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ANDHRA PRADESH ELECTRICITY REGULATORY COMMISSION
11-4-660, 4th & 5th floors, Singareni Bhavan, Red Hills, Hyderabad-500 004.

O.P.No. 32 of 2014

IN THE MATTER OF

Determination of Variable Cost for the period from 01-04-2014 to 31-03-2019 in respect of the Existing plants based on Non Conventional Energy (NCE) sources in the State of Andhra Pradesh

16th May 2014

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1 Background

1.1 By order dated 20th March 2004, the Commission had determined the tariff for purchase of electrical energy generated by non-conventional energy projects in the state of Andhra Pradesh by the Transmission Corporation of Andhra Pradesh Limited (APTRANSCO) in case of R.P. No.84/2003 in O.P. No.1075/2000.

1.2 This order covered the following Non Conventional Energy (NCE) projects:

- a. Biomass based Power Projects
- b. Bagasse based co-generation Power Projects
- c. Industrial Waste to Energy Projects
- d. Municipal Waste to Energy Projects
- e. Mini Hydel Projects
- f. Wind Electricity Generation Projects

1.3 In the above order, the fixed cost was determined for Biomass, Bagasse, Industrial Waste and Mini Hydel projects for their 1-10th year of operation. The variable cost was determined for Biomass, Bagasse and Industrial Waste projects for the period FY 2004-05 to FY 2008-09. A single part tariff for Municipal Waste projects and Wind projects was also determined.

1.4 By O.P. No.5 of 2009 dated 31st March 2009, the Commission determined the variable cost for Biomass, Bagasse and Industrial Waste projects for

the period FY 2009-10 to FY 2013-14 and single part tariff for Wind and Municipal Waste projects was also determined.

- 1.5 The Commission, pursuant to the Hon'ble Appellate Tribunal for Electricity (APTEL) orders dated 20th December 2012 and 30th April 2013, had determined the revised fixed cost for 1-10th year of operation for Biomass, Bagasse, Mini Hydel projects and revised variable cost for the period FY 2004-05 to FY 2008-09 by order dated 22nd June 2013 based on the norms specified by Hon'ble APTEL.
- 1.6 The Commission, pursuant to the Hon'ble APTEL orders dated 20th December 2012 and 30th April 2013, had determined the revised variable cost for Biomass, Bagasse and Industrial Waste projects for the period FY 2009-10 to FY 2013-14, by order dated 6th August 2013 based on the operating norms specified by Hon'ble APTEL.
- 1.7 The Commission has now in this order undertaken the exercise for determination of variable cost norms and the consequent tariff for Biomass, Bagasse and Industrial waste based power projects for the period FY 2014-15 to FY 2018-19.
- 1.8 The Hon'ble APTEL in the order dated 20th December 2012 had directed the Commission to carry out a scientific study to determine the normative parameters specific to the state of Andhra Pradesh for future. The excerpts from the Hon'ble APTEL Order to this effect are as follows:

"However, we feel that there is a need for carrying out a scientific study for determining the normative parameters specific to the state

for future. The study should also take into consideration the technological improvements that have since taken place in the generation by non-conventional energy sources. ^{APTEL} We direct the State Commission to arrange to undertake the study on priority and frame its Tariff Regulations for purchase of power by distribution licensees from NCE sources after considering the Study Report, Central Commission's Regulations and any other relevant information."

1.9 The norms laid down in the Hon'ble APTEL order dated 20th December 2012 were applicable to the computation of variable cost for the period FY 2004-05 to FY 2008-09. Due to the absence of any technical study or further information available from statutory bodies, the same technical norms were extended by the Commission in its order of the 6th August 2013 for the period FY 2009-10 to FY 2013-14. The Commission, as directed by the Hon'ble APTEL has now adopted a holistic approach for the determination of the variable cost norms for NCE sources for the period FY 2014-15 to FY 2018-19. This approach incorporated the following seven elements

- A. Floated a consultation paper on the norms for variable cost determination for Biomass, Bagasse, Industrial waste and single part tariff for Municipal waste projects.
- B. Conducted a public hearing on the issues identified in the consultation paper and noted the comments, objections, suggestions of various stakeholders.
- C. Scrutinised the CEA report on "Operating norms for Biomass based power plants" published in September, 2005 with reference to its applicability to Andhra Pradesh.

- D. Scrutinised the CERC Committee report on the “Performance/ Viability of Biomass based plants operating in the Country including the prevailing biomass prices” published in July, 2013 with reference to its applicability to Andhra Pradesh.
- E. Engaged M/s. KPMG as an independent consultant with a mandate to analyse the operating parameters/norms and economics of NCE projects in general with special reference to their working in Andhra Pradesh to prepare a study report (hereinafter called as study report) on the determination of cost and performance norms for NCE sources.
- F. Undertook field visits to three (3) biomass power plants located in Andhra Pradesh viz., (i). M/s. JOCIL Ltd., (ii). M/s. Matrix Power Pvt. Ltd. and (iii). M/s. Ind-Barath Energies Ltd.
- G. Analysed relevant CERC and State Electricity Regulatory Commission’s (SERC) orders and Regulations with reference to determination of variable cost norms for NCE sources including the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) (first amendment), Regulation 2014.

1.10 The Commission, distilled the independent findings of the seven elements described above and determined the Variable cost norms for Biomass, Bagasse and Industrial waste sources through the process described below.

1.11 As a first step in this process the Commission, had floated a Consultation Paper on determination of norms for the computation of variable cost for Biomass, Bagasse and Industrial Waste projects on 21st February 2014. Subsequently, a public hearing was held on 24th March 2014 and the views of all the stakeholders who submitted their views earlier in writing as well

as orally during the public hearing were noted. Some of the stakeholders had referred to the norms laid down by the Hon'ble APTEL in its 20th December 2012 order for Station Heat Rate (SHR), while requesting for performing an independent analysis to determine the Gross Calorific Value (GCV) and fuel price. The Commission, having adopted a holistic approach described earlier, determined all operational norms based on a distillation of the findings of the seven elements referred to earlier. Following determination of operation norms, the Commission, then proceeded to determine the variable cost for NCE generators for the period FY 2014-15 to FY 2018-19.

2 Biomass based Power Projects

The norms determined by the Commission in its 2004 and 2009 order and the norms fixed by Hon'ble APTEL 2012 order have been summarised in the below table to the extent relevant for variable cost determination.

Biomass Power Project Norms					
	Units	APERC 2004 Order	APERC 2009 Order	APERC June 2013 Order (Based on Hon'ble APTEL judgement)	APERC Aug 2013 Order (Based on Hon'ble APTEL judgement)
Applicability (Variable Cost)	Period	FY 04-05 to FY 08-09	FY 09-10 to FY 13-14	FY 04-05 to FY 08-09	FY 09-10 to FY 13-14
SHR	kCal/kWh	3,700	3,700	4,500	4,500
Auxiliary Consumption	%	9%	9%	10%	10%
GCV	kCal/kg	3,200	3,200	3,300	3,300
Fuel Price (Base year)	Rs./tonne	1,000 (FY 04-05)	2,000 (FY 09-10)	1,300 (FY 04-05)	2,000 (FY 09-10)
Fuel Price escalation	%	5%	5%	6%	5%

CERC in the first amendment to 2012 RE Tariff regulations made in March 2014 and CEA in its 2005 report, while recognising the problems being faced by Biomass developers provided additional allowances on the technical parameters as detailed below:

Allowances provided for Biomass developers			
	CEA 2005 report on Operating norms for Biomass plants referred by Hon'ble APTEL in December 2012 Order	APERC norms adopted in the consequent order issued in August 2013	CERC amendment to 2012 RE Tariff regulations 2014
Operational uncertainties owing to different fuel mixes	5% on SHR	5% on SHR	10 - 12% on SHR
Fuel handling and storage losses	5% on SHR	5% on SHR	7-10% on GCV
Norms	SHR - 4,500 kCal/kWh GCV - 3,300 kCal/kg	SHR - 4,500 kCal/kWh GCV - 3,300 kCal/kg	SHR - 4,200 kCal/kWh GCV - 3,100 kCal/kg
Specific Fuel Consumption	1.36	1.36	1.35

The Commission notes that the Specific Fuel Consumption (SFC) determined by both CERC and CEA is practically the same. The Specific fuel consumption adopted by CERC was 1.35 kg/kWh while CEA had earlier in 2005 adopted a specific fuel consumption of 1.36 kg/kWh. The Commission notes that both CERC and CEA in their respective determinations have recognised the problems being faced by Biomass developers and have provided additional cushion/allowances in finalising either the SHR or the GCV to alleviate these challenges. No allowance/ cushion was suggested in the finalisation of the fuel price by both the agencies.

In its Consultation paper on “Determination of Variable cost of generation for Biomass Power Projects” on 21st February 2014, the Commission had proposed the following variable cost norms to be applicable from FY 2014-15 to FY 2018-19.

Proposed norms in Consultation paper for determination of Variable cost of generation for Biomass Power Projects for the period FY 2014-15 to FY 2018-19		
Parameter	Unit	Proposed Norm
Station Heat Rate	kCal/kWh	4,000
Auxiliary Consumption	%	10%
Gross Calorific Value	kCal/kg	3,300
Fuel Price (FY 2014-15)	Rs./tonne	2,830
Fuel Price Escalation	%	Computed *
Specific Fuel Consumption	Kg/kWh	1.21

** Based on fuel price escalation methodology specified in the consultation paper*

The Consultation paper provided for cushion/allowances for operational challenges in the fuel cost rather than in the GCV or SHR. Accordingly, it determined the SHR and GCV with minimum cushion leading to an SFC of 1.21 kg/kWh. To compensate for operational uncertainties, the fuel cost of Rs.2,431/tonne approved by the Commission in FY 2013-14 was increased to Rs.2,830/tonne for FY 2014-15 in the consultation paper. This indicates a 16% increase in the fuel price which is far above the fuel escalation.

2.1 Station Heat Rate

2.1.1 The Commission had proposed an SHR value of 4,000 kCal/kWh in the Consultation paper.

2.1.2 Biomass Energy Developers Association (BEDA) had argued that SHR of the plant is affected by different fuel mixes and the moisture content of fuel. Consequently, they felt that the additional allowance on SHR due to these factors should be taken into account, and SHR should be fixed at 4,500 kCal/kWh as specified in the Hon'ble APTEL order dated 20th December 2012. The Hon'ble APTEL had referred to the CEA report of 2005 which had determined a Gross SHR of 4,033 kCal/kWh and had allowed a 5% escalation in SHR due to operational uncertainties and an additional 5% escalation due to loss in fuel GCV and loss in fuel weight due to long storage, thereby allowing an SHR of 4,500 kCal/kWh. The CEA report did not give any additional allowance on the GCV and fuel price as the required allowance was already given on the SHR side.

2.1.3 Andhra Pradesh Distribution Companies (APDISCOMS) have submitted that the proposed SHR is on the higher side and stated that an SHR of 3,700 kCal/kWh is appropriate, as fixed by the Commission in the 2004 Order.

2.1.4 M/s.PSR Green Power Projects Private Limited has proposed an SHR value of 4,500 kCal/kWh owing to plant inefficiencies and fuel deterioration.

2.1.5 CERC had constituted a Committee in October 2012 for revisiting the norms of Biomass projects. The Committee, after undertaking a detailed study of selected Biomass plants in India, had determined the average design SHR of Biomass plants as 3,750 kCal/kWh. It was noted that Biomass Plants are forced to operate with all kinds of agro residues irrespective of the moisture content of the fuel due to seasonal availability. The Committee also pointed out that in case of seasonal fuels, the longer storage time affects the performance of the operating Biomass Power stations during season, and during off season they resort to burning low-priced, inferior quality fuel with limited combustion efficiency of boilers, due to unavailability of good quality fuel at affordable prices which also affects the performance. Thus, the Committee recommended a 10-12% operating margin on the SHR. The Committee had proposed an SHR of 4,200 kCal/kWh for stations using travelling grade boiler and 4,125 kCal/kWh for stations using AFBC boiler. This recommendation was adopted in the first amendment to the CERC RE Tariff Regulations 2012 made in March 2014.

2.1.6 Based upon their independent analysis, the consultants appointed by the Commission in their study report has recommended an SHR of 4,200 kCal/kWh for Biomass plants.

2.1.7 The Commission after taking into account the SHR determined by CERC committee report and the SHR recommended in the study report determines for the sake of uniformity, a SHR of 4,200 kCal/kWh for both kinds of boilers for computation of Variable cost for the period FY 2014-15 to FY 2018-19.

2.2 Auxiliary Consumption

- 2.2.1 The Commission had proposed an auxiliary consumption of 10% in the consultation paper.
- 2.2.2 The Biomass Energy Developers Association (BEDA) has argued for determination of auxiliary consumption on the basis of individual configuration of plants and year of operation.
- 2.2.3 The APDISCOMS had argued that the auxiliary consumption of 10% is on the higher side as auxiliary consumption in Biomass plants is much lower than that in coal fired power plants. They proposed that auxiliary consumption be set at 9%, as was accepted in 2004 by most of the power developers including Biomass Energy Developers Association (BEDA).
- 2.2.4 M/s.PSR Green Power Projects Private Limited had proposed an auxiliary consumption of 12% on the ground that hard woody biomass waste needs to be chipped and involves conveying, chipping and the actual auxiliary consumption works out to be higher than 10%.
- 2.2.5 The CERC for its amendment to the principal regulation based on its committee report had determined an auxiliary consumption of 10% for Biomass plants using water cooled condenser from second year onwards and 12% for Biomass plants using air cooled condenser from second year onwards.
- 2.2.6 The Commission noted that all the biomass plants inspected during its field visit used water cooled condensers.

2.2.7 The study report had analysed a sample of biomass players and determined their average auxiliary consumption to be around 10%. Accordingly the study report recommended that an auxiliary consumption of 10% be adopted.

2.2.8 The Commission, after a detailed consideration of the above and noting that only existing plants are coming under the ambit of this order hereby determines an Auxiliary consumption of 10% for computation of variable cost for the period FY 2014-15 to FY 2018-19.

2.3 Gross Calorific Value

2.3.1 The Commission had proposed a GCV of 3,300 kCal/kg in the Consultation paper.

2.3.2 The CEA report of 2005 had given an allowance on the SHR side to account for fuel uncertainties, GCV and weight loss in the fuel due to long storage. Hence, it did not recommend any additional allowance on the GCV side.

2.3.3 Biomass Energy Developers Association (BEDA) stated that the GCV of the as fired fuel has to be adjusted for moisture content to arrive at the GCV in as purchased condition when computing the fuel requirement. It had computed a weighted average GCV of 2,835 kCal/kg and rounded it off to 2,800 kCal/kg to account for uncertainties and variations in an as purchased condition. Their computation is given in the table below:

GCV of Fuel (as purchased) computed by BEDA		
Fuel source (as purchased)	% fuel mix	GCV (kCal/kg)
Rice husk	36.8%	3,090
Juliflora	42.9%	2,850
Agri Residue	20.3%	2,343
Weighted average GCV	100%	2,800

2.3.4 The Commission feels that the approach adopted by the BEDA for the computation of GCV is not justified for the following reasons:

- The Commission during its field visits to Biomass plants in the state noted that juliflora is used in a limited fashion by these plants. The allocation of 42.9% for juliflora by BEDA appears excessive. The stakeholder had used the historical fuel mix specified by the CEA report which was published in 2005. More than 9 years have elapsed and this no longer reflects the prevalent fuel mix in the state.
- The concept of computing the GCV in as-purchased condition is inappropriate as the distinction between as-purchased and as-fired fuel is already being taken into consideration in purchasing decision by building moisture variations into the pricing decision. Purchase prices for high moisture content are proportionately lower than low moisture content fuels. The Commission has separately taken into account the degradation of weight and associated parameters due to storage and handling losses.
- The stakeholder, while requesting for an SHR of 4,500 kCal/kWh which already had accounted for allowances to incorporate possible fuel quality variations, has requested for an independent and additional allowance on the GCV for the same fuel quality variations while computing the fuel requirement. The Commission is of the view that the approach of the stakeholder asking for multiple allowances

on different parameters for the same reasons is self serving and inappropriate.

- CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) (First Amendment) Regulations, 2014 in Statement of Reasons (Page 22) dated 18-03-2014 has specified the following on GCV computation

“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.”

2.3.5 The Commission proposes to follow the CERC approach and determine the GCV in an as-fired condition.

2.3.6 M/s.PSR Green Power Projects Private Limited has proposed a GCV of 2,600 kCal/kg as the biomass fuel contains more than 50% moisture in as-received condition.

2.3.7 CERC Committee had referred to the Biomass Atlas which stated 56% of Biomass fuel availability in Andhra Pradesh is from rice husk and around 33% from agricultural residues. The Commission notes that while the availability of agricultural residues vary with geographical location, the broad indicative mix indicated by the CERC committee report can be adopted. The Commission has computed the weighted average GCV of the Biomass fuel by considering usage of 56% rice husk, 20%

agricultural residues and 24% Juliflora and has considered the GCV of rice husk (3,032 kCal/kg) and agricultural residue (3,524 kcal/kg) captured by the CERC committee from a Biomass project in Andhra Pradesh. The GCV of juliflora as suggested by MNRE as quoted in the CERC Committee Report has been adopted as 2,800 k.cal/kg.

2.3.8 The computation of weighted average GCV with the above individual GCVs is as detailed below.

GCV of Fuel (as fired) computed by the Commission		
Fuel Source (as fired)	% fuel mix	GCV (kCal / kg)
Rice Husk	56%	3,032
Juliflora	24%	2,800
Agri Residue	20%	3,524

The weighted average GCV comes out to around 3,075 kCal/kg.

2.3.9 CERC, in the first amendment to RE Tariff Regulations of 2012 has considered a GCV of 3,100 kCal/kg for mustard husk, rice husk and other husks of biomass fuels under as fired condition of biomass plants.

2.3.10 The study report through a primary research exercise had determined the GCV of Biomass plants in the range of 3,000-3,200 kCal/kg.

2.3.11 The Commission, after a detailed consideration of the above points hereby determines a GCV of 3,100 kCal/kg for biomass fuels under as fired condition of the Variable cost tariff for the period FY 2014-15 to FY 2018-19.

2.4 Fuel Price

2.4.1 The Commission had proposed a fuel price of Rs. 2,830/tonne for Biomass projects for FY 2014-15 in the consultation paper. This price was determined after applying the CERC fuel price indexation mechanism and considering a one-time adjustment of 5% for fuel losses on account of handling and storage.

2.4.2 Biomass Energy Developers Association (BEDA) has argued that fuel price should be determined after determining the fuel requirement in as purchased condition, considering that the moisture content in the fuel increases the fuel weight in as purchased condition. It noted that 1 MT of fuel in an as-fired condition would require 1.372 MT of fuel to be purchased. The weighted average fuel price suggested by them was Rs.4,617/tonne after considering the moisture content, chipping and stacking cost, and losses due to foliage as given below.

Fuel price (as purchased) computed by BEDA		
Fuel Source (as purchased)	% fuel mix	Price (Rs./tonne)
Rice husk	36.8%	3,360
Juliflora	57.2%	4,444
Agri Residue	43.2%	1,943
Weighted Average Fuel price	137.2%	4,617

2.4.3 The Commission notes that the stakeholder while computing the GCV of the fuel in an as purchased condition had considered a 100% fuel mix while it had considered a 137% fuel mix for computing the fuel price. This inconsistent approach cannot be accepted by the Commission as it would lead to an unwarranted increase in the Variable cost. The concept of computing the fuel price in as-purchased condition is incorrect as the

distinction between as-purchased and as-fired fuel is already taken into consideration in the pricing mechanism as pointed out earlier.

2.4.4 People's Monitoring Group on Energy and APDISCOMS have said that the proposed fuel cost is on the higher side and proposed that the Commission adopt a fuel price of around Rs. 2,500/tonne as fixed by CERC for Andhra Pradesh.

2.4.5 The study report had undertaken a market research exercise to determine the biomass fuel prices prevalent in the state, the results of which are captured in the following table.

Fuel price (as fired) determined in the study report		
Fuel Source (as fired)	% fuel mix	Price (Rs./tonne)
Rice Husk	56%	2,800
Juliflora	24%	3,000
Agri Residue	20%	2,100

2.4.6 The report has considered the Biomass fuel mix for Andhra Pradesh as specified by the CERC committee while computing the weighted average fuel price. The weighted average fuel price works out to be Rs. 2,708/tonne.

2.4.7 Considering the uncertainty in the availability and fuel prices of bio fuels, the Commission feels additional comfort needs to be provided to generator. Accordingly, it provides an additional cushion of 5% on the fuel price worked out above.

2.4.8 Therefore, the Commission has determined a base fuel price of **Rs.2,843 per tonne** for FY 2014-15 for computation of the Variable cost for the period FY 2014-15 to FY 2018-19. The price determined is for an as-fired fuel which also includes all transportation and handling costs for the period FY 2014-15. The fuel price escalation will be applicable only from the year FY 2015-16 onwards.

2.5 Fuel Price Escalation

2.5.1 The Commission had proposed the fuel price indexation mechanism in the consultation paper as given in the Regulation 45 of CERC RE Tariff Regulations of 2012. This mechanism is applicable for fuel price adjustment in subsequent years, by considering FY 2012-13 as the base year. It takes into account three parameters, namely, (a) Escalation of fuel handling cost, considering Wholesale Price Index (WPI) as the reference variable, (b) Escalation of fuel cost, considering CERC notified Annual Inflation Rate for indexed energy component in case of captive coal mine source, as the reference variable, and (c) Escalation in transportation cost, considering escalation in High Speed Diesel, as the reference variable. Three multiplying factors have been associated with each of these parameters.

2.5.2 The formula for the fuel price indexation mechanism is:

$$P_{(n)} = P_{(n-1)} * \{a * (WPI_{(n-1)} / WPI_{(n-2)}) + b * (1 + IRC_{(n-1)}) + c * (Pd_{(n-1)} / Pd_{(n-2)})\}$$

2.5.3 For the purpose of tariff computation, the Commission proposed to publish escalation rates based on the indexation methodology for Biomass power projects in Andhra Pradesh for the period FY 2015-16 to

FY 2018-19, before the commencement of the financial year, for which tariff needs to be determined. But, in order to obtain an indicative tariff, the Commission had considered an escalation rate of 6% for Biomass fuel price over the base price of FY 2014-15 for the next five year period.

2.5.4 The Biomass Energy Developers Association argued that the mechanism considers cost of captive coal, which is not related to Biomass fuel. They pointed to the fact that diesel prices increased by 12%, G grade coal by 14% and Subabul price by 20% during September 2009 to September 2013. The stakeholder proposed an escalation rate 12% based on its findings. During the Commission's visits to the three biomass plants, it was noted that Subabul was not used by any of these plants as a fuel. The Commission notes that Subabul is not used by NCE generators in Andhra Pradesh at all in view of its relatively high price and competing demand from paper mills for pulp production. Hence, the Commission rejects the proposal that the increase in Subabul price should be a parameter for increase in Biomass fuel price. In 2009, the diesel prices were regulated. In 2013, the diesel prices are far less regulated. The increase in diesel prices over this period cannot be taken as an indicator for increase in fuel price. Hence, the argument advanced by the objector is not convincing.

2.5.5 The APDISCOMS had suggested that the fuel price escalation of 5%, as adopted in the Hon'ble APTEL order of 2012 should be continued.

2.5.6 The fuel price proposed for FY 2014-15 in the consultation paper (Rs.2,830 per MT) is 16% higher than the approved fuel price for FY 2013-14. The price now determined above is higher at Rs.2,843 per tonne.

Hence, the Commission does not see any merit in the argument that historical escalation has not been taken into account.

2.5.7 CERC in the first amendment to 2012 RE Tariff regulations made in March 2014 had amended the Regulation 44 of the Principal regulations by including the following at the end of Regulation 44

“Alternatively, biomass fuel price shall be decided annually by the appropriate Regulatory Commission through an independent survey which could be carried out by constituting a State level committee consisting of representatives of State Nodal Agency, State Government, Distribution Licensees, biomass power producers association and any other organization”.

2.5.8 This amendment provided an alternative method to the State Commissions for computing the biomass fuel price every year.

2.5.9 The Commission after a careful consideration of Regulation 44 and 45 of CERC RE Tariff Regulations 2012 and the amendment to Regulation 44 feels that the fuel price indexation mechanism specified in Regulation 45 of CERC RE Tariff Regulations 2012 is a preferable option and would like to determine the Biomass fuel price as per the fuel price indexation mechanism. The Commission would like to compute the escalation rates on an annual basis based on the indexation methodology which is fair to both the Biomass developers and the Distribution licensees.

2.5.10 The fuel price determined in this order of Rs. 2,843/tonne would be applicable for FY 2014-15 and the escalation mechanism would be considered to determine fuel price from FY 2015-16 onwards.

2.5.11 The following table lists down the norms considered by the Commission for computing the variable cost for the period FY 2014-15 to FY 2018-19 for Biomass power projects.

Variable cost Norms for Biomass Power Projects		
	Units	Norms
Applicability (Variable Cost)	Period	FY 14-15 to FY 18-19
SHR	kCal/kWh	4,200
Auxiliary Consumption	%	10%
GCV	kCal/kg	3,100
Fuel Price (FY 2014-15)	Rs./tonne	2,843
Fuel Price escalation	%	Computed *
Specific Fuel Consumption	Kg/kWh	1.35

* Based on fuel price escalation methodology

2.5.12 The Variable cost for Biomass power projects for the period from FY 2014-15 to FY 2018-19 is determined as indicated below:

Indicative Variable Cost for Biomass Power Projects for the period FY 2014-15 to FY 2018-19 (Rs. /Unit) *	
Financial Year	Variable Cost (Rs./Unit)
FY 2014-15 **	4.28
FY 2015-16	4.54
FY 2016-17	4.81
FY 2017-18	5.10
FY 2018-19	5.40

* The fuel price escalation is indicative (6%). Actual fuel price escalation would be notified by the Commission before the start of each financial year starting from FY 2015-16.

** This is the rate APDISCOMs have to pay

2.5.13 The Commission, during its field visit has recognised that Biomass developers are facing various challenges like fuel availability problems, fuel storage problems and operational uncertainties due to various types of fuels being utilised. The Commission has attempted to cushion these challenges by proactively assessing operational parameters for biomass players in the above discussed fashion. The Commission feels that these measures would encourage the Biomass players to operate the plants at optimum levels.

3 Industrial Waste based Power Projects

3.1 The Commission would like to continue with the existing mechanism, i.e., the norms proposed for Biomass power projects shall be applicable to Industrial Waste based power projects also.

3.2 The following table lists down the norms considered by the Commission for computing the variable cost for the period FY 2014-15 to FY 2018-19 for Industrial waste based power projects.

Variable cost Norms for Industrial waste based Power Projects		
Applicability (Variable Cost)	Units	Norms
	Period	FY 14-15 to FY 18-19
SHR	kCal/kWh	4,200
Auxiliary Consumption	%	10%
GCV	kCal/kg	3,100
Fuel Price (FY 2014-15)	Rs./tonne	2,843
Fuel Price escalation	%	Computed*
Specific Fuel Consumption	Kg/kWh	1.35

* Based on fuel price escalation methodology

3.3 The Variable cost for Industrial waste based power projects for the period from FY 2014-15 to FY 2018-19 is determined as indicated below:

Indicative Variable Cost for Industrial Waste based Power Projects for the period FY 2014-15 to FY 2018-19 (Rs. /Unit)*	
Financial Year	Variable Cost (Rs./Unit)
FY 2014-15 **	4.28
FY 2015-16	4.54
FY 2016-17	4.81
FY 2017-18	5.10
FY 2018-19	5.40

* *The fuel price escalation is indicative (6%). Actual fuel price escalation would be notified by the Commission before the start of each financial year starting from FY 2015-16.*

** *This is the rate APDISCOMs have to pay.*

4 Bagasse based Power Projects

The Commission recognises that existing Bagasse plants need encouragement as they produce power during the period of the year when demand accelerates.

The norms determined by the Commission in its 2004 and 2009 order and the norms determined by Hon'ble APTEL 2012 order have been summarised in the below table to the extent relevant for variable cost determination.

Bagasse Power Project Norms					
	Units	APERC 2004 Order	APERC 2009 Order	APERC June 2013 Order (Based on Hon'ble APTEL judgement)	APERC Aug 2013 Order (Based on Hon'ble APTEL judgement)
Applicability (Variable Cost)	Period	FY 04-05 to FY 08-09	FY 09-10 to FY 13-14	FY 04-05 to FY 08-09	FY 09-10 to FY 13-14
SHR	kCal/kWh	3,700	3,700	3,600	3,600
Auxiliary Consumption	%	9%	9%	9%	9%
GCV	kCal/kg	2,300	2,300	2,250	2,250
Fuel Price (Base Year)	Rs./tonne	575 (FY 04-05)	950 (FY 09-10)	745 (FY 04-05)	950 (FY 09-10)
Fuel Price escalation	%	5%	5%	5%	5%

The Commission had floated a Consultation paper on "Determination of Variable cost of generation for Bagasse Power Projects" on 21st February 2014 and had proposed the following variable cost norms to be applicable from FY 2014-15 to FY 2018-19

Proposed in Consultation
Norm Paper

Proposed norms in Consultation paper for determination of Variable cost of generation for Bagasse Power Projects for the period FY 2014-15 to FY 2018-19

Parameter	Unit	Proposed Norm
Station Heat Rate	kCal/kWh	3,600
Auxiliary Consumption	%	8.5%
Gross Calorific Value	kCal/kg	2,250
Fuel Price (FY 2014-15)	Rs./tonne	1,281 //
Fuel Price Escalation	%	Computed *
Specific Fuel Consumption	Kg/kWh	1.60

* Based on fuel price escalation methodology specified in the Consultation paper

4.1 Station Heat Rate

4.1.1 The Commission had proposed an SHR value of 3,600 kCal/kWh in the Consultation paper.

4.1.2 M/s. South India Sugar Mills Association (SISMA) was of the opinion that off-season operation of a Bagasse plant should be considered while determining the SHR. The SHR during this period is found to be around 4300-4400 kCal/kWh, as a result of which a higher value for SHR should be allowed.

4.1.3 The SHR of Bagasse based power plants has been fixed at 3600 kCal/kWh by CERC after studying the heat mass balance diagrams and information furnished by MNRE.

Fuel Price

4.1.4 The Commission has considered the SHR as determined by CERC and SERCs in the consultation paper and feels that parameters like SHR cannot be determined based on the performance of plants in the off-season.

4.1.5 Therefore, the Commission has considered an SHR of 3,600 kCal/kWh for computation of Variable cost for the period FY 2014-15 to FY 2018-19.

4.2 Auxiliary Consumption

4.2.1 The Commission had proposed an auxiliary consumption of 8.5% in the consultation paper in line with the CERC RE Tariff Regulations, 2012.

4.2.2 Representatives from South India Sugar Mills said that auxiliary consumption of Bagasse plants should be fixed at least at par with that of Biomass plants.

4.2.3 The Commission is of the view that auxiliary equipment is common between the sugar mill and power plant. As a result, the auxiliary consumption for Bagasse based cogeneration power plants is definitely lower than that of Biomass plants.

4.2.4 CERC had proposed an auxiliary consumption of 8.5% for Bagasse plants in the RE Tariff Regulations of 2012 which would be applicable to Bagasse plants being set up from FY 2013-14. However, since the fixed

cost for 1st-10th of operation for existing Bagasse plants in the state has already been determined by considering an auxiliary consumption of 9%, the Commission feels it is not desirable at this stage to alter the norm for existing plants. Accordingly, the Commission determined Auxiliary consumption at 9% for computation of Variable cost for the period FY 2014-15 to FY 2018-19.

4.3 Gross Calorific Value

4.3.1 The Commission had proposed a GCV of 2,250 kCal/kg for existing Bagasse plants in the state in the consultation paper after a comparative analysis of the GCV values proposed by various SERCs and CERC.

4.3.2 CERC, in the RE tariff regulations of 2012, has specified the GCV for Bagasse as 2,250 kCal/kg.

4.3.3 The Commission has considered a GCV of 2,250 kCal/kg for computation of the Variable cost for the period FY 2014-15 to FY 2018-19.

4.4 Fuel Price

4.4.1 The Commission had proposed a fuel price of Rs.1,281/tonne for Bagasse for FY 2014-15 in the consultation paper. This price was determined after applying the fuel price indexation mechanism on the price approved by the Commission for FY 2013-14.

4.4.2 The South India Sugar Mills Association (SISMA) stated that the fuel price should be worked out using the heat equivalent approach by considering the domestic coal price of Rs. 2,602/tonne and the equivalent GCV. The price so computed works out to be Rs. 1,879/tonne.

4.4.3 APDISCOMS had suggested that fuel price adopted by Hon'ble APTEL in 2012 order when escalated by 5% works out to be Rs.1,212/tonne for FY 14-15 and the same should be adopted.

4.4.4 However, the Commission notes that the price of bagasse for Andhra Pradesh as suggested by CERC in its draft order dated 7th January 2014 is Rs. 1,551/tonne for FY 14-15. This price has been determined by CERC after applying the fuel price indexation mechanism on the price considered by CERC for Andhra Pradesh for FY 2013-14. The Commission observes that the CERC determined bagasse price for Andhra Pradesh is 21% higher than the bagasse price proposed in the consultation paper. The Commission after considering the fact that the Minimum Support prices for Sugarcane has increased significantly during the past few years feels that it is necessary to give the Bagasse based power projects additional comfort on the fuel price side.

4.4.5 Hence, the Commission considers a base fuel price of Rs. 1,551/tonne for FY 2014-15 for computation of the Variable cost for the period FY 2014-15 to FY 2018-19. This fuel price would provide the required incentive to the Bagasse players to perform at their optimum level.

4.5 Fuel Price Escalation

4.5.1 The Commission for computation of Bagasse fuel price escalation would like to adopt the same methodology used for the computation of the Biomass fuel price escalation explained in detail in Section 1.5.

2.5 Escalation Methodology

4.5.2 The fuel price determined in this order of Rs. 1,551/tonne would be applicable for FY 14-15 and the escalation mechanism would be considered to determine fuel price from FY 15-16 onwards.

4.5.3 The below table lists down the norms considered by the Commission for computing Variable cost for the period FY 2014-15 to FY 2018-19 for Bagasse power projects:

Variable cost Norms for Bagasse Power Projects		
	Units	Norms
Applicability (Variable Cost)	Period	FY 14-15 to FY 18-19
SHR	kCal/kWh	3,600
Auxiliary Consumption	%	9%
GCV	kCal/kg	2,250
Fuel Price (FY 2014-15)	Rs./tonne	1,551
Fuel Price escalation	%	Computed *
Specific Fuel Consumption	Kg/kWh	1.60

* Based on fuel price escalation methodology

4.5.4 The Variable cost for bagasse power projects for the period from FY 2014-15 to FY 2018-19 is determined as indicated below:

1.00
- 0.09

.91

Indicative Variable Cost for Bagasse Power Projects for the period FY 2014-15 to FY 2018-19 (Rs. /Unit)*		
Financial Year	Variable Cost (Rs./Unit)	
FY 2014-15	2.73	1551/ton
FY 2015-16	2.89	1644/Ton
FY 2016-17	3.10	3.06 1763.84
FY 2017-18	3.287	3.25 1869.67
FY 2018-19	3.44	3.44 1981.88

2.727
2.89 (1.644 x 1.6 / 0.91)
3.10 x 1.6 / 0.91 (2.82)
2.99 / 0.91 (3.287)
3.12 / 0.91

* The fuel price escalation is indicative (6%). Actual fuel price escalation would be notified by the Commission before the start of each financial year starting from FY 2015-16.

This order is corrected and signed on this 16th day of May, 2014

Sd/-
(P. RAJAGOPAL REDDY)
MEMBER

Sd/-
(R. ASHOKA CHARI)
MEMBER

Sd/-
(DR. V. BHASKAR)
CHAIRMAN

$\frac{1000}{109} \times \frac{1.60}{100} = \frac{1.60}{0.91}$

$\frac{2.48}{1 + 0.09} = 1$

$\frac{1000}{109} \times \frac{1.60}{100} = 1.60$

1000 - 1551

1.55 / kg 1.60

$\frac{100}{109} = 0.91$

$\frac{1.60}{0.91} = 1.76$

0.91

5 Annexure A: Determination of Fuel Price Escalation as per CERC methodology

CERC has explained a Fuel Price Indexation Mechanism in RE Tariff Regulations 2012. This mechanism is applicable for Biomass, Industrial Waste and Bagasse fuel price adjustment in subsequent years, by considering 2012-13 as the base year. It takes into account three parameters, namely, (a) Escalation of fuel handling cost, considering WPI as the reference variable, (b) Escalation of fuel cost, considering CERC notified Annual Inflation Rate for indexed energy component in case of captive coal mine source, as the reference variable, and (c) Escalation in transportation cost, considering escalation in High Speed Diesel, as the reference variable. Three multiplying factors have been associated with each of these parameters. The factors and parameters used for the computation and the detailed computation is given below

$$P_{(n)} = P_{(n-1)} * \{a * (WPI_{(n-1)} / WPI_{(n-2)}) + b * (1 + IRC_{(n-1)}) + c * (Pd_{(n-1)} / Pd_{(n-2)})\}$$

where

$P_{(n)}$: Price per tonne of fuel for n^{th} year

$P_{(n-1)}$: Price per tonne of fuel for $(n-1)^{\text{th}}$ year

a : Factor representing fuel handling cost which is taken as 0.2

b : Factor representing fuel cost which is taken as 0.6

c : Factor representing transportation cost which is taken as 0.2

$WPI_{(n-1)}$: Wholesale Price Index for April of $(n-1)^{\text{th}}$ year

$WPI_{(n-2)}$: Wholesale Price Index for April of $(n-2)^{\text{th}}$ year

$IRC_{(n-1)}$: Average Annual Inflation rate for indexed energy component in case of captive coal mine source for $(n-1)^{\text{th}}$ year

$Pd_{(n-1)}$: Weighted average price of High Speed Diesel for $(n-1)^{\text{th}}$ year

$Pd_{(n-2)}$: Weighted average price of High Speed Diesel for $(n-2)^{\text{th}}$ year

The detailed computation of the fuel escalation factor as per the above methodology is explained below:

Sl. No.	Particulars	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15
	WPI (April)	125	138.6	152.1	163.5	171.3	
	HSD (CERC - Calendar Year)	130.33	147.91	160.99	175.24	210.91	
	Energy Index	3.0%	8.6%	7.6%	6.5%	9.8%	
	Computation of Energy Index						
	Month of notification	Mar-09	Mar-10	Mar-11	Apr-12	Apr-13	
	Escalation Rate (%)	10.8%	8.7%	9.6%	9.5%	9.8%	
	Applicable Tenure (# days)	183	183	183	183	183	
	Month of notification	Nov-09	Dec-10	Oct-11	Oct-12	Oct-13	
	Escalation Rate (%)	- 4.8%	8.5%	5.7%	3.4%	9.8%	
	Applicable Tenure (# days)	182	182	182	182	182	
	Wtd. Avg. Escalation Rate (%)	3.0%	8.6%	7.6%	6.5%	9.8%	
	Escalation Matrix						
1	Fuel Handling cost						
	a	0.20	0.20	0.20	0.20	0.20	0.20
	WPI _{n-1}	123.50	125.00	138.60	152.10	163.50	171.30
	WPI _{n-2}	114.50	123.50	125.00	138.60	152.10	163.50
	Escalation	0.22	0.20	0.22	0.22	0.21	0.21
2	Fuel cost						
	b	0.60	0.60	0.60	0.60	0.60	0.60
	IRC _{n-1}	6.04%	3.00%	8.59%	7.63%	6.47%	9.81%
	Escalation	0.64	0.62	0.65	0.65	0.64	0.66

.22c
 .64b
 .22a

 1.08

Sl. No.	Particulars	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15
3	Transportation cost						
	c	0.20	0.20	0.20	0.20	0.20	0.20
	Pd _{n-1}	135.66	130.33	147.91	160.99	175.24	210.91
	Pd _{n-2}	125.62	135.66	130.33	147.91	160.99	175.24
	Escalation	0.22	0.19	0.23	0.22	0.22	0.24
4	Total Escalation	6.80%	1.26%	10.02%	8.29%	7.15%	10.91%