

**TAMIL NADU ELECTRICITY REGULATORY COMMISSION**  
**(Constituted under Section 82 (1) of the Electricity Act 2003**  
**Central Act 36 of 2003)**

**PRESENT:-**

Thiru.K.Venugopal ..... Member  
and  
Thiru.S.Nagalsamy ..... Member  
**P.P.A.P. No.6 of 2010**  
and  
**I.A.No.1 of 2011**

Pallava Water and Power Pvt.Ltd.  
No.29, Hospital Road  
"Maliks Building" 1<sup>st</sup> Floor, Bangalore – 560 001.

.. Petitioner  
(Ms.Pritha Srikumar,  
Advocate for Petitioner)

Vs

1. The Tamil Nadu Electricity Board  
800, Anna Salai, Chennai – 600 002.
2. Government of Tamil Nadu  
Through its Secretary, Energy Department  
V Floor, Secretariat, St. George Fort  
Chennai – 600 009.
3. Government of Tamil Nadu  
Through its Secretary  
Environment and Forests Department  
Secretariat, St.George Fort  
Chennai – 600 009.

.... Respondents  
(Thiru PH.Vinod Pandian,  
Advocate for Respondents)

**Dates of hearing :03-12-2010 &20-04-2011**

**Date of order: :28-09-2012**

The above P.P.A.P.No.6 of 2010 came up for hearing on the above dates. Ms.Pritha Srikumar appeared for the Petitioner and Thiru.P.H.Vinod Pandian, Standing Counsel for TANGEDCO appeared for the First Respondent. The Second and Third Respondent neither appeared before the Commission nor filed any Written Submissions. The Commission after hearing the Petitioner, First Respondent and

the views of the State Advisory Committee and the stakeholders and upon perusing the documents, passes the following:-

### **ORDER**

**1. Prayer of the Petitioner in P.P.A.P.No.6 of 2010:-**

The prayer of the Petitioner in P.P.A.P.No.6 of 2010 is to pass an order determining the tariff for Biogas Power Plants as detailed in Annexure P-13, P13A, P13B and P13C and Annexure P-14 of the Petition.

**2. Prayer of the Petitioner in I.A. No.1 of 2011 in P.P.A.P. No.6 of 2010:-**

2.1. The prayer in I.A. No.1 of 2011 in P.P.A.P.No.6 of 2010 is that the amendments in the original petition as set out in the said I.A. may be permitted and the amended petition may be taken on record.

2.2. In the said I.A., the Petitioner has sought for amendment of the prayer which is as follows:-

*“Pass an order determining the tariff for Biogas Power Plants as detailed in Annexure P-13 and Annexure P-14”.*

2.3. In the said petition, the Petitioner sought to replace paras 19, 20 and 21 by new paras. The said I.A.No.1 of 2011 seeks to incorporate substantial amendments to the original petition namely, P.P.A.P.No.6 of 2010.

**3. Facts of the Case:-**

The Petitioner being a company incorporated under the Companies Act, 1956 is engaged in the development of Bio energy projects which contribute to sustainable development of rural communities in Tamil Nadu. While referring to the Tariff Order No.2 of 2009 dated 27-04-2009 issued by the Commission for Biomass Power Plant, the Petitioner has stated that the said order does not address the specifics of Bio Power Plant (BPP) which are based on Otto Cycle and which are different from Bio

Power Plant based on Rankine Cycle. Therefore the Petitioner has prayed for fixation of tariff for Bio mass Power Plant which is based on Otto Cycle which addressed the key issue of providing for firm power in rural electric networks through decentralized and distributed facilities.

**4. Contentions of the Petitioner:-**

(a) Biogas Power Plants provide most effective solution to the environmental problems and also provide assured quality power in rural electric networks and organic fertilizer. Biogas Power Plants have enormous potential for contributing to sustainable development of rural India as they provide Stable electric power and Stabilized Compost.

(b) The other benefits of biogas power plants include:-

- (i) Reduction in Government of India subsidies for chemical fertilizers, which could instead be productively deployed for enhancing the quality of rural infrastructure.
- (ii) Mitigation of environment pollution and thereby mitigation of health hazards caused by uncontrolled methanation of poultry litter and sago mill effluent.
- (iii) Significant job creation (typically 100 persons per MW) in Biomass Supply Chain, Biogas Power Plants and Compost Production / distribution.

**5. Hearing on 03-12-2010:-**

On 03-12-2010, the above P.P.A.P.No.6 of 2010 came up before the Commission for admission. The Commission passed the following order:-

*“Petition admitted. Consultative paper be prepared after consultation with the Expert Committee and thereafter the matter may be taken to the State Advisory Committee. An expert committee may be convened for this purpose.”*

## **6. Hearing on 20-04-2011:-**

On 20-04-2011, I.A. No.1 of 2011 filed by the Petitioner for the amendment of the main petition came up for admission before the Commission which passed the following order, namely:-

*“The Pallava Water and Power Pvt. Ltd. submitted a petition in November, 2010 for a project for production of gas using poultry litter etc. and generating electricity using gas engines. The petition of the Pallava Water and Power Pvt. Ltd. was circulated to an Expert Committee. Their views were obtained in a meeting held on 18-02-2011. The Petitioner has filed a petition on 29-03-2011 for an amendment in the original petition filed in November 2010. The amendment seeks to raise the capital cost from Rs.10 crores to Rs.10.5 crores, interest rate from 11% to 13%, interest on working capital from 12% to 14%, depreciation from 4.5% to 7% and O & M expenses from 5.27 % to 6%. There is no change in the scenario between November 2010 and March 2011 to warrant change in the factors, which are definitely more beneficial to the Petitioner. The views of the Expert Committee have been obtained at a considerable cost to the Commission. A revised petition would involve a fresh sitting of the Expert Committee which the Commission thinks is not advisable. The whole exercise of tariff determination will be further delayed. That apart the Commission would like to observe that the exercise of determination of tariff for this specific technology has been undertaken although the tariff for biomass was available, at the instance of the Petitioner. It is not in public interest to incur more expenditure and also delay the process of tariff fixation. Therefore the amendment petition is rejected”.*

## **7. Tariff Determination Process**

7.1 As ordered by the Commission on 3-12-2010, the tariff determination process was initiated by the staff of the Commission. In addition to the direction issued by the Commission on 3-12-2010, the general procedure as specified in the Act and related regulations have also been followed for determination of tariff. It would be relevant here to reproduce the regulation 4 of the Power Procurement from New and Renewable Sources of Energy Regulations, 2008 issued by the Commission.

*“The Commission shall follow the process mentioned below for the determination of tariff for the power from new and renewable sources based generators, namely;-*

- a) initiating the process of fixing the tariff either suo motu or on an application filed by the distribution licensee or by the generator.*
- b) inviting public response on the suo motu proceedings or on the application filed by the distribution licensee or by the generator.*
- d) issuing general / specific tariff order for purchase of power from new and renewable sources based generators.”*

7.2 Accordingly an Expert Committee meeting on power generation based on Biogas/ Biogasification technology was conducted by the Commission on 18-02-2011. The minutes of the expert committee meeting is placed as Annexure–I. A Consultative Paper on “Procurement of Power from Biogas and Biogasification based Power Plants” was issued by the Commission on 25-07-2011 inviting comments / suggestions from various stakeholders to be furnished on or before 25-08-2011. A copy of the consultative paper is placed as Annexure–II. In response to the above public notice, many stakeholders have offered their comments. The comments / views received from the stakeholders on the consultative paper is placed as Annexure–III. The issue was discussed in the State Advisory Committee meeting held on 29-03-2012. The minutes of the State Advisory Committee is placed as Annexure–IV. Taking into account the arguments of the petitioner and respondents, the views of the various stakeholders and the views of the SAC, the Commission issues this tariff order on Biogas based power generation.

## **8. Findings of Commission:-**

### **8.1 Power Procurement from New and Renewable Energy Sources of Energy Regulations,2008**

Section 61 of the Electricity Act, 2003 (Central Act 36 of 2003) stipulates that the State Electricity Regulatory Commission shall specify the terms and conditions for the determination of tariff. In accordance with the above stipulation, the Commission notified the “Power Procurement from New and Renewable Sources of Energy Regulations, 2008” on 8-2-2008.

### **8.2. Commission’s orders on Renewable Energy**

The Commission issued Order No.3 on “Power purchase and allied issues in respect of Non-conventional Energy Sources based Generating Plants and

Non-Conventional Energy Sources based Co-Generation Plants” on 15-5-2006. The said order stipulates tariff rates for power procurement by the distribution licensee from Wind Energy Generators (WEGs), Biomass based generators and Bagasse based co-generators. This was the first Order issued by the Commission on NCES based power plants and the Commission issued the following orders on renewable energy subsequently:

- Comprehensive tariff order on wind energy vide Order No. 1 of 2009 dated 20-03-2009
- Comprehensive tariff order on Biomass based power plants vide Order No. 2 of 2009 dated 27-04-2009
- Comprehensive tariff order for Bagasse based co-generation plants vide Order No. 3 of 2009 dated 06-05-2009
- Tariff Order for projects covered by Jawaharlal Nehru National Solar Mission vide Order No. 1 of 2010 dated 27-05-2010
- Tariff Order for Solar Thermal Projects covered by Jawaharlal Nehru National Solar Mission vide Order No. 2 of 2010 dated 08-07-2010
- Comprehensive tariff order on wind energy vide Order No. 6 of 2012 dated 31-07-2012
- Comprehensive tariff order for Bagasse based co-generation plants vide Order No. 7 of 2012 dated 31-07-2012
- Comprehensive tariff order on Biomass based power plants vide Order No. 8 of 2012 dated 31-07-2012

### **8.3 Legal Provisions**

#### **8.3.1 Related Provisions of the Electricity Act, 2003:**

**8.3.1.1.** The Commission is guided by the following provisions of section 61 of the Act which are relevant to this Order:

*Section 61 - “The Appropriate Commission shall, subject to the provisions of this Act, specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by the following, namely:-*

(a) the principles and methodologies specified by the Central Commission for determination of the tariff applicable to generating companies and transmission licensees;  
(b) the generation, transmission, distribution and supply of electricity are conducted on commercial principles;

(c) the factors which would encourage competition, efficiency, economical use of the resources, good performance and optimum investments;

(d) safeguarding of consumers' interest and at the same time, recovery of the cost of electricity in a reasonable manner;

(e) the principles rewarding efficiency in performance;

(f) multi year tariff principles;

(g) that the tariff progressively reflects the cost of supply of electricity and also reduces cross-subsidies in the manner specified by the Appropriate Commission;

(h) the promotion of co-generation and generation of electricity from renewable sources of energy;

(i) the National Electricity Policy and Tariff Policy”.

**8.3.1.2. Section 86** stipulates the following among other functions of the State Commission.

**Section 86(1)(e)** “promote cogeneration 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, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;”

### **8.3.2 Related Provisions of the National Electricity Policy:**

The guidelines stipulated in the National Electricity Policy on NCES, which are relevant to this Order are reproduced below:

**Clause 5.2.20:** “Feasible potential of non-conventional energy resources, mainly small hydro, wind and bio-mass would also need to be exploited fully to create additional power generation capacity. With a view to increase the overall share of non-conventional energy sources in the electricity mix, efforts will be made to encourage private sector participation through suitable promotional measures.”

**Clause 5.12.1:** “Non-conventional sources of energy being the most environment friendly, there is an urgent need to promote generation of electricity based on such sources of energy. For this purpose, efforts need to be made to reduce the capital cost of projects based on non-conventional and renewable sources of energy. Cost of energy can also be reduced by promoting competition within such projects. At the same time, adequate promotional

*measures would also have to be taken for development of technologies and a sustained growth of these sources.”*

**Clause 5.12.2:** *“The Electricity Act 2003 provides that power and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies.”*

### **8.3.3 Related Provisions in the Tariff Policy**

The Commission is also guided by the following specific provisions of the Tariff Policy of Government of India (Ministry of Power) relating to NCES:

**Clause 5(3) (i):** *“Tariff fixation for all electricity projects (generation, transmission and distribution) that result in lower Green House Gas (GHG) emissions than the relevant base line should take into account the benefits obtained from the Clean Development Mechanism (CDM) into consideration, in a manner so as to provide adequate incentive to the project developers.”*

**Clause 6.0:** *“Accelerated growth of the generation capacity sector is essential to meet the estimated growth in demand. Adequacy of generation is also essential for efficient functioning of power markets. At the same time, it is to be ensured that new capacity addition should deliver electricity at most efficient rates to protect the interests of consumers. This policy stipulates the following for meeting these objectives.”*

**Clause 6.4(1):** *“Pursuant to provisions of section 86(1)(e) of the Act, the appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by April 1, 2006.*

*It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the appropriate Commission.”*

**Clause 6.4(2):** *“Such procurement by distribution licensees for future requirements shall be done, as far as possible, through competitive bidding process under Section 63 of the Act within suppliers offering energy from same type of non-conventional sources. In the long-term, these technologies would need to compete with other sources in terms of full costs.”*



8.3.4 A reading of the Tariff Policy, National Electricity Policy and the Electricity Act 2003 establishes the overwhelming emphasis on environmental friendly renewable sources of energy. As of now, four grid connected bio-gas power plants to the tune of 5.85 MW are in service apart from many off-grid bio-gas power plants in Tamil Nadu.

#### **8.4. Generation – Demand gap in Tamil Nadu**

8.4.1 As on 31-03-2012, the installed capacity of TANGEDCO is 10,237 MW comprising 2,970 MW from TANGEDCO's four thermal stations, 516 MW from four gas turbine stations, 2,191 MW from hydro stations, 1180MW from private sector power projects who have power purchase agreements with TANGEDCO, 214 MW as contribution to Tamil Nadu grid by sale of electricity from captive generating plants, 2,861 MW as Tamil Nadu's share from central generating stations and 305 MW from external assistance.

8.4.2 Besides this installed capacity of 10,237MW, a generating capacity of 7,768 MW is also connected to the Tamil Nadu grid comprising 6954 MW from privately owned wind farms, 635 MW from cogeneration plants of sugar mills, 169 MW from biomass power plants and 7 MW from solar power plants.

8.4.3 The average power availability during 2011-12 has been around 8,000 MW, while the peak demand has been about 11,000 MW, which leaves a deficit of about 3,000 MW. The infirm wind power generation contributes to about 30% of the peak demand during wind season. As TANGEDCO has no balancing capacity to take care of this infirm power during unexpected meteorological changes, the deficit rises to 3,000 to 3,500 MW.

## 8.5. Applicability of this Order

This is a specific order issued on the petition of M/s Pallava Water and Power (P) Ltd and not a generic order. This is applicable for the life period of **twenty years**. Since the TANGEDCO has agreed to purchase the power vide their letter dated 06-09-2010, the TANGEDCO shall sign Power Purchase Agreement with M/s Pallava Water and Power (P) Ltd for purchase of power from the Bio gas generating plant of the petitioner.

## 8.6. Tariff / Pricing Methodology

The Tariff / Pricing Methodology specified in Regulation 4 of the Commission's above said Regulation is reproduced below:

*“(2) While deciding the tariff for power purchase by distribution licensee from new and renewable sources based generators, the Commission shall, as far as possible, be guided by the principles and methodologies specified by:*

- (a) Central Electricity Regulatory Commission*
- (b) National Electricity Policy*
- (c) Tariff Policy issued by the Government of India*
- (d) Rural Electrification Policy*
- (e) Forum of Regulators (FOR)*
- (f) Central and State Governments”*

*(3) The Commission shall, by a general or specific order, determine the tariff for the purchase of power from each kind of new and renewable sources based generators by the distribution licensee.....*

*Provided where the tariff has been determined by following transparent process of bidding in accordance with the guidelines issued by the Central Government, as provided under section 63 of the Act, the Commission shall adopt such tariff.*

*(4) While determining the tariff, the Commission may, to the extent possible consider to permit an allowance / disincentive based on technology, fuel, market risk, environmental benefits and social impact etc., of each type of new and renewable source.*

*(5) While determining the tariff, the Commission shall adopt appropriate financial and operational parameters.*

*(6) While determining, the tariff the Commission may adopt appropriate tariff methodology.*

## **8.7. Preferential Tariff vs. Bidding**

8.7.1 In this regard, it is relevant to discuss the following stipulations of Tariff Policy, which are reproduced below:

*Para 6.4(1): Pursuant to provisions of section 86(1)(e) of the Act, the appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by April 1, 2006. It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the appropriate Commission.*

*para 6.4(2): Such procurement by distribution licensees for future requirements shall be done, as far as possible, through competitive bidding process under section 63 of the Act within suppliers offering energy from same type of non-conventional sources. In the long-term, these technologies would need to compete with other sources in terms of full costs.*

8.7.2 There are very few grid connected Biogas power plants in Tamil Nadu. The cost of generation from Biogas power plants is generally higher than the coal based generation. These plants are not in a position to compete with conventional power plants in terms of tariff. Hence, it is felt that the Biogas power plants should be promoted at preferential tariff. It promotes local community development and creates local employment. It helps to exploit the biomass / wastes from cattle, birds, industries in the State. It reduces the pollution caused by the bio wastes in the local area. Therefore, the Commission proposes that the energy procurement from Biogas power plants by distribution licensees shall be at preferential tariff as determined by the Commission as per para 6(4) (1) of the Tariff Policy.

## **8.8. Market Determined Pricing**

In a free market, where there is adequate competition among various players, the price is determined by the market mechanism. This price could be obtained for long, medium or short term. Wherever market is not developed, performance based

bench mark system of pricing as notified by the Commission by way of tariff regulations are applicable. The issue of competitively procuring power from renewable energy sources in the absence of Guidelines of Government of India for competitive bidding for procurement of NCES power is a subject matter of an appeal before the Hon'ble Supreme Court. In view of this, the Commission adopts the Cost Plus Tariff determination in this Order.

### **8.9. Cost-Plus Tariff Determination**

Cost-Plus Tariff Determination is not the best method and it discourages competition and efficiency. However, to encourage the Bio gas based power generation plants in the State and till the competitive bidding is introduced, Cost-Plus method is followed. As it can be easily designed to provide adequate return to the investor and the Commission has a mandate specified by the Act to promote NCES power, the Commission adopts Cost-Plus Tariff approach in this order.

### **8.10. Single Part vs. Two Part Tariff**

8.10.1. In the Commission's Order No. 8 of 2012 dated 31-07-2012 issued for tariff determination of Bio-mass power plant, the Commission adopted the "**Cost Plus Two Part Tariff**". Generally, the two part tariff is adopted when the fuel cost varies from time to time and the fuel cost is considered as a pass through. The variable component of tariff would take care of such price escalation. The cost of fuel used in the Bio gas plant also varies from time to time. Hence the Commission adopted the cost plus two part tariff for the Bio gas power plants. The stakeholders have also expressed the view that the two part tariff is convenient to accommodate the fuel cost escalation appropriately and therefore a two part tariff is adopted in this order.

### 8.11. Tariff Components

The Commission has carried out a detailed analysis of the existing policies/procedures and commercial mechanisms in respect of power generation from Biogas plants. The tariff determined in a cost-plus scenario, would depend significantly on the following operating and financial parameters:

1. Capital investment
2. Plant Load factor
3. Debt-equity ratio
4. Term of Loan and Interest
5. Life of plant and machinery
6. Depreciation rate applicable
7. Interest on working capital
8. Return on equity
9. Operation and maintenance expenses
10. Auxiliary consumption
11. Fuel cost, Calorific value of fuel, Station Heat Rate and cost of By-product
12. Tariff rate

Each of the above parameters are discussed below in detail.

#### 8.11.1 Capital Investment

The capital cost is one of the important parameters for Biogas power projects tariff determination. The cost of the gas engines is an important factor in determination of overall cost of the plants. The details of capital cost furnished by various agencies are tabulated below:

Sl. No.	Agencies and reference	Capital Cost (Rs. in Crores /MW)
1.	MNRE (Letter dated 19-07-2010)	Rs.12 Crores for 1 MW plant and Rs.11 Crores/MW for 2 MW power plants.
2.	IREDA (Letter dated 25-03-2011)	Rs.7.87 Crores/MW

3.	TEDA (Letter dated 20-04-2010)	Rs.8 Crores/MW (Sago based) Rs.10 Crores/MW (Poultry litter based)
4.	Gujarat ERC (Order No. 2 of 2007)	----
5.	Haryana ERC (Order dated 21-09-2010)	Rs.10.5 Crores/MW (Poultry based)
6.	CMWSSB	Rs.12.54 Crores/MW to Rs.11.14 Crores/MW for Perungudi and Nesapakkam STP.
7.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	Rs.10 Crores/MW

8.11.1.1 In response to the consultative paper, M/s.Pallava Water and Power Private Limited suggested to adopt Rs.12 crores per MW for 1 MW Biogas plant and Rs.11 crores per MW for 2 MW Biogas plant. The IOT Mabagas Limited has suggested to adopt Rs.11 Crores per MW for Biogas power plant. MNRE in its comments has stated that the cost of Biogas project based on distillery spent wash cannot be applied to the projects based on co-digestion of mix of feedstock including crop/agricultural residues. The cost of such projects in all likelihood will be Rs.11 to 12 crores per MW although for first few projects it has been found to be even higher. Amount of subsidy may not be reduced straight away from the equity as the subsidy is released after successful commissioning of the project and in most cases it is adjusted by the lenders against the loans. M/s.Ankur Scientific Energy Technologies Private Limited in its comments has suggested to adopt a capital cost of Rs. 7.00 Crores per MW for Biogasification based power plants.

8.11.1.2 The Central Electricity Regulatory Commission (CERC) in its Terms and Conditions for Tariff determination from Renewable Energy Sources Regulations, 2012 has mentioned a capital cost for Biogas power projects for the year 2012-13 as

Rs. 8.00 Crores/MW. The CERC has arrived at this capital cost taking into account the capital subsidy offered by Gol. The capital cost includes evacuation cost up to inter-connection point.

8.11.1.3 The Commission feels that it is prudent to adopt the capital cost adopted by CERC. Therefore, it is proposed to adopt the capital cost of Rs. 8.00 Crores per MW for Biogas power plants. The capital cost includes evacuation cost up to inter-connection point.

## 8.12. Plant Load Factor (PLF)

8.12.1. PLF has always been a parameter of utmost importance. Normative values of PLF of Biogas / Bio-gasification based power projects adopted/furnished by various agencies are as follows:

Sl. No.	Agencies and reference	PLF in %
1.	MNRE (Letter dated 19-07-2010)	80%
2.	IREDA (Letter dated 25-03-2011)	80%
3.	TEDA (Letter dated 20-04-2010)	60-70% (Sago based) 80% (Poultry litter based)
4.	Haryana ERC (Order dated 21-09-2010)	65% - First year 80% - Subsequent years
5.	CMWSSB	25-40%
6.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	90%

8.12.2 MNRE in its comments has suggested to reduce the PLF to 60% for the first six months, 70% for the next six months and 80% thereafter for Biogas power plants. M/s.Ankur Scientific Energy Technologies Private Limited has suggested to consider a PLF of 60%, 70% & 80% for 1<sup>st</sup> year, 2<sup>nd</sup> year & 3<sup>rd</sup> year onwards respectively. The Central Electricity Regulatory Commission (CERC) in its Terms and Conditions for Tariff determination from Renewable Energy Sources Regulations, 2012 has

mentioned 90% PLF for Biogas power plants. Based on the above, Commission proposes to adopt a PLF of 90% PLF for Biogas power plants as prescribed by CERC.

### 8.13. Debt-equity ratio

The Tariff Policy lays down a debt equity ratio of 70: 30 for power projects. The Commission has proposed to adopt this ratio as specified in its Tariff Regulations 2005.

### 8.14 Term of the Loan and interest

8.14.1 The interest rates suggested / adopted by various agencies are as follows:

Sl. No.	Agencies and reference	Interest on Loan
1.	IREDA (Letter dated 25-03-2011)	12.25%
2.	TEDA (Letter dated 20-04-2010)	13% (Sago based) 14.29% (Poultry litter based)
3.	Haryana ERC (Order dated 21-09-2010)	12.75%
4.	CMWSSB	10%
5.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	11% for 50% of INR debt 6% for 50% of Euro debt

8.14.2 M/s.IOT Mabagas Limited has suggested that the Commission may consider a loan tenure of 10 years with the interest rate of 12.5% to 13.5% for Biogas power plants. M/s.Ankur Scientific Energy Technologies Private Limited has suggested to consider a loan tenure of 5 years with 1 year moratorium period with the interest rate of 13.5% to 14%.

8.14.3 The Commission in its tariff order No.8 dated 31-07-2012 for tariff determination for Bio mass based power plants, has considered a loan period of ten years with moratorium of one year and an interest rate of 12.25%. The commission



decides to adopt a loan period of ten years with moratorium of one year and the interest rate of 12.25% as adopted in its order No.8 dated 31-07-2012.

### **8.15. Life of Plant and machinery**

8.15.1 The life of Biogas power projects suggested / adopted by various agencies are tabulated below:

<b>Sl. No.</b>	<b>Agencies and reference</b>	<b>Life of the Plant</b>
1.	MNRE (Letter dated 19-07-2010)	Civil works – 30 years Electro-Mechanical equipments – 10 years
2.	IREDA (Letter dated 25-03-2011)	20 years 5% for equipments and 10% for others.
3.	TEDA (Letter dated 20-04-2010)	20 years (Sago based) 20 years (Poultry litter based)
4.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	10 years

8.15.2. Most of the experts who participated in the expert committee meeting held on 18-02-2011 have stated that the life period of the Biogas plant cannot be more than 15 years. M/s.Pallava Water & Power Private Limited suggested to adopt a life period of 10 years, M/s.IOT Mabagas Limited suggested to adopt a life period of 12 years and MNRE suggested to adopt a life period of 10 years for Biogas power plants. CERC in its regulation has considered a life period of 20 years for Biogas power projects. In line with the CERC Regulation, the Commission adopts a life period of 20 years for Biogas power projects.

### **8.16. Depreciation**

8.16.1 M/s.Pallava Water and Power (P) Ltd. requested a depreciation of 4.5 % in their petition filed before the Commission. In response to the Commission's

consultative paper, the same firm has suggested to adopt a depreciation rate of 7% per annum. The CERC's Renewable Regulations recommended 'Differential Depreciation Approach' over loan tenure and period beyond loan tenure over useful life computed on 'Straight Line Method'. For the purpose of tariff determination, it is prudent to assume depreciation based on Straight Line Method (SLM) wherein the asset life is to be depreciated to a residual value of 10% of its initial value over the entire asset life. **This translates to an SLM depreciation rate of 4.5% for Biogas projects.**

### 8.17. Interest on working capital

8.17.1 The working capital suggested / adopted by various agencies along with the interest are as follows:

Sl. No.	Agencies and reference	Working capital
1.	IREDA (Letter dated 25-03-2011)	Raw material and O&M cost with 12.25% interest.
2.	TEDA (Letter dated 20-04-2010)	1.46 Crores (Poultry litter based)
3.	Haryana ERC (Order dated 21-09-2010)	Receivables – 1 month sale with 12.25 % interest.
4.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	1 Month O&M Charges + Maintenance Spares (15% of O& M charges) + 2 Months receivables from Debtors + 4 months Feedstock inventory with 12% interest.

8.17.2 The Commission in its order No. 8 of 2012 has included the following components in the working capital:

1. Fuel stock-1 month,
2. O&M expenses – 1 month and
3. Receivables – 1 month.

8.17.3. M/s.IOT Mabagas Limited has stated that the interest rates on working capital are above 13% today. An approximate time of around 4 to 5 months is taken for receiving payment from distribution utility. Sometimes it is even more than 5 months in case of TANGEDCO. The payments for by-product are effected basically by the farmers/dealers with a credit period of around 3 to 4 months. M/s.Ankur Scientific Energy Technologies Private Limited has stated that the interest rates have gone up and it should be based on last one year SBI base rate (which is around 8%-8.5%) plus 5.50% as spread. This will be around 13.5%-14.0%. The components of working capital may include fuel stock for 3 months and O&M expenses for 1 month.

8.17.4 The Commission is of the view that working capital considered by the Commission in its Order No. 8 of 2012 with the interest rate of 12.5% is reasonable and has decided to adopt the same for this project.

### 8.18 Return on Equity

8.18.1 The Return on Equity proposed / adopted by different agencies are tabulated below:

Sl. No.	Agencies and reference	Return on Equity
1.	TEDA (Letter dated 20-04-2010)	19% pre-tax (Poultry litter based)
2.	Haryana ERC (Order dated 21-09-2010)	16%
3.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	19% pre-tax

8.18.2. The Commission in its previous NCES orders has allowed 19.85% pre-tax return on equity, which is higher than the 14% post-tax return on Equity allowed to

conventional power projects. **Hence, the Commission decides to allow 19.85% pre-tax return on equity in this order.**

### 8.19. O&M and Insurance expenses

8.19.1 The O&M expense includes the expenditure on manpower, repairs, spares, consumables and overheads. The O&M expenses suggested / adopted by other agencies are as follows:

Sl. No.	Agencies and reference	O&M expenses
1.	MNRE (Letter dated 19-07-2010)	Rs. 2 /kWh.
2.	IREDA (Letter dated 25-03-2011)	3% of the capital cost for O&M and 0.5% for insurance
3.	TEDA (Letter dated 20-04-2010)	10% (Sago based) 5% (Poultry litter based)
4.	Haryana ERC (Order dated 21-09-2010)	6% of the project cost
5.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	5.25% of capital cost with 5.72% escalation

8.19.2 In response to the consultative paper, regarding O&M and insurance expenditures for Biogas power plants, M/s.Pallava Water & Power Private Limited has suggested to consider O&M cost of 6% per annum. M/s.IOT Mabagas Limited has suggested to consider O&M cost of 7.5%. The MNRE has stated that IREDA has given the data for distillery spend wash based projects where digesters are mostly based on up-flow anaerobic sludge blanket reactors. For the projects based on Co-digestion, the O&M Cost is higher. Hence the O&M cost of 6% of the capital cost may be a correct one.

8.19.3 The Commission considered O&M rate of 4.5% for plant and machineries with 5% escalation per year in its order No. 8 of 2012 for biomass power projects.

8.19.4 Regarding the points raised by the MNRE, unlike the biomass and Co-generation based power plants, the Biogas power plants do not consist of boiler, turbine, high pressure and temperature pipelines, etc. **Therefore, the Commission proposes to adopt the O&M cost of 3% of the capital cost for the first year with 5% escalation thereafter for Biogas Power Plants as recommended by IREDA which will take care of the digester units etc.** Normally the insurance expenditure will form part of the operation and maintenance expenses. Other Commissions have also clubbed the insurance expenditure with O&M expenses. Hence, the Commission decides to club the insurance expenditure with the O&M expenses of 3%.

## 8.20. Auxiliary consumption

8.20.1 In case of Biogas plant, considerable amount of power is required for the associated water treatment system that purifies and recycles the water to facilitate zero effluent discharge to the ground. The auxiliary consumption suggested / adopted by other agencies are as follows:

Sl. No.	Agencies and reference	Auxiliary consumption
1.	MNRE (Letter dated 19-07-2010)	10-12%
2.	IREDA (Letter dated 25-03-2011)	10%
3.	TEDA (Letter dated 20-04-2010)	14.60% (Sago based) 15% (Poultry litter based)

4.	Haryana ERC (Order dated 21-09-2010)	12.74%
5.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	13%

8.20.2 In response to the consultative paper, M/s.Pallava Water & Power Private Limited has suggested to consider 13% auxiliary consumption for Biogas power plants including digester effluent treatment systems. M/s.IOT Mabagas Limited has stated that the Commission may consider 13% as auxiliary power consumption for Biogas power plants since the Biogas plants are required to handle more volume of feedstock with moisture, which requires large pumping, stirring, etc. The MNRE has suggested to adopt 13% auxiliary consumption for Biogas plants. The CERC in its Regulations has considered 12% auxiliary consumption for Biogas power plants. The Commission considered Auxiliary consumption of 10% in its order No. 8 of 2012 for biomass projects. Considering the special nature involved in bio-gas plants such as effluent treatment system etc., **the Commission decides to consider 12% of auxiliary consumption for Biogas plants as considered by CERC.**

### **8.21. Fuel cost, Calorific value of fuel, Station Heat Rate (SHR) and cost of by-product.**

8.21.1 The fuel cost, calorific value of fuel and station heat rate (SHR) suggested / adopted by other agencies are as follows:

<b>Sl. No.</b>	<b>Agencies and reference</b>	<b>Fuel cost, Calorific value of fuel and SHR</b>
1.	MNRE (Letter dated 19-07-2010)	Rs.1/kWh 4500-5000 Kcal/cum.

2.	IREDA (Letter dated 13-01-2010)	Rs.450/Tonne at present (Poultry Litter based). 3000-3500 Kcal/kg.
3.	IREDA (Letter dated 25-03-2011)	5000 kCal/m <sup>3</sup> , 1 m <sup>3</sup> /4 kWh
4.	TEDA (Letter dated 20-04-2010)	Rs.1100/Tonne (Poultry litter based) 5000 Kcal/kg (Sago based) & 4300 Kcal/kg (Poultry litter based)
5.	Haryana ERC (Order dated 21-09-2010)	Rs.370/Tonne (Poultry litter based) Specific fuel consumption 4.21kg/kWh
6.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	Rs.1020/Tonne with 5% escalation Specific fuel consumption 3 kg/kWh

8.21.2 In response to the consultative paper, M/s.Pallava Water & Power Private Limited has suggested to consider Biogas feedstock cost of Rs.1100 per MT with cost realisation from by-product of 10% of the biomass cost in case of Biogas power plants. M/s.IOT Mabagas Limited has stated that the Commission may consider around Rs.1200 per MT for the by-product, compost. The MNRE in its comments has stated that the cost recovery from by-product (digester effluent) be linked to the cost of feedstock as during the process of digestion, the quantity remains the same but there is reduction in percentage of dry solids due to anaerobic digestion of digestible organic matter to produce Biogas. Therefore, the revenue from by-product needs to be pegged at around 10% of the cost of feedstock.

8.21.3. The CERC in its Regulation has considered feed stock price for Biogas plants during 2012-13 to be Rs.990/MT, which is net of any cost recovery from digester effluent. The escalation factor for the fuel is 5% per annum.

8.21.4 The Commission understands that the Biogas fuel cost sought by the petitioner M/s.Pallava Water and Power (P) Ltd is matching with the fuel cost

mentioned by CERC. **Therefore, Commission decides to adopt a fuel cost of Rs.990/MT for Biogas power projects, which is net of any cost recovery from digester effluent.**

8.21.5 Regarding specific consumption of fuel, the Haryana ERC has specified 4.21 kg/kWh for poultry litter based Biogas power plants. The petitioner has reported a specific fuel consumption of 3 kg/kWh. The CERC in its Regulation has also considered a specific fuel consumption of 3 kg of substrate mix per kWh. Therefore, the Commission has considered a specific consumption of 3 kg/kWh in this order.

8.21.6 The by-product cost adopted by different agencies are as follows:

<b>Sl. No.</b>	<b>Agencies and reference</b>	<b>Cost of by-product</b>
1.	Petition filed by M/s.Pallava Water and Power (P) Ltd. before TNERC vide PPAP 6 of 2010	Rs.110/Tonne with 5% escalation
2.	Tamil Nadu Poultry Farmers Federation	Rs.1400/Tonne.
3.	IREDA (Letter dated 25-03-2011)	Quantum of by-product – 0.20 MT (Manure from cow dung), Cost - Rs.2500/MT
4	Khadi & village Industries	Manure cost: Rs. 2268/Tonne

8.21.7. Since the Commission arrived at the fuel cost net of any cost recovery from the digester effluent, the Commission has not considered any by-product benefits derived from Biogas power plants.

## **8.22. Tariff rates**

8.22.1 The financial and operational parameters considered in this order are tabulated below:



Sl. No.	Financial and operational parameters	Financial and operational parameters proposed
1.	Net Capital Cost	Rs.8.00 Crores/MW
2.	PLF	90%
3.	Loan tenure	10 years with 1 year moratorium period
4.	Interest on Loan	12.25%
5.	Life of the plant	20 years
6.	Depreciation	4.5%
7.	RoE	19.85% Pre-Tax
8.	O&M charges including insurance	3% of the capital cost with 5% escalation per year
9.	Working capital	1. Fuel stock-1 month, 2. O&M expenses – 1 month and 3. Receivables – 1 month
10.	Interest on working capital	12.5%
11.	Auxiliary consumption	12%
12.	Fuel cost	Rs.990/MT with 5% escalation per year
13.	Specific fuel consumption	3 kg/kWh

8.22.2 The corresponding tariff has been worked out as below for 20 years considering the above determinants. Fixed cost has been tabulated for a period of 20 years. i.e. up to the life of the project. Variable cost has been furnished for the year 2012-13 and 2013-14.

Tariff for Biogas power plants			
Year of operation	Fixed cost (Rs./unit)	Variable Cost for the FY 2012-13 and FY 2013-04 (Rs / Unit)	Total cost for the FY 2012-13 and FY 2013-04 (Rs / Unit) (2)+(3)
(1)	(2)	(3)	(4)
1	2.64	3.38 (2012-13)	6.02
2	2.66	3.55 (2013-14)	6.21
3	2.59		
4	2.51		
5	2.43		
6	2.36		
7	2.29		
8	2.22		
9	2.15		
10	2.08		
11	2.01		
12	1.94		
13	1.98		

14	2.02		
15	2.06		
16	2.10		
17	2.14		
18	2.19		
19	2.24		
20	2.29		

8.22.3. The variable cost will be Rs.3.38 per unit for the financial year 2012-13 and Rs.3.55 for the financial year 2013-14.

8.22.4 Generally the fixed cost is applicable with respect to the year of operation while variable cost is applicable with respect to the financial year. However, for the simplification of billing procedure, the Commission considered that for projects commissioned during the financial year 2012-13, the first year fixed cost of Rs.2.64 per unit will be applicable till the end of the FY 2012-13. For the financial year 2013-14, the second year fixed cost of Rs.2.66 is applicable. The fixed cost shall be made applicable in the similar manner for the entire life period of the project. The tariff applicable at any point of time would be the sum of fixed cost and the variable cost applicable for the relevant financial year. For example, the tariff for a plant commissioned on 20-07-2012 would be Rs.6.02 (FC 2.64+ VC 3.38) for the period from 20-07-2012 to 31-03-2013 and Rs.6.21 (FC 2.66+VC 3.55) for the period from 01-04-2013 to 31-03-2014. Similarly the tariff shall be calculated for the entire life period.

8.22.5 If the variable cost for the third or subsequent years is not specified by the Commission, the variable cost specified for the second year shall be continued till any revision is effected by the Commission in this regard.

### **8.23. Related issues**

**8.23.1.** In case of third party sale / captive use by the petitioner, the following related

issues approved by the Commission in its Biomass Order No. 8 of 2012 dated 31-07-2012 shall be applicable mutatis mutandis for Bio gas power plants also.

1. Transmission and wheeling charges
2. CDM benefits
3. Reactive power charges
4. Grid availability charges
5. Adjustment of energy generated
6. Scheduling and system operation charges
7. Application fees and Agreement fees
8. Billing and payments
9. Payment security and Security deposit
10. Power factor disincentive
11. Metering and communication arrangements
12. Evacuation of power
13. Energy purchase agreement
14. Energy wheeling agreement
15. Scheduling of power
16. Tariff Review Period / Control Period

#### **8.23.2. Cross Subsidy Surcharge**

The Commission has permitted 25% of cross subsidy surcharge in case of third party sale vide its order dated 03-11-2011 in M.P No.47 of 2010 filed by M/s.Pallava Water and Power (P) Ltd.

#### **8.23.3. Other Conditions**

The tariff approved in this order is further subject to the condition that these projects shall be commenced within a period spread over six to twelve months of the date of this order and shall enter commercial operation within a period of two years of their commencement.

#### **8.24. Tariff Review Period / Control Period**

Clause 6 of the Power Procurement from New and Renewable Sources of Energy Regulations, 2008 specifies that the control period may be ordinarily two years. Hence, the Commission decides that the control period of this Order shall extend up to two years from the date of this order. **Since this is a specific order, the Commission may consider reviewing of fuel cost on filing specific petition by any of the parties to the Power Purchase Agreement at appropriate time.**

#### **9. Appeal:-**

An appeal under section 111 of the Electricity Act, 2003 against this order shall lie to the Appellate Tribunal for electricity within a period of 45 days.

(Sd.....)  
**(S.Nagalsamy)**  
**Member**

(Sd.....)  
**(K.Venugopal)**  
**Member**

/ True Copy /

Secretary  
Tamil Nadu Electricity  
Regulatory Commission

**MINUTES OF THE EXPERT COMMITTEE MEETING ON POWER  
GENERATION BASED ON BIOGAS / BIOGASIFICATION TECHNOLOGY  
HELD ON 18-02-2011**

**Present:**

**Tamil Nadu Electricity Regulatory Commission**

- |                                 |                      |
|---------------------------------|----------------------|
| 1. Thiru. K.Venugopal           | Member-I             |
| 2. Thiru. S.Nagalsamy           | Member- II           |
| 3. Thiru. R.V.Rajah             | Secretary            |
| 4. Thiru. P.Muthusamy           | Director/Engineering |
| 5. Thiru. S.Balathandayudhapani | Director/Tariff      |

**Experts**

- |                                 |   |
|---------------------------------|---|
| 6. Dr. R.Christodas Gandhi, IAS | Chairman and Managing Director/TEDA   |
| 7. Thiru. A.K.Dhussa            | Director/MNRE   |
| 8. Thiru. K.Manoharan           | Under Secretary/Energy<br>Department/GoTN   |
| 9. Dr.S.Balaji                  | Addl. Chief Environmental<br>Engineer/TNPCB   |
| 10. Thiru. N.Balakrishnan       | CE/NCES/TANGEDCO  |
| 11. Dr. S.Dasappa               | Principal Research Scientist/IISc   |
| 12. Thiru. V.Subramanian        | Executive Engineer/CMWSSB   |
| 13. Dr. V.Thangamani            | Senior Professor & Divisional Leader/<br>School of Biosciences and Technology/<br>VIT University        |
| 14. Dr. S.Iniyan                | Professor and Director/Institute of<br>Energy Studies/Anna University                                   |
| 15. Dr.P.Venkatachalam          | Professor and Head of the Department/<br>Department of Bio-energy/Tamil Nadu<br>Agricultural University |
| 16. Thiru. P.R.Muralidharan     | DGM/BIO/TEDA  |
| 17. Thiru. K.Krishan            | M/s. Grameena Abhivrudhi Mandali  |

18. Thiru. Ankur Jain	M/s. Ankur Scientific Energy Technologies Pvt. Ltd.
19. Thiru. Nazeer Baasha	M/s. NSP Green Energy Technologies Pvt. Ltd.
20. Thiru. T.R.Krishnaswamy	M/s. Energreen Power Ltd.
21. Thiru. K.Selvaraj	M/s. Selvam Broilers, Namakkal.

The meeting commenced with the welcome address by Member-I and Member-II of the Tamil Nadu Electricity Regulatory Commission.

**Member-I :** In his welcome address he said that the Commission has received a petition from one of the developers for Biogas based power generation and the Commission has decided to conduct an Expert Committee Meeting. After this meeting, the Commission will conduct a State Advisory Committee (SAC) meeting followed by a hearing, if required. It is understood that the fuel proposed for the project is at present going out of Tamil Nadu and being gainfully utilized elsewhere. In addition to generation of power, the Commission is looking for an environment friendly project.

**Member-II :** This is one of the special process and technology for power generation. The Commission has to fix a tariff rate, which is attractive to the generators and affordable to the buyers. The participants are requested to give their valuable suggestions after the presentation of the petitioner of the project.

**Mr. K. Krishan,** of Grameena Abhivrudhi Mandali was requested to make the presentation on the Biogas based Power Generation Project. Accordingly, Mr. Krishan stated the following :

- ❖ UNDP Study was conducted in 2007-08 on the problems of pollution in Namakkal. The study revealed that 100 MW power project could be installed in Tamil Nadu using bio waste.

- ❖ Indian Policy on power generation is coal centric.
- ❖ The burning of coal is causing environmental and social problems.
- ❖ Due to increase in demand, the cost of natural gas and indigenous / imported coal is increasing. Hence we should optimize the use of bio fuels.
- ❖ Ernst & Young have conducted a study on small size biomass power plants versus large sized biomass power plants using poultry litters.
- ❖ The total potential in this sector would be around 175 MWs while the Secretary, MNRE suggested that the same would be around 100 MWs.
- ❖ Biogas plants could be seen as replacement for natural gas.
- ❖ There are collateral benefits such as assured quality fertilizer / compost.
- ❖ HERC Order of September 2010 specified a tariff of Rs.6.06/unit with high capital cost. HERC Order is in line with the Petition.
- ❖ Price of biomass will match with the landed cost of coal so that feedstock compensation will be reasonable.

**Member-I :** Is there any viability gap funding for such projects? Whether the by-products have been taken into account in the pricing of power generated?

**Mr. K. Krishan** informed that they are expecting support from Govt. of India / Germany. He said that the Variable Cost of this project is around Rs.3/unit whereas the Variable Cost of Heavy Fuel Oil (HFO) based power generation is Rs.7/unit and Natural Gas based power generation is Rs.5/unit. Therefore, if we replace natural gas / HFO with Biogas, it is workable. Further, appropriate treatment has been given to the sale proceed of the by-product. He justified his project with the following technical and financial parameters:

Capital Cost for 1 MW	10.00 Crore
MNRE Subsidy	1.5 Crore (MNRE Circular dated 26.04.10)
Debt (INR)	35%
Debt (Euro)	35%
Equity	30%

Interest on Debt (INR)	11%
Interest on debt (Euro)	6%
Depreciation	4.50 %
O & M (Plant & Machinery, Land & Civil & Insurance)	5.25% ( As per CERC)
R O E	19% Pre-Tax (As per CERC)
Interest on Working Capital	12%
P L F	90%
Auxiliary Consumption	13%
Working Capital – Fixed Charges	1 Month O & M Charges + Maintenance Spares (15% of O & M charges) + 2 Months receivables from Debtors + 4 months Feedstock inventory - As per CERC)
O & M Escalations	5.72 % (as per CERC)

Biomass Feedstock Cost	
Average Biogas Yield	167 Cu.m /MT
Electricity Production	2 kWh/ Cu m
Specific Fuel Consumption	3 kg./kWh
Average Feedstock Cost	Rs. 1020 / MT
Fuel Cost Escalations	5% per Yr. (as per CERC)
Residues	
Residues after composting (>75% TS)	4,000 MT/MW
Production Cost	Rs. 1,350 /MT
Compost price	Rs. 2000 / MT
Nett Cost of feedstock (Considering margin from Compost sales)	Rs. 910 / MT
Total tariff (Rs./kWh)	Rs.6.15/kWh in the 1 <sup>st</sup> year and Rs.7.52/kWh in the 10 <sup>th</sup> year.

**In his presentation, Thiru. V. Subramanian, Executive Engineer, Chennai Metro Water and Sewerage Board, stated the following:**

- ❖ CMWSSB has four running Sewerage Treatment Plant based Power generating plants totaling 3.2 MW and additional two plants are underway.
- ❖ 1 cubic metre of Biogas produces one unit of electricity.



- ❖ It fulfills 80% power requirement of the treatment plants.
- ❖ In all, they have saved Rs.19.00 Crores at Rs.3.50 per kWh.
- ❖ O&M cost is reduced to Rs.600/ML.
- ❖ The equivalent CER value is 12 Euros / Rs.720, which can be correlated to 1 ML sewage, which is equal to 0.80 tonnes of CO<sub>2</sub>.
- ❖ The cost of generation of electricity is around Rs.3.59/unit and the Capital Cost of the project is around Rs.20.00 Lakh / ML of sewage.

The following parameters are furnished by the CMWSSB:

**Capital cost and O&M details:**

Sl. No.	Location of STP	Estimated gas production m <sup>3</sup> per day	Gas Engine		Make	Cost of Gas Engine In Rs. Crores
			Capacity KVA	Max. power production KW		
1	Perungudi	10,080	1317	1064	GE Genbacher	2.67
2	Koyambedu	6,900	627	560	GE Genbacher	0.78
3	Nesapakkam	4,800	527	475	Deutz	2.00
4	Kodungaiyur	12,500	1317	1064	GE Genbacher	2.67

Description / Name of STP	Kodungaiyur 110mld STP	Nespakkam 40mld STP	Koyambedu 60mld STP	Perungudi 54mld STP	Under constn 60mld Peru STP	Under constn 54mld Nesa STP
CAPITAL COST ( Rs in lakhs )						
Total amount ( Rs in lakhs )	995.259	568.760	677.360	818.113	1254.157	1113.574
CAPITAL COST PER ML (Rs in lakhs )	9.04	14.22	11.28	15.15	20.9	20.62

Average units of power produced per day	13743	5002	5320	8692	9500	6000
Average bio gas generation in cum per day	6250	2500	2533	3780	4130	3000
KWh / Gas Consumption	2.2	2	2.1	2.3	2.3	2
O&M Expenditure for Full Plant in Rs per ML of water	900	1175	629	1236	570	512

### **Gas Generation and CDM Benefit details**

Description / Name of STP	Unit	Nespakkam	Koyambedu	Perungudi	Kodungaiyur	Total
<b>CERs IN LIEW OF POWR FROM GRID</b>						
Installed capacity	KW	475	560	1064	1064	
Energy Generation 330 days	KWH / year	$5000 \times 330 = 16,50,000$	$8000 \times 330 = 26,40,000$	$1000 \times 330 = 33,00,000$	$1000 \times 330 = 33,00,000$	
CO2 reduction electricity displacement (CERs)	CER / year	1320	2112	2640	2640	
Total CERs for 4 STPs						8712
Grand Total CERs / year from 4 STPs		4188	4785	23514	18369	53212

### **Cost of generation**

#### Capital Cost

Gas engine cost for 10 years : Rs 281.62 lakhs

Other cost (50 years, hence for 10 yrs 1/5): Rs 107.30 lakhs

Interest cost @ 10% p.a : Rs 388.92 lakhs

Total cost for 10 years : Rs 777.84 lakhs

Total electricity produced in 10 Years : 31,727 MWH

Electricity cost per kWh : Rs 2.45

#### O&M Cost

10,000 hrs : Rs 3 lakhs; 20,000 hrs : Rs 80 lakhs; 30,000 hrs : Rs 3 lakhs;

40,000 hrs : Rs 80 lakhs; 60,000 hrs : Rs 5 lakhs;

Total 80,000 hrs Running maintenance: Rs 171 lakhs;

Staff and other O&M cost for 10 years : 12 x 10 : Rs 120 lakhs

Oil should be changed 6 times a year, the cost 1.2 x 6 x 10 : Rs 72 lakhs

Total cost for 10 years : Rs 363 lakhs

Total electricity produced in 10 Years : 31,727 MWH

Electricity cost per kWh : Rs 1.14

**Hence, total Electricity cost per kWh : Rs 3.59**

It is noted that there is no fuel cost / fuel preparation cost in gasifier using sewerage as feedstock.

**Member-I** requested the participants to comment on Technology of the Project.

#### **Dr. S. Dasappa, Indian Institute of Science:**

- ❖ Commented on the good initiative taken in Tamil Nadu.
- ❖ Technology is relevant for effective utilization of waste.
- ❖ Intervention of technology is absolutely required.
- ❖ Emission norms shall be strictly followed.
- ❖ Initiative taken by Metro Water is laudable.
- ❖ Disposal of Sodium Sulphate from the scrubber of the plant is an issue to be addressed. Even in sugar industry, Sodium Sulphate is being burnt in the boiler.
- ❖ Improving boiler efficiency is also important.

#### **Dr. S. Balaji, Tamil Nadu Pollution Control Board :**

- ❖ He made reference to the Water Act.

- ❖ In the regulatory norms, all industries to comply with emission as per the new norms on Suspended Particulate Matter (SPM). The slurry should undergo necessary treatment.
- ❖ NOx level should be taken care.
- ❖ At Koyambedu, vegetable waste was being used to produce power, which is not working now due to problem in the gas engine.
- ❖ In poultry industry, the sludge should be treated and used as a fertilizer to safeguard the environment.
- ❖ In Pattukottai, 6.5 KW poultry litter based power plant unit is under operation.
- ❖ In Paramakudi, agriculture waste is used for power generation.

**Member-I** stated that the Commission does not look into the tariff alone but also will look into the socio economic benefits of the scheme and it should be quantified. Accordingly, M/s. Grameena Abhivrudhi Mandali, the petitioner has been directed to implead the Secretaries of Energy and Environment Department of GoTN as respondents in this petition.

**Dr. P. Venkatachalam, Tamil Nadu Agricultural University** commented as follows:

- ❖ The technology is excellent.
- ❖ They are currently utilizing the technology in their 7.5 KW Biogas plant for dairy unit and hostels.
- ❖ Feedstock availability will be a problem for large scale units. Therefore, we should use mixed feed stock.
- ❖ In slurry management, separation of liquid and solid and value addition is important.

**Thiru. K. Selvaraj, on behalf of M/s Selvam Broilers, Namakkal,** stated the following :

- ❖ Many poultry farms are scattered and have very small size of power generating units. Help of TANGEDCO is required to export the power to the grid.

**Thiru. T.R. Krishnaswamy, Director, Energreen Power Ltd.** stated the following :

- ❖ Sewage waste is an under utilized resource in our country. Not even 35% of the total sewage is treated and the balance is let off into the sea / land leading to increase of methane gas.
- ❖ Pollution Control Board should be tough on local bodies for sewage treatment. State can generate 2000 MW of power using sewage waste.

**Dr. V. Thangamani, VIT University** stated the following :

- ❖ VIT is associated with Haneovur University, Germany, in developing two power projects using banana waste as fuel.

**Dr. Iniyar, Director, IES, Anna University,** stated the following:

- ❖ Anna University in association with MNRE is handling projects on vapour absorption system for cold storage application by using Biogas produced from vegetable waste.
- ❖ Automobile application by using Biogas is also under consideration.

**Thiru. P.R. Muralidharan, DGM, TEDA** stated the following:

- ❖ He stated that two biomass methanation power plants using poultry litter i.e. G.K. Bio of 1.5 MW and Subashri of 2.5 MW at Namakkal and Arasi

Biogasification Plant at Sultanpet could not operate commercially as there is no specific tariff to the Biogas / gasification power plants.

**Member-I** stated that the plants could be operated by sale of power through open access.

**Thiru. Muralidharan** stated the following :

- ❖ The plants could not operate due to other problems also.
- ❖ Applications for setting up of 75.5 MW of poultry litter based power generation projects are received.
- ❖ Five applications are on combustion mode.
- ❖ 38 MW is on biomethanation gasifier route.
- ❖ MNRE gives financial assistance up to 2 MW capacity plants.

**Member-I** asked whether it is due to the subsidy from MNRE that there are many 2 MW plants?

**Thiru. Muralidharan** stated the following :

- ❖ Agency's request is on per MW cost.
- ❖ The tariff fixed @ Rs.4.50/unit under biomass based power generation is too low due to escalation in cost of fuel.
- ❖ As compared to wind energy, quantity of Biogas based power generation is low; hence better tariff may be given.

**Member-II** asked TEDA to comment on the technology.

**Thiru. Muralidharan** replied the following :

- ❖ They are not much concentrating on technology.
- ❖ Low tariff and grid connectivity is the problem.

**CMD, TEDA** suggested setting up higher size of power plants for efficient use.

**Thiru. A.K. Dhussa, Director, MNRE** stated the following :

- ❖ The estimated capacity from the industrial waste is around 1300 MW, 2500 MW from urban waste and 16000 MW from biomass.
- ❖ The subsidy varies from Rs.20 lakhs to Rs.3.00 Crores per MW, which varies with technology.
- ❖ We adopt the European technology.
- ❖ 1 MW Biogas based power plant using cattle dung exists at Ludhiana and 1.2 MW power plant is coming up at Madhya Pradesh.
- ❖ 1.6 MW power plant using fruit and vegetable waste at Jalgaon is coming up.
- ❖ Mixed feed based Biogas power plant is more advantages from feedstock availability / price point of view.
- ❖ 2 MW subsidy limit is applicable only for non-industrial waste based power plants and maximum subsidy for a project is Rs.5 Crores.
- ❖ In small plant, productivity is less.
- ❖ Plant capacity and command area for fuel should be optimized; otherwise transport cost of fuel feed stock will become high.

**Thiru. N.Balakrishnan, Chief Engineer/NCES/TANGEDCO** stated the following:

- ❖ We are getting firm power from 27 Co-generation and 18 bio-gas power plants. Therefore, we should get reasonable tariff
- ❖ There is also an option of third party sale

**Member-I** remarked that if it is 3<sup>rd</sup> party sale, the Commission does not have a role, as the tariff for 3<sup>rd</sup> party sale is not regulated.

**Thiru. N.Balakrishnan, Chief Engineer/NCES/TANGEDCO** stated the following:

- ❖ We will take the power, if the tariff is reasonable.
- ❖ Questioned M/s.Grameena about getting more energy from bio-gas power plant for specific fuel.

**Mr. K. Krishan** was affirmative to the question raised by the Chief Engineer/NCES/TANGEDCO and explained the various processes involved in bio-gas generation. Stressed on the importance of silage preparation and superior quality feeding of animal feed. Sustainability of feed stock is more important than the size of the plant.

**Member-I** sought comments on the following parameters:

- (a) Plant Load Factor
- (b) Debt-Equity ratio – 70:30
- (c) Term of the loan – 10-12 years

The general consensus was that the plant load factor could be high and comparable to CCGT plants. As regards Debt-Equity ratio 70:30 was generally accepted. As regards tenure of the loan, the following comments were offered:

**Thiru. Ankur Jain, M/s. Ankur scientific energy technologies Pvt. Ltd.** stated that the tenure of term loan cannot be more than 7 years.

**Thiru. T.R. Krishnaswamy, Director, Energreen Power Ltd.** stated that the term of loan can be maximum of 7 years.

**Mr. K. Krishan** stated that they have proposed term loan for 10 years because of their background and it can not be treated as a bench mark for other projects. 7 years is more realistic.



**Thiru. Ankur Jain, M/s. Ankur scientific energy technologies Pvt. Ltd.** stated that the interest on loan can be in the range of 12-14%.

**Mr. K. Krishan** suggested the interest on loan of around 13.1% with the SBI base rate of 7.6% is realistic. For small promoters 12.5% to 15% may be considered due to their credit rating.

**Thiru. T.R. Krishnaswamy, Director, Energreen Power Ltd.** suggested the interest rate of SBI PLR rate with half percent addition.

**Member-I** sought for clarification from MNRE on subsidy issue.

**MNRE** representative clarified that they provide only capital subsidy and there is no concessional lending from IREDA.

**Member-I** sought for comments on Return on Equity:

### **Return on Equity**

**Mr. K. Krishan** stated that they expect RoE of 19% pre-tax due to high risk profile.

**Member-I** clarified that there are differences in the proceeding before the CERC and SERCs. While buyers are not appearing before the CERC, they appear before SERCs. CERC may not receive any major objections from the ultimate buyers. TANGEDCO's major concern is that all costs have to be patted on to the consumers.

**TANGEDCO** stated that 2 MW Biogas plant by Sastha Energy at Vellore has a generation cost of Rs.2.63 per unit. The capital cost of the 2 MW power plant is

11 Crores and the interest on loan to be 12% and the tenure of loan should be 10 years.

**Member-I** remarked that the longer the term of the loan, the tariff is not front loaded.

**Thiru. Ankur Jain** commented that the term of the loan may be checked with commercial banks.

**Member-II** enquired about the lending rates of PFC and REC.

**Mr. K. Krishan** stated that the REC lends only to the Govt. projects and PFC does not support less than 10 MW projects. RoE should be 19% pre-tax or 16% post tax.

**Thiru. T.R. Krishnaswamy** stated that in the initial stages of the projects, there should be a guaranty of high IRR with incentives and may be reverted to standard norms later to attract investments.

**Member-I** commented that if such precedence is created now, it can not be changed later. He sought for comments on life of the plant and depreciation.

### **Plant life and Depreciation**

**MNRE** stated that the digesters are made up of concrete and the life span for this civil work can be more than 30 years. The life for electro-mechanical parts shall be 10 years.

**Member-I** asked why the life span should be restricted to 10 years when maintenance can push it beyond 10 years.

**Member-II** said that the life might have been indicated by the manufacturer of the engine.

**Thiru. Ankur Jain** stated that life span of the gasifier would be between 10-20 years, while engine can have only 10 years. The imported engines from U.S would have a life of 15 years, but the cost is higher by 2 to 2.5 times the locally made engines.

**Thiru. T.R. Krishnaswamy** stated that after running of around 25,000 to 35,000 hours, the older machines can be exchanged with new one with 60% of the current cost. The R&M cost would be 4-5% of the capital cost.

**Member-I** stated that the depreciation may be on straight line method.

**TANGEDCO** stated that the life of the plant would be 20 years and if the maintenance is better, it can be extended to 25 years also.

**Dr. S. Dasappa** stated that the life of the plant can not be more than 15 years and the reasonable life period is 10 to 15 years.

**Thiru. Ankur Jain** stated that 20 to 25 years would be the life of the boiler. As per M/s. Cummins India, the life can not be more than 10 years.

**Member-I** enquired about the fair life of the plant as per GOI notification of 1994.

**Dr. S. Dasappa** there is no enough data available with the GOI for bio-gas.

**Thiru. Ankur Jain** stated that we can go as per the manufacturers' recommendations by getting necessary inputs. Even for the Natural gas based power plants, the life is not more than 20-25 years.

**Member-I** clarified that if the manufacturers recommendations are considered, they would load all the costs on O&M and decrease the capital cost. This is a dicey situation and therefore the life of the plant has to be fixed. Commission will also examine other types of experiences. He also invited comments on the capital cost.

### **Capital Cost**

**Thiru. K. Krishan** stated that the plant at Ludhiyana can be considered as the bench mark. The cost in Europe is 3-3.5 Million Euros per MW for IGCC power plant. As per the HERC order, the capital cost is Rs.10.5 Crores per MW.

**MNRE** suggested Rs.10 Crores per MW, which would be reduced further once the larger projects come. Customs and Excise duties are exempted. Even though the competition is increasing, the cost may not come down like solar power plant.

**Thiru. K. Krishan** stated that entire technology is transferred from Germany.

**Dr. Dasappa** stated that gasification technology is moving from India to overseas. Therefore, volume will really reduce the costing.

**Thiru. Ankur Jain** stated that for biomass gasification, the cost would be Rs.7 to Rs.8 Crores/MW. GE and Caterpillar are the only two manufacturers of Gas engines in India and therefore the delivery duration is increased and the cost will not be coming down.

**TANGEDCO** stated that machineries cost will be around Rs.3.60-4.00 Crores/MW. The total cost would be Rs.5 Crores/MW including civil cost.

**Member-II** enquired about the details given by others.

**Thiru. Ankur Jain** replied that per MW cost will come down for large capacity projects.

Then, **Member-I** requested the audience to comment on O&M expenses including insurance.

### **O&M Expenses**

**Thiru. K. Krishan** stated that Grameena has sought 5.82% of capital cost while HERC have accepted 6% of capital cost.

**Thiru. Ankur Jain** stated that the overall O&M Cost would be 9-9.5% of fixed cost.

**Member-I** enquired about the process of fixing the tariff in HERC.

**Thiru. K. Krishan** has stated that they conducted public hearing before fixing tariff.

**TANGEDCO** stated that the O&M expenditure would be around 40 paise/unit.

**Member-I** stated that the Commission can also refer the data furnished by CMWSSB.

**MNRE** stated that the number of hours of operation in CMWSSB case is very low and hence their O & M cost may also be low. Besides sewage is directly used and not processed like Bio-Gas plant.

**Thiru. K. Krishan** has stated that their capital cost is higher as compared to CMWSSB's cost.

**Thiru. Ankur Jain** stated that the man power cost is high and hence O&M cost will also be high, to which **Member-I** stated that automation may take care of the man power cost.

**Member-I** sought for comments on Components of Working Capital and Interest on Working Capital.

**Working capital and Interest on Working Capital**

**Thiru. T.R. Krishnaswamy** stated that 17-18% will be the interest on working capital.

**Thiru. Ankur Jain** stated that in Gujarat 2-3 months of the receivables and 45 days fuel stock are component of working capital. During monsoon period, sufficient storage of fuel stock is required.

**Member-I** stated the Commission is guided by CERC norms and if the buyer pays in time under LC basis, a discount of 2.5% is offered whereas 1% discount is offered if the payment is made within 30 days.

**Member-II** stated that in Tamil Nadu there is no continuous rain and therefore storage is not an issue.

**Thiru. T.R. Krishnaswamy** stated that during monsoon harvesting is an issue due to which, cost would increase.

**Member-I** sought comments on Station Heat Rate, Fuel Cost and Calorific Value of Fuel.

**Station Heat Rate, calorific value and cost of fuel**

**Thiru. K. Krishan** stated that Biogas yield is more important than calorific value.

**Member-I** stated that more analysis needs to be done in this matter.

**Thiru. K. Krishan** replied that enough analysis is available for SHR.

**MNRE** stated that Biogas is related to volatile solids. Every kg of volatile solids yields of 800 litres.

**Thiru P. Muthusamy, Director (Engg.)** enquired **Thiru. K. Krishan** about the SHR in their DPR.

**Thiru. Ankur Jain** stated that Calorific Value of gas of 3800 kcal can be considered.

**Dr. S. Dasappa** stated that SHR can be fixed based on the boiler based power generation of 3800-4000 kcal. 5 MW rankine cycle can also be achieved in Biogas based power generation also.

**Member-I** sought comments on Fuel Cost and stated that the naphtha based generation projects are being converted into natural gas based power generation due to increase in cost of naphtha. Similar situation of captive market should not happen in this case.

**Thiru. K. Krishan** has replied that biomass prices will track coal prices.

**Member-I** stated that the fuel for Biogas plants should be mixed one. He enquired the M/s. Grameena Abhivrudhi Mandali whether they have any long term contract for fuel supply to which Thiru. K.Krishan replied that they do not have any long term contract with poultry farmers.

**Dr. S. Dasappa** suggested that such projects should have multi fuel capabilities.

**Dr. R. Christodas Gandhi, IAS, CMD, TEDA** stated that the solar power plant uses free resources. The Biogas gives clean energy and also cleaning the environment. Therefore, Biogas power plant deserves special tariff as compared

to other NCEs based power plant including solar. Total potential in Tamil Nadu will not exceed 200 MW in 5-10 years and this will not impact much on the tariff of distribution licensee.

**Member-I** enquired about the cost of the poultry litter.

**Thiru. K. Selvaraj** replied that the cost is around Rs.1400/tonne and only in rainy season, the poultry wastes are being sent to Kerala.

**Thiru. P. Venkatachalam, TNAU** stated that the poultry litter is sent to Kerala for cultivation of button mushrooms.

**Dr. R. Christodas Gandhi** asked **Thiru. K. Selvaraj** about the possibility of making long term contract of poultry waste with the promoters. He also stated that TNPCB can bring some regulation on transporting poultry litter for safeguarding the environment.

**Dr. S. Balaji, TNPCB** stated that for transporting of poultry waste up to 5 kms distance, there is no restriction.

**Thiru P. Muthusamy, Director (Engg.)** enquired about the research done regarding calorific value of poultry fuel to which **Dr. R. Christodas Gandhi** replied that they have done availability study on poultry waste in which some reference have been made on calorific value and the same will be ready in two months.

**Thiru. Ankur Jain** stated that there is no complication in gasification. Biomass is preprocessed at Rs.400/tonne.

**Member-I** sought comments on auxiliary consumptions.



### **Auxiliary Consumption**

**Thiru. K. Krishan** replied that the digestive treatment part consumes major power and it alone would be more than 5%.

**Dr. S. Dasappa** stated that it would be comparable to biomass gasification.

**Member-I** said that auxiliary consumption of Metro Water can be taken on record.

**TANGEDCO** submitted that auxiliary consumption would be 10% without feedstock processing.

**Member-I** sought comments on sharing of CDM benefits.

### **CDM Benifits**

**Thiru. K. Krishan** replied that there is no methodology for organic fertilizers due to methane mitigation.

**Member-I** enquired about the efforts taken by the investors to get the CDM benefits.

**TANGEDCO** replied that the sharing should be 50: 50.

**Thiru. T.R. Krishnaswamy** stated that formula should be based on the transaction cost involved in obtaining the CDM benifits.

### **Duration of EPA**

**Member-I** stated that the EPA duration may be co-terminous with the life of the project.

Regarding infrastructure development charge, **Member-I** enquired about the evacuation voltage.

**TANGEDCO** replied that the evacuation voltage would be 11/22 KV.

**Member-I** stated that it can be site specific and the matter of Infrastructure Development Charge is subjudice. He requested TANGEDCO to consult within their organization and revert back to the Commission.

Regarding manure cost, **Member-I** stated that the bye-product pricing is to be accounted for, for arriving at the sale of rate of electricity.

**Thiru. K. Krishan** has replied that Rs.2000/tonne is the cost of the by product.

**Thiru P. Muthusamy, Director (Engg.)** enquired about the % of by product over the fuel quantity.

**MNRE** stated that Rs.2000/tonne is optimistic.

**Dr. S. Balaji, TNPCB** stated that Rs.500-1500/tonne is reasonable. The by-product cost from the municipal waste has increased from Rs.5/kg to Rs.60/kg.

**Thiru. K. Krishan** stated that the average tariff in Europe is around 8 Euro/unit.

**Dr. S. Dasappa** stated that the cost of the by product would be around Rs.15-40/kg or 3-4% of the input material.

**Thiru. P. Venkatachalam, TNAU** stated that the cost of value addition to the by product cost is high.

**Thiru. T.R. Krishnaswamy** stated that the cost of the by product would be around 3-4% of the input cost. In India, the market for bio-char is very low.

**Member-I** sought for comment on PLF.

**Thiru. Ankur Jain** stated that 80% PLF is reasonable.

**Thiru. K. Krishan** replied that they are requesting a generic tariff for the benefit of all.

Finally **Member-I** and **Member-II** thanked all the participants for their valuable suggestions.

**Sd/-**  
**Secretary,**  
**Tamil Nadu Electricity Regulatory Commission**

**TAMIL NADU ELECTRICITY REGULATORY COMMISSION**  
**Consultative Paper on “Procurement of Power from Biogas and**  
**Biogasification based Power Plants”**

***(Comments/Suggestions are invited on or before 25-08-2011)***

**1.0 Need for the consultative paper:**

1.1 Commission in its hearing held on 03-12-2010 on the petition filed by M/s. Pallava Water and Power Pvt. Ltd. (P.P.A.P. No. 6 of 2010) for fixation of tariff to their proposed poultry litter based Biogas plant, has passed the following order:

*“Petition admitted. Consultative paper be prepared after consultation with the Expert Committee and thereafter the matter may be taken to the State Advisory Committee. An expert committee may be convened for the purpose.”*

Accordingly, an expert committee meeting on power generation based on Biogas / Biogasification technology was conducted by the Commission on 18-02-2011.

1.2 As per MNRE report, the potential for Biogas power plants using the bio waste generated by Sago & Starch mills and Poultry farms in Salem and Namakkal districts is around 100 MW. Such Biogas plants will also address the environment pollution caused by Sago & Starch mills and Poultry farms waste significantly.

1.3 Similarly, there is a considerable potential for bio-gasification based power generation in Tamil Nadu due to availability of biomass. Bio-gasification systems are inherently clean, relatively efficient, and commercially available for converting inexpensive fuels such as biomass. Biogas and Biogasification based power generation will create local employment and community development. Commission feels that a focused effort should be made to implement such Biogas / bio-gasification based power plants. Considering the above, the Commission floats this Consultative Paper to elicit the views of stakeholders.

## **2.0 Technology**

### **2.1 Biogas**

2.1.1 Biogas is a clean fuel produced through anaerobic digestion of a variety of organic wastes such as animal, agricultural, domestic and industrial wastes. The anaerobic digestion comprises three steps, namely, -

1. Decomposition (hydrolysis) of plant or animal matter to break down complex organic materials into simple organic substances,
2. Conversion of decomposed matter into organic acids, and
3. Conversion of acids into methane gas.

Biogas consists of methane and carbon-di-oxide and traces of other gases such as hydrogen, carbon monoxide, nitrogen, oxygen and hydrogen sulphide. The percentage of methane in the gas determines its calorific value as the other constituents do not contribute to the energy content. This gas has a relatively high calorific value (5000 kCal/m<sup>3</sup>).The methane content of Biogas is appreciably high, at 60%.

2.1.2 In India, especially in Tamil Nadu, biodegradable organic wastes such as cow dung, kitchen waste, Sago & Starch Mills / Poultry farms waste, etc. can be potential energy sources for power generation from Biogas based power plants.

2.1.3 There are also collateral benefits of the by-products from the Biogas plants such as superior quality organic fertilizer and waste heat utilization of Biogas engines, either to meet thermal energy needs of Sago mills or to establish cold storages.

### **2.2 Biogasification**

Gasification is a process in which solid biomass material (wood waste, agro residues, branches and twigs of plants etc.) is subjected to partial combustion in

the presence of a limited supply of air. The ultimate product is a combustible gas mixture termed as producer gas. This gas has a relatively low calorific value (900 – 1110 kCal/m<sup>3</sup>). The typical composition of this gas is methane, carbon monoxide, hydrogen, nitrogen and carbon-di-oxide. This gas can be burnt easily and used for process heat or power generation. The plants operate totally on biomass with absolutely no input of fossil fuels.

### **2.3 Benefits**

1. These technologies eliminate all the pollution related problems associated with biomass power plants.
2. The leftover sludge in the Biogas plant is a valuable by-product, extremely useful in farms. While it keeps its nutrients for the crops, with the gas removed, the fertiliser does not smell. It can be sprayed directly onto the crops.
3. Biogas is a renewable, low carbon fuel that is already widely, and often economically available throughout the country. Its production and use also brings additional environmental and social benefits. Correctly managed, Biogas is a sustainable fuel that can deliver a significant reduction in net carbon emissions when compared with fossil fuels.
4. It leads to employment generation in the rural areas.
5. The Plant Load Factors of these power plants are high when compared to other renewable power plants.
6. It has a very short gestation period of a few months.

## **3.0 Legislative and Regulatory Framework for development of Biogas / bio-gasification based power Projects.**

### **3.1 Related Provisions of Electricity Act, 2003**

*Section 3(1): The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilisation of resources*

*such as coal, natural gas, nuclear substances or materials, **hydro and renewable sources of energy.***

*Section 61(h): The Appropriate Commission shall, subject to the provisions of this Act, specify the terms and conditions for determination of tariff and in doing so shall be guided by the following namely,*

*(h) the promotion of cogeneration and generation of electricity from renewable sources of energy,*

*(i) the National Electricity Policy and Tariff Policy.*

*Section 62(1)(a): The appropriate Commission shall determine the tariff in accordance with the provisions of this Act for –*

*(a) supply of electricity by a generating company to a distribution licensee:*

*Section 62(2): The appropriate Commission may require a licensee or a generating company to furnish separate details, as may be specified in respect of generation, transmission and distribution for determination of tariff.*

*Section 62(5): The Commission may require a licensee or a generating company to comply with such procedures as may be specified for calculating the expected revenues from the tariff and charges which he or it is permitted to recover.*

*Section 86(1)(e): The State Commission shall promote cogeneration 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, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee.*

### **3.2 Related Provisions of National Electricity Policy:**

*“5.2.20 Feasible potential of non-conventional energy resources, mainly small hydro, wind and bio-mass would also need to be exploited fully to create additional power generation capacity. With a view to increase the overall share of non-conventional energy sources in the electricity mix, efforts will be made to encourage private sector participation through suitable promotional measures.”*

*“5.12.2 The Electricity Act 2003 provides that co-generation and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time*

*before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies.”*

### **3.3 Related Provisions of National Tariff Policy:**

*Para 6.4“(1) Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by April 1, 2006. It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission.*

*(2) Such procurement by Distribution Licensees for future requirements shall be done, as far as possible, through competitive bidding process under Section 63 of the Act within suppliers offering energy from same type of non-conventional sources. In the long-term, these technologies would need to compete with other sources in terms of full costs.”*

### **3.4 Commission’s Regulations on Power Procurement from New and Renewable Sources:**

In exercise of the powers conferred under section 61(h) read with section 86(1)(e) and section 181 of the said Electricity Act, 2003, the Commission notified the “Power Procurement from New and Renewable Sources of Energy Regulations 2008” on 8.02.2008.

### **4.0 Power position in Tamil Nadu**

4.1 The generating capacity connected to TNEB’s grid including the allocation from Central Generating Station is 10,214.55 MW as on 01-04-2011 comprising 2,970 MW from TNEB’s four thermal stations, 516 MW from four gas turbine stations, 2,187 MW from 33 hydro stations, 17.55 MW from TNEB’s wind farm, 1,180 MW from private sector power projects, 214 MW as contribution to Tamil Nadu grid by sale of electricity from captive generating plants, 2,825 MW as Tamil Nadu’s share from central generating stations and 305 MW as external assistance.



4.2 Generating capacity from privately owned wind farms is 5,887.165 MW as on 01-04-2011. The installed capacity of cogeneration in sugar mills is 609.9 MW and biomass power project is 139.09 MW. The installed capacity of Solar PV power project is 5 MW.

4.3 The average power availability during the last quarter of 2010-11 was around 9,000 MW. The expected peak demand for 2011-12 may vary from 11,000 to 11,500 MW which leaves a deficit of around 2,000 to 2,500 MW. The deficit in the State is likely to continue for few more years since the capacity addition in the next few years is expected to be less than the projected increase in demand. Therefore, any capacity addition will help the State to a great extent to tide over the shortage of power prevailing in the State.

#### **5.0 Biogas / Biogasification power projects in Tamil Nadu**

As of now, four grid connected bio-gas power plants to the tune of 5.85 MW and one grid connected bio-gasification Power Plant of 2 MW capacity are in service in Tamil Nadu. Apart from the above, there are many off-grid bio-gas / bio-gasification based power plants in Tamil Nadu.

#### **6.0 Applicability of proposed order**

The order shall come into force from the date of its issue. The tariff fixed in the proposed order shall be applicable to all the Biogas / Biogasifier based power generation projects commissioned on or after the date of this order. It should be noted that the existing contracts and agreements between the Biogas / Biogasifier generators and the distribution licensee signed prior to this order would continue to remain in force. However, the Biogas / Biogasifier generators and the distribution licensee shall have the option to mutually re-negotiate the existing agreements / contracts in line with this order before the expiry of the contracts / agreements. Any renewal of the said contracts / agreements, new contracts / agreements shall be in conformity with this order.

## **7.0 Tariff Determination Process**

With regard to tariff determination process, the relevant portion of Regulation 4 of the Power Procurement from New and Renewable Sources of Energy Regulation, 2008 is reproduced below:

*The Commission shall follow the process mentioned below for the determination of tariff for the power from new and renewable sources based generators, namely;-*

- a) initiating the process of fixing the tariff either suo motu or on an application filed by the distribution licensee or by the generator.*
- b) inviting public response on the suo motu proceedings or on the application filed by the distribution licensee or by the generator.*
- c) issuing general / specific tariff order for purchase of power from new and renewable sources based generators.*

In accordance with the above regulations, the Commission has prepared this consultative paper to elicit the views and suggestions of the stake holders.

## **8.0 Tariff / Pricing Methodology**

The relevant portion of Tariff / Pricing Methodology as specified in Regulation 4 of the Commission's above said Regulation is reproduced below.

*(2) While deciding the tariff for power purchase by distribution licensee from new and renewable sources based generators, the Commission shall, as far as possible, be guided by the principles and methodologies specified by:*

- (a) Central Electricity Regulatory Commission*
- (b) National Electricity Policy*
- (c) Tariff Policy issued by the Government of India*
- (d) Rural Electrification Policy*
- (e) Forum of Regulators (FOR)*
- (f) Central and State Governments*

*(3) The Commission shall, by a general or specific order, determine the tariff for the purchase of power from each kind of new and renewable sources based generators by the distribution licensee.*

*Provided where the tariff has been determined by following transparent process of bidding in accordance with the guidelines issued by the Central Government, as provided under section 63 of the Act, the Commission shall adopt such tariff.*

*(4) While determining the tariff, the Commission may, to the extent possible consider to permit an allowance / disincentive based on technology, fuel, market risk, environmental benefits and social impact etc., of each type of new and renewable source.*

*(5) While determining the tariff, the Commission shall adopt appropriate financial and operational parameters.*

*(6) While determining the tariff the Commission may adopt appropriate tariff methodology.*

### **8.1 Preferential tariff or by bidding process**

8.1.1 In this connection, it is relevant to discuss the following stipulations of National Tariff Policy which are reproduced below:

**Section 6.4(1):** ..... *It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the appropriate Commission.*

**Section 6.4(2):** *Such procurement by distribution licensees for future requirements shall be done, as far as possible, through competitive bidding process under Section 63 of the Act within suppliers offering energy from same type of non-conventional sources. In the long-term, these technologies would need to compete with other sources in terms of full costs.*

8.1.2 There are very few grid connected Biogas / Biogasification based power plants in Tamil Nadu. The cost of generation from Biogas / Biogasification based power plants are generally higher than the coal based generation. These plants are not in a position to compete with conventional power plants in terms of tariff. Hence, it is felt that the Biogas / Biogasification based power plants should be promoted at preferential tariff. It also promotes local community development and creates local employment. It helps to exploit the biomass / wastes from cattle, birds, industries in the State. Therefore, the Commission proposes that the energy procurement from Biogas / Biogasification based power plants by distribution licensees shall be done at preferential tariff as determined by the Commission as per 6(4) (1) of the tariff policy.

## **8.2 Project Specific or Generalized Tariff**

A Generalized tariff mechanism would provide incentive to the investors for use of most efficient equipment to maximize returns and for selecting the suitable site while a project-specific tariff would provide each investor, irrespective of the machine type, the stipulated return on equity which, in effect, would shield the investor from the uncertainties involved. Capacity of most of the proposed Biogas / Biogasification based power plants is limited to a few MWs. Almost, the conditions prevail in different sites are same. Hence, it is not advisable to adopt project specific tariff in such a context. It is suggested that the Commission may issue a generalized tariff order for Biogas / Biogasification based power plants. It is proposed that whenever there is a petition from large Biogas / Biogasification based power plants, the Commission may consider project specific tariff order.

## **8.3 Cost-Plus Tariff Determination**

Cost-plus tariff determination is a more practical method. It can be easily designed to provide adequate returns to the investor and a surety of returns will lead to larger investment in Biogas / bio-gasification based power plants. It is also in line with Regulation 4(6) of "Power Procurement from New and Renewable Sources of Energy Regulations 2008".

## **8.4 Single Part vs. Two Part Tariff**

The tariff of bio-gas / bio-gasification based power plants depends upon the availability and cost of the fuel. The availability and cost also varies with location and season. Therefore, two part tariff is proposed for bio-gas / bio-gasification based power plants. Two part tariff is applied in order to recover fixed and variable costs through the fixed and variable components of tariff. Variable component of tariff takes care of the escalation in fuel price.

## **9.0 Tariff Components**

The Commission has carried out a detailed analysis of the existing policies/procedures and commercial mechanisms in respect of power generation

from Biogas / Biogasification based power plants. The tariff determined in a cost-plus scenario, would depend significantly on the following operating and financial parameters:

1. Capital investment
2. Plant Load factor
3. Debt-equity ratio
4. Term of Loan and Interest
5. Life of plant and machinery
6. Depreciation rate applicable
7. Interest on working capital
8. Return on equity
9. Operation and maintenance expenses
10. Auxiliary consumption
11. Fuel cost, Calorific value of fuel, Station Heat Rate and cost of By-product
12. Tariff rate

Each of the above parameters are discussed below in detail.

## **9.1 Capital Investment**

### **9.1.1 Gross capital cost**

9.1.1.1 The capital cost is one of the most important parameters for Biogas / Biogasification based power projects tariff determination. The cost of the gas engines is an important factor in determination of overall cost of the plants. The details of capital cost furnished by various agencies are tabulated below:

<b>Sl. No.</b>	<b>Agencies and reference</b>	<b>Capital Cost (Rs. in Crores /MW)</b>	
		<b>Biogas power plants</b>	<b>Biogasification based power plants</b>
1.	MNRE (Letter dated 19-07-2010)	Rs.12 Crores for 1 MW plant and Rs.11 Crores/MW for 2 MW power plants.	
2.	IREDA (Letter dated 25-	Rs.7.87 Crores/MW	Rs.5.82

	03-2011)		Crores/MW
3.	TEDA (Letter dated 20-04-2010)	Rs.8 Crores/MW (Sago based) Rs.10 Crores/MW (Poultry litter based)	
4.	Gujarat ERC (Order No. 2 of 2007)	----	Rs.2 Crores/MW after adjusting CFA of Rs.1.5 Crores/MW.
5.	Haryana ERC (Order dated 21-09-2010)	Rs.10.5 Crores/MW (Poultry based)	
6.	CMWSSB	Rs.12.54 Crores/MW to 11.14 Crores/MW for Perungudi and Nesapakkam STP.	
7.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	Rs.10 Crores/MW	

9.1.1.2 Mr. Krishan, M/s. Grameena Abhivrudhi Mandali (Chairman of SPV M/s.Pallava Water and Power (P) Ltd.) in his presentation during the Expert Committee meeting held on 18-02-2011 has stated that the capital cost of the proposed Biogas project is Rs.10 Crores/MW with Rs.1.5 Crores/MW as subsidy from MNRE. The Chennai Metro Water and Sewerage Board (CMWSSB) in their presentation have stated that the latest capital cost of the project is around Rs.20.00 Lakh / ML of sewage.

9.1.1.3 Indian Renewable Energy Development Agency (IREDA) a financing institution of Government of India, has reported a capital cost of **Rs. 7.87 Crores / MW for Biogas power plants and Rs.5.82 Crores / MW for Biogasification based Power Plants**. Commission proposes that it is prudent to adopt the capital cost furnished by IREDA. The capital cost furnished by IREDA is inclusive of power evacuation cost.

### **9.1.2 Capital Subsidy**

MNRE has provided Central Financial Assistance (CFA) of Rs.1.5 Crores / MW to the grid connected power projects with 100% producer gas engines. Similarly, the CFA provided for a Biogas power project is Rs.1.5 Crores / MW. Hence, the Commission considers that the above capital subsidy shall be available for such projects and therefore shall be reduced from the capital cost.

### **9.1.3 Infrastructure Development Charge for evacuation of power.**

9.1.3.1 The Hon'ble Appellate Tribunal for Electricity in its judgment dated 08-01-2010 against the Appeal No. 93/2009 filed by TNEB has ruled that a generating company is liable to pay the TNEB the Infrastructure Development Charges (IDC) fixed by the TNEB for establishing, operating and maintaining the sub-stations on behalf of the generators to do the evacuation work. Therefore, the generating company is liable to pay the Infrastructure Development Charges (IDC) to the Distribution Licensee / State Transmission Utility for establishing, operating and maintaining the sub-stations. The matter with regard to levy of IDC is subject to the outcome of the Civil Appeal No.1304 of 2010 filed by Indian Wind Energy Association before the Hon'ble Supreme Court of India.

9.1.3.2 As the project cost furnished by the IREDA is already inclusive of IDC, it is not necessary to reload the IDC cost to be collected by the Distribution Licensee / State Transmission Utility with the project cost.

### **9.1.4 Net Capital Cost**

After deducting the capital subsidy, the net capital cost works out as follows:

**Biogas Plants: [7.87 – 1.5) = 6.37] Rs. 6.37 Crores per MW.**

**Biogasification based Plants: [5.82 – 1.5) = 4.32] Rs.4.32 Crores per MW.**

This net capital cost is inclusive of all the costs such as plant and machineries, civil works, land cost/rent/lease, Power evacuation cost, etc.

## 9.2 Plant Load Factor (PLF)

9.2.1 PLF has always been a parameter of utmost importance. Normative values of PLF of Biogas / Biogasification based power projects adopted by various agencies are as follows:

Sl. No.	Agencies and reference	PLF in %	
		Biogas power plants	Biogasification based power plants
1.	MNRE (Letter dated 19-07-2010)	80%	
2.	IREDA (Letter dated 25-03-2011)	80%	80%
3.	TEDA (Letter dated 20-04-2010)	60-70% (Sago based) 80% (Poultry litter based)	
4.	Gujarat ERC (Order No. 2 of 2007)		80%
5.	Haryana ERC (Order dated 21-09-2010)	65% - First year 80% - Subsequent years	
6.	CMWSSB	25-40%	
7.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	90%	

9.2.2 The petitioner M/s. Pallava Water and Power (P) Ltd. claims 90% PLF for their project. But, this concept paper demands for generalized tariff order. It is reasonable to adopt the PLF recommended by IREDA for both Biogas and Biogasification based power plants. **Therefore, Commission proposes 80% PLF for both Biogas and Biogasification based power plants.**

## 9.3 Debt-equity ratio

The Tariff Policy lays down a debt equity ratio of 70: 30 for power projects. The Commission has proposed to adopt this ratio as specified in its Tariff Regulations 2005.



#### 9.4 Term of the Loan and interest

9.4.1 The interest rates suggested / adopted by various agencies are as follows:

Sl. No.	Agencies and reference	Interest on Loan	
		Biogas power plants	Biogasification based power plants
1.	IREDA (Letter dated 25-03-2011)	12.25%	12.25%
2.	TEDA (Letter dated 20-04-2010)	13% (Sago based) 14.29% (Poultry litter based)	
3.	Gujarat ERC (Order No. 2 of 2007)		12%
4.	Haryana ERC (Order dated 21-09-2010)	12.75%	
5.	CMWSSB	10%	
6.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	11% for 50% of INR debt 6% for 50% of Euro debt	

9.4.2 CERC has considered the long-term PLR of State Bank of India plus 150 basis points as adequate. Mr. Krishan, M/s. Grameena Abhivrudhi Mandali (Chairman of SPV M/s.Pallava Water and Power (P) Ltd.) in his presentation during the Expert Committee meeting held on 18-02-2011 has stated that they got cheaper loan due to their tie up with European firms. The Commission fixed a tenure of ten years with moratorium of one year and 12% interest in its Tariff Order Nos.1, 2 and 3 of 2009 and 1 and 2 of 2010 as suggested by IREDA at that time. IREDA has now recommended 12.25% interest rate. **Therefore, the Commission proposes to adopt the interest rate of 12.25% with loan tenure of 10 years with 1 year moratorium period.**

#### 9.5 Life of Plant and machinery

9.5.1 The life of Biogas / Biogasification based power projects suggested / adopted by various agencies are tabulated below:

Sl. No.	Agencies and reference	Life of the Plant	
		Biogas power plants	Biogasification based power plants
1.	MNRE (Letter dated 19-07-2010)	Civil works – 30 years Electro-Mechanical equipments – 10 years	
2.	IREDA (Letter dated 25-03-2011)	20 years 5% for equipments and 10% for others.	20 years 5% for equipments and 10% for others.
3.	TEDA (Letter dated 20-04-2010)	20 years (Sago based) 20 years (Poultry litter based)	
4.	Gujarat ERC (Order No. 2 of 2007)		20 years
5.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	10 years	

9.5.2 Most of the experts participated in the expert committee meeting held on 18-02-2011 have stated that the life of the Biogas plant can not be more than 15 years. Therefore, Commission proposes to consider a useful life of 15 years for Biogas plants and 20 years for bio-gasification plants.

## 9.6 Depreciation

M/s.Pallava Water and Power (P) Ltd. considered depreciation of 4.5 % in their petition filed before TNERC vide PPAP 6 of 2010. The CERC's renewable regulations recommended 'Differential Depreciation Approach' over loan tenure and period beyond loan tenure over useful life computed on 'Straight Line Method'. Since the Commission proposed to consider 'cost plus single part average tariff' for fixing tariff in this case, 'Differential Depreciation Approach' has not been considered. Hence, for the purpose of tariff determination, it is prudent to assume depreciation based on Straight Line Method (SLM) wherein the asset life is to be depreciated to a residual value of 10% of its initial value over the

entire asset life. This translates to an SLM depreciation rate of 6% per annum for Biogas projects and 4.5% for bio-gasification projects.

### 9.7 Interest on working capital

9.7.1 The working capitals suggested / adopted by various agencies along with the interest are as follows:

Sl. No.	Agencies and reference	Working capital	
		Biogas power plants	Biogasification based power plants
1.	IREDA (Letter dated 25-03-2011)	Raw material and O&M cost with 12.25% interest.	Raw material and O&M cost with 12.25% interest.
2.	TEDA (Letter dated 20-04-2010)	1.46 Crores (Poultry litter based)	
3.	Gujarat ERC (Order No. 2 of 2007)		Cost of fuel – 1 ½ months; O&M expenses – 1 month; Receivables – 2 months sale and Maintenance spares with 10.75% interest.
4.	Haryana ERC (Order dated 21-09-2010)	Receivables – 1 month sale with 12.25 % interest.	
5.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	1 Month O & M Charges +Maintenance Spares (15% of O & M charges) + 2 Months receivables from Debtors + 4 months Feedstock inventory with 12% interest.	

9.7.2 CERC fixed an interest rate equivalent to average State Bank of India short term PLR during the previous year plus 100 basis points.

9.7.3 Commission in its order Nos. 2 and 3 of 2009 has included the following components in the working capital with 12% interest:

1. Fuel stock-1 month,
2. O&M expenses – 1 month and
3. Receivables – 1 month.

9.7.4 Therefore, the Commission has proposed to adopt the above working capital with 12.25% interest rate as suggested by IREDA.

### 9.8 Return on Equity

9.8.1 The Return on Equity proposed / adopted by different agencies are tabulated below:

Sl. No.	Agencies and reference	Return on Equity	
		Biogas power plants	Biogasification based power plants
1.	TEDA (Letter dated 20-04-2010)	19% Crores (Poultry litter based)	
2.	Gujarat ERC (Order No. 2 of 2007)		14%
3.	Haryana ERC (Order dated 21-09-2010)	16%	
4.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	19%	

9.8.2 The Tariff Regulations of the Commission stipulates 14% post tax RoE for conventional fuel based generating stations. With the objective of promoting renewable energy, Commission in its NCES Tariff Order Nos.1, 2 and 3 of 2009 and 1 and 2 of 2010 have considered 19.85% pre-tax return on equity from 01-04-2009. The CERC has adopted RoE of 19% pre tax for the first ten years and 24% for the remaining 15 years for renewable projects. The Commission proposes to adopt 19.85% pre-tax return on equity for this order, which translates in to 15.5% post-tax.

## 9.9 O&M and Insurance expenses

9.9.1 The O&M expense includes the expenditure on manpower, repairs, spares, consumables and overheads. The O&M expenses suggested / adopted by other agencies are as follows:

Sl. No.	Agencies and reference	O&M expenses	
		Biogas power plants	Biogasification based power plants
1.	MNRE (Letter dated 19-07-2010)	Rs. 2 /kWh.	
2.	IREDA (Letter dated 25-03-2011)	3% of the capital cost for O&M and 0.5% for insurance	3% of the capital cost for O&M and 0.5% for insurance.
3.	TEDA (Letter dated 20-04-2010)	10% (Sago based) 5% (Poultry litter based)	
4.	Gujarat ERC (Order No. 2 of 2007)		7% of the capital cost with 5% escalation.
5.	Haryana ERC (Order dated 21-09-2010)	6% of the project cost	
6.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	5.25% of capital cost with 5.72% escalation	

9.9.2 IREDA has recommended 3% of the capital cost for O&M expenses and 0.5% for insurance, while HERC has considered 6% of the capital cost for the Biogas power plants. The GERC has considered 7% of the capitals cost for Biogasification based power plants. Commission considered O&M rate of 4.5% for plant and machineries with 5% escalation per year in its order No. 2 and 3 of 2009 for biomass and Bagasse based co-generation projects.

9.9.3 Unlike the biomass and Co-generation based power plants, the Biogas and Biogasification based power plants do not consist of boiler, turbine, high pressure and temperature pipelines, etc. **Therefore, Commission proposes to adopt the O&M cost of 3% of the capital cost for the first year with 5% escalation**

**thereafter for Biogas and Biogasification based Power Plants as recommended by IREDA.**

9.9.4 Regarding insurance expenses, Commission considered an insurance rate of 0.75% of the machinery cost for the first year with reduction by half a percent of the previous year's insurance cost every year thereafter in order No. 2 and 3 of 2009. IREDA has recommended an insurance cost of 0.5% of the capital cost for Biogas and Biogasification based power plants. Considering the nature of Biogas / Biogasification based power plants, **Commission proposes an insurance rate of 0.5% of the capital cost for the first year and to be reduced by half a percent of the previous year's insurance cost every year thereafter.**

#### **9.10 Auxiliary consumption**

9.10.1 In case of Biogas plant, considerable amount of power is required for the associated water treatment system that purifies and recycles the water to facilitate zero effluent discharge to the ground. The auxiliary consumption suggested / adopted by other agencies are as follows:

Sl. No.	Agencies and reference	Auxiliary consumption	
		Biogas power plants	Biogasification based power plants
1.	MNRE (Letter dated 19-07-2010)	10-12%	
2.	IREDA (Letter dated 25-03-2011)	10%	10%
3.	TEDA (Letter dated 20-04-2010)	14.60% (Sago based) 15% (Poultry litter based)	
4.	Gujarat ERC (Order No. 2 of 2007)		10%
5.	Haryana ERC (Order dated 21-09-2010)	12.74%	
6.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	13%	

9.10.2 Commission considered Auxiliary consumption of 10% in its order No. 2 and 3 of 2009 for biomass and Bagasse based co-generation projects. Considering the special nature involved in bio-gas plants such as effluent treatment system, etc. **it is proposed to consider 12% of auxiliary consumption for Biogas plants and 10% of auxiliary consumption for Biogasification based power plants.**

**9.11 Fuel cost, Calorific value of fuel, Station Heat Rate (SHR) and cost of by-product.**

9.11.1 The fuel cost, calorific value of fuel and station heat rate (SHR) suggested / adopted by other agencies are as follows:

Sl. No.	Agencies and reference	Fuel cost, Calorific value of fuel and SHR	
		Biogas power plants	Biogasification based power plants
1.	MNRE (Letter dated 19-07-2010)	Rs.1/kWh 4500-5000 Kcal/cum.	
2.	IREDA (Letter dated 13-01-2010)	Rs.450/Tonne at present (Poultry Litter based). 3000-3500 Kcal/kg.	Rs.2500/Tonne at present 3629 Kcal/kg.
3.	IREDA (Letter dated 25-03-2011)	5000 kCal/m <sup>3</sup> , 1 m <sup>3</sup> /4 kWh	1200 kCal/kg, 1 m <sup>3</sup> /1.4 kWh
4.	TEDA (Letter dated 20-04-2010)	Rs.1100/Tonne (Poultry litter based) 5000 Kcal/kg (Sago based) & 4300 Kcal/kg (Poultry litter based)	
5.	Gujarat ERC (Order No. 2 of 2007)		Rs.1000/Tonne with 5% annual escalation 3300 Kcal/kg. 4290 Kcal/kWh.
6.	Haryana ERC (Order dated 21-09-2010)	Rs.370/Tonne (Poultry litter based) Specific consumption 4.21kg/kWh	fuel

7.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	Rs.1020/Tonne with 5% escalation Specific fuel consumption 3 kg/kWh	
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9.11.2 The survey on efficiency of new generation gas engines reveals a range of 35% to 45% depending upon the capacity. Therefore, assuming an electrical efficiency of 40% for bio gas based power plants is reasonable and this translates in to the station heat rate of 2150 kCal/kWh. Regarding calorific value of the bio gas, the MNRE has reported a calorific value of 4500 to 5000 kCal/cum, whereas, the IREDA has mentioned a calorific value of 5000 kCal/cum. Since there is no data available on the conversion ratio of poultry litter in to Biogas, the above data could not be used to find out the specific consumption of fuel.

9.11.3 Regarding specific consumption of fuel, the Haryana ERC has specified 4.21 kg/kWh for poultry litter based Biogas power plants. The petitioner has reported a specific fuel consumption of 3 kg/kWh. Therefore, the Commission considered a specific consumption of 3 kg/kWh in this concept paper.

9.11.4 Regarding bio-gasification based power plants, the specific fuel consumption could not be arrived from the data furnished by different agencies. However, the Gujarat ERC has furnished a calorific value of 3300 kCal/kg and a Station Heat Rate of 4290 kCal/kWh which translates into a specific fuel consumption of 1.3 kg/kWh.

9.11.5 Regarding the cost of the fuel for Biogas based power plants, the HERC has considered a cost of Rs.370/tonne after adjusting the cost of by-product. The HERC has not furnished the cost of fuel or the by-product separately. Hence, the actual cost of the fuel could not be ascertained. The Commission proposes to adopt a fuel cost of Rs.1020/MT with 5% escalation as furnished by the petitioner.



9.11.6 The fuel cost for bio-gasification vary from state to state and is state specific. Commission in its order No. 2 of 2009 for biomass power plants has considered a biomass cost of Rs.2000/MT for the year 2009-10 with 5% escalation per year. This translates into a fuel cost of Rs.2200/MT for the year 2011-12. Therefore, Commission proposed to consider a biomass cost of Rs.2200/MT for the year 2011-12 with 5% escalation thereafter.

9.11.7 The by-product cost adopted by different agencies are as follows:

Sl. No.	Agencies and reference	Cost of by-product	
		Biogas power plants	Biogasification based power plants
1.	Petition filed by M/s.Pallava Water and Power (P) Ltd. Before TNERC vide PPAP 6 of 2010	Rs.110/Tonne with 5% escalation	
2.	Tamil Nadu Poultry Farmers Federation	Rs.1400/Tonne.	
3.	IREDA (Letter dated 25-03-2011)	Quantum of by-product – 0.20 MT (Manure from cow dung), Cost - Rs.2500/MT	Quantum of by-product – 0.038 MT (Charcoal), Cost - Rs.7500/MT

The Khadi & village industries Commission have also estimated the cost of bio-enriched manure as Rs.2268/Tonne.

9.11.8 Regarding, the benefit arrived due to sale of by-product, it is proposed to adopt the figure furnished by IREDA. IREDA has stated that the quantity of by-product for each tonne of fuel (cow dung) is 0.2 MT. If the same analogy is adopted here, the quantum of by-product for each unit of electricity is **0.6 kg / kWh**. Commission has proposed to adopt this quantity for arriving at the benefit accrued out of sale of by-product. Regarding cost of by-product, Commission has proposed to adopt **Rs.2500 / MT** as recommended by IREDA with 5% escalation in the manure price.

9.11.9 Regarding, bio-gasification based power plants, IREDA has stated that the quantum of by-product for each unit of electricity generated is 0.051 kg/kWh and the cost of by-product is Rs.7500 / MT.

9.11.10 It is proposed to deduct the per unit benefit from the sale of by-product from the total per unit cost of energy.

### 9.12 Tariff rate

9.12.1 The financial and operational parameters proposed in the paper are tabulated below:

Sl. No.	Financial and operational parameters	Financial and operational parameters considered	
		Biogas power plants	Biogasification based power plants
1.	Net Capital Cost	Rs.6.37 Crores/MW	4.32 Crores/MW
2.	PLF	80%	80%
3.	Loan tenure	10 years with 1 year moratorium period	10 years with 1 year moratorium period
4.	Interest on Loan	12.25%	12.25%
5.	Life of the plant	15 years	20 years
6.	Depreciation	6%	4.5%
7.	RoE	19.85% Pre-Tax	19.85% Pre-Tax
8.	O&M charges including insurance	3% of the capital cost with 5% escalation per year	3% of the capital cost with 5% escalation per year
9.	Insurance Expenses	0.5% of the capital cost for the first year and reduction by half a percent of the previous year's cost every year thereafter	0.5% of the capital cost for the first year and reduction by half a percent of the previous year's cost every year thereafter
10.	Working capital and interest	1. Fuel stock-1 month, 2. O&M expenses – 1 month and	1. Fuel stock-1 month, 2. O&M expenses

		3. Receivables – 1 month with 12.25% interest	– 1 month and 3. Receivables – 1 month with 12.25% interest
11.	Auxiliary consumption	12%	10%
12.	Fuel cost	Rs.1020/MT with 5% escalation per year	Rs.2200/MT with 5% escalation per year
13.	Specific fuel consumption	3 kg/kWh	1.3 kg/kWh.
14.	Cost of by-product	Rs.2500/MT with 5% escalation per year	Rs.7500/MT with 5% escalation per year
15.	Quantity of by-product production	0.6 kg/kWh	0.051 kg/kWh.

9.12.2 The corresponding tariff has been worked out as below for 15 years considering the above determinants for Biogas based Power Plants. Fixed cost has been tabulated for a period of 15 years. i.e. up to the life of the project. Variable cost has been furnished for the year 2011-12 and 2012-13.

<b>Tariff for Biogas power plants</b>				
Year	Fixed cost (Rs./unit)	Variable Cost (Rs./unit)	Revenue from sale of by-product (Rs./unit)	Total cost (Rs./unit) (2)+(3)-(4)
(1)	(2)	(3)	(4)	(5)
1	2.58	3.48	1.50	4.56
2	2.60	3.65	1.58	4.68
3	2.53			
4	2.46			
5	2.40			
6	2.33			
7	2.27			
8	2.20			
9	2.14			
10	2.08			
11	2.02			
12	1.96			
13	1.99			
14	2.03			
15	2.06			

9.12.3 Similarly, the tariff for Biogasification based power plants is worked out as below for 20 years:

<b>Tariff for Biogasification based power plants</b>				
Year	Fixed cost (Rs./unit)	Variable Cost (Rs./unit)	Revenue from sale of by-product (Rs./unit)	Total cost (Rs./unit) (2)+(3)-(4)
(1)	(2)	(3)	(4)	(5)
1	1.63	3.25	0.38	4.50
2	1.64	3.41	0.40	4.66
3	1.60			
4	1.55			
5	1.51			
6	1.47			
7	1.42			
8	1.38			
9	1.34			
10	1.30			
11	1.27			
12	1.23			
13	1.25			
14	1.28			
15	1.30			
16	1.33			
17	1.36			
18	1.39			
19	1.42			
20	1.45			

9.12.4 The first year tariff is applicable for a period of one year from the date of commissioning of the project. The second year tariff is applicable for one year thereafter and so on. As the control period expires on 31-03-2013, it is expected that the next tariff order would be in position by then. The variable cost for the third year will be determined in the next tariff order. If the variable cost for the third year is not specified by the Commission, the variable cost specified for the second year shall be continued beyond the period till any revision is effected by the Commission in this regard.

## **10. Related issues**

The following are the issues related to power generation, transmission, wheeling and consumption from Biogas / Biogasification based power plants:

1. Transmission and wheeling charges
2. Cross subsidy surcharge
3. CDM benefits
4. Reactive power charges
5. Grid availability charges
6. Adjustment of energy generated
7. Scheduling and system operation charges
8. Application fees and Agreement fees
9. Billing and payments
10. Payment security and Security deposit
11. Power factor disincentive
12. Metering and communication arrangements
13. Evacuation of power
14. Energy purchase agreement
15. Energy wheeling agreement
16. Renewable energy purchase obligation
17. Tariff Review Period / Control Period

### **10.1 Transmission & Wheeling charges and line losses**

Commission has uniformly adopted transmission and wheeling charges including line losses at 5% and 7.5% for HT / EHT and LT services respectively in respect of wind, biomass and bagasse based generation in its orders issued in 2009. Since the TNEB has been unbundled with effect from 01-11-2010, it is prudent to fix the Transmission and Wheeling charges separately. Tamil Nadu has a reasonable penetration of power from renewable energy sources. Hence, it is proposed to fix the transmission and wheeling charges nearer to the level of actual line losses. Therefore, a transmission charges of 3% has been proposed

for these power plants. Wheeling charges at HT level is 7% and for LT level is 15%.

### **10.2 Cross subsidy surcharge**

Commission in its order No. 1, 2 and 3 of 2009 fixed 50% of the cross subsidy surcharge for wind, biomass and bagasse based generators as a promotional measure for renewable energy. On similar lines, Commission proposes 50% of the cross subsidy surcharge for Biogas / Biogasification based power projects also.

### **10.3 CDM Benefits**

The Forum of Regulators has recommended that CDM benefits should be shared on gross basis starting from 100% to developers in the first year and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developer and the consumer in the sixth year. Thereafter, the sharing of CDM benefits will remain equal till such time the benefits accrue. The Commission adopted this formula in its order Nos. 1, 2 and 3 of 2009 and 1 and 2 of 2010. Commission proposes the same formula for Biogas / Biogasification based power projects. Distribution Licensee shall account for the CDM receipts in the next ARR filing.

### **10. 4 Reactive Power Charges**

Commission has proposed to adopt the rate specified in Indian Electricity Grid Code for reactive power charges.

### **10.5 Grid Availability Charges**

Grid availability charges shall be collected as per the Commission's order in force.

### **10.6 Adjustment of generated energy**

As per the Commission's Open access regulations open access **is permitted to all the HT consumers (with sanctioned demand of 63 kVA and above)**. A person covered by a policy relating to captive generation or generation through non conventional energy sources shall be eligible to avail open access for their own use irrespective of contract demand. Similarly, A person covered by a policy relating to captive generation or generation through non conventional energy sources shall be eligible to avail open access in respect of third party sale subject to the phasing of open access in the Commission's Open Access Regulations.

### **10.7 Scheduling and system operation charges**

The scheduling and system operation charges have been prescribed in Order No.2 dated 15-5-2006 of the Commission. The prescribed charges are Rs.1000 / day irrespective of capacity. With a view to incentivise renewable energy project, the Commission, by an amendment to the Order No.2, prescribed charges of Rs.1000 / day per 1.65 MW and above. For capacity less than 1.65 MW, proportionate charges were prescribed. This order as amended from time to time shall continue to apply for Biogas / Biogasification based generators.

### **10.8 Application fees and agreement fees**

The Intra State Open Access Regulations 2005 of the Commission were amended in 2008 to provide for concessional application fees and agreement fees for generators of non conventional and renewable sources of energy. The application fees under the Energy Wheeling Agreement was fixed at Rs.200 per MW subject to a maximum of Rs.5000 and the agreement fees under Energy Wheeling Agreement was fixed at Rs.2000 per MW subject to a maximum of Rs.50000 on the consideration that generators of renewable sources of energy have small capacities compared to generators of conventional energy. The agreement fee for Energy Purchase Agreement has been fixed at Rs.2000 per MW or part thereof. As regards the Energy Purchase Agreement, Commission's Fees and Fines Regulations 2004 prescribes Rs.2000 per MW or part thereof as

the fees for approval of Power Purchase Agreement by the Commission as against Rs.2500 per MW or part thereof leviable for conventional power plants. This fee shall be collected by the licensee and passed on to the Commission. In case of frequent changes in the usage of the energy as well as the change of drawal point necessitate extra clerical work. Therefore, the Commission proposes that every time a generator seeks such a change either through an amendment to an existing agreement or through a fresh agreement, an additional charge equivalent to the application fees and agreement fees shall be leviable by the licensee on the generator.

### **10.9 Billing and Payment**

10.9.1 When a renewable energy generator sells power to the distribution licensee, the generator will raise a bill every month for the net energy sold after deducting the charges for start up power and reactive power. The distribution licensee shall make payment to the generator within 30 days of receipt of the bill. Any delayed payment beyond 30 days will attract interest at the rate of 1% per month.

10.9.2 If a Biogas / Biogasification based generator utilizes the power for captive use or if he sells it to a third party, the distribution licensee shall raise the bill at the end of the month for the net energy supplied. The licensee should record the generation and consumption simultaneously. While preparing the bill, peak hour generation shall be adjusted against peak hour consumption. Off peak generation shall be adjusted against off peak consumption. Normal generation shall be adjusted against normal consumption. Peak hour generation and normal hour generation can be adjusted against lower slot consumption. Excess consumption will be charged at the tariff applicable to the consumer. Transmission and wheeling charges, scheduling and system operation charges and cross subsidy surcharge, wherever applicable, shall be recovered from the bill. The net amount recoverable from the consumer shall be raised in the bill.



### **10.10 Payment Security and Security Deposit**

10.10.1 The National Tariff Policy calls for adequate and bankable security arrangements to the generating companies. This mechanism has been found impractical, as there are more number of generators and distribution licensee is unable to offer security for such numbers. Therefore, the Commission believes that penalty for delayed payment by the licensee would serve the ends of justice.

10.10.2 As regards the security deposit of the consumer, the Commission proposes to retain the present arrangements. i.e., two times the maximum net energy supplied by the distribution licensee in any month in the preceding financial year shall be taken as the basis for the payment of security deposit by the consumers.

### **10.11 Power factor disincentive.**

As per the Commission's retail tariff order, power factor disincentive is applicable to a consumer as a percentage of current consumption charges. The average power factor recorded by the meter shall be the reference for calculation of the disincentive. On the same analogy, captive / third party consumers shall be liable for disincentive based on the gross energy consumption and the applicable demand.

### **10.12 Metering and Communication Arrangements**

The metering and communication arrangements shall be in accordance with the following:

- (1) Central Electricity Authority (Installation and Operation of Meters) Regulations,
- (2) Tamil Nadu Electricity Distribution Code,
- (3) Tamil Nadu Electricity Grid Code,
- (4) Tamil Nadu Electricity Intra State Open Access Regulations.

The meters shall be installed by the Distribution Licensee / STU depending upon the injection voltage at the cost of generators.

### **10.13 Evacuation of power**

10.13.1 As per section 10 of the Electricity Act, 2003, the duties of the generating company shall be to establish, operate and maintain generating stations, tie-lines, sub-stations and dedicated transmission lines connected therewith in accordance with the provisions of this Act or the rules or regulations made thereunder. Therefore, a generating company is liable to establish the interfacing line at its cost.

10.13.2 In addition to the above stipulation, the Commission proposes the following procedure for creation of evacuation facilities.

- (a) STU shall within 30 days of receipt of application from generators, intimate whether or not the long term access can be allowed without further system strengthening.
- (b) If further system strengthening is essential, the results of study conducted by the STU based on the request of generators shall be intimated within ninety days of such request of generators.
- (c) Feasibility based on system studies shall be established within six months at the latest.
- (d) Clearances, approvals, certificate, if any, required by generators shall be issued within a month time.
- (e) The distribution licensee is not liable to pay compensation to the consumer on Open Access for deemed generation benefits in case the

distribution licensee is unable to evacuate power due to failure of the Transmission and Distribution facility

#### **10.14 Energy Purchase Agreement**

The draft format for the Energy Purchase Agreement (EPA) shall be prepared and submitted to the Commission by the TANGEDCO within 15 days from the date of this tariff order. The agreement shall be co-terminus with the life of the project. The distribution licensee shall execute the Energy Purchase Agreement within a month of receipt of application from the generator. The parties to the agreement may be given the option of exit in case of violation with three months notice to the other party.

#### **10.15 Energy Wheeling Agreement (EWA)**

The draft format for the Energy Wheeling Agreement (EWA) shall be prepared and submitted to the Commission by the TANGEDCO within 15 days from the date of this tariff order. The agreement shall be as per Commission's Open Access Regulations. The concerned nodal agency should execute the EWA within one month from the date of submission of application with all relevant details for such agreement by the Biogas / bio-gasification based generators or the third party purchaser, as the case may be.

#### **10.16 Renewable Purchase Obligation**

As per the Commission's Renewable Energy Purchase Obligation Regulations, 2010, every obligated entity shall purchase not less than defined minimum percentage of its consumption of energy from renewable energy sources under the Renewable Purchase Obligation (RPO) during a year **as specified in the Commission's tariff regulations/orders on renewable energy issued from time to time.**

### **10.17 Tariff Review Period / Control Period**

With regard to tariff Review Period / Control Period, the specific provisions of Regulation 6 of Regulations on “Power Procurement from New and Renewable Sources of Energy, 2008” are reproduced below:

*“The tariff determined by the commission in the tariff order shall be applicable for the power purchase agreement period of **twenty years**. The control period may ordinarily be **two years**. When the Commission revisits the tariff and allied issues after the control period, the revision shall be applicable only to the generator of new and renewable energy sources commissioned after the date of such revised order”*

**(By order of the Commission)**

**Secretary  
Tamil Nadu Electricity Regulatory Commission**

**Annexure-III**

**Comments of various stake holders on the Consultative Paper on “Procurement of Power from Biogas and Biogasification based Power Plants”**

**A. Comments for Biogas power plant tariff**

**1. Biogas**

**M/s.Pallava Water & Power Private Limited**

In Para 2.1.1 the last two sentences may be modified to read as “Biogas has relatively high calorific value (4300 Kcal/m<sup>3</sup> with methane content of 53 to 55% or 5000 Kcal/ m<sup>3</sup> with methane content of 60%.

Para 2.1.2 may be amended as “In India especially in Tamil Nadu biodegradable organic waste such as cow/poultry manure, agricultural residues, food industry solid waste and liquid effluents, whole sale vegetables market wastes, kitchen waste, etc can be potential source for electric + thermal energy from Biogas based power plants

Para 2 may be modified as “The digester effluent of the Biogas plant contains significant amount of organic carbon and major/micro nutrients. The digester effluent is appropriately treated to separate all suspended solids so as to be in compliance with PCB norms. The suspended solids are then composted to produce assured quality organic manure which significantly improves soil carbon and water retaining capacity, apart from addition of NPK and micro nutrients. The liquid, post solid separation, contains dissolved ammonium and potassium and hence can be integrated with micro irrigation systems. Thus there can be significant increase in farm yields and farmers income apart reduced need for subsidized chemical fertilizers.

**2.Power Position in Tamil Nadu**

**M/s.Pallava Water & Power Private Limited**

As per TNERC order no.3 of 2010 dated 31<sup>st</sup> July 2010, seven numbers liquid fired IPPs in Tamil Nadu having cumulative approved capacity of 8,593 million KWH, had very good charge in 2009-2010 ranging from Rs.5.42 to 6.05 per KWH

**3. Applicability of Proposed Order**

**M/s.Pallava Water & Power Private Limited**

The Biogas tariff under discussion is for co-digestion of multiple substrates. Hence, sentence 2 may be amended as “The tariff fixed in the proposed order shall be applicable for all Biogas power plants based on co-digestion of manure, agricultural residues and other bio waste/bio mass gasifier based power generation projects commissioned on or after the date of this order

#### **4. Gross & Net Capital Cost**

##### **M/s.Pallava Water & Power Private Limited**

IREDA indicated figure of Rs.7.87 crores per MW is evidently not for Biogas power plant, based on mesophilic process, with co-digestion of multiple substrates and latest technology. Hence Gross capital cost norm may be adopted as per MNRE recommendations of Rs.12 crores per MW for 1 MW plant and Rs.11 crores per MW for 2 MW plant.

##### **M/s.IOT Mabagas Limited**

The total project cost per MW of Biogas power projects(including land, biomethanation plant, engines, electrical switchyard for evacuation) is equal to Rs.12.5 crores per MW.

Considering the evacuation cost and capital subsidy available, the net capital cost shall be considered as Rs.11 crores per MW

##### **Ministry of New and Renewable Energy**

The cost of Biogas project based on distillery spent wash cannot be applied to the projects based on co-digestion of mix of feedstock including crop/agricultural residues. The cost of such projects in all likelihood will be Rs.11 to 12 crores per MW although for first few projects it has been found to be even higher.

Amount of subsidy may not be reduced straight away from the equity as the subsidy is released after successful commissioning of the project and in most cases it is adjusted by the lenders against the loans.

#### **5. Term and interest of loan**

##### **M/s.IOT Mabagas Limited**

Commission may consider loan tenure of 10 years (9 years of repayment + 1 year of moratorium). Interest rate of 12.5% to 13.5% available in the market may be considered by the commission.

## **6. Working Capital and Interest**

### **M/s.IOT Mabagas Limited**

The interest rates on working capital are above 13% today. An approximate time of around 4 to 5 months is taken for receiving payment from distribution utility. Sometimes it is even more than 5 months in case of TANGEDCO the payments for by-product are effected basically by the farmers/dealers with a credit period of around 3 to 4 months.

## **7. Infrastructure development charge for evacuation of power**

### **M/s.Pallava Water & Power Private Limited**

In view of advantages of this proposed power plant, TNERC could order Biogas/biomass gasifier based power plants based on otto cycle, would essentially be tail end of the grid generation with evacuation at 22/11KB, with resultant benefits to TANGEDCO in the form of voltage recommendation reduced, T&D losses and avoided costs for distribution network up gradation. Consequently TANGEDCO should construct, at its cost the 11/22KB lines from nearest TNEB substation to the substation within the Biogas/biomass gasifier based power plant facility.

The transmission line from TANGEDCO's nearest substation to the Biogas/biomass gasifier based power plant substation should be constructed by TANGEDCO at its cost.

### **M/s.IOT Mabagas Limited**

The TANGEDCO should construct at its own cost the 11/22KV transmission lines from the nearest TANGEDCO substation to the Biogas power project switchyard/evacuation transformers.

### **Ministry of New and Renewable Energy**

For the projects having the potential of providing firm power at tail end of the grid the IDC for evacuation of power may not be levied on the project proponents and the electricity board should bear the cost of transmission lines up to the project facilities.

## **8. Life of the plant and machinery**

### **M/s.Pallava Water & Power Private Limited**

TNERC may consider useful life of 10 years for Biogas power plants

**M/s.IOT Mabagas Limited**

Commission may consider a useful operating life of around 12 years.

**Ministry of New and Renewable Energy**

The project may require to be replaced even before the life span of 15 years.

**9. Depreciation**

**M/s.Pallava Water & Power Private Limited**

TNERC may consider depreciation rate of 7% per annum

**Ministry of New and Renewable Energy**

Depreciation may be considered at a maximum of 7%.

**10.O&M and insurance expenses**

**M/s.Pallava Water & Power Private Limited**

Commission may consider O&M cost of 6% per annum since the O&M cost considered by the commission is only for the Biogas power plants. Commission has not considered the O&M cost for digester effluent treatment system.

**M/s.IOT Mabagas Limited**

Biogas projects have higher O&M costs owing to effect of H<sub>2</sub>S on the system and the equipments are more exposed to rough and tough of feedstock with higher moisture. The average variable cost increase in a project is more than 9 to 10% and the commission is herewith requested to consider the O&M cost to be above 7.5%.

**Ministry of New and Renewable Energy**

The IREDA has given the data for distillery spend wash based projects were digesters are mostly based on up-flow anaerobic sludge blanket reactors. For the projects based on Co-digestion the O&M Cost is higher. Hence the O&M cost of 6% of the capital cost may be correct one.



## **11. Auxiliary consumption**

### **M/s.Pallava Water & Power Private Limited**

Commission may consider 13% auxiliary consumption for Biogas power plants including digester effluent treatment systems.

### **M/s.IOT Mabagas Limited**

Commission may consider 13% as auxiliary power consumption for Biogas power plants since the Biogas plants are required to handle more volume of feedstock with moisture, which requires large pumping, stirring, etc.

### **Ministry of New and Renewable Energy**

The auxiliary consumption of 13% need to be allowed.

## **12. Plant Load Factor**

### **Ministry of New and Renewable Energy**

It is suggested that PLF may be reduced to 60% for the first six months, 70% for the next six months and 80% thereafter.

## **13.Cost of feedstock and by- product**

### **M/s.Pallava Water & Power Private Limited**

We are unable to reconcile the figures given by IREDA and believe that there has been some inadvertent errors that crept into IREDA's communication. Hence the commission is requested to adopt for generic tariff order. The Biogas feedstock cost of Rs.1100 per MT with cost realisation from by-product of 10% of the biomass cost in case of Biogas power plants.

### **M/s.IOT Mabagas Limited**

Commission may consider around Rs.1200 per MT for the by-product composed.

### **Ministry of New and Renewable Energy**

It is suggested that cost recovery from by-product (digester effluent) be linked to the cost of feedstock as during the process of digestion, the quantity remains the

same but there is reduction in % of dry solids due to anaerobic digestion of digestible organic matter to produce Biogas. Therefore the revenue from by-product needs to be pegged at around 10% of the cost of feedstock.

#### **14. Tariff Rate**

##### **M/s.Pallava Water & Power Private Limited**

The tariff may be modified taking into account the parameters suggested above. The variable cost for third year should be determined as per CERC norms for price escalation in biomass cost. Should there be no mutual agreements between power generator and TANGEDCO, on variable cost, the power generator should be automatically eligible for sales to third party under open access.

#### **15. Transmission and wheeling charges and line losses**

##### **M/s.Pallava Water & Power Private Limited**

The transmission and wheeling charges including line losses should be retained at 5% for HT/EHT services in respect of Biogas/biomass gasification based power plants.

##### **M/s.IOT Mabagas Limited**

Transmission and wheeling charges should be retained at 5% for HT/EHT services. The line losses be considered at around 2% for HT services.

#### **16.Cross subsidy surcharge**

##### **M/s.Pallava Water & Power Private Limited**

Cross subsidy surcharge may be made 0% for Biogas/biomass gasification based power plants.

##### **M/s.IOT Mabagas Limited**

Cross subsidy surcharge may be made 0% for Biogas/biomass gasification based power plants.

## **17. Sharing of CDM benefits**

### **M/s.IOT Mabagas Limited**

Commission may consider not to share the CDM revenues with the distribution utility.

## **18.Scheduling and system operation charges**

### **M/s.Pallava Water & Power Private Limited**

The commission has stated that for the capacity less than 1.65 MW, the scheduling and system operation charges will be collected on proportionate basis as applicable to the charges for 1.65 MW power plants. These aspects may be clearly defined by the commission.

## **19.Payment security and security deposit**

### **M/s.Pallava Water & Power Private Limited**

Revolving letter of credit equal to 1 month billing should be provided by TANGEDCO. Furthermore, if payment is delayed by more than 60 days (i.e) 90 days from date of receipt of the bill, the generators should be eligible to terminate the PPA and have automatic eligibility for open access.

### **M/s.IOT Mabagas Limited**

Letter of credit equal to two months billing should be provided by TANGEDCO. Also if the payment is delayed beyond 30 days from the date of receipt of invoice from the generator, TANGEDCO should pay an interest of minimum 5% of invoice value. If the delay exceeds more than 6 months than the generator should be eligible to terminate the PPA and have automatic eligibility to any other power sale options. If the TANGEDCO is able to make payment within 7 working days from the date of receipt of invoice, they can deduct 0.5% of the invoice value as incentive for before time payment.

## **20. Tariff review period/control period**

### **M/s.Pallava Water & Power Private Limited**

Should there be no mutual agreement on variable charge after the control period, the Biogas/biomass gasifier based power generator should be entitled to terminate the PPA and avail open access.

## **21. Other Comments**

### **M/s.Pallava Water & Power Private Limited**

Over the long term, it would be in the interest of Tamil Nadu to promote bio waste to Biogas + organic fertilizer projects as they would have many advantages. By seeing the price trends of imported LNG/natural gas, it will be apparent that Biogas is indeed a cost efficient alternative for electricity as well as transport facilities. Even in the short term TANGEDCO would accrue various economic benefits from Biogas plants.

TNERC could consider issuing tariff order applicable only for plants commissioned between April 2012 to March 2015. TNERC could adopt norms as per HERC tariff order dated 21-9-2010 for 5.6 MW poultry litter based Biogas power plant. This would result in 2012-2013 tariff of Rs.6.43 per kWh. The PPA term could be 10 years. TANGEDCO and generator may renew the PPA after 10 years at mutually acceptable terms and conditions. Considering the sharing of CER revenues, the real average tariff over 10 years period would not exceed Rs.6.5 per kWh. The sharing of CER at 50% with TANGEDCO would result in earning of Rs.0.65 per kWh by TANGEDCO. Hence this factor needs to be considered while computing the tariff for Biogas power plant

## **B. Comments for Biogasification based power plants**

### **1.Gross Capital Investment**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

Being the new technology coupled with Producer gas Engine and other accessories, our suggestion is that Gross capital investment should be considered at Rs.700 Lacs. Based on our experience, detailed realistic cost break up enclosed in **Annexure "I"** for 1 MW Bio-Gasification based power plant.

### **2.Plant Load Factor (PLF)**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

Considering the stabilization period, PLF should be considered 60%, 70% & 80% for 1<sup>st</sup> year, 1<sup>nd</sup> year & 3<sup>rd</sup> year onward respectively. This will be in line with CERC norms for Biomass based power plant.

### **3.Term of the Loan and interest**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

In general, no Financial Institution provides Term loan for a period of 10 years. Maximum tenure is in the range of 5-7 years so our suggestion is to consider tenure of 5 years with 1 year moratorium period. Further, interest rates have gone up so it should be based on last 1 years SBI base rate (which is around 8%-8.5%) plus 5.50% as spread. This will be around 13.5%-14.0%.

### **4.Working Capital**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

Interest rates have gone up so it should be based on last 1 years SBI base rate (which is around 8%-8.5%) plus 5.50% as spread. This will be around 13.5%-14.0%. Suggestion is as under:-

1. Fuel stock should be considered for 3 months due to seasonality of various crop residues.
2. O&M expenses – 1 Month

### **5.O&M Expenses**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

O&M cost for biomass gasifiers plant will be higher than that for biomass power plant based on the Rankine cycle, as man power costs do not reduce proportionately with unit rating. In addition higher expenditure towards feedstock preparation incurs extra cost on processing of agri-residues to obtain quality as required as feedstock for biomass gasification plant. The realistic cost for O&M is around 46.25 lakhs per MW and the biomass sizing and drying cost would be in between Rs.14 lakhs and 28 lakhs per MW. The escalation factor would be around 5% per year.

### **6.Auxiliary Consumption**

#### **M/s.Ankur Scientific Energy Technologies Private Limited**

Commission may consider an auxiliary consumption of 12%.

## **7.Fuel Cost**

### **M/s.Ankur Scientific Energy Technologies Private Limited**

The biomass cost should be considered at Rs.2800 per MT with 5% escalation per year considering the drying and sizing costs of biomass.

## **8.Cost of by-product**

### **M/s.Ankur Scientific Energy Technologies Private Limited**

The by-product price should be considered at Rs.5000 per MT and the quantity should be 0.04 Kg per kWh.

## **9.Transmission and wheeling charges and line losses**

### **M/s.Ankur Scientific Energy Technologies Private Limited**

The transmission charges should be considered at 2% and wheeling charges at 4%.

## **10.Cross subsidy surcharge**

### **M/s.Ankur Scientific Energy Technologies Private Limited**

No cross subsidy surcharge should be levied

**MINUTES OF THE 23<sup>rd</sup> STATE ADVISORY COMMITTEE MEETING HELD ON**  
**29-03-2012**

**Members Present:**

1. Thiru. K. Venugopal, Member, TNERC.
2. Thiru. S. Nagalsamy, Member, TNERC.
3. Thiru. S. Gunasekaran, Secretary, TNERC.
4. Thiru. Rajeev Ranjan, CMD, TNEB Ltd. & TANGEDCO Ltd. and Chairman, TANTRANSCO Ltd.
5. Thiru. Sudeep Jain, CMD, TEDA.
6. Tmt. M.P. Nirmala, Secretary to Government, Co-operation, Food & Consumer Protection Department, GoTN.
7. Thiru. M.C. Murali, Chief Electrical Engineer, Southern Railways.
8. Thiru. K.R. Thangaraj, Member, SAC.
9. Thiru. K. Kathirmathiyon, Member, SAC.
10. Thiru. N.K. Ranganath, Member, SAC.
11. Thiru. K. Alagu, Member, SAC.
12. Thiru. K. Kasthurirangaian, Member, SAC.
13. Thiru. R. Desikan, Member, SAC.

**Special Invitee :**

1. Thiru. Prashant M. Wadnere, Deputy Secretary to Government, Finance Department, GoTN.

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Thiru K. Venugopal, Member, TNERC welcomed the participants for the discussion on Revision of Comprehensive Tariff on Wind Energy, Biogas and Biogasification based generation, Bagasse based co-generation and Biomass Power Plants. He then, requested Thiru K. Muthusamy, Director (Engineering) to present the salient features on the Revision of Tariff on Wind Energy. Accordingly, Thiru K. Muthusamy presented the salient features of the proposed Order on Wind Energy.

**Thiru. K. Venugopal, Member, TNERC** then requested the SAC Members to offer their comment on the various parameters as aforesaid. The views of the SAC Members are as under:

- **Tmt. M.P. Nirmala** stated that in Panchayats like Chinniyampalayam Village in Coimbatore District, the small capacity wind mills are used for pumping the water, running the motor, illumination of street lights etc. She requested the Commission to encourage the small capacity wind mills. The Panchayats are not able to encourage renewable because they do not have any technical expertise. She also suggested usage of rice husk for generation of energy from Biomass. She also suggested usage of human/animal wastes for generation of Biogas for running the power plants. The biomass unit near Tiruvallur with one Crore investment is failure due to lack of technicality. We also approached IIT to sort out the issue.
- **Thiru S. Nagalsamy, Member, TNERC** stated that the purpose of the meeting is to discuss the issues related with tariff. You can approach TEDA for technical assistance.
- **Thiru K.R. Thangaraj** stated that the existing practise of Banking for wind energy should be continued and also suggested for increasing the power purchase cost from wind energy to enable the Wind Energy Generators (WEG) to repay their loans obtained from Banks & Financial Institutions.
- **Thiru K. Kathirmathiyon** suggested for real time settlement for wind generators. When there is sufficient power, the Distribution Licensee supplies power to all. But, during shortage conditions, industries get power from banking and the common men do not get supply. He suggested to revisit the concept of banking. He also stated that reasonable price should be given for wind energy purchase.
- **Thiru S. Nagalsamy, Member, TNERC**, on the question of sale of wind energy stated that the WEG sell their surplus wind energy to TANGEDCO. He also asked whether the Commission fix the rate or UI rate may be adopted for real time settlement.



- **Thiru K. Kathirmathiyon** stated that instead of banking the wind energy, amount can be settled to the generators. He also suggested that actual transmission loss should be collected from WEG for Transmission and Wheeling of Wind Energy. He further stated that TANGEDCO should not depend on wind energy since it is available only during the wind season.
- **Thiru R. Desikan** stated that a band should be fixed for purchase of wind energy from WEGs instead of single purchase price. He further stated that a floor price and ceiling price should be fixed by the Commission for purchase of wind power within which the licensee can operate depending on his requirement.
- **Thiru S. Nagalsamy, Member, TNERC** stated that if we have band, at what rate the distribution licensee will buy?
- **Thiru R. Desikan** stated that the Distribution Licensee may purchase the wind energy at competitive rate.
- **Thiru K. Venugopal, Member, TNERC** appreciated the point and stated that the borrowing ability of the Distribution Licensee will improve. He also stated that when wind energy availability is at its peak, the rates are quoted below the price in the Unscheduled Interchange (UI) Mechanism and therefore Bidding may be resorted.
- **Thiru K. Alagu** stated that he supports the WEG on all aspects.
- **Thiru. N.K. Ranganath** stated that the insurance should be allowed on replacement value of machinery instead of a fixed percentage. He further stated that the working capital components should be reasonable. He

also stated that the recovery of Infrastructure Development Charge (IDC) by TANGEDCO should be reasonable.

- **Thiru. M.C. Murali** stated that the Railways has fixed a target of 10% for purchase of energy from Non-Conventional Energy Sources (NCES) by the end of the year 2020. Of which, wind is the main source for power procurement from NCES. At present, Railway is having a wind energy power plant with a capacity of 10 MW. He questioned whether IDC should be incurred by the producer or by the buyer? He also agreed for payment of charges for extending the Banking facility, since wind energy is seasonally available.
- **Thiru. Prashant M. Wadnere** stated that CERC has fixed Rs.9 lakhs as O&M expenses and the escalation factor (5.72%) fixed by CERC is on higher side. Commission methodology of fixing O&M is more flexible.
- **Thiru. K. Kasthurirangaian** stated that wind energy is available for 6 months in a year. The WEG produces energy required for one year in six months and the surplus is being sold to TANGEDCO. This surplus is saved in the form of Banking with TANGEDCO and is drawn at the time of requirement during non-wind season.
- **Thiru. K. Kathirmathiyon** stated that he stressed the need to pay for the surplus energy being sold to TANGEDCO within 30 days as against Banking.
- **Thiru. K. Kasthurirangaian** stated that MNRE stressed the need to utilise power generated through renewable energy sources. Like the case of reinsurance energy can be banked with other states which are in need during the wind season and can be taken back when our state requires the power during summer season. He requested that the Banking facility

should continue. He further stated that bidding cannot be resorted by the WEG since there is only one buyer (distribution licensee) in Tamil Nadu. Also, TANGEDCO has to pay the money in advance as against the present practise of delaying of payment for WEG.

- **Thiru. K. Venugopal, Member, TNERC** stated that during bidding other buyers (open access consumers) apart from TANGEDCO are also permitted to bid. Open access within the State has been allowed to all HT consumers with effect from 17-02-2010.
- **Thiru. Rajeev Ranjan** stated that Open Access is permitted by TNERC and it is in vogue at present in the State. Nobody is preventing the wind generator in selling their wind power to others. But, the WEGs are not in a position to sale particular quantity at particular time.
- **Thiru. K. Venugopal, Member, TNERC** stated that the only problem is scheduling of wind energy.
- **Thiru. K. Kasthurirangaian** stated that while fixing the tariff the time value of money should be considered. The gold was sold cheaper in the yester years, which become costly now and therefore the tariff for wind energy should reflect and link to the time value of money.
- **Thiru. K. Kathirmathiyon** stated that linking of wind tariff to the time value of money will lead to problem to the end consumers.
- **Thiru. N.K. Ranganath** stated that escalation in cost should be there while fixing the wind tariff and it should not be indexed with gold.

- **Thiru. K. Kasthurirangaian** stated that the Banking period should be changed from June to May of every year. He further stated that forecasting and scheduling helps in regulating the Grid availability.
- **Thiru. R. Desikan** stated that the pricing of wind energy should be considered taking into account the enormous subsidies and grants given by the Central Government, World Bank, etc.
- **Thiru. K. Venugopal, Member, TNERC** stated that at the time of introduction of generation of power from wind energy Government has given subsidies to encourage WEG. Subsequently, it was withdrawn.
- **Thiru. K. Kasthurirangaian** stated that WEG claims either accelerated depreciation or Generation Based Incentive (GBI).
- **Thiru. Sudeep Jain** stated that bidding route can be explored for fixing of wind tariff. This will lead to competition from all the WEG - either big or small. There are multiple sellers of wind energy. Bidding can be done after identifying the geographical location. He further stated that the concept of Banking is not practically possible since electricity cannot be stored; it can only be consumed at the time of generation.
- **Thiru. Rajeev Ranjan** stated that wind energy creates more problem than the benefits accorded to the State. The wind power is not reliable. It does not possess quality also. The grid stability is hampered due to non-scheduling of wind power and reactive power. TANGEDCO is paying a heavy price for allowing Banking facility to the WEGs. It buys power in bulk from wind generators during wind season and the same cannot be utilised fully due to transmission problem and as such the surplus power injected to the grid gets no price due to UI mechanism. The neighbouring States are drawing power at that time without much cost. At the same

time, TANGEDCO buys costly power during summer season when the WEGs are utilising their banked power. So in both the ways TANGEDCO is at loss and hence he requested that Banking should be dispensed with. Moreover, TANGEDCO pays huge price for grid instability for its unscheduled injection of power during wind season. He apprehended that there may be cartelisation by the WEG. We may adopt bidding for purchase of wind power, if there is no cartel among the WEGs. At present, the WEG can sell their power to any buyers within the State.

- **Thiru. K. Venugopal, Member, TNERC** stated that since there are more than 2000 generators, cartelisation is not possible.
- **Thiru. Rajeev Ranjan** stated that safeguarding should be put in place while exercising competitive bidding.
- **Thiru. K. Kasthurirangaian** stated that Banking through traders can be explored.
- **Thiru. Rajeev Ranjan** stated that the purchase price of power in the Southern States is 3 to 4 times costlier than rest of the country. At present, TANGEDCO is Rs.14/unit for purchase of power from the market. Therefore the Banking facility should be revisited and should be dispensed with. As regards scheduling it is high time to do it now since technological solution is available at present. Also, forecasting techniques also available. Installation of ABT meter should be done. This gets rid of scheduling problem. For evacuation of energy huge investments are required. Huge investments are also required for transmission of energy. Therefore, a healthy mix between wind energy and reliable power in the grid should be maintained.

- **Thiru. K. Venugopal, Member, TNERC** stated that manoeuvrability of grid should be seen. In an interconnected system of 1 Lakh MW generation, injection of 1000 MW of wind energy will not create any problem. But, injection of 1000 MW in the SR grid with 30,000 MW generation will create lots of problem.
- **Thiru. Rajeev Ranjan** stated that Harmonics produced by wind machines should also be seen. There are solutions for get rid of this problem but there is a cost attached to it. Scheduling is one of the issues during power purchase from wind mills.
- **Thiru. K. Venugopal, Member, TNERC** stated that scheduling of wind energy should be done.
- **Thiru. K. Kasthurirangaian** stated that power trading can be explored during wind season.
- **Director, (Transmission)/TANTRANSCO** stated that the Commission should go for break-up of the capital cost.
- **Thiru Nagalsamy, Member, TNERC** stated that the wind mill cost was Rs.2 crore /MW when the capital cost of thermal power plant was Rs.3 crore/MW. On what basis TANGEDCO says the cost of wind mill should not be more than Rs.4 crore/MW.
- **Thiru. M.C. Murali, Chief Electrical Engineer, Southern Railways** stated that the manufacturers refused to quote the rate of wind mills. Something is hidden.

- **Director, (Transmission)/TANTRANSCO** stated that nobody knows the exact capital cost. We may go for repowering of wind machines. Incentive should be given to those generators who go for better CUF.
- **Thiru. K. Kasthurirangaian** stated that the wind generators who opt repowering will get old tariff rate of Rs.2.75/unit.
- **Director, (Transmission)/TANTRANSCO** stated that with the assistance of Commission we can have separate policy for repowering. The present rate of interest will not be constant for 25 years. Interest rate should be restated once in three years and therefore should be re-visited according to the RBI rate.
- **Thiru. K. Venugopal, Member, TNERC** stated that since there are more number of WEGs, re-visiting of interest rate is not possible. He added that projection of interest rate for 25 years is difficult and cannot be done.
- **Thiru Nagalsamy, Member, TNERC** stated that the interest rate is not a big component and questioned how the future rate of interest can be assessed?
- **Director, (Transmission)/TANTRANSCO** stated that RoE of 15.5% post tax is prevailing elsewhere. When the capital cost is not correct, the O&M rate fixed based on the capital cost may also be not correct.
- **Thiru. K. Venugopal, Member, TNERC** asked what kind of technical standards available to fix the O&M cost. Also asked will there be any reduction in cost if the machines are Indianised.

- **Thiru. K. Kasthurirangaian** stated that the wind mills may run at a wind density of 200 Watts/sq. m. But, type-3 machines in India can run even at low velocity of wind.
- **Thiru. K. Kasthurirangaian** stated that the wind mill cost has grown up in the last one year.
- **Director, (Transmission)/TANTRANSCO** stated that the cost of wind mill should come down. Scheduling charges should be levied on wind mill for their injection of power into the grid.
- **Thiru. N.K. Ranganath** stated that cost of wind mill may be known from the P&L account and balance sheet of the company.
- **Thiru. K. Kasthurirangaian** stated that the CERC guideline of scheduling is applicable only to the wind machines of more than 10 MW capacity.
- **Director, (Transmission)/TANTRANSCO** stated that the CDM benefits availed by the NCES generators should be considered while arriving at the tariff.
- **Thiru. K. Venugopal, Member, TNERC** asked whether the TANGEDCO has taken any steps to collect the CDM benefits availed by the promoters.
- **Thiru. N.K. Ranganath** stated that it may take years to get the benefits of the CDM. One can get the information from the net about the persons registered for CDM benefit.
- **Thiru. M.C. Murali, Chief Electrical Engineer, Southern Railways** stated that getting CDM benefits is a complicated process and the small generators may not go for CDM benefits.



- **Thiru. K. Kasthurirangaian** stated that we hardly get the CDM benefits and it's a difficult process.
- **Thiru. K. Venugopal, Member, TNERC** stated that if the availing of CDM benefits is difficult, why do we need NCES power. It should be on implementable way.
- **Thiru. Sudeep Jain, CMD, TEDA** stated that TEDA initiated dialogue with the industries on availing the CDM benefits. TEDA can be a consultant on this issue.
- **Director, (Transmission)/TANTRANSCO** stated that the wind generators can at least do some mock exercise on scheduling.
- **Thiru Nagalsamy, Member, TNERC** queried whether the WEGs have taken any efforts on this issue.
- **Thiru. K. Kasthurirangaian** stated that no progress has been made by CERC in enforcing scheduling and forecasting. CERC asked the MNRE to constitute taskforce to find out the ways to implement scheduling and forecasting. He also stated that group scheduling is possible by installing the ABT meters in the feeder. CERC regulation also says the same. TANGEDCO and TANTRANSCO may install ABT meters in all the feeders.
- **Thiru. K. Venugopal, Member, TNERC** stated that all generators including wind generators should be scheduled.
- **Thiru Nagalsamy, Member, TNERC** stated that the Commission should look in to the interests of all the stakeholders. Generating company

expects good return, Distribution Licensee expects firm power and the consumer wants lower tariff. In the early days, managing the wind energy was easier. But, it is difficult with the installed capacity of 6000 MW. Unless the Southern Region Grid is connected with the rest of the grid in India, wind power evacuation will not be solved. Managing 6000 MW infirm power with 10,000 MW firm power will be difficult. Whereas, it will be manageable with 1 Lakh MW.

- **Thiru. K. Kasthurirangaian** stated that they always stress the central leaders to provide assistance in terms of money to solve the wind power evacuation problem in Tamil Nadu.
- **Thiru Nagalsamy, Member, TNERC** stated that wind power is surplus during the Period from June to November. There is a cost mismatch when the time wind energy is purchased through banking and allowing drawal when the cost of power purchase is more. The TANGEDCO has already reached the RPO of 9%. There is no need for them to buy wind power now. If wind power is purchased through bidding both the generators and the consumers will be benefitted. The cost ratio between the thermal and wind power plant is same even now when compared with the early days. Like re-insurance, the concept of re-banking is not possible since it involves cost element like transmission and wheeling.
- **Thiru. K. Kasthurirangaian** stated that the Distribution Licensee can supply the surplus power to traders and take back from them at a later date or can adjust on unit to unit basis with other parts of the Country.
- **Thiru. K. Venugopal, Member, TNERC** stated that corridor for transfer of electricity to other parts of the Country may not always be available and this should be studied in detail. He also read out the abstract of the letter received from the Principal Secretary/Energy Dept./GoTN., which states that the banking should be dispensed with and scheduling should be done

by all WEGs duly installing the ABT meters. He asked the Director/Engineering and Director/Tariff to start presentation on Biogas and Biogasification based generation, Bagasse based co-generation and Biomass Power Plants and the same were presented by the Directors.

- **Thiru. Sudeep Jain, CMD, TEDA** stated that clearance was given to 17 Biogas projects to the tune of 75 MW and 40 MW gasification projects. But, only 7 Biogas projects have been commissioned. So far, 165 MW of biomass power projects have been commissioned. Due to non-availability of feedstock, some of the generators have gone for coal. Further consent was given to install new projects to the tune of 52 MW and recommended for around 256 MW. But none of them have signed PPA.
- **Thiru Nagalsamy, Member, TNERC** asked the experiences of the generator regarding the tariff.
- **Thiru. Sudeep Jain, CMD, TEDA** stated that feedback of the generators is that the present tariff for biomass is not viable..
- **Thiru. K. Venugopal, Member, TNERC** asked whether the generators objects variable cost or fixed cost.
- **Thiru. Sudeep Jain, CMD, TEDA** replied that the variable cost is not in line with the market term. We want to know the actual cost in the market.
- **Thiru. K. Kasthurirangaian** stated that the power from these kind of sources should be encouraged.
- **Thiru. K.R. Thangaraj** stated that this kind of generation should be encouraged and reasonable tariff should be given to the generators

- **Thiru. K. Kathirmathiyon** asked the percentage of contribution from these sources.
- **Thiru. Rajeev Ranjan, CMD, TNEB Ltd. & TANGEDCO Ltd. and Chairman, TANTRANSCO Ltd** stated that percentage is not much.
- **Thiru. K. Kathirmathiyon** stated that there is no much encouragement from TANGEDCO. He also stated that the fuel cost recommended by different stakeholders vary much.
- **Thiru. K. Kasthurirangaian** stated that this should be promoted duly considering the fact that there would not be any coal in the near future.
- **Thiru. N.K. Ranganath** stated that capital costs for biomass and Bagasse based co-generation is reasonable. But, there is vast difference in the capital costs of the Biogas and Biogasification based power projects. The corporations may give the fuel at free of cost instead of charging.
- **Thiru. K. Venugopal, Member, TNERC** stated that considering the importance of poultry waste Biogas project, Commission impleaded the Secretaries of Environment and Energy.
- **Thiru. M.C. Murali** stated that whether the co-generation power is fed into the grid.
- **Thiru Nagalsamy, Member, TNERC** stated that the sugar mills thrives because of the co-generation in the past 15 years.
- **Thiru. Prashant M. Wadnere, Deputy Secretary to Government, Finance Department, GoTN** stated that it is desirable to promote this kind

of projects. But, the fuel price should be checked and to what extent the power from this kind of project is used should also be assessed.

- **Thiru. Sudeep Jain, CMD, TEDA** stated that the biomass power in the grid is very small when compared to the total energy mix. But, it creates lot of employment in the rural area, which has multiple effect on the society.
- **Thiru. N.K. Ranganath** stated that we have little experience in this kind of projects. It is better to adopt the technology faster.
- **Thiru. Rajeev Ranjan, CMD, TNEB Ltd. & TANGEDCO Ltd. and Chairman, TANTRANSCO Ltd** stated waste disposal should also be considered. Nowadays demand for Bagasse is more and acute shortage prevails. Even TNPL is not getting enough Bagasse. TNERC should look in to usage of coal in these stations. TANGEDCO welcomes this. But, scarcity of the fuel is the important issue. Things change in time. For example, demand for fly ash is more now, which was given at free of cost earlier.
- **Thiru Nagalsamy, Member, TNERC** asked whether is it possible to check up the type of fuel used to find out the variable cost. Co-generation runs for 8 months in a year and for rest of the months it is closed. Hence, alternative fuels can be used.
- **Thiru. K. Venugopal, Member, TNERC** concluded the meeting with vote of thanks.

**(By order of the Commission)**

**(S.Gunasekaran)  
Secretary**

