

CENTRAL ELECTRICITY REGULATORY COMMISSION

NEW DELHI

Explanatory Memorandum for CERC Draft (Terms and Conditions for Tariff determination from Renewable Energy Sources) (Third Amendment) Regulations, 2014

1. Background

1.1 In accordance with Regulation 8 of the RE Tariff Regulations- 2012, the Commission issued an Order on determination of generic levelled generation tariff for RE generating stations. (Petition No. 35/2012 (suo-motu) dated 27th March, 2012. While dealing with the comments received from the various stakeholders regarding biomass sector, in the above referred Order the Commission observed as under:

“Based on the suggestions received from the projects developers, Industry associations representing the biomass sector and Ministry of New and Renewable Energy(MNRE), the Commission has decided to constitute a Committee which will visit existing plants and conduct a detailed study on the performance/viability of such plants operating in the country including the prevailing biomass prices.”

1.2 Accordingly, the CERC constituted a Committee on 11th October, 2012 under the Chairmanship of the Secretary, CERC to undertake a detailed Study on the “Performance/Viability of Biomass based plants operating in the Country including the prevailing biomass prices”.

1.3 The Committee deliberated and collected information and data from various stakeholders and also visited sites of power developers to understand the issues at stake in different operation of the biomass based power plants.

1.4 After detailed examination, the Committee felt that the challenges being faced by the biomass plants primarily stem out of fuel related issues, viz.:-lack of availability of surplus biomass, poor quality of biomass fuel, inadequate fuel collection, distribution & supply mechanism, competitive buyers of biomass and price rise, resulting in to usage of waste biomass and lower plant load factor. After extensive deliberations, the Committee finalized its report and submitted to the Commission on 16th July, 2013.

1.5 The Committee recommended following normative parameters suggested by the Committee for the consideration of the Commission for determination of generic tariff:

- i. Station Heat Rate (SHR):
 - a. 4200 kcal/kWh for station using travelling grate boilers; and
 - b. 4125 kcal/kWh for stations using AFBC boilers
- ii. Gross Calorific Value (GCV): 3100 kcal/kg
- iii.
- iv.
- v.
- vi.

1.6 The Commission on consideration of request of MNRE proposed second amendment to RE Tariff Regulations on 25th November 2014 allowing use of fossil fuel for biomass projects up to 15% in terms of calorific value on annual basis. The Commission in the Statement of Reason, however, reiterated that

“the normative Station Heat Rate has been specified considering the usage of 100% biomass, and that the proposal of permitting usage of fossil fuel up to 15% in terms of calorific value on annual basis might have an impact on SHR. The Commission directs the staff to examine the same separately and submit a report for consideration and suitable action in future.”

2. Assessment of Impact on SHR on allowing use of fossil fuel upto 15% of calorific value.

2.1 The commission in its SOR for the first amendment to RE tariff regulations noted that;

“Most of the stake holders submitted that biomass plants are operating with specific fuel consumption of 1.5-1.8 kg/kWh and above. As such they have suggested that the SHR be fixed 4500 kcal/kWh for projects using travelling grate boiler and for air cooled condenser and 4400 kcal/kWh for project using AFBC boiler and 4200kcal/kWh for project using water cooled condenser. Stakeholders have suggested such parameters based on the operational experience, CEA Report,2005, fuel related losses (i.e. qualitative and quantitative degradation of biomass), inferior quality of fuel, limitation in keeping operating temperature parameters as per boiler design resulted into lower boiler efficiency. One of the stake holders has suggested 5% efficiency difference between AFBC & Travelling Grate Boiler technologies should be considered. Different biomass fuels have different calorific values, and hence the Specific Fuel Consumption (SFC) varies from one type to another type of biomass, which has direct bearing on the SHR achieved .Further, Biomass being a low density fuel often clogs and jams the feeding systems adversely affecting the SHR. The SHR for a biomass plant, being very sensitive to the local conditions and local fuels having widely varying properties, cannot be fixed on theoretical basis alone without allowing adequate margin for variations. The Committee in its report considered the average design SHR of 3750 kcal/kWh and operating margin of 10-12% over the design heat rate. This translates in to a SHR of 4125-4200 kcal/kWh. Accordingly; the Committee recommended the SHR of 4200 kcal/kWh for station using travelling grate boilers and 4125 kcal/kWh for stations using AFBC boilers for determination of tariff of bio-mass power plants. The Committee’s above recommendation is also based on the actual results of some of the plants visited. Considering the above, the Commission decided to retain the norms as suggested in the draft Regulations.”

2.2 It may be noted that the SHR of 4200 kcal/kWh and 4125 kcal/kWh respectively was provided in the Regulation keeping in view the stipulation that the plant would operate with 100% biomass fuel. Now that fossil fuel use has been allowed to the extent of 15%, it is felt that operating margin may be revised from 10% & 12% to 9% & 11% for AFBC and Traveling grate boilers respectively as fossil fuel support will improve plant performance. Also as operating margin was specified for biomass fuels to allow for variations particular to biomass fuels, the same must be pro-rated to the calorific value contribution of the biomass fuels only i.e. to a normative of 85% of total heat contribution. Operating margin for fossil fuel heat value contribution should be limited to 4.5% on lines of the similar provisions in the CERC Conventional Tariff Regulations, 2014.

Therefore, the new SHR for Biomass based power plants using Travelling grate as well as AFBC boiler is worked out as under:

- Calorific value contribution through Fossil fuel per kWh:
 - Calorific contribution through Fossil Fuel for each unit of electricity generation (H_{Fossil})
 - = (Average Design SHR)[†] x 15% x (1+ Operating Margin)
 - = 3750x0.15 x (1+Operating Margin) kcal/kWh
 - (H_{Fossil}) = 562.5 x (1+ 4.5%) kcal/ kWh = 587.81 kcal/ kWh

[†] 15% contribution to average design heat rate has been taken instead of 15% contribution to final SHR which includes operating margin of 10-12% for biomass fuels

- Calorific value contribution required through Biomass Fuel per kWh, considering 15% has been met through use of fossil fuel:

$$(H_{\text{Biomass}}) = (\text{Average Design SHR}) * 0.85 = 3750 * 0.85 \text{ kcal/ kWh}$$

$$(H_{\text{Biomass}}) = 3187.5 \text{ kcal/kWh}$$

- Determination of SHR on consideration of operating margin for Biomass Fuels:

$$\text{SHR} = (H_{\text{Fossil}}) + (H_{\text{Biomass}}) \times (1 + \% \text{Operating Margin allowed for Biomass fuel})$$

- Therefore,

- i. For Travelling Grate Boilers, considering a 11% operating margin

$$\text{SHR} = (H_{\text{Fossil}}) + (H_{\text{Biomass}}) \times (1 + 11\%)$$

$$\text{SHR} = 587.81 + 3187.5 \times (1.11) \text{ kcal/kWh} = 4125.94 \text{ kcal/kWh}$$

- ii. For AFBC Boilers, considering a 9% operating margin

$$\text{SHR} = (H_{\text{Fossil}}) + (H_{\text{Biomass}}) \times (1 + 09\%)$$

$$\text{SHR} = 587.81 + 3187.5 \times (1.09) \text{ kcal/kWh} = 4062.19 \text{ kcal/kWh}$$

2.3 Accordingly the normative SHR for Biomass projects using AFBC boilers and Travelling Gate boilers should be 4062.19 kcal/kWh and 4125.94 kcal/kWh respectively.

2.4 Accordingly the Commission proposes that, Regulation 38 of the Principal Regulations shall be substituted as under:

“38. Station Heat Rate

The Station Heat Rate for biomass power projects shall be as under:

- a. 4126 kcal/kWh for project using travelling grate boilers;
- b. 4063 kcal/kWh for project using AFBC boilers.”

3. Determination of Calorific Value of Fuel:

3.1 On the issue of determination of GCV of fuel, the Commission in its SOR for the first amendment to the RE tariff regulations noted that;

“The Committee collected GCV details of various fuels used from the project developers located in the States of Hyderabad, Rajasthan, Gujarat and Punjab and based on the same recommended GCV in its Report. Some of the stakeholders are also in agreement with Commission’s proposal which was based on the Committee Report. Some of the stakeholders have suggested further reduction in GCV in the range of 2300 to 3000 kcal/kg. The Committee also recognized that the plants are keeping minimum inventory of various types of biomass for three to four months and in this duration there is reduction in GCV due to various reasons like mixing of sand, mud and foreign materials, losses in handling, exposure to wind and rain etc. Such losses are between 7-10% for the entire year. Based on the above factors, the Committee recommended the normative GCV value for the Biomass Plants for determination of generic tariff as 3100 kcal/kg for mustard husk, rice husk and other kinds of biomass fuel under as fired condition. Considering the same, the Commission has decided to retain the norm as proposed in the draft Regulations which is also in line with the recommendation received from MNRE (Given vide its letter dated 30th September, 2011) and as recommended in the CEA Report.”

- 3.2 As now use of fossil fuel up to 15% of calorific value annually has been allowed, it is required that the specific fuel consumption of a normative biomass–fossil fuel combination be determined to derive the normative GCV of the fuel combination .
- 3.3 The new required value of GCV of normative biomass–fossil fuel combination is determined as under;

$$\text{GCV} = \text{SHR}/(\text{Specific Fuel Consumption}) = \text{SHR}/\{(M_{\text{Fossil}}) + (M_{\text{Biomass}})\}$$

Where,

- a. (M_{Fossil}) is the Fossil Fuel Consumption, for 15% calorific contribution per kWh
 And, $(M_{\text{Fossil}}) = (H_{\text{Fossil}})/(\text{Normative GCV of Fossil Fuel}) = 587.81/3600 \text{ kg} = 0.16 \text{ kg}$
- b. (M_{Biomass}) is Biomass Fuel Consumption per kWh, considering 15% calorific contribution through fossil fuel
 And, $(M_{\text{Biomass}}) = (H_{\text{Biomass}}) \times (1 + \% \text{ operating margin}) / (\text{Normative GCV of Biomass})$

Therefore,

- i. For Travelling Grate Boilers,
 $(M_{\text{Biomass}}) = 3187.5 \times (1.11)/3100 \text{ kcal/kWh} = 1.14 \text{ kg}$
 Normative GCV = $4126 / (0.16 + 1.14) = 3173.85 \text{ kcal/kg}$
- ii. For AFBC Boilers,
 $(M_{\text{Biomass}}) = 3187.5 \times (1.09)/3100 \text{ kcal/kWh} = 1.12 \text{ kg}$
 Normative GCV = $4063 / (0.16 + 1.12) = 3174.22 \text{ kcal/kg}$

- 3.4 Accordingly the GCV of normative biomass and fossil fuel combination is proposed to be 3174 kcal/kg and Regulation 43 of the Principal Regulations is proposed to be substituted as under:

“43. Calorific Value

The Calorific Value of the fuel used for the purpose of determination of tariff shall be 3174kcal/kg.”