

**BEFORE THE KARNATAKA ELECTRICITY REGULATORY COMMISSION AT  
BENGALURU**

**TARIFF DETERMINATION NO: 01/2015**

**BETWEEN:**

**BIOMASS ENERGY FOR RURAL INDIA (BERI) PROJECT / SOCIETY  
KARNATAKA STATE BIOENERGY DEVELOPMENT BOARD**

.....Petitioner

**AND:**

**STATE OF KARNATAKA AND OTHERS**

.....Respondents

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Date: 24-02-2016  
BENGALURU

Petitioner

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**BIOMASS ENERGY FOR RURAL INDIA (BERI) PROJECT / SOCIETY  
KARNATAKA STATE BIOENERGY DEVELOPMENT BOARD,  
RD & PR Department, Govt. of Karnataka,  
#116, 8<sup>th</sup> Cross, Railway Parallel Road,  
Kumara Park West, Bengaluru-560020**

.....Petitioner

**AND:**

- 1. The Additional Chief Secretary,**  
Energy Department, Govt.of Karnataka,  
Vikasa Soudha,  
Bengaluru -560001.
- 2. The Managing Director,**  
Karnataka Power Transmission Corporation Ltd.  
Kaveri Bhavan,  
K.G.Road,  
Bengaluru
- 3. The Managing Director,**  
Karnataka Renewable Energy Development Ltd.  
Maharani's College Compound,  
Palace Road,  
Bengaluru -560001
- 4. The Managing Director,**  
Bangalore Electricity Supply Company Limited  
Corporate Office, K.R.Circle,  
Bengaluru -560001

.....Respondents

**MEMORANDUM OF DETERMINATION OF TARIFF IN RESPECT OF  
GRID INTERACTIVE BIOMASS GASIFIER POWER PLANT UNDER  
SECTION 62(1) (a) WITH SECTION 64 & 86 (1) (e) OF THE ELECTRICITY  
ACT 2003 AND REGULATION - 9 OF THE KERC**

The Petitioner above named respectfully submits as follows:

1. The address of the Petitioner for the purpose of court notice and process of this Hon'ble Commission is as shown in the cause title above. The address of the Respondents for the same purpose is as shown in the cause title above.
2. The Petitioner had appeared before this Hon'ble Commission during a Public Hearing on 25<sup>th</sup> September, 2014 and wrote to the Hon'ble Commission praying for the determination of the tariff applicable to Biomass Gasifier Power Plants, as per Central Electricity Regulatory Commission (CERC) tariff Order dated 3<sup>rd</sup> March, 2015 as determination of generic levelled generation tariff for the FY 2015-16. Again on 5<sup>th</sup> August, 2015 the Hon'ble Commission was pleased to advise the Petitioner to make project specific request for tariff fixation for its commissioned 400 KW (1X200 kw + 2X100kw commissioned and 2X250 kw are yet to be commissioned) Biomass Gasifier Power Plants installed in Tumakuru District.
3. The Petitioner is grateful that the Hon'ble Commission has seen it fit to consider a specific tariff for Biomass Gasifier based Power Plants, located at the "tail end" of rural electric grids, enabling assured electricity supply to rural households & micro enterprises between 6 pm to 11 pm, which coincides with the "peak demand" period of the Karnataka grid. It is humbly submitted though, that generic biomass tariff that has been fixed by the Hon'ble Commission, has omitted to take into account the differences between technology parameters for Biomass Boiler based Power Plants (based on the Rankine cycle) and for Biomass Gasifier Power Plants (based on the Otto cycle). The Hon'ble Commission has also omitted to take into account the differences in economic viability for BESCO to purchase power from 10 MW Biomass Power Plant (with power evacuated at 132 KV, as base load unit) and for 200/250 KW Biomass Gasifier Plant (with power evacuated at 11 KV rural grid, essentially during peak load periods).

The Petitioner therefore humbly and respectfully submits that a review of some of these parameters may kindly be made so as to make the tariff sustainable. The Petitioner is therefore filing this present application seeking a review of some of the tariff parameters that were determined by the Hon'ble Commission on the grounds set out below.

**Operating and Maintenance Expenses:**

4. The Hon'ble Commission was pleased to fix the operating and maintenance cost at Rs. 30.00 lakhs per MW, which pertains to Biomass Power Plants based on the Rankine cycle. This figure is considerably lower than Rs 47.26 lakhs per MW for Biomass Gasifier Power Projects, as fixed by the CERC vide its Order dated 3<sup>rd</sup> March 2015 related to generic levelled generation tariff for the Financial year 2015-16. It is humbly submitted that the Petitioner has actual O&M Costs at its commissioned 200 KW Biomass Gasifier plant of Rs 69.00 lakhs per MW per annum, with PLF of 40% and auxiliary power consumption of 15%, as against CERC computations based on unit rating of 1 MW, with PLF of 85% and auxiliary power consumption of 10%. For easy reference the actual O&M costs of 1X200 KW Biomass Gasifier Power Plant are attached and we humbly request that these be considered by the Hon'ble Commission.
5. It is therefore submitted that based on the O&M Costs for 200 KW Biomass Gasifier Power Plant, be fixed at least at Rs. 60 lakhs per MW per year.

**Specific Fuel Consumption:**

The Hon'ble Commission was pleased to fix the station heat rate at 4000 kcal per Kwh and the calorific value of fuel at 3300 kcal per kg, and to therefore arrive at a fuel requirement of 1.21 kg per Kwh.

6. It is humbly submitted that the above values pertain to Biomass Power Plant, based on the Rankine cycle and having unit rating on 8 to 10 MW. Furthermore, the biomass fuel considered is agricultural residues, which are fired in Biomass Boilers.

7. It is humbly submitted that the aforementioned assumptions would not be applicable to Biomass Gasifier Power Plants, firing prepared biomass fuel, which needs to be woody biomass with size of 5 to 10 cm and moisture content below 15%. Further, as per a study conducted by the Indian Institute of Science (I.I.Sc), Bengaluru, the average calorific value of the prepared woody biomass with 15% moisture content is 15 MJ per kg and the specific fuel consumption for Biomass Gasifier power plants of 100 to 250 KW capacity is 1.36 Kg/ Kwh. A Copy of the IISc. report is attached. It is pertinent to point out that this value of Specific Fuel Consumption is in line with the norm adopted by the CERC in its tariff Order dated 3<sup>rd</sup> March 2015.
8. It is humbly submitted that considering the aforementioned documentary evidence provided by the petitioner, and considering the nature of biomass fuels used by the petitioner, the specific fuel consumption be fixed at 1.36 kg/ KWh.

**Fuel (Biomass) Price:**

9. The Hon'ble Commission was pleased to consider the fuel price at Rs. 2100 per ton. It is humbly submitted that this value is, currently, insufficient even for agricultural residues and the actual costs incurred by the petitioner for prepared woody biomass are much higher.
10. It is humbly submitted that the actual cost of the prepared woody biomass fuel, which is being incurred by the petitioner is in excess of Rs. 4,000 per ton (the biomass cost sheet is enclosed for kind reference). It is further, submitted that the Hon'ble Commission has not considered the CERC norm of Rs 3,144.80/ton in its tariff Order dated 3<sup>rd</sup> March 2015.
11. In these circumstances, it is submitted that it is only just and fair that these aspects ought to have been taken into consideration and that the biomass fuel price ought to have been considered at Rs. 4,000 per ton for our 400 KW Biomass Gasifier Power Plants installed in Tumakuru District.

**Levelling Tariff (fixed for 10 Years):**

12. In view of the foregoing, the petitioner submits prayer to the Hon'ble Commission to fix levelling tariff, for 10 years period, of Rs 8.76 per KWH for 400 KW Biomass Gasifier Power Plant in Tumakuru District, which would supply assured quality power to 11 KV rural feeders, including during the evening Peak Power Period. The project visualizes biomass feedstock supply, through the active involvement of the local community.

13. In the circumstance set forth herein above, the Petitioner humbly submits that it is only just and fair that the Hon'ble Commission be pleased to pass a project specific tariff for 400 KW Biomass Gasifier Power Plant in Tumakuru District, that would showcase a Distributed Generation facility at the "Tail End" of rural grid. It is humbly submitted that the petitioners project (total 1 MW capacity) is ready for commissioning and the petitioner must start operating the project to start recuperating the already incurred costs, which would lead to replication of such projects, perhaps as hybrid solutions along with Solar PV, to supply assured quality power in rural grids, including during the peak load period of 6 pm to 11 pm, without need for battery storage.

**14. Uniqueness of BERI Project:-**

BERI Project is a unique energy project that focused on decentralized, bottom-up power generation using biomass gasification technology. The project was implemented between 2001 and 2012. The Global Environment Facility (GEF), the United Nations Development Programme (UNDP), the Indo-Canada Environment Facility (ICEF) & the Govt. of Karnataka & Govt. of India came together to support the agendas of environmental sustainability, poverty reduction.

The Project was unique in three respects. Those are:

1. Ensured supply of Biomass through a dedicated plantation to run 1 MW cumulative biomass gasifier plants on a continuous basis.
2. Strengthened grid interaction at the tail end with 11 kv line to the rural area.
3. Established operational benchmarks for sub-megawatt biomass based power plants on the field.

The benefits of the project are imparted to all the farming community for irrigation, drinking water, watershed management system in the overall improvement of the rural livelihood including landless households, women's self help groups. This is a unique renewable energy programme implemented in India, in Karnataka State for its replication in other parts of the country & outside the country where biomass resources are available in plenty. The Project is more unique on wake of the present day global warming / climate change effect as it produces carbonfree, clean and green energy. Hence the project deserves a suitable support to take forward its objectives.

### **PRAYER**

WHEREFORE, the Petitioner above named respectfully prays that this Hon'ble Commission may be pleased to:

- A) Review the KERC order dated 10<sup>th</sup> July 2014 / 01<sup>st</sup> January 2015 and fix the power purchase tariff for a 10 years period at a fixed tariff of Rs 8.76/ KWh in respect of the power generated by the BERI Project at Tumkuru District.
- B) Pass any other order /s in the interest of justice and equity.

Petitioner

Date:

Place: Bengaluru

## **FUEL COST**

### **Actual Cost of fuel (woody biomass) incurred under the project.**

1. On site Price of wet biomass with 45% moisture content is Rs.2500/ton.
2. Transportation and handling cost is Rs.500/ton.
3. Cost of processing is Rs.350/ton.
4. Cost of non-usable portion of the biomass which pertains to moisture which amounts to about 25% of the weight of the wet biomass which needs to be removed. This increases the cost by another Rs.625/ton.
5. Cost of non-usable biomass such as barks, saw dust etc. This increases the cost of usable biomass by Rs.250/ton.
6. Hence, the total cost of usable biomass works out to Rs.4, 225/ton.



## O & M COST OF 200 KW POWER PLANT

There are 3 biomass gasifier power generating units (1X200 kw, 2X100 kw) installed at Kabbigere village in Koratagere Taluk, Tumkur dist. Operated one unit at a time due to shortage of man power and raw material. No unit worked continuously (except 1000 hrs bench marking operation of 1X100 kw, GG-3 unit) due to various reasons such as mechanical, electrical, raw material and labour (skilled / unskilled) problem which led to lower PLF.

The details of field staff working & the O&M expenses at Kabbigere Plant is as follows;

### Details of Man Power in BERI Project at Kabbigere Plant:-

Project Officer	-	1
Project Supervisor	-	1
Desk Operator (Synchronizing) (Skilled)	-	1
Engine Operator (Skilled)	-	1
Gasifier Operator (Skilled)	-	1
Loading & unloading of biomass and Ash handling etc (Unskilled)	-	2
Biomass handling, (cutting, drying, transport etc) (Un-skilled)	-	6

### Month wise O&M cost incurred during the year 2010:-

Sl No.	Month	Plant Staff Salary	Gasifier maintenance	Project Officer(Energy) salary	House Rent (at Thovinakere / Kabbigere)
1.	Jan-2010	74,087/-		24,000/-	2500/-
2.	Feb-2010	20,500/-		24,000/-	2500/-
3.	March-2010	21,500/-		24,000/-	2500/-
4.	April-2010	21,000/-		24,000/-	2500/-
5.	May-2010	20,500/-		24,000/-	2500/-
6.	June-2010	31,900/-	2,03,584/-	24,000/-	2500/-
7.	July-2010	67,800/-	3,450/-	24,000/-	2500/-
8.	Aug-2010	20,500/-	20,382/-	24,000/-	2500/-
9.	Sep-2010	22,701/-	34,861/-	24,000/-	2500/-
10.	Oct-2010	79,680/-	1,00,106/-	24,000/-	2500/-
11.	Nov-2010	47,500/-	81,660/-	24,000/-	2500/-
12.	Dec-2010	59,500/-	1,39,822/-	24,000/-	2500/-
<b>Total Amount</b>		<b>4,87,168/-</b>	<b>5,83,865/-</b>	<b>2,98,000/-</b>	<b>30,000/-</b>

**Note:** O&M includes total operation & maintenance of the plant, power evacuation, biomass handling, Ash / charcoal disposal, effluents (ETP) disposal, plant upkeep services, regular, preventive and breakdown maintenance etc.,

**Total Annual operation & Maintenance cost of 1X200 kw capacity unit:**

Staff Salary	-Rs.	4, 87,168/-
Project Officer (E) Salary	-Rs.	2, 98,000/-
Gasifier maintenance	-Rs.	5, 83,865/-
Other Exp (House rent)	-Rs.	<u>30,000/-</u>
Total	-Rs.	<b><u>13, 99,033/-</u></b>

Based on these parameters, the O&M expenses of 1 Mw capacity Biomass power plant is arrived at **Rs.69,95,165/-**

1. IMPACT ON CONSUMER TARIFF : BESCO power purchase, during FY 2015-16 was 29,095.32 million KWh. Consequently, purchase of 1 million KWh from 240 KWe Biomass Gasifier Unit of KSBDB (erstwhile BERI) will be no impact on Consumer tariffs or BESCO economics.

## 2. CASE FOR DDG BASED ON BIOMASS GASIFIER :

(a) Biomass Gasifier technology has evolved to enable use of processed agriculture/ forest waste as feedstock. Hence, the resource envisaged is locally available in rural & tribal areas + effective utilisation of this resource (through producing processed fuel) will create jobs/ entrepreneurs in rural/ tribal areas

(b) Biomass Gasifiers will be able to provide electricity in early morning as well as late evening hours (unlike Solar Power Plants), which is the period when local community most needs electricity. As these periods also coincide with the "peak demand" periods, it benefits the Distribution Utility.

When comparing cost of Biomass Gasifier power with that of Solar PV power, it would be necessary to give "premium" for power supplies during 'peak power' periods. It would also be pertinent to compare cost of Biomass Gasifier power with cost of power supply from "Solar PV + Battery Storage" system.

(c) Biomass Gasifier based Power Plants, apart from generating electricity, can supply thermal energy (from engine exhaust & jacket water), for which KSBDB is developing "end use" systems. Furthermore, the Biomass Gasifier residue can be processed to value added products, eg Bio-Char, which KSBDB intends to showcase.

Consequently, once "economies of scale" are achieved, the cost of electricity supply from Biomass Gasifiers will become competitive.

(d) KSBDB is a unit under GoK/ RDPR Department. We hence represent the interests of rural communities, in context of their need for "firm power when required", local jobs creation, increased farmer income through compensation for agriculture residues/ farm yields increase through use of Bio-Char.

It is for this reason that KSBDB intends to showcase techno-economics of Biomass Gasifiers, through appropriate use of Co-Products & efficient O&M, by reviving the plants built under the BERI project.

## 3. CASE FOR INCENTIVISED TARIFF FOR BIOMASS GASIFIERS :

The Hon Commission, very correctly, facilitated Solar PV Industry to achieve "economies of scale" by initially providing incentivised tariffs ... Rs 8.40/KWh vide order dated 10 Oct 2010 ... Rs 6.51/ KWh vide order dated 30th July 2015 ... Rs 5.67/KWh vide order dated 2 May 2016.

It would be only appropriate that the Hon Commission extends the same approach to Biomass Gasifier based Power Plants. Starting with tariff of Rs 8.40/KWh, perhaps limited to initial 5 MW of Biomass Gasifier Power Plants rated 100 to 500 KW.

It would otherwise lead to an anomalous situation of benefits having been extended, in recent past, to "offshore manufacturers of Solar PV Cells/ Modules" but the same benefit not being extended to indigenous manufacturers of Biomass Gasifiers & Rural entrepreneurs who produce processed biomass fuel/ retail bio-char.

## 4. PRAYER

It is KSBDB's prayer that the Hon Commission awards Rs 8.40/KWh as fixed tariff for 10 years to its 3 Nos Biomass Gasifier Power Plant installations, constructed under the BERI project.

## **RESPONSE TO BESCOM REPLY (through Just Law) on 26<sup>th</sup> August 2016**

### **5(a) Operating and maintenance expenses:**

- \* Respondent reiterating O&M costs norms as applicable to Rankine cycle Power Plants does not carry merit as our Plant is based on the Otto cycle. The rationale is the same as higher O&M costs adopted for Gas fired Combined Cycle Power Plants (based on the Brayton Cycle) as compared to Utility Range Coal fired Power Plants (based on the Rankine Cycle).
- \* At any rate, we have not sought specific O&M cost but a fixed tariff for 10 years. Hence, the Respondent's arguments are not sustainable.

### **5(b) Specific fuel consumption:**

- \* Respondent reiterating Specific Fuel Consumption norms as applicable to Rankine cycle Power Plants does not carry merit as our Plant is based on the Otto cycle..
- \* At any rate, we have not sought specific O&M cost but a fixed tariff for 10 years. Hence, the Respondent's arguments are not sustainable.

### **5(c) Fuel Price of bio mass:**

- \* Respondent reiterating Fuel Price norms as applicable to Rankine cycle Power Plants does not carry merit as our Plant is based on the Otto cycle, which required superior quality (processed biomass) fuel. The rationale is the same as higher fuel price norms adopted for Gas fired Combined Cycle Power Plants, as compared to mine head based Utility Range Coal fired Power Plants.
- \* At any rate, we have not sought specific O&M cost but a fixed tariff for 10 years. Hence, the Respondent's arguments are not sustainable.

### **5(d) Levellized tariff for 10 years:**

- \* Respondent arguments on cost of electricity from Power Exchanges or Utility range Power Plants does not carry merit, as they are obligated to promote Renewable Energy.
- \* Enabling tariffs, during phase of initial commercialization, have been provided by the Respondent to Solar PV Power Plants, with most of the equipment being imported. It is, hence, ironical that the Respondent should oppose an enabling tariff to Biomass Gasifier Power Plant, based on indigenous technology and with a major component of tariff going towards prepared biomass cost, which would benefit local farmers as well as create local jobs.
- \* The tariff that we have sought is in line with the tariff accepted by the Respondent for Solar PV Power Plants, during phase of initial commercialization. For each 240 KW unit, this constitutes 1 million KWh/year (equivalent to power purchase from 625 KWp Solar PV Power Plant). Hence, even for 1 MW of BERI project capacity, the power purchase would be equivalent to 2.5 MWp Solar PV Power Plants and the Respondent has supported much larger Solar PV capacity, during phase of initial commercialization.

**5(e) Uniqueness of BERI project:**

- \* The Respondent does not at all contest the benefits of DEG (Decentralized Energy Generation) for power supplies to rural/ tribal villages, which have low load factor and hence much higher cost of delivered power (though line specific recovery of Capital Servicing + O&M costs related to Distribution network management & commercial operations in such areas)
- \* The contention of the Respondent that enabling tariff paid to us will have impact on its consumer tariff is specious and not based on facts. During FY 2015-16 the Respondent purchased 29,095.32 million KWh. Consequently, even 4 million KWh/year purchase from us (at preferential price of say Rs 3.5/KWh) will have impact of Rs 0.00048/KWh.

**6. Justify its demands for determination of the tariff.**

- \* We have provided factual data of cost of generation, as computed by I.I.Sc, as well as the reference of CERC tariff orders.
- \* Apart from this, we are only seeking enabling project specific tariff, as already accepted by the Respondent for Solar PV Power Plants, during phase of initial commercialization.

**7. Basis seek for review of the orders of this Hon'ble Commission**

- \* The units have been shut down for the past many years due to totally non economical tariff.
- \* Furthermore, there have been advancements, since our Plants commissioning, in Biomass Gasifier Technology, which gives confidence that with economics of scale, DEG based on Biomass Gasifier Technology and based on locally available surplus biomass, will exhibit techno-economic viability.
- \* More specifically, with advanced technology Biomass Gasifiers & using local available surplus biomass, the cost of power supply is likely to be lower than Solar Energy stored in batteries, which is being evaluated by Distribution Utilities.
- \* It is hence entirely within the Powers of the Hon Commission to issue a Project specific revised tariff.

**9. Re: Para 1 to 3:**

- \* These have been addressed by us in earlier paragraphs and hence we are refraining from repetition of rebuttal.

**10. Re: Para 4 to 5:**

- \* These have been addressed by us in earlier paragraphs and hence we are refraining from repetition of rebuttal.

**11. Re: Para 6 to 8:**

- \* These have been addressed by us in earlier paragraphs and hence we are refraining from repetition of rebuttal.

**12. Re: Para 9 to 11:**

- \* These have been addressed by us in earlier paragraphs and hence we are refraining from repetition of rebuttal.

**13. Re: Para 12 to 13:**

- \* These have been addressed by us in earlier paragraphs and hence we are refraining from repetition of rebuttal.

**14. Re: Para 14:**

- \* These have been addressed by us in earlier paragraphs. However, we highlight the following which supports our case for enabling BERI project to meet the objectives for which it was established by MNRE/GoK, with support from UNDP and ICEF.
- \* There have been advancements, since our Plants commissioning, in Biomass Gasifier Technology, which gives confidence that with economics of scale, DEG based on Biomass Gasifier Technology and based on locally available surplus biomass, will exhibit techno-economic viability.
- \* More specifically, with advanced technology Biomass Gasifiers & using local available surplus biomass, the cost of power supply is likely to be lower than Solar Energy stored in batteries, which is being evaluated by Distribution Utilities.

**15. WHEREFORE it is prayed that this Hon'ble Court may be pleased to announce Project Specific tariff, fixed rate of Rs 8.78/KWh for 10 years, for up to 4 million KWh/year supplies, in the interests of justice and development.**

