

RAJASTHAN ELECTRICITY REGULATORY COMMISSION

JAIPUR

In the matter of petition under Section 62 and 86 of the Electricity Act, 2003 read with RERC (Terms and Conditions for determination of Tariff for Renewable Energy Sources- Biomass, Biogas and Biomass Gasifier Energy) Regulations, 2015.

Coram :

Shri Vishvanath Hiremath, Chairman
Shri Rajendra Prasad Barwar, Member
Shri Suresh Chandra Dinkar, Member

Petitioner(s): M/s Rajasthan State Ganganagar Sugar Mills Ltd., Nehru Sahakar Bhawan, 4th Floor, Bhawani Singh Marg, Jaipur.

Respondent(s): (1) Ajmer Vidyut Vitran Nigam Ltd., through its Managing Director, Panchsheel Nagar, Makarwali Road, Ajmer-305004.
(2) Jodhpur Vidyut Vitran Nigam Ltd., through its Managing Director, New Power House, Industrial Area, Jodhpur-342003.
(3) Jaipur Vidyut Vitran Nigam Ltd., through its Managing Director, Vidyut Bhawan, Janpath, Jaipur, 302005.

Date of hearing(s): 23.03.2017, 11.07.2017, 09.11.2017 and 30.11.2017

Date of Order: 25.01.2018

ORDER

1. Petitioner is a company registered under the Companies Act, 1956 with its registered office at Nehru Sahakar Bhavan, 4th floor, Bhawani Singh Marg, Jaipur.

2. Rajasthan State Ganganagar Sugar Mills Ltd ('RSGSML') has made an application before the Commission on 03.03.2017 for determination of tariff under Section 62 and 86 of the Electricity Act,2003 read with the RERC (Terms and Conditions for determination of Tariff for Renewable Energy Sources- Biomass, Biogas and Biomass Gasifier Energy)Regulations, 2015. RSGSML intends to sell power to the State Discoms namely- Jaipur Vidyut Vitran Nigam Ltd.,('JVVNL'), Ajmer Vidyut Vitran Nigam Ltd.,('AVVNL') and Jodhpur Vidyut Vitran Nigam Ltd.,('JdVVNL') (hereinafter 'Discoms') vide Petition No.1100/17.
3. In pursuance to an application submitted by the Petitioner, the Rajasthan Renewable Energy Corporation Ltd ('RREC') vide its letter No. RREC/PRN-39/Biomass/RSGSM/D-4242 dated 19.10.2015 permitted the Petitioner to set up its bagasse based co-generation power plant of 4.95 MW capacity at Chak 23-F, Kaminpura, Sriganganagar in Rajasthan to produce and sell surplus energy/power to Discoms under the "Policy for promoting generation of electricity through non-conventional resources 2004" issued by Government of Rajasthan vide Energy department notification dated 25.10.2004 and the amendments issued from time to time, followed by the "Policy for promoting Generation of Electricity from Biomass, 2010" issued by the Government of Rajasthan dated 26.02.2010 as amended from time to time.
4. The petitioner thereafter entered into a PPA with the respondent Discoms on 30.12.2015 for the sale of surplus power generated from its 4.95MW bagasse based (water cooled) co-generation power plant for a period of 20 years from the date of commercial operation (COD) of the power plant as per the tariff determined by the Commission from time to time.

Subsequently, the Petitioner has established and commissioned the power plant on 9.05.2016 connected to 132 kV GSS Kaminpura of RVPN, Ganganagar and supplying electricity to the Discoms. Hence, the present petition.

5. The Petitioner in its petition has submitted that :

(1) Commission in exercise of the power conferred on it under Section 61 and 62 read with Section 181 of the Electricity Act, 2003 and all other powers enabling it in this behalf, has framed the RERC (Terms and Conditions for Determination of Tariff for Renewable Energy Sources-Biomass, Biogas and Biomass Gasifier Energy) Regulations, 2015 which shall be applicable for determination of tariff in cases covered under these Regulations from FY 2015-16 and onwards upto FY 2018-19.

(2) As per Regulation 7 of the RERC RE-Biomass, Biogas and Biomass Gasifier Tariff Regulations, 2015, the Commission may initiate process for determination of generic tariff for Biomass, Biogas and Biomass Gasifier based power plants on Suo-Motu basis. The Commission, therefore, through order dated 23.08.2016 determined the generic tariff for Biomass, Biogas and Biomass Gasifier based power plants getting commissioned during FY 2016-17 as under:

Table-7: Tariff for Biomass based power plants to be commissioned during FY 2016-17 and opting Biomass fuel price determined based on recommendations of the State Level Committee:

FY 2016-17	Water cooled condenser	
	Without availing AD Benefit	With AD benefit availed.
Fixed charges (Rs/kWh) (Levellised for 20 years)	2.83	2.66
Variable charges (Rs/kWh)	4.00	4.00
Applicable Tariff (Rs/kWh)	6.83	6.66

- (3) The plant set up by the petitioner is bagasse based (water cooled) co-generation power plant and Power Purchase Agreement (PPA) has also been executed between the parties on 30.12.2015. As the tariff could not be mutually agreed upon by the parties the respondents advised the petitioner to file a petition before the Commission for determination of tariff for sale of surplus power to the respondents. The cost of the generation per unit comes to around ₹ 8.82/kWh. It is, therefore, requested that Commission may be pleased to pass such order approving the tariff as per the cost sheet attached hereto.
- (4) This power plant is the first and the only bagasse (fibre part of sugar cane after extraction of juice) based co-generation power plant set up in the State of Rajasthan and there is no generic tariff determined by the Commission for such bagasse based cogeneration plant to be set up in the State.

6. The prayer made in the petition is as follows:

- "(1) Allow the present tariff petition and approve the tariff at the rate of Rs. 8.82 which is the actual production cost per unit of the petitioner.*
- (2) In the alternative to prayer (a), approve the generic tariff fixed for Biomass based power plants (water cooled) without availing AD benefit vide order dated 23.08.2016 to be adopted in the case of the petitioner for the sale of surplus power generated to the respondents from its 4.95 MW Bagasse based Co-Generation Plant as per PPA dated 30.12.2015.*
- (3) Pass any such other order as this Hon'ble Commission may deem fit and proper in the facts and circumstances of the case."*

7. The petitioner was directed to publish notices in the newspapers of the application as required under Section 64(2) of the Electricity Act, 2003.

8. The petitioner accordingly published the notices on the following dates :

Table-1: List of newspapers and date of publication:

Newspapers	Date of publication
Rashtradoot (Bikaner edition) (Hindi)	02.09.2017
Dainik Bhaskar (Sriganganagar, Bikaner edition) (Hindi)	02.09.2017
Indian Express (Jaipur edition) (English)	03.09.2017

The tariff application was also placed on the Petitioner's website as well as on the Commission's website. The last date of receiving comments/suggestions was 28.09.2017.

9. It is observed that no comments/suggestions were received on the tariff application in response to the notices.
10. The petition was finally heard on 30.11.2017. During the hearing the petitioner highlighted the features of the plant and grounds in support of tariff prayed for. Since the State Discoms have agreed to buy power generated from the petitioner's power plant the Commission may determine the tariff.

Determination of Tariff:

11. Section 86(1)(e) of the Electricity Act, 2003 mandates promotion of co-generation and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person. Section 61 (h) of the Act also provide that, while specifying the terms and conditions of determination of tariff, the Commission shall be guided by the objective of promotion of co-generation and generation of electricity from renewable sources of energy. Section 62 of the Act provides for determination of tariff for supply

of electricity by a generating company to a distribution licensee as per procedure prescribed under Section 64.

12. The Commission notes that revised Tariff Policy notified by the Central Government on 28.01.2016 in pursuance to Section 3 of the Electricity Act, 2003 has stipulated that the Appropriate Commission may determine preferential tariff for procurement of power by distribution licensee from non-conventional sources of energy till issue of notification of procurement of power from renewable energy sources through competitive bidding by Central Government. The relevant extracts of para 6.4 (2) of the Tariff Policy is given below:

“(2) States shall endeavor to procure power from renewable energy sources through competitive bidding to keep the tariff low, except from the waste to energy plants. Procurement of power by Distribution Licensee from renewable energy sources from projects above the notified capacity, shall be done through competitive bidding process, from the date to be notified by the Central Government. However, till such notification, any such procurement of power from renewable energy sources projects, may be done under Section 62 of the Electricity Act, 2003. While determining the tariff from such sources, the Appropriate Commission shall take into account the solar radiation and wind intensity which may differ from area to area to ensure that the benefits are passed on to the consumers.”

13. The Central Government has published the competitive bidding guidelines for the State Discoms to procure power generated from solar and wind energy power plants only under Section 63 of the Electricity Act, 2003.
14. Considering above and the Petition No.1100/17 of RSGSML, the Commission hereby decides to proceed with determination of the tariff under Section 62 of the Electricity Act,2003 in respect of electricity generated from petitioner's bagasse based co-generation power plant.

Petitioner's submissions:

15. The petitioner along with the petition has furnished the cost sheet containing tariff calculation as follows:

**Table-2: Cost sheet submitted by the Petitioner:
STRUCTURE OF TARIFF**

S. No.	Component	Amount (In Rs.)		Total Amount
		Steam Generation	Power Generation	
A	Fixed Cost			
1	Operation and Maintenance :-			
	1. Employees Cost	7,00,000	3,00,000	10,00,000
	2. Process Material/Chemicals	50,000	25,000	75,000
	3. Repairs & Maintenance	1,00,000	75,000	1,75,000
	4. Water	2,00,000	0	2,00,000
	Total	10,50,000	4,00,000	14,50,000
2	Depreciation :-			
	1. Book Value of Plant & Machinery Purchased during 2015-16	17,31,03,752	13,51,44,039	30,82,47,791
	2. WDV as on 31-3-2016 as shown in Balance Sheet	16,00,55,998	12,49,57,511	28,50,13,509
	3. Depreciation Amount @18.10 % as per Company Act, 2013 (for one month)	36,82,000	28,76,000	65,58,000
3	Interest on Loan Capital :- there is no any loan capital	0	0	0
4	Interest on working Capital :- No any amount for interest on working capital has been taken.	0	0	0
5	Return on equity :- No any amount for return on equity has been taken			
	Total of Fixed Costs	47,32,000	32,76,000	80,08,000
	Total steam Generated 2,96,10,000			
	Steam used for electricity Generation 2,16,54,864			
	Proportionate expenditure of steam for power		34,60,683	
B	Fuel Cost (per ton)			
1	Electricity generated 3492720 units			
2	Steam required (6.20*3492720) 2,16,54,864 kgs.			
3	Bagasse required (2,16,54,864/2.35) 9215 Ton			
4	Bagasse Rate as per RERC order Rs. 2613.39 per Ton for the year 2016-17			
5	expenditure on bagasse (9215*2613.39)		2,40,19,072	
6	Total exp. for power generation 32 76 000 + 34,60,683 + 2,40,19,072)		3,08,19,072	
7	Per unit electricity Cost (3,08,19,072 /		8.82	

3492720)			
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Cost sheet of steam generation (per unit)

Name of the Production		Steam Generation			
Period in consideration		one month (30days)			
A-Quantitative Statement					
	Particulars		Unit	Qty.	
1	Cane Crushing Capacity per Month (1500 TCDx30 days)		M.T.	45000	
2	Quantity of Bagasse Produced (45000 x 28/100)		M.T.	12600	
B- Cost Information					
	Particulars	Quantity	Rate/M.T.	Amount Rs.	Cost/Unit
1	Water			200000	0.0068
2	Bagasse Production in M.T	12600	2613.39	32928714	1.1121
3	Process Materials/ Chemicals			50000	0.0017
4	Direct Employees Cost			700000	0.0236
5	Repairs and Maintenance			100000	0.0034
6	Depreciation			3682000	0.1243
	Total cost			37660714	1.2719
C- Steam output and cost per unit					
1	Anticipated monthly steam generation (12600 *1000*2.35 = 29610000 units) Where- Monthly bagasse= 12600 M.T. or 12600000 kgs. (12600x1000) Bagasse steam Ratio- 1kg=2.35 unit		29610000	37660714	1.2719

Cost sheet of power generation (per unit)

A Quantitative Statement					
S.no.	Particulars		Unit	One Month Qty.	
1	Monthly Production Capacity (4.95x24Hrx30 days)		KWH	3564000	
2	Quantity Produced (4.94*.98*24*30)		KWH	3492720	
3	Wastage @ 2% (3492720*.02)			69854.40	
4	Net units available for self-use and export			3422865.60	
5	Steam units required for generation of 3492720 units of electricity	3492720*6.20 =21654864			
B Cost Information of Power Generation					
	Particulars	Qty. in kgs.	Rate /unit	Amount Rs	Cost per Unit Rs/K.W.H.
	Steam cost.	21654864	1.2719	27542821.5	7.8858
2	Process Materials/ Chemicals			25000	0.0072
3	Direct Employees Cost			300000	0.0859
5	Repairs and Maintenance			75000	0.0215
6	Depreciation			2876000	0.8234

	Total	3492720 unit of electricity		30818821.5	8.8237
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16. The petitioner in cost sheet attached with its petition has worked out the cost of power generation as ₹ 8.8237/kWh as under:

(1) The petitioner in its cost sheet has allocated fixed cost components for base period of one month as under:

S. No.	Component	Amount (In Rs.)		Total Amount in Rs
		Steam Generation	Power Generation	
A	Fixed Cost			
1	Operation and Maintenance :			
	1. Employees Cost	700000	300000	1000000
	2. Process Material/Chemicals	50000	25000	75000
	3. Repairs & Maintenance	100000	75000	175000
	4. Water	200000	0	200000
	Total	1050000	400000	1450000
2	Depreciation :-			
	1. Book Value of Plant & Machinery Purchased during 2015-16	173103752	135144039	308247791
	2. WDV as on 31-3-2016 as shown in Balance Sheet	160055998	124957511	285013509
	3. Depreciation Amount @18.10 % as per company Act, 2013 (for one month)	3682000	2876000	6558000
3	Interest on Loan Capital :- there is no any loan capital	0	0	0
4	Interest on working Capital :- No any amount for interest on working capital has been taken.	0	0	0
5	Return on equity :- No any amount for return on equity has been taken			
	Total of Fixed Costs	4732000	3276000	8008000
	Total steam generated 2.96.10,000			
	Steam used for electricity generation 2,16,54,864			
	Proportionate expenditure of steam for power		34,60,683	

(2) Cost of steam generation:

Considering the period of one month (30 days) with cane crushing capacity of 1500 TCD, the petitioner has worked out the cane requirement of 45000 MT(=1500 TCDx30 days). With bagasse

production rate of 28%, the quantity of bagasse produced is 12600 MT (= 45000 MT x 28/100). With bagasse fuel steam ratio of 2.35, in the petition anticipated monthly steam generation worked out as 29610000 units (=12600x1000x2.35). The total cost to produce the above quantity of steam has been projected as follows:

S.No.	Particulars	Amount in ₹
1.	Water	2,00,000
2.	Bagasse @ ₹ 2613.39/MT for 12600 MT	3,29,28,714
3.	Process Materials/Chemicals	50,000
4.	Direct Employee cost	7,00,000
5.	Repairs and Maintenance	1,00,000
6.	Depreciation	3,68,2000
	Total cost	37660714

The steam output cost per unit, thus, worked out by the petitioner is ₹ 1.2719/unit of steam (=37660714/29610000).

(3) Cost of power generation per unit:

The petitioner in its cost sheet has projected monthly electricity production capacity as 3564000 kWh (=4.95 MW x 1000 x 24 hrs x 30 days) from which 98% of electricity production is estimated as 3492720 kWh (=4.95MWx1000x0.98x24hrsx30 days). Considering wastage of 2%, the net units available for self-use and export has been projected as 3422865.60 kWh. With specific steam consumption of TG set as 6.2 kg/kWh, the steam requirement for generation of above units of electricity is worked out as 21654864 units of steam (=3492720 x 6.20). The total cost of power generation considered in the cost sheet is as under:

S.No.	Particulars	Amount in ₹
1.	Steam cost (=21654864 x 1.2719)	2,75,42,821.5
2.	Process Materials/Chemicals	25,000
4.	Direct Employee cost	3,00,000
5.	Repairs and Maintenance	75,000
6.	Depreciation	28,76,000

Total	3,08,18,821.5
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Therefore, the rate for generation of 3492720 units of electricity worked out by the petitioner is ₹ 8.8237/kWh (=3,08,18,821.5/3492720).

17. In an alternative, the petitioner has also requested to allow them generic tariff determined vide Commission's order dated 23.08.2016 applicable to Biomass (water cooled) power plants without availing AD benefit.

Commission's Views:

18. From perusal of the petition and material submitted it is observed that:
- (1) In the cost sheet attached with the petition, the cost calculations are on 30 days (month) basis instead of annual basis.
 - (2) The petitioner in its cost sheet workings has charged depreciation of 18.10% on Written Down Value (WDV) contrary to regulatory practice of considering Differential Depreciation approach of charging depreciation at a higher rate over the loan period and a lower rate beyond the loan tenure over the useful life of plant computed on Straight Line Method (SLM) method. Further, the petitioner has not claimed any amount towards interest on loan capital, interest on working capital and Return on Equity in the above cost sheet.
 - (3) In the cost sheet, the rate of fuel (bagasse) has been considered as ₹ 2613.39/MT in accordance with para 40 of the Commission's order dated 23.08.2016 derived based on indexation mechanism applicable to Biomass power plants for FY 2016-17. However, while preparing the projected profitability for the year 2013-14 onwards in DPR, the petitioner has assumed cane price as ₹2250/MT and realization from bagasse as ₹ 1800/MT.

- (4) In the petition, the specific steam consumption of TG set= 6.2 units of steam/kWh, steam/fuel ratio 1kg fuel=2.35 units of steam has been furnished, however, specific fuel consumption in kg/kWh has not been projected. Considering above parameters, the total specific fuel consumption works out to be 2.63 kg/kWh. For petitioner's plant having the crushing capacity 1500 TCD for a month, i.e., 30 days, 45000 MT sugarcane is fed, out of which 28% bagasse is produced, which works out to be 12600 MT. Considering steam/fuel ratio of 2.35 given in DPR, total anticipated monthly steam generation is 29610000. Out of this 21654864 units (i.e.,73.14%) are stated to be used for electricity generation. The bagasse used for power generation is derived to 1.92 kg/kWh, which is higher than 1.60 kg/kWh considered by CERC and other SERCs.
- (5) The petitioner has also submitted DPR titled '*MODERNISATION, EXPANSION AND SHIFTING OF 1500 TCD EXPENDABLE TO 2500 TCD SUGAR PLANT. 4.95 MW BAGASSE BASED POWER PLANT*' September,2012(revised). The petitioner has taken project cost for sugar plant as ₹ 93.00 Crs to be financed with 40% as own contribution, 40% from SDF and remaining 20% from financial institutions. Further, interest on term loan is projected as 12.50% p.a. on reducing balance with repayment in seven years with one year moratorium period. The interest on working capital has also been projected as 12.50% on 50% average sugar stock with 25% margin on levy and free sugar. However, in cost sheet the total book value of plant and machinery purchased during 2015-16 has been projected as ₹ 30.82 Crs. Further, in the cost sheet, interest on term loan and working capital is not taken. The plant of the petitioner is already commissioned, the petitioner has projected book value of capital expenditure on steam generation and power generation in

cost sheet, however, the copy of the audited documents and other material in support of the expenditure incurred is not furnished.

19. It is observed that CERC in their Tariff Regulations distinguish between biomass and non-fossil fuels based co-generation power projects in terms of technology/process and have specified separate norms/parameters for determination of their generic tariff. CERC vide their order dated 29.04.2016 has specified the different parameters for Biomass and non-fossil based cogeneration power projects and have specified different tariff as follows:

Table- 3: Comparison of CERC parameters Biomass vis-à-vis Non-fossil fuel based co-generation FY 2016-17:

S.No.	Parameter	Unit	Biomass	Non-fossil fuel based co-generation
1.	Capital cost [@]	₹ Lakh/MW	₹ 559.03 Lakh/MW	₹ 452.75 Lakh/MW
2.	O& M expenses	₹ Lakh/MW	₹ 47.26 Lakh/MW	₹ 19.99 Lakh/MW
3.	PLF	%	First six month of stabilization-60% Remaining six months of first year (after stabilization)-70% Second year onwards-80%	53% (other States)
4.	Aux. Consumption	%	During first year 11% and 10% from second year onwards	8.50%
5.	SHR	kcal/kwh	4126 (Travelling grate)	3600
6.	GCV	kcal/kg	3174	2250
7.	Fuel price ^{\$\$}	₹/MT	2789	1919.93
8.	Applicable tariff ^{###}	₹/kWh	7.14	6.14

[@] : Capital cost for project other than straw and Juliflora with water cooled condenser.

^{\$\$} : Fuel price applicable to plants set up in Rajasthan.

^{###} :Tariff without AD benefit applicable to plants set up in other States incl. Rajasthan.

20. Commission vide its order dated 23.08.2016 has determined the generic tariff applicable to the biomass power plants opting biomass fuel price determined based on recommendations of the state level committee and to be set up during FY 2016-17 as under:

Table-4: Tariff for Biomass power projects power projects for FY 2016-17:

FY 2016-17	Water cooled condenser		Air cooled condenser	
	Without availing AD Benefit	With benefit availed AD	Without availing AD Benefit	With benefit availed AD
Fixed charges(₹/kWh) (Levellised for 20 years)	2.83	2.66	3.08	2.89
Variable Charges(₹/kWh)	4.00	4.00	4.32	4.32
Applicable Tariff(₹/kWh)	6.83	6.66	7.40	7.21

21. It is observed from above that it is not reasonable to equate the tariff determined for bagasse based co-generation power projects with the tariff determined for Biomass based power projects. Tariff of bagasse based co-generation plant would be lower than a biomass power project as evident from the comparison made in earlier paras. Further, the Biomass power plants are set up in IPP mode, whereas, in the co-generation projects with power generation increase the overall efficiency in the operations of a sugar mill.
22. In view of the observations made in the foregoing paras, the Commission cannot accept the alternate request of approving the tariff as the same applicable to Biomass power plants (water cooled) set up during FY 2016-17.
23. The generic tariff orders issued in respect of RE sources do not deal with tariff for non-fossil bagasse based co-generation power projects. Commission notes that the petitioner's plant is first one to have been set up in the State and the Regulations specifying the normative parameters for determination of a bagasse based co-generation are still to be

notified. Further, there are observations as regards the petition filed by the petitioner already discussed in preceding para. It is further noted that the petitioner's plant has already achieved COD in FY 2016-17, however, it has not produced any duly audited material/document to substantiate the cost projected by it in the petition and cost sheet/DPR attached with it and to apply prudence check.

24. In light of the above discussions, Commission considers it appropriate to consider the material placed by the petitioner before it and also recent orders passed by CERC and other SERCs for determination of tariff for supply of electricity generated from bagasse based non-fossil fuel based cogeneration plants to the distribution licensees. The following factors have been considered to arrive at the tariff for the petitioner's bagasse based co-generation power plant.

- (1) Tariff Structure
- (2) Useful life and tariff period
- (3) Capital Cost
- (4) Debt Equity ratio
- (5) Return on Equity
- (6) Depreciation
- (7) Interest rate on long term loan
- (8) Interest on Working Capital
- (9) O&M Expenses
- (10) Plant Load Factor
- (11) Auxiliary consumption
- (12) Station Heat Rate and Gross Calorific Value
- (13) Fuel Price

The above factors and orders of other Commissions and finally adopted by the Commission have been discussed in the following paras:

General:

(1) Tariff structure:

25. The petitioner in its petition based on calculations for a month has worked out a single part tariff of ₹ 8.82/kWh, however, the fuel component for the same is not worked out. CERC and most of SERCs have determined the two part tariff for bagasse based power plants. Commission has adopted two part tariff for Biomass, Biomass gasifier and Biogas based power plants which is having levelled fixed cost component over the life of plant and variable cost component which varies when fuel cost varies from time to time. The levelled tariff approach takes care of the time value of money and also gives certainty of tariff over the life of the project to the developers. For Discoms, front loading gets avoided as the costs get spread over the life of project.
26. In view of the above, Commission has decided to adopt two part tariff for determination of tariff continue with cost-plus tariff as adopted for Biomass power plants. Accordingly, for bagasse based co-generation project of the petitioner, two part tariff has been determined in this order.

(2) Useful life and tariff period:

27. As per the petition, the PPA signed by the petitioner is for twenty years. CERC and other SERCs consider the useful life of bagasse based co-generation power plants as 20 years. Commission has also adopted useful life of twenty years for Biomass, Biomass gasifier and Biogas power plants and determines the tariff for a tariff period equal to useful life in this order.

28. Accordingly, the Commission decides to keep useful life and tariff period for the project as 20 years.

Common Financial Parameters:

(3) Capital Cost:

29. In the DPR attached with petition, the estimated project cost for sugar plant has been projected as ₹ 93.00 Crs, however, component specific to power generation is not identified. The petitioner in the cost sheet attached with petition has considered book value of plant and machinery purchased during 2015-16 as ₹ 30.82 Crs and WDV as on 31.03.2016 stated to be as shown in balance sheet as ₹ 28.50 Crs. Considering total book value of the plant during FY 2015-16 as ₹ 30.82 Crs, the capital cost per MW works out to ₹ 6.23 Cr/MW. The petitioner has not submitted capital cost per MW for power generation. Considering book value of expenditure towards power generation of ₹ 13.51 Cr/MW during 15-16 as given in cost sheet, the capital cost works out to ₹ 2.73 Cr/MW. Based on assumption of the cost sheet attached that 73.133% of cost of steam generation is apportioned to power generation, considering the proportionate expenditure of steam for power, the total capital expenditure for power generation works out ₹ 26.17 Crs (=12.66 Cr + 13.51 Cr) which on per MW works out to ₹ 5.29 Cr/MW. Further, it is noticed that the petitioner has not submitted the detailed audited document to substantiate the capital cost considered by in the cost sheet.

30. The capital cost adopted in the Orders of the other Commissions is as follows:

Table-5: Capital cost considered by CERC and other SERCs:

CERC (other states)(FY 16- 17)	KERC	MERC	TNERC	BERC	GERC
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CERC (other states)(FY 16- 17)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper May-2016
₹ 452.75 Lakh/MW	₹ 475 Lakh/MW	₹ 495 Lakh/MW	₹ 520 Lakh/MW	₹ 451 Lakh/MW	₹ 466 Lakh/MW

Commission notes that the capital cost adopted by other Commissions is in the range of ₹ 451 to 520 Lakh/MW.

31. Considering the above facts, Commission considers the capital cost of ₹ 452.75 Lakh/MW, adopted by CERC for FY 2016-17, as reasonable and therefore, decides to adopt the same in this order.

(4) Debt Equity ratio (DE Ratio):

32. CERC and SERCs consider Debt equity ratio as 70:30. The Commission has also adopted the same Debt Equity ratio for determination of tariff of wind, solar and Biomass power plants set up in the State. Therefore, Commission decides to continue with same normative Debt-Equity ratio, accordingly, the Debt-equity ratio of 70:30 has been considered in this order.

(5) Return on Equity (RoE):

33. In the DPR, the petitioner while preparing the projected profitability for the year 2013-14 onwards has projected simple internal rate of return on capital investment of ₹ 93.00 Cr in sugar plant on 10 year basis as 16.23%. However, in cost sheet the petitioner has not claimed any amount towards RoE in tariff calculation. However, the Commission considers appropriate to allow RoE allowable under the Regulatory approach.

34. The Return on Equity adopted by CERC and other SERCs are as follows:

Table-6: RoE considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
20%-First 10 years 24%-After 10 years	16% with tax as a pass through	16% grossed up with MAT of 21.34% and with income tax rate of 34.61% after first 10 years.	20% pre-tax	20%-First 10 years 24%-After 10 years	14% and the tax payment of MAT @ 20.008% for first 10 years and corporate tax @ 32.445 p.a. for next 10 years.

It is seen from above that SERCs have adopted different approaches towards RoE. CERC and BERC allow a pre-tax RoE of 20% for first 10 years and 24% afterwards. KERC allows RoE of 16% with tax as a pass through. Commission has considered a uniform RoE of 16% grossed up with MAT for first 10 years and grossed up with corporate tax rate thereafter for determination of tariff of the RE power plants, i.e., Wind, Solar and Biomass based power plant being set up in the State.

35. In view of the above, Commission considers it appropriate to adopt the same RoE norm of 16% grossed up with MAT for first 10 years and grossed up with corporate tax rate thereafter as considered for determination of tariff of other RE plants set up in the State in the present order.

(6) Depreciation:

36. The petitioner in the cost sheet attached with petition has considered book value of plant and machinery purchased during 2015-16 as ₹ 30.82 Crs and WDV as on 31.03.2016 as shown on balance sheet as ₹ 28.50 Crs. Considering above, the petitioner with depreciation of 18.10% on WDV method as per the Company Act, 2013 has worked out total depreciation as ₹ 65.58 Lakh, out of which ₹ 36.82 Lakh for steam generation and

₹ 28.76 Lakh for power generation. The petitioner in the DPR has projected Depreciation on straight line method as per rate specified in Companies Act. The approach followed by the petitioner in cost sheet for tariff calculation is contrary to the approach followed for considering depreciation in determination of tariff, where the depreciation is charged from the date the asset is put to use, i.e., from COD – 9.05.2016 in petitioner's case. Further, the depreciation methodology considered in cost sheet is on WDV method against the differential depreciation approach of charging depreciation at a higher rate over the loan period and a lower rate beyond the loan tenure over the useful life of plant computed on Straight Line Method (SLM) method followed in regulatory approach. Commission has to follow the regulatory approach in case of depreciation. The depreciation considered by CERC and other SERCs for Bagasse based power projects is as under:

Table-7: Depreciation rates considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
5.83% - 12 years and 2.51% after 12 years	5.83% for 12 years taking asset value 95% of capital cost after deducting cost of land 5% and taking 10% of the asset value as salvage value.	5.83% for first 12 years and 2.51% thereafter for remaining useful life of 8 years.	4.5% p.a. SLM on 85% of capital cost	7%-First 10 years and 2% for next 10 years	6%- upto 10 yrs 3%- 11 th -20 th year

37. Commission in its Tariff Regulations for wind, solar and biomass power projects has specified depreciation rate of 5.83% for the first 12 years of the tariff period and the remaining depreciation shall be spread over the remaining useful life of the project from 13th year onwards. CERC and other SERCs also follow the same approach.

38. In view of the above, Commission decides to adopt depreciation rate of 5.83% for the first 12 years of the tariff period and the remaining depreciation shall be spread over the remaining useful life of the project from 13th year onwards in this order as specified by the Commission for determination of tariff of other RE projects set up in the State.

(7) Interest rate on long term loan:

39. It is noted from the cost sheets attached with the Petition, the petitioner has projected that there is no loan capital and therefore, did not consider any interest charges. The petitioner in DPR has projected the total capital expenditure of ₹ 93 Cr for sugar plant with 40% financed from SDF at 7% and at 12.50% p.a. from Fls/Banks/NCDC. However, as per the regulatory approach for determination of tariff a cost for funds needs to be considered, therefore, Commission decides to consider the interest rate in this order. The interest rate on term loan considered by CERC and other SERCs is under:

Table-8: Interest rate on term loan considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
300 bps + SBI base rate (=12.76% p.a.)	250 bps above SBI rate (=12.50% p.a.)	9.54% + 300 bps (=12.54% p.a.)	13% p.a.	300 bps + SBI base rate (=12.76% p.a.)	Existing SBI rate 9.30% + 300 bps (=12.30%)

40. Commission has also specified interest rate on term loan benchmark as average SBI Base rate prevalent during the first six month of the year previous to the relevant year plus 300 bps. It is observed that CERC and other SERCs have also adopted SBI base rate as benchmark and have allowed 300 bps margin over it.

41. Considering above, Commission also consider it appropriate to adopt the interest rate norm of SBI base rate plus 300 bps as specified by the Commission for determination of tariff of solar, wind and Biomass power plants set up in the State and accordingly, has considered the same as 12.76% (=9.76%+3.00%) for FY 2016-17 in tariff calculations.

(8) Interest on Working Capital :

42. The petitioner in its cost sheet attached with the petition has not considered any amount towards interest on working capital. Further, working capital requirement is also not mentioned. However, in DPR the petitioner has projected interest on working capital as 12.50% p.a. on 50% average sugar stock with 25% margin on levy and free sugar. As per the regulatory practice, to run a business successfully, there is requirement of a working capital for which interest is to be paid. Accordingly, Commission decides to allow interest rate on working capital. The interest rate on working capital adopted by CERC and other SERCs is as follows:

Table-9: Interest on working capital considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
350 bps + SBI base rate (=12.76% p.a.)	13.25%	9.54% + 350 bps (=13.04% p.a.)	13.50% p.a.	350 bps + SBI base rate (=13.26% p.a.)	9.30% + 200 bps (=11.30% p.a.)

43. Commission has specified interest on working capital benchmark as average SBI Base rate prevalent during the first six month of the year previous to the relevant year plus 250 bps. It is observed that CERC and other SERCs have also adopted SBI base rate as benchmark and have allowed 200-350 bps margin over it.

44. In view of the above facts, Commission considers it appropriate to adopt the same interest on working capital norm as average SBI base rate plus 250 bps as specified for solar, wind and Biomass power plants. Further, it is observed that CERC considers the working capital requirement for Biomass and non-fossil based cogeneration as same. Similar to this, Commission also considers it appropriate to consider the working capital requirement same as specified for determination of tariff of solar, wind and Biomass power plants set up in the State and the same is considered as 12.26%(=9.76%+2.50%) in this order.

(9) Operation & Maintenance Expenses:

45. Petitioner in its cost sheet has projected total O&M expenses for a month as under:

S.No.	Component	Amount (₹. Lakh)
1	Employee Cost	10
2.	Process Material/Chemicals	0.75
3.	Repair & Maintenance	1.75
4.	Water	2.00
Total:-		14.50

Out of the above, the Petitioner has projected ₹ 10.50 Lakh/month towards steam generation and ₹ 4.00 Lakh/month for power generation. The petitioner has considered salary and wages for co-generation as ₹ 25 Lakh p.a. in DPR which works out to approx. ₹ 2.00 Lakh/month against ₹ 3.00 lakh projected in cost sheet. Considering the 73.133% steam is used for power generation as submitted by petitioner, the proportionate expenditure for power would be ₹ 7.68 Lakh/month. The total O&M expenses towards power generation, therefore, works out to ₹ 10.68 (= 3.00 + 7.68) Lakh/month and ₹ 128.16 Lakh/annum(=10.68 x 12). The annual O&M expenses for power generation works out to ₹ 25.89

Lakh/MW. The plant is to be operated for 236 days in a year, therefore, the O&M expenses worked out on the basis of record placed is on higher side. Commission notes that O&M expenses allowed for a Biomass power plant with water cooled condenser for FY 2016-17 as ₹ 37.72 Lakh/MW. However, as noted earlier, the O&M expenses for a Bagasse based co-generation power projects will be lower than O&M Expenses of a Biomass power plant. Therefore, Commission decides to specify the O&M Expenses norm for the petitioner's plant accordingly. The O&M Expenses specified by CERC and other SERCs are as follows:

Table-10: O&M Expenses considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
₹ 19.99 L/MW	3% of capital cost (=₹ 14.25 L/MW)	₹ 17.82 L/MW	₹ 18.91 L/MW	₹ 19.99 L/MW	3% of project cost (=₹ 13.91L/MW)

46. The O&M Expenses specified by CERC and SERCs vary from ₹ 13.91 L/MW to ₹ 19.99 Lakh/MW. It is observed that O&M Norm is technology specific. In view of this, Commission considers ₹ 19.99 Lakh/MW specified by CERC as appropriate to be considered in this order. Further, Commission has specified an escalation of 5.85% in O&M expenses for wind, solar and Biomass power plants. Therefore, the same annual escalation rate of 5.85% has been considered over the tariff period.

Operational Parameters:

(10) Plant Load Factor:

47. Petitioner in its petition has provided generation of 3564000 kWh for a month and projected net units available for self-use and export as 3422865.60 kWh. However, annual PLF achieved by the power generation has not been submitted. Further, the petitioner in its DPR has projected

number of operating days as 150 days (crushing) + 86 days (off season) = 236 days , considering load factor of 92%, PLF works out to be 59.48% . The PLF considered by CERC and other SERCs is as follows:

Table -11 : PLF considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
53%	60%	60%	55%	53%	60%

CERC considering 150 days (crushing) + 60 days (off season)= 210 operating days has specified PLF of 53% for 'other States' category which includes Rajasthan.

48. In view of the above facts, Commission considers it appropriate to consider PLF as 59.48% as per the number of operating days submitted in DPR in this order.

(11) Auxiliary consumption:

49. The petitioner has submitted cost calculation on monthly basis where 2% loss has been considered in quantity of electricity produced and a further wastage of 2% has been considered to arrive at net electricity units available for self-use and export. The auxiliary consumption considered by CERC and other SERCs for bagasse based cogeneration plants are as follows:

Table -12 : Auxiliary consumption considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
8.50%	9.00%	8.50%	8.50%	8.50%	8.50%

50. It is observed that CERC has specified auxiliary consumption of 8.50% for bagasse based cogeneration plants for other states including Rajasthan.

Accordingly, Commission considers it appropriate to consider auxiliary consumption of 8.50% in this order.

(12) Station Heat Rate (SHR) and Gross Calorific Value(GCV):

51. The petitioner in its petition has submitted steam fuel ratio of 2.35 and specific steam consumption of TG set as 6.2 kg/kWh. However, the specific fuel consumption is not furnished. Further, the parameters SHR and GCV are also not furnished in the petition. The SHR, GCV and specific fuel ratio specified by other Commissions is as follows:

Table-13: Station Heat Rate, GCV and Specific fuel consumption considered by CERC and other SERCs:

CERC/ SERC	CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order	Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
SHR	3600	-	3600	3240	3650	3600
GCV	2250	-	2250	2300	2275	2250
Specific fuel consum ption	1.60	1.60	1.60	1.41	1.60	1.60

52. It is observed that CERC and most of the Commissions have specified specific fuel consumption ratio as 1.60 kg/kWh with SHR as 3600 kcal/kWh and GCV as 2250 kcal/kWh. Accordingly, Commission decides to adopt SHR as 3600 kcal/kWh, GCV as 2250 kcal/kWh and specific fuel consumption of 1.60 kg/kWh in this order.

(13) Fuel Price:

53. The petitioner has considered bagasse price as ₹ 2613.39/MT in its petition same as biomass fuel price considered by the Commission for FY 2016-17

based on the indexation mechanism. The bagasse fuel price considered by CERC and other SERCs is as follows:

Table -14 : Fuel price considered by CERC and other SERCs:

CERC (other states)	KERC	MERC	TNERC	BERC	GERC
Order dated 29.04.2016	Order dated 01.01.2015	Order dated 29.04.2016	Order dated 31.03.2016	Order dated 01.08.2016	Discussion paper: May 2016
₹1919.93/MT	₹1600/MT	₹2443.18/ MT	₹1788/MT	₹1924.15/ MT	₹1580/MT

54. It is observed from above, apart from MERC, the average bagasse price considered by other Commissions is in the range of ₹ 1600-1924/MT. It is also observed that price of bagasse fuel is lesser than Biomass as no transportation cost is incurred.
55. It is noted that though the petitioner has considered bagasse price as ₹ 2613.39/MT in their cost sheet. However, in financial parameters assumption it has not submitted the cost at which it is purchasing sugar cane. Commission notes that contrary to a biomass power plant set up in a IPP mode, the in-house bagasse produced from sugar cane crushing is a waste material and does not involve any cash outflows. Bagasse is the only fuel which is being generally used by the cogenerators and the same is available within the premises of a sugar mill and thus, there is no transportation cost incurred on the procurement of bagasse. Further, a part of the heat is used by the process steam which results in lower SHR. The Commission notes that proposal to set up the cogeneration plant is to optimally utilize the scarce energy sources readily available, as an integral part of sugar factory. Otherwise, the owners of a sugar factory will have to handle the problem of disposal of bagasse. Nevertheless, a nominal price has to be attributed to the bagasse generated internally.

56. CERC in its order dated 29.04.2016 had specified biomass price of ₹ 3003.01/MT and bagasse price as ₹1919.93/MT for 'other States' category for FY 2016-17. Similarly, for the States, CERC on an average specified price of bagasse ₹ 1100/MT lower than biomass fuel prices for FY 2016-17.
57. Further, the "Policy for Promoting Generation of Electricity from Biomass, 2010" notified by the Govt. of Rajasthan prescribes that price of Biomass produced from Prosopis-Juliflora/other energy plantation shall be determined by the DLEC for every year on the basis of fuel cost prescribed by the Commission. GoR vide its Amendment dated 2.06.2016 has prescribed that in case the fuel cost prescribed by the Commission does not provide for break-up of cutting/uprooting, loading/unloading, transportation, chipping and Biomass cost, 65% of the cost prescribed by the Commission shall be taken cost towards cutting/uprooting, loading/unloading, transportation and chipping on lump-sum basis. However, costs such as uprooting, cutting, loading, unloading and chipping are not incurred in procuring bagasse. The Biomass Fuel Supply Study" February 2017 available on the RRECL web site provides the average transportation cost for Juliflora during 2016 as ₹ 800/MT and loading and loading cost as ₹ 210/MT totaling to ₹ 1010/MT.
58. The department of food & public distribution has fixed fair and remunerative price (FRP) of sugarcane as ₹ 230/Quintal with basic recovery level of 9.50%. This price translates to ₹ 2300/MT. In the DPR submitted, petitioner while projecting profitability for 2013-14 onwards has projected cane price as ₹ 2250/MT and realization from bagasse as ₹ 1800/MT.

59. In view of the above, considering rate realized from bagasse and bagasse price projected by other Commissions, the biomass fuel price of ₹ 2875/MT determined by the Commission and subtracting transportation cost of ₹ 1100/MT, Commission is of the view that for internally generated bagasse, a fuel price of ₹ 1775/MT as reasonable and accordingly, the same has been considered towards price of bagasse in this order.
60. In light of the above discussions and considering the approved parameters, the following parameters have been considered for determination of tariff:

Table-15: Parameters considered by the Commission in the order:

S.No.	Parameter	Value
1.	Capital cost (₹ Lakh/MW)	452.75
2.	Debt: Equity ratio	70:30
3.	Return on Equity (RoE)	16% grossed up with MAT for first 10 years and grossed up with corporate tax rate thereafter
4.	Depreciation (%)	5.83% for the first 12 years of the tariff period and the remaining depreciation shall be spread over the remaining useful life of the project from 13 th year onwards
5.	Interest rate on long term loan (%)	average SBI Base rate prevalent during the first six month of the year previous to the relevant year plus 300 bps(=12.76%).
6.	Interest on working capital (%)	average SBI Base rate prevalent during the first six month of the year previous to the relevant year plus 250 bps (=12.26%).
7.	O&M Expenses (₹ Lakh/MW) and escalation.	₹ 19.99 Lakh/MW for FY 2016-17 with an annual escalation of 5.85%.
8.	Plant Load Factor (%)	59.48%
9.	Auxiliary Consumption (%)	8.50%
10.	Station Heat Rate (kcal/kWh)	3600 kcal/kWh
11.	Gross Calorific Value (kcal/kg)	2250 kcal/kWh
12.	Fuel price (Rs/MT)	₹ 1775/MT for FY 2016-17

61. In consideration of the above, the tariff for the 4.95 MW bagasse based cogeneration power plant set up by the Petitioner is determined as under:

Table-16: Tariff for 4.95 MW Bagasse based power plant commissioned during FY 2016-17:

S.No.	Particulars	FY 2016-17
1	Levellised Fixed Charges (₹/kWh)	2.43
2.	Variable Charges (₹/kWh)	3.10
3	Applicable tariff without AD benefit (₹/kWh)	5.53
4.	Net Tariff with AD benefit (₹/kWh)	5.35

The above levellised fixed charges shall be applicable for the entire life of the plant, whereas, the variable charges component of tariff shall increase at the rate of 5% or as fixed by the Commission from time to time for each subsequent financial year ,i.e., FY 2017-18 onwards. The detailed calculations for determination of tariff are annexed.

62. Commission's order:

- (1) The tariff determined by the Commission is ₹ 5.53 per unit without availing AD benefit and ₹ 5.35 per unit with AD benefit for purchase of power by the State Discoms namely-JVVNL, AVVNL and JdVVNL for FY 2016-17. For the period FY 2017-18 and upto the terminating year of PPA, the variable component will increase 5% p.a. till re-determined by the Commission. For claiming tariff without AD benefit, the petitioner shall submit the undertaking as being submitted by other RE projects in the State.
- (2) The tariff determined above shall be applicable from COD of the plant. The tariff for electricity supplied by the petitioner's plant before COD shall be only at the variable charges determined above for FY 2016-17.
- (3) The State Discoms shall make the payment for the energy supplied by the plant till date of this order in installments as may be mutually agreed upon.
- (4) The reactive energy charges applicable to above projects shall be at par with that of other renewable energy generation sources.

Hence, the reactive energy tariff approved by the Commission for the other RE sources like wind and solar shall be applicable to the project.

- (5) The proceeds of carbon credit under CDM benefits if availed shall be in the ratio of 25:75 between the distribution licensee and generating company respectively. The share of 25% obtained by the distribution licensee shall be passed on to the consumers.

63. The petition stands disposed of in terms of this order.

(Suresh Chandra Dinkar)
Member

(Rajendra Prasad Barwar)
Member

(Vishvanath Hiremath)
Chairman

TARIFF DETERMINATION FOR BAGASSE BASED CO-GENERATION POWER PLANT

ANNEXURE

FY 2016-17

S. No.	Assumption Head	Sub-Head	Sub-Head (2)	Unit	Base Case
1	Power Generation	Capacity	Installed Power Generation Capacity	MW	1
			Auxiliary Consumption during stabilisation	%	8.50%
			Auxiliary Consumption after stabilisation	%	8.50%
			PLF (Stabilization for 6 months)	%	59.48%
			PLF (during first year after Stabilization)	%	59.48%
			PLF (Second year onwards)	%	59.48%
			Useful life of Power Plant	Years	20
2	Project Cost	Capital Cost/MW	Project cost	Rs Lakh/MW	452.75
		3 Sources of Fund	Debt: Equity	Debt	%
Equity	%			30%	
Debt Component	Total Debt Amount		Rs Lakh	316.93	
	Total Equity Amount		Rs Lakh	135.83	
Equity Component	Loan Amount		Rs Lakh	316.93	
	Interest Rate		%	12.76%	
4	Financial Assumptions		Fiscal Assumptions	Income Tax (for yr-11 to yr-20)	%
		MAT Rate (for yr-1))		%	20.39%
5	Working Capital	Depreciation	MAT Rate (for yr-2 to yr-10)	%	19.06%
			80 IA benefits	Yes/No	Yes
		Accelerated depreciation benefit(Rs/kWh)	Yes/No	0.18	
		Depreciation Rate	%	5.83%	
		Years for 5.83% rate		12	
		For Fixed Charges			
		O&M Expenses	Months	1	
Maintenance Spares (% of O&M exepenses)	%	20%			
Receivables for Debtors	Months	1.5			
For Variable Charges					
Biomass Stock	Months	4			
Interest On Working Capital	%	12.26%			
6	Fuel Related Assumptions	Heat Rate	SHR after Stabilisation period	kCal/kWh	3600
			SHR during Stabilization Period	kCal/kWh	3600
		Bagasse	Bagasse Price(FY16-17)	Rs/MT	1775
			GCV - Bagasse	kCal/kg	2250
7	Operation & Maintenance	power plant	Bagasse Price Escalation Factor for working capital require	%	5%
			Esca. in O & M Expense	%	5.85%
			Total No. of Hours	hrs	8760

TARIFF DETERMINATION FOR BAGASSE BASED CO-GENERATION POWER PLANT

For Cogeneration plants to be commissioned during FY 2016-17

Cost of Generation

Particulars of Generation	Unit	Years-->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Installed Capacity	MW		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gross Generation	MU		5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21
Auxiliary Consumption	MU		0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Net Generation	MU		4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77

Variable Cost	Unit	Years-->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Biomass Cost	Rs Lakhs		147.98	155.38	163.14	171.30	179.87	188.86	198.30	208.22	218.63	229.56	241.04	253.09	265.74	279.03	292.98	307.63	323.01	339.17	356.12	373.93
Per unit Variable Cost	Rs/kWh		3.10	3.26	3.42	3.59	3.77	3.96	4.16	4.37	4.59	4.82	5.06	5.31	5.57	5.85	6.15	6.45	6.78	7.11	7.47	7.84

Fixed Cost	Unit	Years-->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
O&M Expenses	Rs Lakhs		19.99	21.16	22.40	23.71	25.09	26.56	28.12	29.76	31.50	33.34	35.30	37.36	39.55	41.86	44.31	46.90	49.64	52.55	55.62	58.88
Depreciation	Rs Lakhs		26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32
Interest on term loan	Rs Lakhs		38.76	35.39	32.02	28.65	25.28	21.91	18.54	15.17	11.80	8.43	5.06	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs Lakhs		10.90	11.33	11.78	12.26	12.77	13.30	13.87	14.46	15.09	15.76	16.53	17.27	17.85	18.72	19.64	20.61	21.63	22.70	23.82	25.00
Return on Equity	Rs Lakhs		27.30	26.85	26.85	26.85	26.85	26.85	26.85	26.85	26.85	26.85	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45
Total Fixed Cost	Rs Lakhs		123.36	121.14	119.46	117.88	116.40	115.03	113.78	112.65	111.65	110.79	114.75	114.18	100.16	103.35	106.72	110.28	114.04	118.01	122.21	126.65
Per unit Fixed Cost	Rs/kWh		2.59	2.54	2.51	2.47	2.44	2.41	2.39	2.36	2.34	2.32	2.41	2.39	2.10	2.17	2.24	2.31	2.39	2.48	2.56	2.66
Per unit Fixed Cost considering accelerated	Rs/kWh		2.41	2.36	2.33	2.29	2.26	2.23	2.21	2.18	2.16	2.14	2.23	2.22	1.92	1.99	2.06	2.13	2.21	2.30	2.38	2.48

Levelised per unit fixed charges (Rs/kWh) **2.43**
(Without Availing AD Benefit)

Levelised per unit fixed charges (Rs/kWh) **2.25**
(With Availing AD Benefit)

Applicable Tariff for plants commissioned during FY 2016-17

Variable Cost (FY 2016-17)	3.10	Rs/kWh
Levelised Fixed Cost	2.43	Rs/kWh
Applicable Tariff (FY 2016-17)	5.53	Rs/kWh
Accelerated Depreciation	0.18	Rs/kWh
Net Tariff (FY 2016-17)	5.35	Rs/kWh

TARIFF DETERMINATION FOR BAGASSE BASED CO-GENERATION POWER PLANT

Determination of Accelerated Depreciation Benefit for Biomass Power Projects

ANNEXURE...

Depreciation amount	90%	
Depreciation rate	5.83%	
Tax Depreciation rate	80%	
Additional depreciation rate	20%	
Income Tax	33.06%	30.90% (yr-2 onwards)
Capital Cost	452.75	Rs Lakh/MW

Year(s)-->	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Depreciation	%	2.92%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	5.83%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Depreciation	Rs Lacs	13.21	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32
Accelerated Depreciation																					
Opening balance	%	100.00%	50.00%	5.00%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Allowed during the year	%	50.00%	45.00%	4.00%	0.80%	0.16%	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing	%	50.00%	5.00%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Accelerated depreciation	Rs Lacs	226.38	203.74	18.11	3.62	0.72	0.14	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net depreciation benefit	Rs Lacs	213.17	177.33	(8.30)	(22.79)	(25.69)	(26.27)	(26.38)	(26.40)	(26.41)	(26.41)	(26.41)	(26.41)	(11.32)	(11.32)	(11.32)	(11.32)	(11.32)	(11.32)	(11.32)	(11.32)
Tax Benefit	Rs Lacs	70.48	54.79	(2.56)	(7.04)	(7.94)	(8.12)	(8.15)	(8.16)	(8.16)	(8.16)	(8.16)	(8.16)	(8.16)	(3.50)	(3.50)	(3.50)	(3.50)	(3.50)	(3.50)	(3.50)
Discounted Tax Benefit	Rs Lacs	70.48	52.13	(2.20)	(5.46)	(5.55)	(5.13)	(4.65)	(4.20)	(3.79)	(3.42)	(3.09)	(2.79)	(1.08)	(0.97)	(0.88)	(0.79)	(0.72)	(0.65)	(0.58)	(0.53)
Levelised tax benefit	Rs Lacs	8.12																			
Energy Generation	MU	2.38	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77
Discounted Generation	MU	2.38	4.54	4.09	3.70	3.34	3.01	2.72	2.45	2.22	2.00	1.80	1.63	1.47	1.33	1.20	1.08	0.98	0.88	0.80	0.72
Levelised generation	MU	4.51																			
Per Unit Benefit	Rs/kWh	2.96	1.15	(0.05)	(0.15)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Discount Factor		1.00	0.90	0.81	0.74	0.66	0.60	0.54	0.49	0.44	0.40	0.36	0.32	0.29	0.26	0.24	0.22	0.19	0.18	0.16	0.14
Applicable Discount Factor		1.00	0.95	0.86	0.78	0.70	0.63	0.57	0.51	0.46	0.42	0.38	0.34	0.31	0.28	0.25	0.23	0.20	0.18	0.17	0.15
Levelised ITAX benefit	Rs/kWh	0.18																			

Note(s):

1. In the above calculations, depreciation for the first year has been considered as 50.00%(= 50% of (80%+20%)) and generation for the first year has been considered as 50% of the normative generation as per CERC
2. For working out Tax benefit, income tax rate for the first year has been considered as 33.06% and a tax rate of 30.90% for subsequent years.
3. Figures may not tally exactly on account of rounding of .