 of 2003);
 - b) **'Auxiliary energy consumption'** or 'AUX' in relation to a period in case of a generating station means the quantum of energy consumed by auxiliary equipment of the generating station, and transformer losses

within the generating station, expressed as a percentage of the sum of gross energy generated at the generator terminals of all the units of the generating station;

- c) **'Biomass'** means wastes produced during agricultural and forestry operations (for example straws and stalks) or produced as a by-product of processing operations of agricultural produce (e.g., husks, shells, deoiled cakes, etc); wood produced in dedicated energy plantations or recovered from wild bushes/weeds; and the wood waste produced in some industrial operations;
- d) **'Biomass gasification'** means a process of incomplete combustion of biomass resulting in production of combustible gases consisting of a mixture of Carbon monoxide (CO), Hydrogen (H₂) and traces of Methane (CH₄), which is called producer gas;
- e) **'Biogas'** means a gas created when organic matter like crop residues, sewage and manure breaks down in an oxygen-free environment (ferments);
- f) **'Capital cost'** means the capital cost as defined in regulations 12, 25, 28, 33, 44, 52,57, 62, 70 and 77;
- g) **'Commission'** means the Central Electricity Regulatory Commission referred to in sub-section (1) of section 76 of the Act;
- h) **'Conduct of Business Regulations'** means the Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999 as amended from time to time;
- i) **'Control Period or Review Period'** means the period during which the norms for determination of tariff specified in these regulations shall remain valid;
- j) **'Gross calorific value'** or 'GCV' in relation to a fuel used in generating station means the heat produced in kCal by complete combustion of one kilogram of solid fuel or one liter of liquid fuel or one standard cubic meter of gaseous fuel, as the case may be;
- k) **'Gross station heat rate'** or 'SHR' means the heat energy input in

- kCal required to generate one kWh of electrical energy at generator terminals of a thermal generating station;
- l) **'Hybrid Solar Thermal Power Plant'** means the solar thermal power plant that uses other forms of energy input sources along with solar thermal energy for electricity generation, and wherein not less than 75% of electricity is generated from solar energy component;
- m) **'Installed capacity'** or 'IC' means the summation of the name plate capacities of all the units of the generating station or the capacity of the generating station (reckoned at the generator terminals), approved by the Commission from time to time;
- n) **'Inter-connection Point'** shall mean interface point of renewable energy generating facility with the transmission system or distribution system, as the case maybe:
- i. in relation to wind energy projects and solar photovoltaic Projects, inter-connection point shall be line isolator on outgoing feeder on HV side of the pooling sub-station;
 - ii. in relation to small hydro power, biomass power and non fossil fuel based cogeneration power projects and solar thermal Power Projects the, inter-connection point shall be line isolator on outgoing feeder on HV side of generator transformer;
- o) **'MNRE'** means the Ministry of New and Renewable Energy of the Government of India;
- p) **'Municipal solid waste'** or 'MSW' means and includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes;
- q) **'Non-firm power'** means the power generated from renewable sources, the hourly variation of which is dependent upon nature's phenomenon like sun, cloud, wind, etc., that cannot be accurately predicted;
- r) **'Non fossil fuel based co-generation'** means the process in which

more than one form of energy (such as steam and electricity) are produced in a sequential manner by use of biomass provided the project may qualify to be a co-generation project if it fulfills the eligibility criteria as specified in clause (4) of Regulation 4;

- s) **'Operation and maintenance expenses'** or 'O&M expenses' means the expenditure incurred on operation and maintenance of the project, or part thereof, and includes the expenditure on manpower, repairs, spares, consumables, insurance and overheads;
- t) **'Project'** means a generating station or the evacuation system upto inter-connection point, as the case may be, and in case of a small hydro generating station includes all components of generating facility such as dam, intake water conductor system, power generating station and generating units of the scheme, as apportioned to power generation;
- u) **'Refuse derived fuel'** or 'RDF' means segregated combustible fraction of solid waste other than chlorinated plastics in the form of pellets or fluff produced by drying, de-stoning, shredding, dehydrating, and compacting combustible components of solid waste that can be used as fuel;
- v) **'Renewable Energy'** means the grid quality electricity generated from renewable energy sources;
- w) **'Renewable Energy Power Plants'** means the power plants other than the conventional power plants generating grid quality electricity from renewable energy sources;
- x) **'Renewable Energy Sources'** means renewable sources such as small hydro, wind, solar including its integration with combined cycle, biomass, bio fuel cogeneration, urban or municipal waste and other such sources as approved by the MNRE;
- y) **'Small Hydro'** means Hydro Power projects with a station capacity up to and including 25 MW;
- z) **'Solar PV power'** means the Solar Photo Voltaic power project that uses sunlight for direct conversion into electricity through Photo Voltaic

technology;

- aa) **'Solar Thermal power'** means the Solar Thermal power project that uses sunlight for direct conversion into electricity through Concentrated Solar Power technology based on either line focus or point focus principle;
- bb) **'Tariff period'** means the period for which tariff is to be determined by the Commission on the basis of norms specified under these Regulations;
- cc) **'Useful Life'** in relation to a unit of a generating station including evacuation system shall mean the following duration from the date of commercial operation (COD) of such generation facility, namely:-
- | | |
|--|----------|
| (a) Wind energy power project | 25 years |
| (b) Biomass power project with Rankine cycle technology | 20 years |
| (c) Non-fossil fuel cogeneration project | 20 years |
| (d) Small Hydro Plant | 35 years |
| (e) Municipal Solid Waste (MSW)/ and Refuse Derived Fuel (RDF) based power project | 20 years |
| (f) Solar PV/Solar thermal power project | 25 years |
| (g) Biomass Gasifier based power project | 20 years |
| (h) Biogas based power project | 20 years |

dd) **'Year'** means a financial year.

- (2) Save as aforesaid and unless repugnant to the context or if the subject-matter otherwise requires, words and expressions used in these regulations and not defined, but defined in the Act, or the Indian Electricity Grid Code or the Central Electricity Regulatory Commission (Terms and conditions of Tariff) Regulations, 2014 shall have the meanings assigned to

them respectively in the Act or the Indian Electricity Grid Code or the Central Electricity Regulatory Commission (Terms and conditions of Tariff) Regulations, 2014.

3. **Scope and extent of application**

These regulations shall apply in all cases where tariff, for a generating station or a unit thereof commissioned during the Control Period and based on renewable sources of energy, is to be determined by the Commission under Section 62 read with Section 79 of the Act.

Provided that in cases of Wind, Small Hydro projects, Biomass power based on Rankine cycle, non-fossil fuel based cogeneration projects, Solar PV , Solar Thermal power projects, Biomass gasifier, Biogas power project, Municipal solid waste and Refuse derived fuel based power projects, these regulations shall apply subject to the fulfillment of eligibility criteria specified in Regulation 4 of these Regulations.

4. **Eligibility Criteria**

- a) **Wind power project** – using new wind turbine generators, located at the sites approved by State Nodal Agency/State Government.
- b) **Small hydro project** – located at the sites approved by State Nodal Agency/State Government using new plant and machinery, and installed power plant capacity to be lower than or equal to 25 MW at single location.
- c) **Biomass power project based on Rankine cycle technology** – Biomass power projects using new plant and machinery based on Rankine cycle technology and using biomass fuel sources, without use of fossil fuel.
- d) **Non-fossil fuel based co-generation project:** The project 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:

Topping cycle mode of co-generation – Any facility that uses non-fossil fuel input for the 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 be greater than 45% of the facility's energy consumption, during season.

Explanation- For the purposes of this clause,

- (a) 'Useful power output' is the gross electrical output from the generator. There will be an auxiliary consumption in the cogeneration plant itself (e.g. the boiler feed pump and the FD/ID fans). In order to compute the net power output it would be necessary to subtract the auxiliary consumption from the gross output. For simplicity of calculation, the useful power output is defined as the gross electricity (kWh) output from the generator.
- (b) 'Useful Thermal Output' is the useful heat (steam) that is provided to the process by the cogeneration facility.
- (c) 'Energy Consumption' of the facility is the useful energy input that is supplied by the fuel (normally bagasse or other such biomass fuel).
- (d) 'Topping Cycle' means a co-generation process in which thermal energy produces electricity followed by useful heat application.

- e) **Solar PV and Solar Thermal Power Project** – Based on technologies approved by MNRE.
- f) **Biomass Gasifier based Power Project** – The project shall qualify to be termed as a biomass gasifier based power project, if it is using new plant and machinery and having a Grid connected system that uses 100% producer gas engine, coupled with gasifier technologies approved by MNRE.
- g) **Biogas based Power Project** – The project shall qualify to be termed as a biogas based power project, if it is using new plant and machinery and having

grid connected system that uses 100% Biogas fired engine, coupled with Biogas technology for co-digesting agriculture residues, manure and other bio waste as may be approved by MNRE.

- h) **Municipal solid waste (MSW) based power projects** – The project shall qualify to be termed as a Municipal solid waste (MSW) based power project if it is using new plant and machinery based on Rankine cycle technology and using Municipal solid waste (MSW) as fuel sources
- i) **Refuse derived fuel (RDF) based power projects** – The project shall qualify to be termed as a Refuse derived fuel (RDF) based power project, if it is using new plant and machinery based on Rankine cycle technology and using Refuse derived fuel (RDF) as fuel sources

Chapter 1: General Principles

5. Control Period or Review Period

The Control Period or Review Period under these Regulations shall be of three (3) years, of which the first year shall be the financial year 2017-18.

Provided further that the tariff determined as per these Regulations for the RE projects commissioned during the Control Period, shall continue to be applicable for the entire duration of the Tariff Period as specified in Regulation 6 below.

Provided also that the revision in Regulations for next Control Period shall be undertaken six months prior to the end of the first Control Period and in case Regulations for the next Control Period are not notified until commencement of next Control Period, the tariff norms as per these Regulations shall continue to remain applicable until notification of the revised Regulations subject to adjustments as per revised Regulations.

6. Tariff Period

- a) The Tariff Period for Renewable Energy power projects will be same as their Useful Life as defined in Regulation 2 (1) (cc)
- b) Tariff period under these Regulations shall be considered from the date of commercial operation of the renewable energy generating stations.
- c) Tariff determined as per these Regulations shall be applicable for Renewable Energy power projects, for the duration of the Tariff Period as stipulated under Clause (a) and (b).

7. Project Specific tariff

- a) Project specific tariff, on case to case basis, shall be determined by the Commission for the following types of projects:
- i. Solar PV and Solar Thermal;
 - ii. Wind Energy (including on-shore and off-shore);
 - iii. Biomass Gasifier based projects; if a project developer opts for project specific tariff;
 - iv. Biogas based projects; if a project developer opts for project specific tariff;
 - v. Municipal Solid Waste and Refuse Derived Fuel based projects with Rankine cycle technology;
 - vi. Hybrid Solar Thermal Power Projects;
 - vii. Other hybrid projects include renewable–renewable or renewable–conventional sources, for which renewable technology is approved by MNRE;
 - viii. Any other new renewable energy technologies approved by MNRE.
- b) Determination of Project specific tariff for generation of electricity from such renewable energy sources shall be in accordance with such terms and conditions as stipulated under relevant Orders of the Commission.
- c) No annual generic tariff shall be determined for the technologies mentioned in Clause (a) of this Regulation. Financial and Operational norms as may be specified would be the ceiling norms while determining the project specific tariff.

Provided that the financial norms as specified under Chapter-2 of these Regulations, except for capital cost, shall be ceiling norms while determining the project specific tariff.

8. Petition and proceedings for determination of tariff

- (1) The Commission shall determine the generic tariff on the basis of suo-motu petition six months in advance at the beginning of each year of the Control

period for renewable energy technologies for which norms have been specified under the Regulations.

(2) A petition for determination of project specific tariff shall be accompanied by such fee as may be determined by 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 in 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) Any other information that the Commission requires the petitioner to submit.

(3) The proceedings for determination of tariff shall be in accordance with the Conduct of Business Regulations.

9. Tariff Structure

The tariff for renewable energy technologies shall be 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;

Provided that for renewable energy technologies having fuel cost component, like biomass power projects and non-fossil fuel based cogeneration, single part

tariff with two components, fixed cost component and fuel cost component, shall be determined.

10. Tariff Design

- (1) The generic tariff shall be determined considering the year of commissioning of the project, on levellised basis for the Tariff Period. Provided that for renewable energy technologies having single part tariff with two components, tariff shall be determined on levellised 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.
- (2) For the purpose of levellised tariff computation, the discount factor equivalent to Post Tax weighted average cost of capital shall be considered.
- (3) Levellisation shall be carried out for the 'useful life' of the Renewable Energy project.
- (4) The above principles shall also apply for project specific tariff.

11. Despatch principles for electricity generated from Renewable Energy Sources:

- (1) All renewable energy power plants except for biomass power plants with installed capacity of 10 MW and above, and non-fossil fuel based cogeneration plants shall be treated as 'MUST RUN' power plants and shall not be subjected to 'merit order despatch' principles.
- (2) The biomass power generating station with an installed capacity of 10 MW and above and non-fossil fuel based co-generation projects shall be subjected to scheduling and despatch code as specified under Indian Electricity Grid Code (IEGC) and Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2014 including amendments thereto.

(3) Scheduling of wind and solar energy shall be governed as per the aforesaid provisions of Central Electricity Regulatory Commission (Indian Electricity Grid Code) (Third Amendment) Regulations, 2015 and Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) (Second Amendment) Regulations, 2015 as amended from time to time.

Chapter 2: Financial Principles

12. Capital Cost

The norms for the Capital cost as specified in the subsequent technology specific chapters 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.

Provided that for project specific tariff determination, the generating company shall submit the break-up of capital cost items along with its petition in the manner specified under Regulation 8.

13. Debt Equity Ratio

(1) For generic tariff to be determined based on suo-motu petition, the debt equity ratio shall be 70:30.

(2) For Project specific tariff, the following provisions shall apply:-

If the equity actually deployed is more than 30% of the capital cost, equity in excess of 30% shall be treated as normative loan.

Provided that where equity actually deployed is less than 30% of the capital cost, the actual equity shall be considered for determination of tariff:

Provided further that the equity invested in foreign currency shall be designated in Indian rupees on the date of each investment.

14. Loan and Finance Charges

(1) Loan Tenure

For the purpose of determination of tariff, loan tenure of 13 years shall be considered.

(2) Interest Rate

- (a) The loans arrived at in the manner indicated in Regulation 13 shall be considered as gross normative loan for calculation for interest on loan. The normative loan outstanding as on April 1st of every year shall be worked out by deducting the cumulative repayment up to March 31st of previous year from the gross normative loan.
- (b) For the purpose of computation of tariff, normative interest rate of two hundred (200) basis points above the average State Bank of India Marginal Cost of Funds based Lending Rate (MCLR) (one year tenor) prevalent during the last available six months shall be considered.
- (c) Notwithstanding any moratorium period availed by the generating company, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed.

15. Depreciation

- (1) The value base for the purpose of depreciation shall be the Capital Cost of the asset admitted by the Commission. The Salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the Capital Cost of the asset.
- (2) Depreciation rate of 5.28% per annum for first 13 years and remaining depreciation to be spread during remaining useful life of the RE projects considering the salvage value of the project as 10% of project cost shall be considered.
- (3) Depreciation shall be chargeable from the first year of commercial operation.

Provided that in case of commercial operation of the asset for part of the year, depreciation shall be charged on pro rata basis.

16. Return on Equity

- (1) 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.
- (2) The normative Return on Equity shall be 14%, to be grossed up by prevailing Minimum Alternate Tax (MAT) as on 1st April of previous year for the entire useful life of the project.

17. Interest on Working Capital

- (1) The Working Capital requirement in respect of Wind energy projects, Small Hydro Power, Solar PV and Solar thermal power projects shall be computed in accordance with the following:
 - a) Operation & Maintenance expenses for one month;
 - b) Receivables equivalent to 2 (Two) months of energy charges for sale of electricity calculated on the normative Capacity Utilisation Factor (CUF);
 - c) Maintenance spare @ 15% of operation and maintenance expenses
- (2) The Working Capital requirement in respect of Biomass power projects with Rankine Cycle technology, Biogas, Biomass Gasifier based power projects, non-fossil fuel based Co-generation, Municipal Solid Waste and Refuse Derived Fuel projects shall be computed in accordance with the following clause :
 - a) Fuel costs for four months equivalent to normative Plant Load Factor (PLF);
 - b) Operation & Maintenance expense for one month;
 - c) Receivables equivalent to 2 (Two) months of fixed and variable charges for sale of electricity calculated on the target PLF;
 - d) Maintenance spare @ 15% of operation and maintenance expenses

- (3) Interest on Working Capital shall be at interest rate equivalent to the normative interest rate of three hundred (300) basis points above the average State Bank of India MCLR (One Year Tenor) prevalent during the last available six months for the determination of tariff.

18. Calculation of CUF/PLF:

The number of hours for calculation of CUF/PLF (wherever applicable) for various RE technologies shall be 8766.

19. Operation and Maintenance Expenses

- (1) 'Operation and Maintenance or O&M expenses' shall comprise repair and maintenance (R&M), establishment including employee expenses, and administrative and general expenses.
- (2) Operation and maintenance expenses shall be determined for the Tariff Period based on normative O&M expenses specified by the Commission subsequently in these Regulations for the first Year of Control Period.
- (3) Normative O&M expenses allowed during first year of the Control Period (i.e. FY 2017-18) under these Regulations shall be escalated at the rate of 5.72% per annum over the Tariff Period.

20. Rebate.

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

21. Late payment surcharge

In case the payment of any bill for charges payable under these regulations is

delayed beyond a period of 60 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.

22. Sharing of CDM Benefits

- (1) The proceeds of carbon credit from approved CDM project shall be shared between generating company and concerned beneficiaries in the following manner, namely-
 - a) 100% of the gross proceeds on account of CDM benefit to be retained by the project developer in the first year after the date of commercial operation of the generating station;
 - b) In the second year, the share of the beneficiaries shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after the proceeds shall be shared in equal proportion, by the generating company and the beneficiaries.

23. Subsidy or incentive by the Central / State Government

The Commission shall 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 under these Regulations.

Provided that the following principles shall be considered for ascertaining income tax benefit on account of accelerated depreciation, if availed, for the purpose of tariff determination:

- i) 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.
- ii) Capitalization of RE projects during second half of the fiscal year. Per unit benefit shall be derived on levelled basis at discount factor equivalent to

weighted average cost of capital.

24. Taxes and Duties

Tariff determined under these regulations shall be exclusive of taxes and duties as may be levied by the appropriate Government:

Provided that the taxes and duties levied by the appropriate Government shall be allowed as pass through on actual incurred basis.

Chapter 3: Technology specific parameters for Wind Energy

25. Capital Cost

The Commission shall determine only project specific capital cost and tariff based on prevailing market trends for wind energy project.

26. Capacity Utilisation Factor (CUF)

(1) CUF norms for this control period shall be as follows:

Annual Mean Wind Power Density (W/m²)	CUF
Upto 220	22%
221-275	24%
276-330	28%
331-440	33%
> 440	35%

(2) The annual mean wind power density specified in sub-regulation (1) above shall be measured at 100 meter hub-height.

(3) For the purpose of classification of wind energy project into particular wind zone class, as per MNRE guidelines for wind measurement, wind mast either put-up by NIWE or a private developer and validated by NIWE, would be normally extended 10 km from the mast point in all directions for uniform terrain and limited to appropriate distance in complex terrain with regard to complexity of the site. Based on such validation by NIWE, state nodal agency should certify zoning of the proposed wind farm complex.

27. Operation and Maintenance (O & M) Expenses

The Commission shall determine only Project Specific O&M Expenses based on the prevailing market information.

Chapter 4: Technology specific parameters for Small Hydro Project

28. Capital Cost

(1) The normative capital cost for small hydro projects during first year of Control Period (FY 2017-18) shall be as follows:

Region	Project Size	Capital Cost (Rs. Lakh/ MW)
Himanchal Pradesh, Uttarakhand, West Bengal and North Eastern States	Below 5 MW	1000
	5 MW to 25 MW	900
Other States	Below 5 MW	779
	5 MW to 25 MW	707

(2) Capital Cost Indexation Mechanism

The Capital Cost for SHP as specified for first year of control period will remain valid for the entire duration of the control period unless reviewed earlier by the Commission.

29. Capacity Utilisation Factor

CUF for the small hydro projects located in Himachal Pradesh, Uttarakhand, West Bengal and North Eastern States shall be 45% and for other States, CUF shall be 30%.

Explanation: For the purpose of this Regulation normative CUF is net of free power to the home state if any, and any quantum of free power if committed by the developer over and above the normative CUF shall not be factored into the tariff.

30. Auxiliary Consumption

Normative Auxiliary Consumption for the small hydro projects shall be 1.0%.

31. Operation and Maintenance Expenses

- (1) Normative O&M expenses for the first year of the Control period (i.e. FY 2017-18 shall be as follows.

Region	Project Size	O&M Expense (Rs. Lakh/ MW)
Himachal Pradesh, Uttarakhand, West Bengal and North Eastern States	Below 5 MW	36
	5 MW to 25 MW	27
Other States	Below 5 MW	29
	5 MW to 25 MW	21

- (2) Normative O&M expenses allowed under these Regulations shall be escalated at the rate of 5.72% per annum for the Tariff Period for the purpose of determination of levellised tariff.

**Chapter 5: Technology specific parameters for Biomass Power Projects
based on Rankine Cycle Technology**

32. Technology Aspect

The norms for tariff determination specified hereunder are for biomass power projects based on Rankine cycle technology application using air-cooled or water-cooled condenser.

33. Capital Cost

- (1) The Commission proposes to determine normative capital cost for FY 2017-18 for Biomass Projects as under;

Biomass Rankine Cycle Projects	Capital Cost (FY 2017-18) (Rs. lakhs/ MW)
Project [other than rice straw and juliflora (plantation) based project] with water cooled condenser	559.03
Project [other than rice straw and Juliflora(plantation) based project] with air cooled condenser	600.44
For rice straw and juliflora (plantation) based project with water cooled condenser	610.80
For rice straw and juliflora (plantation) based project with air cooled condenser	652.20

(2) Capital Cost Indexation Mechanism

The Capital Cost for Biomass Power Projects based on Rankine Cycle Technology as specified for first year of the control period will remain valid for the entire

duration of the control period unless reviewed earlier by the Commission.

34. Plant Load Factor

(1) Threshold PLF for determining fixed charge component of Tariff shall be:

- a) During Stabilisation: 60%
- b) During the remaining period of the first year (after stabilization): 70%
- c) From 2 Year onwards: 80 %

(2) The stabilisation period shall not be more than 6 months from the date of commissioning of the project.

35. Auxiliary Consumption

The auxiliary power consumption factor shall be as follows:-

a) For the project using water cooled condenser:

- i. During first year of operation : 11%
- ii. From 2nd year onwards : 10%

b) For the project using air cooled condenser:

- i. During first year of operation : 13%
- ii. From 2nd year onwards : 12%

36. Station Heat Rate

The Station Heat Rate for biomass power projects shall be :

- a) For projects using travelling grate boilers : 4200 kCal/kWh
- b) For projects using AFBC boilers : 4125 kCal/ kWh

37. Operation and Maintenance Expenses

(1) Normative O&M expenses for the first year of the Control period (i.e. FY

2017-18 shall be Rs. 40 Lakh per MW.

(2) Normative O&M expenses allowed at the commencement of the Control Period (i.e. FY 2017-18) under these Regulations shall be escalated at the rate of 5.72% per annum.

38. Fuel Mix

(1) The biomass power plant shall be designed in such a way that it uses different types of non-fossil fuels available within the vicinity of biomass power project such as crop residues, agro-industrial residues, forest residues etc. and other biomass fuels as may be approved by MNRE.

(2) The Biomass Power Generating Companies shall ensure fuel management plan to ensure adequate availability of fuel to meet the respective project requirements.

39. Use of Fossil Fuel

The use of fossil fuels shall not be allowed.

Provided that for the biomass power projects commissioned on or before 31.03.2017, the use of fossil fuels to the extent of 15% in terms of calorific value on annual basis shall be allowed for the tariff period from the date of commissioning.

40. Monitoring Mechanism for the use of fossil fuel

(1) The Project developer shall furnish a monthly fuel usage statement and monthly fuel procurement statement duly certified by Chartered Accountant to the beneficiary (with a copy to appropriate agency appointed by the Commission for the purpose of monitoring the fossil and non-fossil fuel consumption) for each month, along with the monthly energy bill.

(2) Non-compliance with the condition of fossil fuel usage by the project developer,

during any financial year, shall result in withdrawal of applicability of tariff as per these Regulations for such biomass based power project.

41. Calorific Value

The Calorific Value of the biomass fuel used for the purpose of determination of tariff shall be at 3100 kCal/kg.

42. Fuel Cost

Biomass fuel price during first year of the Control Period (i.e. FY 2017-18) shall be as specified in the table below and shall be escalated at 5% to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable on biomass prices.

State	FY2017-18 (Rs./MT)
Andhra Pradesh	2873.22
Haryana	3270.39
Maharashtra	3344.85
Punjab	3420.56
Rajasthan	2854.60
Tamil Nadu	2826.05
Uttar Pradesh	2922.86
Other States	3073.05

Chapter 6: Technology specific parameters for Non-fossil fuel based Cogeneration Projects

43. Technology Aspect

A project shall qualify as a non-fossil fuel based Co-generation project, if it is in accordance with the eligibility criteria as specified under Regulation 4(d).

44. Capital Cost

The normative capital cost for the non-fossil fuel based cogeneration projects shall be Rs. 492.5 Lakh/MW for high boiler pressure projects for the first year of Control Period (i.e. FY 2017-18), and will remain valid for the entire duration of the control period unless reviewed earlier by the Commission.

45. Plant Load Factor

- (1) For the purpose of determining fixed charge, the PLF for non- fossil fuel based cogeneration projects shall be computed on the basis of plant availability for number of operating days considering operations during crushing season and off-season as specified under clause (2) below and load factor of 92%.
- (2) The number of operating days for different States shall be as follows:

State	Operating Days	Plant Load Factor (%)
Uttar Pradesh and Andhra Pradesh	120 days (crushing) + 60 days (off-season) = 180 days operating days	45%
Tamil Nadu and Maharashtra	180 days (crushing) + 60 days (off-season) = 240 days operating days	60%
Other States	150 days (crushing) + 60 days (off-season) = 210 days operating days	53%

46. Auxiliary Consumption

The auxiliary power consumption factor shall be 8.5% for the computation of tariff.

47. Station Heat Rate

The Station Heat Rate of 3600 kCal / kWh for power generation component alone shall be considered for computation of tariff for non-fossil fuel based Cogeneration projects.

48. Calorific Value

The Gross Calorific Value for Bagasse shall be considered as 2250 kCal/kg. For the use of biomass fuels other than bagasse, calorific value as specified under Regulation 41 shall be applicable.

49. Fuel Cost

- (1) The price of Bagasse for first year of the Control Period (i.e. FY 2017-18) shall be as specified in the table below and shall be escalated at 5% to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levellized tariff, a normative escalation factor of 5% per annum shall be applicable on bagasse prices.

State	Bagasse Price FY2017-18 (Rs. / MT)
Andhra Pradesh	1622.16
Haryana	2307.26
Maharashtra	2273.75
Punjab	2030.49
Tamil Nadu	1747.51
Uttar Pradesh	1809.57
Other States	1964.71

- (2) For use of biomass other than bagasse in co-generation projects, the biomass prices as specified under Regulation 42 shall be applicable.

50. Operation and Maintenance Expenses

- (1) Normative O&M expenses during first year of the Control period (i.e. FY 2017-18) shall be Rs. 21.13 Lakh per MW.
- (2) Normative O&M expenses allowed at the commencement of the Control Period (i.e. FY 2017-18) under these Regulations shall be escalated at the rate of 5.72% per annum.

Chapter 7: Technology specific parameters for Solar PV Power Project

51. Technology Aspects

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

52. Capital Cost

The Commission shall determine only project specific capital cost and tariff based on prevailing market trends for Solar PV projects.

53. Capacity Utilisation Factor

The CUF for Solar PV project shall be 19%.

Provided that the Commission may deviate from above norm in case of project specific tariff determination in pursuance of Regulation 7 and Regulation 8.

54. Operation and Maintenance Expenses

The Commission shall determine only project specific O&M expenses based on prevailing market trends for Solar PV project.

55. Auxiliary Consumption

The auxiliary consumption factor shall be 0.25% of gross generation.

Provided that the Commission may deviate from the above norm in case of project specific tariff determination in pursuance of Regulation 7 and Regulation 8.

Chapter 8: Technology specific parameters for Solar Thermal Power Project

56. Technology Aspects

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

57. Capital Cost

The Commission shall determine only project specific capital cost and tariff based on prevailing market trends for Solar Thermal project.

58. Capacity Utilisation Factor

The CUF for solar thermal project shall be 23%.

Provided that the Commission may deviate from the above norm in case of project specific tariff determination in pursuance of Regulation 7 and Regulation 8.

59. Operation and Maintenance Expenses

The Commission shall determine only project specific O&M expenses based on prevailing market trends for Solar Thermal project.

60. Auxiliary Consumption

The auxiliary consumption factor shall be 10%.

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Provided that the Commission may deviate from the above norm in case of project specific tariff determination in pursuance of Regulation 7 and Regulation 8.

Chapter 9: Technology specific parameters for Biomass Gasifier Power Projects

61. Technology Aspect

The norms for tariff determination specified hereunder are for biomass gasifier based power projects.

62. Capital Cost

The normative capital cost for the biomass gasifier power projects based on Rankine cycle shall be Rs. 592.88 Lakh/MW (FY 2017-18 during first year of Control Period) and shall be same for subsequent years unless specifically ordered by the Commission. After taking into account of capital subsidy of Rs 150.00 lakhs/MW, net project cost shall be Rs. 442.88 Lakh/MW for FY 2017-18.

63. Plant Load Factor

Threshold PLF for determining fixed charge component of tariff shall be 85%.

64. Auxiliary Consumption

The auxiliary power consumption factor shall be 10% for the determination of tariff.

65. Specific fuel consumption

Normative specific fuel consumption shall be 1.25 kg per kWh.

66. Operation and Maintenance Expenses

(1) Normative O&M expenses for the first year of the Control period (i.e. FY 2017-18) shall be Rs. 52.83 Lakh per MW

- (2) Normative O&M expenses allowed at the commencement of the Control Period (i.e. FY 2017-18) under these Regulations shall be escalated at the rate of 5.72% per annum.

67. Fuel Mix

- (1) The Biomass Gasifier based power plant shall be designed in such a way that it uses different types of non-fossil fuels available within the vicinity of biomass power project such as crop residues, agro- industrial residues, forest residues etc. and other biomass fuels as may be approved by MNRE.
- (2) The Biomass Gasifier based Power Generating Companies shall ensure fuel management plan to ensure adequate availability of fuel to meet the respective project requirements.

68. Fuel Cost

Biomass fuel price for the Biomass gasifier based power project applicable for FY 2017-18 shall be the same as for Biomass based power project (Rankine cycle) as mentioned in Regulation 42.

Chapter 10: Technology specific parameters for Biogas based Power Projects

69. Technology Aspect

The norms for tariff determination specified hereunder are for grid connected biogas based power projects that uses 100% Biogas fired engine, coupled with Biogas technology for co-digesting agriculture residues, manure and other bio waste as may be approved by MNRE.

70. Capital Cost

The normative capital cost for the biogas based power shall be Rs. 1185.76 Lakh/MW (FY 2017-18 during first year of Control Period) and will remain valid for the entire duration of the control period unless reviewed earlier by the Commission After taking into account of capital subsidy of Rs. 300 Lakhs/MW, net project cost is Rs. 885.76 Lakh/MW.

71. Plant Load Factor

Threshold PLF for determining fixed charge component of Tariff shall be 90%.

72. Auxiliary Consumption

The auxiliary power consumption factor shall be 12% for the determination of tariff.

73. Operation and Maintenance Expenses

(1) Normative O&M expenses for the first year of the Control period i.e. FY 2017-18 shall be Rs. 52.83 Lakh per MW

(2) Normative O&M expenses allowed at the commencement of the Control Period (i.e. FY 2017-18) under these Regulations shall be escalated at the rate of 5.72% per annum.

74. Specific Fuel Consumption

Normative specific fuel consumption shall be 3 kg of substrate mix per kWh.

75. Fuel Cost (Feed stock Price)

Feed stock price during first year of the Control Period (i.e. FY 2017-18) shall be Rs. 1228.72 /MT and shall be escalated at 5% to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelized tariff, a normative escalation factor of 5% per annum shall be applicable.

Chapter 11: Technology specific parameters for Power Projects using Municipal Solid Waste / Refuse Derived Fuel and based on Rankine cycle technology

76. Technology Aspect

The norms for tariff determination specified hereunder are for power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) and are based on Rankine cycle technology application, combustion or incineration, Bio-methanation, Pyrolysis and High end gasifier technologies.

77. Capital Cost

The Commission shall determine only project specific capital cost and tariff based on prevailing market trends for MSW/RDF projects.

78. Plant Load Factor

(1) Threshold PLF for determining fixed charge component of tariff for the power projects which use MSW and RDF shall be:

	PLF	MSW	RDF
a)	During Stabilisation	65%	65%
b)	During the remaining period of the first year (after stabilization)	65%	65%
c)	From 2 nd year onwards	75%	80%

(2) The stabilisation period shall not be more than 6 months from the date of commissioning of the project.

79. Auxiliary Consumption

The auxiliary power consumption for MSW/RDF based power projects shall be 15%.

80. Station Heat Rate

The Station Heat Rate for MSW/RDF based power projects shall be 4200 kcal/kWh.

81. Operation and Maintenance Expenses

The Commission shall determine only project specific O&M expenses based on prevailing market trends for MSW/RDF projects.

82. Calorific Value

The Calorific Value of the RDF fuel used for the purpose of determination of tariff shall be at 2500 kcal/kg.

83. Fuel Cost

RDF price during FY 2017-18 shall be Rs 1,800 per MT and shall be escalated at 5% to arrive at the base price for subsequent years of the Control Period, unless specifically reviewed by Commission. For the purpose of determining levelled tariff, a normative escalation factor of 5% per annum shall be applicable.

No fuel cost shall be considered for determination of tariff for the power projects using MSW.

Chapter 12: Miscellaneous

84. Deviation from norms

Tariff for sale of electricity generated from a generating station based on renewable energy sources, may also be agreed between a generating company and a licensee, in deviation from the norms specified in these regulations subject to the conditions that the levellised tariff over the useful life of the project on the basis of the norms in deviation does not exceed the levellised tariff calculated on the basis of the norms specified in these regulations.

85. Power to Relax

The Commission may by general or special order, for reasons to be recorded in writing, and after giving an opportunity of hearing to the parties likely to be affected, may relax any of the provisions of these Regulations on its own motion or on an application made before it by an interested person.

Sd/-

(Sanoj Kumar Jha)
Secretary

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APPENDIX

Form-1.1: Form Template for (Wind Power or Small Hydro Project or Solar PV/Solar thermal)

S.No.	Assumption Head	Sub-Head	Sub-Head(2)	Unit	Parameter
1.	Power Generation	Capacity	Installed Power Generation Capacity Capacity Utilization Factor Commercial Operation Date Useful Life	MW % mm/yyyy years	
2.	Project Cost	Capital Cost/MW	Normative Capital Cost Capital Cost Capital Subsidy, If any Net Capital Cost	Rs. Lakh/MW Rs. Lakh Rs. Lakh Rs. Lakh	
3.	Financial Assumptions	Debt Equity Debt Component Equity Component Depreciation Incentives	Tariff Period Debt Equity Total Debt Amount Total Equity Amount Loan Amount Moratorium Period Repayment Period (incl Moratorium) Interest Rate Equity amount Return on Equity for first 10 years Return on Equity 11th year onwards Discount Rate Depreciation Rate for 1st 12 yrs. Depreciation Rate 13th years onward Generation Based Incentives, If any Period for GBI	Years % % % Rs. Lakh Rs. Lacs Years Years % Rs. Lacs % p.a. % p.a. % % % Rs. L p.a. Years	
4.	Operation & Maintenance	Normative O&M expense O&M expense per annum Escalation factor for O&M expense		Rs. Lakh/MW Rs. Lakh %	
5.	Working Capital	O&M expense Maintenance Spare Receivables Interest on Working Capital	(% of O&M expenses)	Month s % Month s % p.a.	

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Form-1.2: Form Template for (Biomass Power, Municipal Solid Waste, Refuse Derived Fuel or Non-fossil fuel based Cogen)

S.No.	Assumption Head	Sub-Head	Sub-Head(2)	Unit	Parameter
1.	Power Generation	Capacity	Installed Power Generation Capacity Auxiliary Consumption factor PLF(during stabilisation upto 6 months) PLF (during 1st year stabilisation) PLF (2nd year onwards) Commercial Operation Date Useful Life	MW % % % % mm/yyyy Years	
2.	Project Cost	Capital Cost/MW	Normative Capital Cost Capital Cost Capital Subsidy, If any Net Capital Cost	Rs. Lakh/MW Rs. Lakh Rs. Lakh Rs. Lakh	
3.	Financial Assumptions	Debt Equity Debt Component Equity Component Depreciation Incentives	Tariff Period Debt Equity Total Debt Amount Total Equity Amount Loan Amount Moratorium Period Repayment Period (incld Moratorium) Interest Rate Equity amount Return on Equity for first 10 years Return on Equity 11th year onwards Discount Rate Depreciation Rate for 1st 12 yrs. Depreciation Rate 13th years onward Generation Based Incentives, If any Period for GBI	Years % % % Rs. Lakh Rs. Lacs Years Years % Rs. Lacs % p.a. % p.a. % % % % Rs. L p.a. Years	
4.	Operation & Maintenance	Normative O&M expense O&M expense per annum Escalation factor for O&M expense		Rs. Lakh/MW Rs. Lakh	

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5.	Working Capital	O&M expense Maintenance Spare Receivables Interest on Working Capital	(% of O&M expenses)	Mont lis % Mont lis % p.a.	
[6.	Fuel related assumptions	Station Heat Rate Fuel types & mix	During stabilisation post stabilisation Biomass fuel type-1 Biomass fuel type-2 Municipal Solid Waste fuel Refuse Derived Fuel fossil fuel (coal) GCV of Biomass fuel type-1 GCV of Biomass fuel type-2 GCV of Municipal Solid Waste fuel GCV of Refuse Derived Fuel GCV of fossil fuel (coal) Biomass Price (fuel type-1)/yr-1 Biomass Price (fuel type-2)/yr-1 Municipal Solid Waste Price /yr-1 Refuse Derived Fuel Price / yr-1 fossil fuel price (coal) : yr-1 fuel price escalation factor	kCal/Kwh kCal/Kwh % % % % % kCal/Kwh kCal/Kwh kCal/Kwh kCal/Kwh kCal/Kwh Rs/MT Rs/MT Rs/MT Rs/MT Rs/MT Rs/MT % p.a.] ¹⁰³⁷	

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Form-2.1: Form Template for (Wind Power or Small Hydro Project or Solar PV/Solar thermal) : Determination of Tariff Components

Units Generation	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	
Installed Capacity	MW																										
Net Generation	MU																										

Tariff Components (Fixed charge)	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	
O&M Expenses	Rs Lakh																										
Depreciation	Rs Lakh																										
Interest on term loan	Rs Lakh																										
Interest on working Capital	Rs Lakh																										
Return on Equity	Rs Lakh																										
Total Fixed Cost	Rs Lakh																										

Per Unit Tariff components	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	
PU O&M Expenses	Rs/kWh																										
PU Depreciation	Rs/kWh																										
PU Interest on term loan	Rs/kWh																										
PU Interest on working Capital	Rs/kWh																										
PU Return on Equity	Rs/kWh																										
PU Tariff Components	Rs/kWh																										

Levellers Tariff	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	
Discount Factors																											
Discounted Tariff components	Rs/kWh																										
Levellers Tariff	Rs/kWh																										

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Form-2.2: Form Template for (Biomass Power, Municipal Solid Waste, Refuse Derived Fuel or Non-fossil fuel based Cogen) : Determination of Tariff Components

Units Generation	Unit	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8	Yr-9	Yr-10	Yr-11	Yr-12	Yr-13	Yr-14	Yr-15	Yr-16	Yr-17	Yr-18	Yr-19	Yr-20	Yr-21	Yr-22	Yr-23	Yr-24	Yr-25	
Installed Capacity	MW																										
Net Generation	MU																										
Tariff Components (Fixed charge)																											
O&M Expenses	Rs Lakh																										
Depreciation	Rs Lakh																										
Interest on term loan	Rs Lakh																										
Interest on working Capital	Rs Lakh																										
Return on Equity	Rs Lakh																										
Total Fixed Cost	Rs Lakh																										
Tariff Components (Variable charge)																											
Biomass fuel type-1	Rs Lakh																										
Biomass fuel type-2	Rs Lakh																										
Fossil fuel (coal)	Rs Lakh																										
Municipal Solid Waste	Rs Lakh																										
Refuse Derived Fuel	Rs Lakh																										
Sub-total (Fuel Costs)	Rs Lakh																										
Fuel cost allocable to power	%																										
Total Fuel Costs	Rs Lakh																										
Per Unit Tariff components (fixed)																											
PU O&M Expenses	Rs/kWh																										
PU Depreciation	Rs/kWh																										
PU Interest on term loan	Rs/kWh																										
PU Interest on working Capital	Rs/kWh																										
PU Return on Equity	Rs/kWh																										
PU Tariff Components (Fixed)	Rs/kWh																										
PU Tariff Components (Variable)	Rs/kWh																										
PU Tariff Components (Total)	Rs/kWh																										
Levillised Tariff																											
Discount Factors																											
Discounted Tariff components (fixed)	Rs/kWh																										
Discounted Tariff components (variable)	Rs/kWh																										
Discounted Tariff components (total)	Rs/kWh																										
Levillised Tariff (fixed)	Rs/kWh																										
Levillised Tariff (variable)	Rs/kWh																										
Levillised Tariff (total)	Rs/kWh																										