



తెలంగాణ రాష్ట్ర పునరుద్ధరణ ఐ.ఇ.ఎస్. వినయ అభివృద్ధి సంస్థ లిమిటెడ్  
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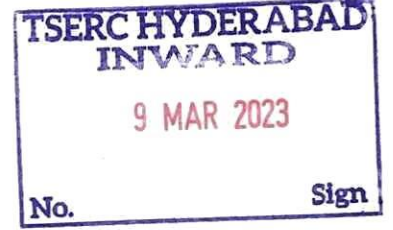
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Ref: TSREDCO/Biomass/TSERC/2022-23 / 1170

Date: 08/03/2023

To  
The Secretary (FAC)  
Telangana State Energy Regulatory Commission (TSERC)  
#11-4-660, 5<sup>th</sup> Floor,  
Singareni Bhavan, Redhills  
Hyderabad



Sir,

Sub: TSREDCO- Study for Determining the Normative Parameters for Biomass & Bagasse Based Power projects located in Telangana state- submission of Final Report- Reg

Ref: 1) Letter No: TSERC/ Secy/JD(TE)/OSD(TE)/E.No/D.No594/22 dated 27.10.2022

2) Letter No: TSERC/ Secy/JD(TE)/OSD(TE)/D.No 654/22 dated 22.11.2022

With reference to the 2<sup>nd</sup> cited above, I am herewith submitting the 3sets of signed final study report for Determining the Normative Parameters for Biomass & Bagasse Based Power projects located in Telangana state for the period 2014-2019.

The above study report submitted for your information

Thanking you sir

Encl: A/a

Yours faithfully

T.Srihuivasulu  
Member Convener

Copy Submitted to:

- 1) The Committee Members
- 2) VC&MD, TSREDCO

Report of the Members of the Committee to Study Normative Parameters for Biomass and Bagasse based Power Plants Located in Telangana

The members of the committee constituted by Hon'ble TSERC has verified the documents supported by developers and based on secondary source of data to ascertain the moisture content of the Biomass fuels, Gross Calorific values and fuel costs & escalation parameters for the fuels used in the Biomass & Bagasse power plants in pursuance of the directions issued by the Commission.

In continuation to that, committee communicated the Emails to Biomass/Sugar mills Developers association and individual Biomass & bagasse Power plants to submit the key parameters and certified/audited Fuelcosts related to Biomass and Bagasse power plants. In response we have received partial response from M/s Rithwik Power Projects Limited(RPPL) & M/s Shalivahana Green Energy Limited plants. It is further submitting that as all Biomass plants in the Telangana are not in operation and PPA expired all Biomass power projects in Telangana state. Due to paucity of time, In view of this the committee has made best efforts to ascertain key parameters from primary data shared by Developers and other secondary research reports/source data.




**A. Fuel Mix:**

RPPL is a public limited company which has a factory at Tekulapalli Village, Penuballi Mandal, Khammam. The plant is a biomass-based power plant with an installed capacity of 6 MW. The company entered into a PPA with the TS DISCOM to sell the power as per tariff determined by the Hon'ble Commission, TSERC. COD of the plant is 23.11.2002 and the PPA expired on 22.11.2022.

The power plant uses Rice Husk, Woody Biomass (Juliflora and Subabul) and other Agri Residues as a fuel to generate power. The fuel is fed to the boiler through bunkers which act as storage buffers, whereas Woody Biomass and Cotton Stalks are fed directly into the boiler. The Woody Biomass and Cotton Stalks are chopped into small pieces before being fed into the boiler.

The company submitted the below mentioned self certified fuel mix in year wise.

Type of fuel	Fuel Mix%		
	Rice Husk	Juliflora	Other biomass
2014-15	25%	14%	61%

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	2015-16	27%	14%	59%
	2016-17	29%	15%	56%
	2017-18	25%	13%	61%
	2018-19	23%	15%	62%
	<b>Average</b>	<b>26%</b>	<b>14%</b>	<b>60%</b>

Based on above data it is assessed that, on average of 5 years data it is noted that following fuel mix used in RPPL, Rice Husk (about 26%), wood waste (14%) and Other Agro waste (60%) in the Boiler. Rice Husk, Juliflora and Cotton Stalks are available from January to August, December to July and January to April respectively. The sellers bring the Rice Husk to the plant in lorries and unload it in the yard whereas the agents/farmers transport Woody Biomass to the plant by lorries/tractors where it is directly unloaded into the machines, chopped into pieces and stored in the yard to be dried naturally for later use.




Further, 2<sup>nd</sup> Project SGEL is a public limited company which has a factory at Mancheial (M&Dist). The plant is a biomass-based power plant with an installed capacity of 6 MW. The company entered into a PPA with the TS DISCOM to sell the power as per tariff determined by the Hon'ble Commission, TSERC. COD of the plant is 07.12.2002 and the PPA expired on 06.12.2022.

The power plant uses Rice Husk, other Agri Residues and coal as a fuel to generate power. The fuels are fed to the boiler through bunkers which act as storage buffers. The Other biomass are chopped into small pieces before being fed into the boiler.

The company submitted the below mentioned self certified fuel mix in year wise.

Type of fuel	Fuel Mix%		
	Rice Husk	Other biomass	coal
2014-15	64.16%	21.68%	14.16%
2015-16	54.9%	30.0%	15.1%
2016-17	54.9%	30.0%	15.1%
2017-18	63.15%	23.43%	13.42%
2018-19	60.43%	25.04%	14.53%
<b>Average</b>	<b>59.51%</b>	<b>26.05%</b>	<b>14.45%</b>

Based on above data it is assessed that, on average of 5 years data it is noted that following fuel mix used in SGEL, **Rice Husk (about 60%), Other Biomass ( 26%) and Coal (14%) in the Boiler.** Rice Husk, Juliflora and Cotton Stalks are available from January to August, December to July and January to April respectively. The sellers bring the Rice

		
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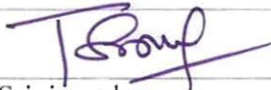
Husk to the plant in lorries and unload it in the yard whereas the agents/farmers transport Woody Biomass to the plant by lorries/tractors where it is directly unloaded into the machines, chopped into pieces and stored in the yard to be dried naturally for later use.

The Committee carefully examined the submission of the BEDA data & others for fuel mix; it is observed that as fuel supplies to biomass power plants completely is unorganized sector and there are no proper evidential documents on fuel price and fuel mix sources in supplier wise. As fuel mix varies significantly in season wise and geographical region. As power plants are located in different regions in Telangana, it is difficult to ascertain single fuel mix for entire region.

Different varieties of biomass fuels are used for generating power as it is noted that biomass/bagasse power companies are completely in unorganised, as highlighted by the CEA vide its report dated September 2005. Hence the Committee requested all the biomass developers and Baggase based power projects to submit the data. RPPL&SGEL which are two among the five plants in recent past operation to submit the audited data of biomass fuels for FY 2014-15. Accordingly, RPPL& SGEL furnished the audited data. Based on the audited data so submitted, the committee computed the mix percentages of various biomass fuels used by RPPL&SGEL's Biomass power plant as given in the table below:

The Committee compared the above fuel mix percentages with the fuel mix percentages specified in CEA report and this APERC Commission's order dated 16.05.2014 and two power plants as shown below:

Type of fuel	Fuel Mix% as per data of RPPL	Fuel mix % as per SGEL	Fuel Mix% as per data of CEA	Fuel Mix % considered in APERC Commission's order dt 16.05.2014
Rice Husk	26%	60%	36.8%	56%
Juliflora	14%	-	42.9%	24%
Other biomass/ Agro residues	60%	26%	20.3%	20%
Coal		14%		
Total	100%	100%	100%	100%

		
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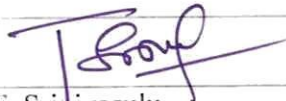
After careful examination of the data, the fuel mix are not matching with respective plants as well as commission data. Further, the fuel mix will vary from year to year and season to season. Therefore, the Committee is not inclined to consider data submitted by RPPL & SGEL, hence committee has considered the fuel mix as per CEA report.

**B. Moisture content:**

It is to submit that, as submitted in earlier paragraphs that all biomass power plants are not in operation, it is difficult to ascertain moisture content physically. It is to be noted that, based on the sample reports submitted by the above companies, the moisture content varied from time to time. In their latest submissions, they requested to consider the moisture content as 11.21% for Rice Husk, 16.35% for Other biomass/Agro residues and coal is 15.93% for as Received basis from third party reports submitted by SGEL and 14.48%.for Rice Husk, 34.54% for wood chips and other Biomass residues i.e., Palmoil bunches 40%, palmoil fiber 29.3% and 5.93% for Maize cobs as Received basis from third party reports submitted by RPPL . The moisture content of palmoil bunches samples is higher compared to that mentioned in the CEA Report, 2005 and the submissions of SGEL & RPPL . The Committee examined the matter carefully and compared the moisture content as shown in the table below:

	BEDA submission data			CEA report			SGEL			RPPL		
	Rice Husk	Cotton Stalk	Juliflora/ wood chips	Rice Husk	Cotton Stalk	Juliflora	Rice Husk	Other biomass	coal	Rice Husk	wood chips	Palmoil bunches
Moisture in as-received condition (%)	3.89	55	10.25	0	40	40	11.21 %	15.93 %	15.9 3%	14.48 %	40%	29.3%
Moisture in as-fired condition (%)	0	15	20	0	15	20	Not submitted			Not submitted		

In respect of all the fuel mixes, the moisture content claimed by BEDA and the test results of the samples shown in the above table not matching, not in correlation with the claim of the BEDA. Therefore, the committee is inclined to consider the moisture content in as received basis for various biomass fuels as per CEA report. The data regarding moisture

		
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content as fired basis is not available anywhere. Hence, the committee has considered the CEA data.

**C. GROSS CALAROFIC VALUE:**

Commission in its order in OP No.32 of 2014 has issued Gross Calorific value of 3100 Kcal/kg ; in present scenario RPPL has submitted third party test report Gross calorific values of various kind of fuels. Here is summary of GCV reports and based on fuel mix of RPPL; gross calorific value is assessed as 3204 kcal/kg.

	<b>GCV As Received based on RPPL Data</b>	<b>Fuel Mix</b>	<b>Proportionate GCV</b>
Ricer husk	3897	26%	1013.22
Wood Chips	4123	14%	577.22
Others/Agri Residues	2689	60%	1613.4
		<b>Average GCV</b>	<b>3203.84</b>



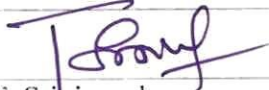
Therefore, based on the committee is inclined to consider the average GCV of 3204 Kcal/kg.

**D. STATION HEAT RATE:**

There is no biomass power plant in operation in Telangana. It is to submit that Hon'ble commission has determined variable cost of Biomass power plants for FY 2019-2020 and FY 2020-2021 in OP NO. 15 of 2020 and OP No.21 of 2020 dated 28.08.2020 where in considered 4200 Kcal/kWh as SHR. In view of this committee is inclined to consider 4200 Kcal/kwh as SHR.

**E. Fuel Cost Issues for Biomass based Plants**

Committee has requested BEDA/ISSISMA and Developers to submit the balance sheets and cash receipts for purchase of fuels. As some of the developers informed that there is no such records and balance sheet of same from their end. In response to our letter, M/s RPPL has submitted the data pertains to fuel cost. Based on RPPL and APTEL parameters committee has arrived the fuel cost.

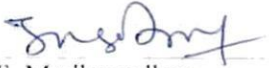

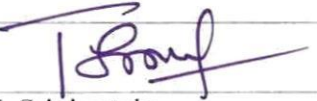
		
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As per RPPL data Fuel Cost Calculation								
Fuel Mix % As per data of RPP L.	Qty As fired ( kg).i.e 1.36	Conversion Factor	Qty as fired	Fuel Cost Without Handling ( in Rs/ Ton)	Fuel Cost with Handling ( in Rs/Ton)		Proportionate Price in Rs	Fuel Cost considered for tariff determination
A	$B=(1.36*A)/100$	As per APTEL Order ( C)	B/C					( Rs/Ton)
26	0.354	1	0.3536	2482.61	2800	317.39	990.08	3181
37	0.503	0.75	0.670933	2637.98	3000	362.02	2012.8	
37	0.503	0.75[1]	0.670933	931.93	2100	1168.07	1408.96	
100			1.713848				4059.6	

It is further submit that, as this data provided by M/s RPPL is not certified by their auditor. In view of the committee has not inclined completely the data provided by M/s RPPL. Also it is further submit that, as fuel mix varies from plant to plant, it is noted from some of the plants as majority of plants uses coal also as one of the fuel .

In view of this Committee has undertaken market research from various sources it is understood that rice husk cost varies from Rs.2000 to 2800 /MT and Juliflora cost varies from Rs. 1700 to Rs.2800/MT and Coal cost for that period taken as Rs.2850/MT including handling charges.

Based on the above parameters, tentative fuel costs for calculated and presented in

		
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**FUEL COST CALCULATION AS PER market Research data**

Type fuel	Fuel Mix % As per data of SGEL	Qty As fired ( kg).i.e 1.36	Conversion Factor	Qty as fired	Fuel Cost with Handling ( Rs/Ton)	Proportionate Price( Rs/Ton)	Fuel Cost considered for tariff determination ( Rs/Ton)
	A	$B=(1.36*A)/100$	As per APTEL Order ( C)	B/C			
Rice husk	61	0.830	1	0.8296	2400	1991.04	2535
Juliflora	24	0.326	0.75	0.4352	2100	913.92	
COAL	14	0.190	1	0.1904	2850	542.64	
<b>Total</b>	<b>100</b>			1.4552		3447.6	

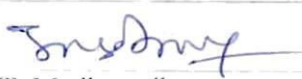


The committee has carefully examined the submissions of the fuel prices submitted by RPPL & SGEL. However, the data submitted is not supported with audited documents. Hence, the committee has arrived average fuel cost based on the above two company parameters, i.e. Rs. 2855 /MT for the period FY 2014-15 to 2018-19.

**F. FUEL Cost Escalation**

In response to our request on submission of fuel cost data pertains to Month wise and source wise from Biomass power developers, we have received only partial unaudited data from M/s Shalivahana and M/s RPPL. Based on the developers submitted data and market research of committee has analysed and ascertained escalation cost year wise.

Here is summary of coal cost in year wise:

S.No	Coal cost ( Rs./MT)	Escalation
2014-2015	2,942	0
2015-2016	3,081	5%
2016-2017	2,122	-45%
2017-2018	3,000	29%
2018-2019	3,222	7%
<b>Average</b>	<b>2873</b>	<b>-1.00 %</b>

		
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Based on M/s SGEL Submitted data, average fuel cost for year wise arrived, same summarised in table below:



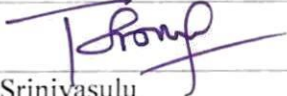
AVERAGE FUEL PRICES DURING THE YEAR 2014 TO 2019 as per SGEL Data						
Month / Year	Rice Husk Cost (Rs./MT)	Escalation %	Fire wood (Rs./MT)	Escalation %	other biomass (Rs./MT)	Escalation %
FY 2014-15	2,286		2,107		2,083	
FY 2015-16	2,410	5.42%	2,308	9.55%	2,020	-3.03%
FY 2016-17	2,351	-2.44%	2,170	-5.99%	1,855	-8.14%
FY 2017-18	2,350	-0.04%	-		2,081	12.19%
FY 2018-19	2,441	3.85%			2,099	0.85%
FY 2019-20	2,493	2.14%			1,152	-45.14%
<b>Average</b>	<b>2,388</b>	<b>1.79%</b>	<b>1,646</b>	<b>1.78%</b>	<b>1,882</b>	<b>-8.65%</b>

From the above table it is clear that, escalation percentage varies significantly in fuel wise.

It is further submit that Hon'ble commission has issued orders for year wise escalation cost for Biomass Projects are presented in table below, based on that it is observed that average of 3.14% annual escalation.

	Actual Fuel Cost Escalation Considered by Hon'ble commission	Order Date
FY 2014-15		
FY 2015-16	7.53%	16th July 2015
FY 2016-17	-5.02%	04th April 2016
FY 2017-18	0.95%	8th June 2017
FY 2018-19	9.08%	10th April 2018
<b>Average</b>	<b>3.14%</b>	

It may be noted in this context that the commission approved fuel price for biomass for FY 2019-2020 and FY 2020-2024, as this order having not been challenged, attained finality. Hence any escalation allowed on base price for FY 2014-2015 shall not result in the fuel price exceeding the approved fuel price for FY 2019-20 for the past period. Hence committee recommended considering the escalation rate of 2% over base year price.

		
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SUMMARY OF NORMATIVE PARAMETERS:



Sl.no.	Parameter Description	As per the committee recommended parameters	As per the Commission's Order dated 16.05.2014
1	Station Heat Rate	4200 kcal/kwh	4200 kcal/kwh
2	Gross Calorific Value of fuel	3203 Kcal/kg	3100 Kcal/kg
3	Fuel Price base year (FY 2014-15)	Rs 2855/ MT	Rs 2843/ MT
4	Specific Fuel Consumption	1.311 Kg/kwh	1.35 Kg/kwh
5	Fuel Cost Escalation	2%	

**2. Fuel Cost issue of Bagasse based power plants:**

We have requested Sugar Mills Developers Association to provide actual data like fuel cost, invoices and audited account to arrive the Bagasse fuel price. In response we have received the booklets of SISMA and fuel consumption calculation from M/s Kakatiya Cement and Sugar Industries Limited. Here is the summary of M/s KCSIL data.



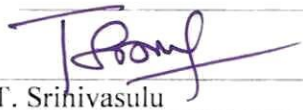
Year	Bagasse (GCV)	Coal(GCV)	SFC ( Kg/kWh)	SIIR (Kcal/kWh)
2014-15	2200	3100	2.19	5044
2015-16	2150	2900	2.14	4742
2016-17	2250	3150	2.13	4929
2017-18	2100	3050	2.16	4743
2018-19	2270	2950	2.12	4971
			<b>2.15</b>	

On request of committee, SISMA and their members are not able to submit the invoices and full audited details for the entire product sold by them in the whole year.

		
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Further the committee has undertook market research to assess the cost of Bagasse fuel price. The market prices of bagasse are not available directly as this is by product of sugar mills. The bagasse prices assessed in market research are much lesser than what the commission has approved in its order dated 16.05.2014.

In view of the limited availability of data in primary and secondary research, committee is inclined to consider the APERC order in OP No.32 of 2014 dated 15.12.2022; as the operation of Bagasse power plants not vary significantly from location to location, **in view of this committee considered Rs. 1489 per tonne.**

		
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