BEFORE THE TAMIL NADU ELECTRICITY REGULATORY COMMISSION
CHENNAI

SUO MOTU PROCEEDINGS

Present : **Hon'ble Thiru A.Balraj, Chairman**
Hon'ble Thiru.S.Thangarathnam, Member
Hon'ble Thiru B.Jeyaraman, Member

Order No 3 dated 15-5-2006

In the matter of : Power purchase and allied issues in respect of Non-Conventional Energy Sources based Generating Plants and Non-Conventional Energy Sources based Co-Generation Plants

In exercise of the powers conferred by section 181 read with section 61(h), 86(1)(e) of the Electricity Act, 2003 (Act 36 of 2003) and all other powers enabling it in this behalf, the Tamil Nadu Electricity Regulatory Commission, having considered a draft consultative paper and a draft discussion paper by the staff of the Commission, the views of the stakeholders, received as written comments, consulted the members of the State Advisory Committee, heard the issues raised in a public hearing , heard the views of the experts in a round table conference, the reply of the Tamil Nadu Electricity Board and having considered the documents available on record, passes this order, to fix the power purchase and procurement process, including the price for procurement of power by the Tamil Nadu Electricity Board and other distribution licensees in Tamil Nadu from Non-Conventional Energy Sources based Generating Plants and Non-Conventional Energy Sources based Co-Generation Plants. This order shall come into force from the date of its issue.

Sd…….	Sd…….	Sd….
B.Jeyaraman	S.Thangarathnam	A.Balraj
Member	Member	Chairman

1.0 PREAMBLE

1.1 Power Scenario in Tamil Nadu

The TNEB's generating capacity as on 31.03.2006 is 10011 MW comprising 2970 MW from four Thermal Stations, 424 MW from four Gas Turbine Stations, 2137 MW from 33 Hydro Stations, 1101 MW from Private Sector Projects, 178 MW as contribution to Tamil Nadu grid by sale of electricity from Captive Generating Plants and 2841 MW as Tamil Nadu's share from Central Generating Stations and 360 MW as external assistance. Generating capacity from privately owned wind farms is 2912.11 MW and TNEB's wind farm capacity is 19.355 MW. The installed capacity of Cogeneration in sugar mills is 314.6 MW, Biomass power project is 32.85 MW and through solar is 0.165 MW.

The gross generation was 52,345 million units (MU) and a total of 41,200 MU was consumed in Tamil Nadu during the year 2004-2005. As per the TNEB's data, the gross generation is 55489 MU and the total consumption is 43710 MU for the year 2005-06. The historical annual growth in energy consumption in Tamil Nadu is in the order of 5% to 6% in the previous 10 years. With a spinning reserve of 500 MW, the net deficit will be around 597 MW in 2006-07. The corresponding energy shortage will be around 1072 MU for the year 2006-07.

1.2 The importance of Non Conventional Energy Sources (NCES)

Global concern over pollution problems caused by the increase in green house gases emission and consequent climate changes have resulted in paradigm shift in the approach towards development of energy sector in all the countries. The need for adoption of clean technology, improving end use efficiency and diversifying energy bases etc., have all been seriously considered by the Government of India since the sixth five year plan, and the country is poised for a considerable increase in the use of renewable energy sources in its transition to a sustainable energy base. Renewable energy sources such as wind, sun, hydro power and bio mass are abundant and they not only augment the energy

generation, but also contribute to improvement in the environment, drought control, energy conservation, employment generation, upgrading of health and hygiene, social welfare, security of drinking water, increased agricultural yield and production of bio-fertilizers. The pace of development has been accelerated through fiscal and tax incentives.

1.3 NCES Scenario- India

The potential and achievement so far in respect of various new and renewable sources of energy technologies in India as on 31-03-2006 are as below:

Sources / Systems	Potential	Harnessed / Achieved
Biomass based Power	19,500 MW	912.53 MW
Biomass Gasifiers		69.87 MW
Solar Photo Voltaic Power	20 MW/ sq km	2.74 MW
Wind Power	45,000 MW	5340.60 MW
Small Hydro Power (up to 25 MW)	15,000 MW	1826.43 MW
Energy recovery from waste	2,700 MW	45.78 MW

Sources: Ministry for Non-Conventional Energy Sources (MNES).

Total installed capacity of India is around 1,24,287 MW as on 31-03-2006.(*Source: Ministry of Power, Government of India*). The contribution of renewable sources has reached around 8661 MW up to 31-03-2006, representing approximately 6.97 % of the total installed capacity in India.

1.4 NCES Scenario - Tamil Nadu

The estimated potential from various sources of renewable energy, in the state of Tamil Nadu are as follows:

Estimated capacity for Power Generation from Renewable in Tamil Nadu

Source	Potential	Presently Installed (MW) as on 31.03.2006
Wind Power	**4500 MW**	**2931.465**
Biomass Power	**500 MW**	**32.85**
Bagasse based Co-generation		**314.6**
Solar Photovoltaic Power	**20 MW/ sq km**	**0.165**

Sources: TNEB & MNES

Out of many other sources of Non conventional energy, Tamil Nadu is blessed with conducive natural meteorological and topographical settings for wind power generation. The harnessing of wind energy is the highest in Tamil Nadu with an installed capacity of 2931.465 MW as against the country's installed capacity of around 5340.60 MW. The passes detailed below are endowed with heavy wind flows because of the tunneling effect.

Name of the Pass	Districts
Palghat	Coimbatore, Erode
Shencottah	Tirunelveli, Tuticorin
Aralvoimozhi	Tirunelveli, Tuticorin, Kanyakumari
Sea coast	Uvari, Tuticorin, Rameswaram, Poompuhar, Ennore

2.0 BACKGROUND AND NEED OF THIS ORDER

The Commission have taken into account the existing practices adopted by Tamil Nadu Electricity Board (TNEB) and the guidelines from the Ministry for Non-Conventional Energy Sources (MNES), in respect of NCES.. The policy of MNES and other related issues are discussed below.

2.1 MNES guidelines

(1) The State Electricity Board will announce a base purchase price every year for the electrical energy purchased by it from non-conventional energy based power projects. These rates shall be valid from 1st April to 31st March of the

following year. The base electrical energy purchase price valid for 1994-95 shall be a minimum of Rs.2.25 / kWh.

(2) The base price shall be escalated at a minimum rate of 5% every year. Announcement of revised base prices shall be made by the State Electricity Board (SEB) on 1st April every year.

(3) A promoter / developer shall be entitled to receive the base price set out in Power Purchase Agreement (PPA) for all electrical energy delivered from his project to the State grid for the duration of the Power Purchase Agreement. The rate shall be equal to the base price in the year of signing of PPA, escalated at a rate of 5% per year for a period of 10 years, from the date of signing of the Power Purchase Agreement. From the end of the 10th year, and for the remaining duration of the Power Purchase Agreement, the new purchase price shall be equal to the purchase price at the end of the 10th year or the High Tension (HT) tariff prevalent in the State at that time, whichever is higher.

(4) The SEB will undertake to transmit on its grid the power generated, and make it available to the producer for captive use or to a third party within the State at a uniform wheeling charge of 2 % of the energy fed into the grid, irrespective of the distance from the generating station. The third party must be a HT consumer of the Board, unless the Board relaxes this stipulation.

(5) A banking period up to one year.

2.2 TNEB's Practice:

(1) Taking the guidelines issued by MNES, the purchase rate was originally fixed at Rs 2.25 per unit from 1-12-95 with 5 % annual increase for five years. After the five year period, the rate has been pegged at Rs 2.70 per unit without any escalation.

(2) Wheeling is permitted to two numbers of HT industrial services only. The wheeling charge was originally 2 % only and revised on 27-9-2001 to 5 % .The next review shall be after five years. At present, around 65 % of the wind mill developers are under wheeling category and the balance 35 % alone are selling to TNEB. The wind mill generators (who have installed their wind mills prior to

12-4-2000) are presently permitted to wheel their energy to services other than industrial also, subject to the condition that they should pay to TNEB the difference in tariff as applicable to HT industrial service and the category of service wheeled to. For bio-mass and co-generation, the wheeling charges is 10% plus 2 % as tie-line transmission charges.

(3) The wind mill generators may either sell the surplus energy available after adjustment to TNEB at an outright price of Rs 2.70 per unit or bank the surplus. Banking charges is 5 % of the energy banked. The banking period starts from 1st April of every year to 31st March of the succeeding year. The unutilized banked energy as on 31st March of every year will be considered as lapsed. The banking charges shall be reviewed after five years from 27-9-2001. Banking for Biomass and co-generation is three months.

(4) TNEB started imposing a disincentive for the reactive power drawal, from the year 1995, on the basis of monthly average power factor (pf). If the average pf is less than 0.85, the disincentive was fixed at 1 % of the energy generated for every reduction of 0.01 below 0.85 pf. Considering the practical difficulties encountered in computing the average power factor, it was later changed to unit basis at 10 paise / kVARh. Wind Energy Generators (WEG) preferred to pay this compensation instead of installing capacitors to improve the pf. Hence the rate was subsequently increased to 30 paise / kVARh and later to Re 1.00 / kVARh. WEGs took up the matter in the High Court and as a sequel to the orders of the High Court and taking into account the technical and other issues, TNEB revised the rates as follows from May 2002:

- To classify WEGs who draw reactive power (kVARh) at 10 % or less, of the net active power exported as partially erring consumers and to classify those who draw more than 10 % of the net active power exported as erring consumers as far as the drawal of the reactive power is concerned.
- To levy a compensation charge of 30 ps / kVARh for the partially erring consumers and Re 1.00/ kVARh for the erring consumers.

2.3 National Electricity Policy

The guidelines stipulated in the National Electricity Policy on NCES which are relevant in the present context are reproduced below.

Section 5.2.20 Feasible potential of non-conventional energy resources, mainly small hydro, and 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.

Section 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.

Section 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.

2.4 Need of this order

The growth of the NCES based generation in the State underwent changes from time to time depending on the prevailing power and tariff scenario in the State. However, the enactment of EA 2003 brought out rational thinking on NCES policies. The Act stipulates promotional measures for generation from NCES.

Some of the policies/procedures followed by the TNEB need to be revisited to implement the spirit behind the Act provisions. Since Tamil Nadu is endowed with high potential for NCES development, the Commission decided to come out with benign policies / procedures to develop this environment friendly energy sources which will help the State for sustained development of its energy need.

3.0 CONSULTATIVE PAPER AND DISCUSSION PAPER ON NCES.

The staff of the Commission prepared a draft consultative paper on "Policy on purchase of power from Renewable Energy Sources and Co-generation in Tamil Nadu". The draft consultative paper was hosted on the website of the Commission on 10-04-2004 for easy access to the public. Copies of the draft consultative paper were sent to all State Advisory Committee (SAC) Members and special invitees on 1-11-2004 and the consultative paper was discussed in the State Advisory Committee meeting held on 24-11-2004. The list of Committee Members and special invitees who attended the SAC meeting held on 24-11-2004. is given in Annexure I. A public notice was issued on 26-04-2005 in leading daily newspapers in English and Tamil, inviting objections/comments/views on the consultative paper and to inform the public and other stakeholders about the Pubic Hearing to be held on 18-05-2005 on the above consultative paper. The last date for filing of objections/comments/views on the consultative paper was fixed as 10-05-2005. The list of stakeholders who have expressed their views in public hearing held on 18-05-2005 is given in Annexure - II. The list of stakeholders who have communicated their views through letters for the public hearing held on 18-05-2005 is given in Annexure - III. TNEB also furnished their written comments. Similarly Commission's staff prepared a draft discussion paper on "Tariff related Issues for Non Conventional Energy Sources". Copies of the draft consultative paper were sent to all State Advisory Committee Members and special invitees on 24-10-2005 and the discussion paper was discussed in the State Advisory Committee meeting held on 11-11-2005. The list of Committee (SAC) Members and special invitees who attended the SAC meeting held on 11-11-2005 is given in Annexure IV. A public

notice was issued on 18-11-2005 in leading daily newspapers in English and Tamil, inviting objections/comments/views on the consultative paper. The last date for filing of objections/comments/views was fixed as 30-11-2005. Based on the request of the stake holders, the last date was extended up to 15-12-2005. A notice dated 29-11-2005 for Pubic Hearing to be held on 23-12-2005 was published on the website of the Commission and in leading daily newspapers in English and Tamil. The draft discussion paper was hosted on the website of the Commission for easy access to the Public. The draft consultative paper was provided for inspection at the Commission's office and also made available for sale. The list of stakeholders who have expressed their views in public hearing held on 23.12.2005 is given in Annexure - V. The list of stakeholders who have communicated their views through letters for the public hearing held on 23.12.2005 is given in Annexure - VI. TNEB have also furnished their written comments.

Considering the large installed capacity of wind power in Tamil Nadu and its impact on the Tamil Nadu Grid, a **round table conference** was conducted on "Wind power tariff and related issues" on 24-12-2005 at Chennai. Wind power experts from various States and from different development, financial and consultancy institutions have participated and expressed their views. The subject-wise objections/comments/views received during the public hearing, SAC Meeting, TNEB and written comments / views received from other stake holders are discussed in section 8.

4.0 APPLICABILITY OF ORDER

This order shall come into force from the date of its issue. This order shall be applicable to all future and renewal of existing contracts / agreements for the Non-Conventional Energy Sources (NCES) based Generating Plants and Non-Conventional Energy Sources based Co-Generation Plants located within the State of Tamil Nadu. It should be noted that the existing contracts and agreements between NCES based generators and the distribution licensee signed prior to the date of issue of this order would continue to remain in force.

However, the NCES based generators and the distribution licensees shall have the option to mutually re-negotiate the existing agreements / contracts, if any, in line with this order even before the expiry of the contracts. Any renewal of the said contracts / agreements, new contracts / agreements shall be in line with this order.

5.0 DEFINITIONS.

(a) "Cogeneration" means a process, which simultaneously produces two or more forms of useful energy (including Electricity)

(b) "Firm Power" means injecting of atleast 700 units in to the grid by the generator per hour per scheduled MW . [This calculation is based on a normative load factor of 70% (i.e. 1000 kWh x 70% Load Factor = 700 units per hour)].

(c) "**Infirm Power"** means the energy supplied that is not firm power, which is interruptible on a very short notice.

6. TARIFF PRINCIPLES

6.1 Tariff related provisions of the Act

(1) The Commission is guided by the following tariff related provisions of the Act which are relevant to this order.

(a) the principles and methodologies specified by the Central Commission for determination of the tariff applicable to generating companies;
(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) safe guarding 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) promotion of co-generation and generation of electricity from renewable sources of energy; and

(h) the National Electricity Policy and Tariff Policy.

(2) Section 61(h) mandates that the appropriate Commission, shall be guided by the promotion of co-generation and generation of electricity from renewable sources of energy while specifying the terms and conditions for determination of tariff.

(3) Section 86(1)(e) of the Electricity Act of 2003 requires that the Commission shall promote renewable sources of energy through (a) ensuring that Licensees extend the grid suitably to draw power from renewables and (b) ensuring that each Licensee purchases a minimum requirement as a percentage of total consumption in his area of supply.

6.2 Provisions in the Tariff Policy of GOI

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

(1) Section 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.

(2) Section 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.

(3) Section 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.

(4) 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.

The Commission is also guided by section 5.3 of the tariff policy which stresses on the "performance based cost of service regulation" in respect of Return on Investment, Depreciation, Cost of Debt and Operating Norms.

7. APPROACH

Guided by the above tariff principles, the Commission have carried out a detailed analysis of the various existing policies/procedures and commercial mechanisms instituted by GoTN and TNEB in respect of NCES. Commission have also analysed the orders issued by other Commissions on the tariff related issues of NCES. The Commission considered the following methodologies and important factors to arrive at the tariff for NCES based generators.

- Pricing Methodology
- General / Project specific.
- Two part tariff / single part tariff
- Capacity Utilization Factor / Load factor

- Fuel cost
- Capital investment
- Life of plant and salvage value
- Depreciation rate applicable
- Operation and maintenance expenses
- Debt-equity ratio
- Interest costs on debt (cost of loan / debt)
- Term of Loan
- Return on equity
- Insurance Cost

The Commission also considered the comments / suggestions provided in the public hearing, SAC, TNEB, round table conference and from other stake holders. The issue-wise comments / suggestions are discussed below.

8. ISSUE-WISE COMPILATION OF COMMENTS / SUGGESTIONS AND COMMISSION'S VIEWS / DECISIONS

Issue No. 1: Classification / Changes required on various definition:

Mr. Vellingiri, M/s.Tamil Nadu News Print & Papers Ltd. (TNPL) during the public hearing has stated that alternatively, a separate category called Captive Co-Generation (cogen) Sugar Mills can be created in addition to the existing classifications viz. (1) Captive Generation (2) Bagasse based Co-Gen. (3) Captive Co-Generation and the tariff should be equal or maximum of 5% less than bagasse based Co-gen. He has also stated that M/s. TNPL, as CGP, is also exporting power to TNEB grid and in the present proposal, the captive co-gen tariff is linked with captive generation with additional 10%. M/s.TNPL desires the classifications as bagasse based and non-bagasse based with marginal difference in tariff. Further he has stated that Co-gen units export only the surplus power and hence the classification as firm / infirm is not applicable for co-gen units. Chairman & Managing Director, M/s. TNPL in his written submission for the public hearing has stated that the captive cogen units may be exempted from

classifying the power as firm and infirm power. He has also stated that the firm power may be defined as power committed to supply on monthly basis as against hourly basis proposed in the concept paper.

Mr. Arvind Gupta, M/s.Tamil Nadu Power Producers Assn. (TNPPA) during the public hearing has stated that in the concept paper, there is no mention about Waste Heat Power generation. Even IREDA considers waste heat power generation as a NCES. Hence he has requested that it should be included as a NCES power and all benefits passed on. They have also stated that the fossil fuel based waste heat recovery generation may be treated as cogen if it satisfies the cogen criteria without supplementing the heat at power generation point and the wheeling charges and other benefits shall be at par with cogen plants using bagasse.

Mr. Manickam, M/s.The South Indian Sugar Mills Association (SISMA) during the public hearing has stated that the sugar mills are basically situated and distributed in rural areas and gives stability to the grid. Sugar factories should be given co-gen status irrespective of whether they give the bagasse to TNPL units or burn in their own units. He has also stated that by the proposed categorization, the sugar mills supplying to TNPL is loosing 60 paise and hence it is no longer attractive to supply bagasse fibre to TNPL. Hence both the categories may be treated as Co-gen, otherwise they may not be able to supply bagasse to TNPL at all. Mr. Raman of M/s. SISMA has stated that sugar mills use other Biomass fuels. Hence it may be called sugar mill cogen instead of bagasse based cogen plant.

Thiru G.N.Periyasamy, Agriculturist, in the 7th State Advisory Committee meeting has stated that the tapioca stalks and wastes may be included as one of the sources of non-conventional energy.

Commission's Views / Decisions

Section 61 of the Act requires that the appropriate Commission shall, specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by promotion of **co-generation and generation of electricity from renewable sources of energy.** For the consideration of promotional measures, the Commission have classified the generating plants as follows based on the energy source used for generation of electricity.

1. Fossil fuel based Captive Generating Plants
2. Fossil fuel based Co-generation plants
3. Non-Conventional Energy Sources based Generating Plants
4. Non-Conventional Energy Sources based Co-Generation Plants

The criteria for the above generating plants are given in the respective orders of the Commission. The Commission is of the view that no more classification is necessary.

Waste Heat Power generation has now been classified in a general way, under cogeneration. However, depending upon the nature of fuel used by the plants, it will be further classified into fossil fuel based cogeneration plants or NCES based cogeneration plants.

For the bagasse based cogen units, using conventional fuel for start up, stabilization and extended operational days, the Commission have decided to adopt the following MNES's eligibility criteria.

> **For Bagasse/Biomass Cogeneration Projects:** Bagasse, forestry and agro-based industrial residues. Mix of conventional and/or non-conventional fuel, up to 25 per cent only, allowed in both cases to achieve extended operating days in a year.

The categorization of power plants who are supplying bagasse fibre to TNPL will be done accordingly.

Regarding using of tapioca stalks as biomass fuel, it is up to the developer to decide on its commercial viability. No separate order from the Commission is necessary in this connection.

Issue No. 2 : Tariff methodology

Mr. M.Palaniappan, IWEA, during the public hearing held on 23.12.2005 has stated that normalised cost plus single part tariff is acceptable. He has also stated that a differential tariff for existing and new projects may be considered. He has also suggested that instead of simple average tariff, a levelised tariff may be considered which includes time value of money and stated that the discounting factor suggested is the weighted average capital cost of the project as against average cost plus single part tariff proposed. **Mr.Venkat Sundaram, Secretary, IWEA** has added that with the weighted average cost of capital it works out to Rs. 3.55 per KWh as against Rs.3.09KWh computed by the Commission.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that the tariff can be a levelised one based on the realities and not a front loaded one.

M/s.Tamilnadu Power Producers Association in their written submission have suggested a single part tariff with cost plus approach, generalized single levelised tariff.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have stated that the tariff can be single part with cost plus approach, generalized single levelised tariff. They have also stated that for bio mass energy, the tariff design could be single part cost plus and generalized

Mr.K.Kasthurirangaian, Vice Chairman, M/s.Indian Wind Power Association in his written submission has requested to adopt cost plus tariff which is fair & reasonable. He has also recommended to devise a levelised tariff duly factoring the 'Time value of Money' as against simple avg. suggested by the TNERC.

The Director, M/s.Goyal Ispat Ltd. in his written submission has stated that the tariff can be single part with cost plus approach, generalized single levelised tariff.

Ms.Kalaivani, Chennai in her written submission has stated that the auxiliary consumption, capital expenditure and O&M expenditure are to be apportioned to steam cost and power cost. She has also requested the commission to reduce the norms & parameters for tariff determination in case of Cogen plants.

Dr.Pramod Deo, Chairman, MERC during the round table conference has stated that the project has to be attractive to investors and cost plus return is better option to attract investors. He has also stated that it is advisable to give normative base cost plus return and the tariff be front loaded

Mr.Debashish Majumdar, Managing Director, IREDA during the round table conference has stated that the tariff for wind energy could be a cost plus base.

Manish Agarwal, Head – Power Practice, CRISIL during the round table conference has stated that project specific cost plus tariff is preferable. He has also stated that there should be certainty of policy and the policy should be clear with fixed tenure and tariff so that the lender would be comfortable. He has also stated that the tariff should be for the year of commissioning and the tariff could be escalated after 14 years.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference suggested the need to rethink on uniform tariff for same locality. He has also stated that differential tariff could be adopted based on area, age of machines capacity of machines and location advantage and the proposed tariff may be single part. *He has also stated that under levelised tariff, higher rate is assumed initially which declines over a period of time, it is necessary to allow escalation at a reasonable rate (2.5% to 3%) to take care of inflation.*

Further he has stated that there are constraints in transmission facility in the Southern Region. In order to strengthen the infrastructure for evacuation including transmission lines, funds may be raised by levying Cess at four paise per unit on industrial and commercial consumer categories so that the fund could be used for strengthening of the infrastructure for renewable energy or alternatively, investors choosing to invest in high CUF areas where transmission lines are choked may be levied higher charges towards evacuation and transmission facilities.

Mr.T.B.Chikkoba, Member (Retired), TNEB during the round table conference has stated that the tariff should be cost plus and when allowing cost plus tariff, the environmental benefit need not be factored. He has further suggested that present worth concept need not be used. The present worth concept may be used for comparing the two projects. Whether we use simple average method or discounted method the results will be the same. He has also stated in the 7th State Advisory Committee meeting that a cost plus single part tariff is the best option and the tariff may be on a levelised basis.

Mr.K.Varahala Rao, General Manager-Power Division, M/s.Nuziveedu Seeds Ltd. in his written submission has suggested that tariff can be determined on a levelised basis over the life of the project instead of average tariff as it does not take into account the time value of money. For this, the discount rate of 12% may be considered. He has also suggested that the revised tariff may be made

applicable for the existing wind turbines set up after 2002 also with effect from the date of revised Tariff order.

Chairman, TNEB during the 5th SAC Meeting has suggested that two part tariff cannot be extended to wind power project as the wind energy is infirm in nature. In order to have uniform policy for all renewable sources of energy, two part tariff cannot be extended to renewable energy project. He has also suggested taking into consideration the project cost, fuel and quality of power, tariff can be fixed on cost plus basis, separately for power from renewable sources, bio mass, cogeneration and municipal waste. It can be levelised and remain firm.

Commission's Views / Decisions

Since wind energy is not amenable (with the existing technology) to merit order dispatch principles because of infirm nature, and all the costs of wind electric generators are fixed, the single part tariff is considered more suitable for wind power. Therefore, Commission accepts the majority views for a cost plus, generalized single part tariff. The commission have decided to categorize the Wind Energy Generators in two groups as below:

1. Group I Projects: (a) Wind power projects Commissioned, and to be commissioned based on agreements executed prior to the date of this order.

2. Group II Projects: Wind power projects to be commissioned based on future agreements after the date of this order.

In regard to levelised tariff, the Commission accepts the views expressed by Thiru.T.B.Chikkoba, Member (Retired), TNEB. To factor-in the time value of money, in calculating the tariff, the escalation provided for O&M charges, derating of the CUF after 10 year period and grouping of the existing and proposed generators in two categories, are expected to address this issue.

Issue No. 3 : Purchase Price:

Mr.D.A.Prabhakar, M/s.Tirunelveli District Consumer Protection Association during the public hearing has stated that Wind Energy is infirm power and it should not be considered on par with other firm power and there should not be any raise in the tariff. He has stated that TNEB have surplus generation and is exporting power to neighboring States and hence at this situation, it is a question whether tariff revision is necessary. He has also added that any tariff raise on purchase of power will affect only the poor consumer. As there is reduction in interest rate and the wind mill developers get income tax (IT) relief etc., he has requested that the Commission may fix lower tariff for newly installed wind mills.

Mr. V.R. Sreekumaran, M/s.NEG Micon during the public hearing has stated that TNERC have arrived at Rs.2.79 as the per unit rate. He has added that if the same parameter is considered with a discount factor of 12% over a period of 20 years, the tariff works out to Rs.3.07. He has also submitted that a levelised tariff of Rs.3.25 over a period of 20 years and an inflation of 5% on levelised tariff, works out to Rs.2.10 in 10th year, which is a pay back period of loan and Rs.1.29 in the 20th year. Hence, he has suggested that Rs 3.25 will be reasonable considering the time value of money. Mr.Ramesh Kymal, of the above company in his written submission has recommended that the tariff for wind power be fixed between the rates prevailing in states of Karnataka(Rs.3.40/unit) and Maharashtra (Rs.3.50/unit). He has also stated that there shall not be any dispatch restriction for wind energy. It should have a 'must run" status as per Grid Code. Mr.Ramesh Kymal of M/s. NEG Micon in his written submission has requested to consider that at least 25% of the total power generated is from renewable sector in terms of total units generated in line with the provision of Electricity Act.

Mr. M.Palaniappan, M/s.Indian Wind Energy Association, (IWEA) during the public hearing has suggested that an environmental benefit @ 20 paise premium may be fixed over the cost of generation especially for wind energy. He has also stated that the project cost of Rs.4.50 crs /MW, CUF of 25%, project period of 20 years, SLM depreciation @ 4.5% with 10% residual, debt-equity ratio of 70:30 and loan period of 10 years are acceptable. With the above assumptions, he has stated that the unit rate will work out to Rs.3.50 and this rate is lesser than the variable cost of P.P. Nallur Independent Power Producer (IPP). He has suggested that a flat tariff is suggested for first 10 years @ Rs.3.50 and in the 11th year a reduction of 50 paise can be proposed i.e. @ Rs.3.00, thereafter with a compounding increase @ 5% every year till the 20th year. He has also stated that in a study made in Maharashtra on wind energy generation, due to distributed wind generation, the distribution losses have come down. He has requested that a similar study may be made in Tamil Nadu. He has also stated that the minimum power purchase from NCES @ 10% is not sufficient considering the potential of NCES in the State and hence suggested that the minimum percentage may be increased to 20% or above. He has also stated that Wind energy is not amenable to dispatch under ABT and that the concept paper has no mention about it.

Mr.K.Kasthurirangaian, Vice Chairman, M/s.Indian Wind Power Association (IWPA) during the public hearing has stated that the average cost arrived at does not include time value of money and also stated that with a levelised cost for 20 years with time value for money in a cost plus approach and with 16% post tax of RoE, the tariff works out to Rs.3.25 over the period of 20 years and added that his association requests the TNERC to fix this rate. He has also stated that assuming a nominal inflation @ 5%, the tariff applicable is Rs.3.10 in the 2nd year, Rs.2.10 in the 10th year and Rs.1.29 in the 20th year. He has also suggested the following.

- For factoring Environmental benefits, due credits to be given @ 20 paise per unit.
- Any incentive allowed by Government should not be factored in the price.
- Between two part / single part tariff, single part tariff to continue.
- Buy back Rate at Rs.3.40 paise as a levelised tariff for next 10 to 20 years.

He has further requested that the minimum limit of power purchase may be fixed as 25% as suggested by Hon' President and that there should be no restriction in the penetration of power from NCES. He has also stated that they are generally in agreement to most of the points mentioned in the concept paper.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association (TNSMA) in his written submission has stated that though annual tariff escalation @ 5% was recommended as per the norms of MNES, there was no sufficient escalation for past several years. In addition he has pointed out that TNEB is also making extraordinary delay in releasing payments to promoters who opt for sale of energy with delay ranging between 4-5 months sometimes. During the public hearing he has stated that the actual power purchase price of TNEB is Rs.2.70 but they have to pay at least Rs.3.50.

Mr.Sriramamurthy, Member, APERC during the round table conference has stated that before the commission's NCES tariff review, NCES based developers in AP were allowed captive generation and third party sale with lot of incentives. MNES policy guidelines-base year was shifted from 1994-95 to 1995-96 in 2003 - 04 and with the escalation of 5% the tariff was fixed at 348 paise in AP. Due to attractive tariff, biomass plants were run at 95% and sometimes exceeding 100% PLF. Licensees came up with a representation that third party sale by NCES based generators hit them hard as they are snatching away industrial consumers and hence they are loosing the cross subsidy. Commission reviewed the policy during 2004-05. Commission proposed two tailored tariffs (fixed and variable) for

biomass and bagasse plants. Beyond 85% PLF, only variable cost was allowed. For wind energy a fixed tariff of Rs 3.37/kWh was proposed (as on 01-04-2004). The tariff is frozen for a period of five years. (Date of order 20-03-2004). APERC fixed a 5% RPPO (Renewable Power Purchase Obligation) out of which 0.5% is earmarked exclusively for wind power. The RPPO is applicable not only to distribution licensee but also to third party purchaser through open access.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the environmental benefits quantified as 10 paise per unit may be added to the cost while calculating the tariff.

Mr.P.Janakiraman, Chennai in his written submission has stated that the cost of Rs.2.70 per unit is reasonable taking into account the investment at Rs. 4 crores plus per MW, interest on loan at 9-10%, depreciation at 4.5%, O&M charges at 1.25%, ROE at 14-16%, and generation at 24.69% CUF. He has recommended an addition of 5-10paise / unit in recognition and acceptance of environmental benefits unless it is already loaded in the 16%. He has suggested that different methodologies may be adopted based on experience and perceptions. He has also suggested that the existing practices (cost of power, wheeling charges, banking charges, buy back rate, etc.) which are in line with MNES guidelines may be continued since they have not posed any serious problems so far. However, they may be reviewed as and when necessary.

Mr. Giri, M/s.Indian Wind Turbine Manufacturers' Association during the public hearing has stated that earlier MNES had been giving exemption to 9 to 10 components which has now been reduced to only 4 components. He has also stated that hybrid tariff is required with the following parameters.

With Capital Cost of 4.50 Crores, O & M cost of 1.5%, ROE at 16%, depreciation of 7.83%, CUF of 20% , Interest rate at 10.5% with front end loading, the tariff structure will be at Rs.4.31 in the first year and Rs.2.23 in the 20th year.

- He has also suggested as alternative I, a pre determined tariff of Rs.3.31 for first year and escalated @ 1% for 6 years and Rs.3.47 for 7 to 20th year.
- He has suggested as alternative II, a pre determined tariff of Rs.3.12 for the first year and escalating 2% for the first 10 years and freeze at Rs.3.68 for 11 – 20 years.
- He has suggested as alternative III, a pre determined tariff of Rs.3.42 throughout 20 years.

He has stated that safe return for huge investment is required. He has further requested for exemption of wind energy from merit order and ABT requirements and requested to be considered as "must run" station.

Mr. Vellingiri, M/s.TNPL during the public hearing has stated that TNPL manufactures paper and bagasse is the main raw material. He has stated that bagasse is obtained from sugar mills on fuel substitution basis which is a unique arrangement prevailing only in Tamil Nadu. He has added that in 2000-01, TNEB fixed tariff for the Normal Co-gen Sugar Mill Units & TNPL type Co-Gen units, with difference in tariff at the rate of Rs.0.25 but however, as on date, the difference in tariff has been eliminated. He has also stated that under the present concept paper, the TNPL type cogen has been classified under CGP and the difference in tariff is 60 paise which is very high compared to present values which will affect the sugar mill and the TNPL units in its operation. Hence he has requested that the TNPL sugar mills be treated on par with other sugar mills. The company in their written submission has stated that alternately, if grouping the TNPL tied up sugar mills as bagasse based cogen plants is not possible, a new classification may be introduced viz. 'Captive cogeneration sugar mills' with a tariff at a maximum of 5% lower than bagasse based cogen plants and exempt sugar mills from classifying power as firm power and infirm power. They have also stated that as per the proposal the tariff for Captive cogeneration plants is 10% higher than the captive generation plants and therefore requested that as

captive cogen plants as basically cogen plants, the tariff for captive cogen plants may be fixed in relation to cogen plants rather than captive generation plants ie. it may be fixed at a maximum of 5% lower than the bagasse based cogen units instead of 10% higher than captive generation plants.

Mr. Ram Thiagarajan, SISMA, during the public hearing has stated that in G.O.Ms.No. 230 dt.16.6.93, a tariff rate equivalent to HT I tariff less 2% transmission charges was guaranteed and the G.O. permitted wheeling & banking @ 10% & 2% respectively. He has added that payment was assured within 30 days with surcharge provisions while in a BP issued by TNEB, the tariff was fixed at Rs.2.73 with no escalation effective from April 2000. He has further stated that the sugar mills supplying to TNPL were separately categorized and paid only at CPP rate**.** He has also stated that due to different tariff for TNPL tied up sugar mills, sugar mills may not able to supply to TNPL. He has also stated that the difference of tariff is higher in the proposed tariff. He has suggested that both are Co-Generation Plants and there shall not be any difference in tariff and both shall be paid considering them as bagasse based Co-gen plant. The association has also stated that fuel cost assumed is Rs.575/MT equivalent to the cost of pit head coal. Considering the high moisture content fuel used in the Cogen plant, they have suggested to consider a higher cost of Rs.897/-, which is equivalent to the cost of lignite for the same calorific value.

M/s.Tamil Nadu Power Producers Association in their written submission has stated that the purchase price for bagasse based cogen plants shall be at Rs.3.15 per unit.

Mr. T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer), during the public hearing has stated that 10 paise for environment benefit is very less and recommended that 30 paise may be provided considering the economics and that NCES power penetration of minimum 20% may be fixed**.**

Mr. Manickam, M/s.Sakthi Sugars, during the public hearing has stated that 2500 MW of wind mills are running in summer and help the TNEB to overcome seasonal air-conditioning load and hence suggested that wind energy deserves a better treatment. He has also stated that TNEB arbitrarily defined the season and off season for the sugar mills and during off season TNEB pays CPP rate and in season bagasse rate and even though, a generating set is run on bagasse, CPP rate is paid as per the off season period fixed by the TNEB. Instead, he has suggested that as certified by the Commissioner of sugars, it may be taken as the season or off season and paid accordingly based on certification by GoTN as season or off season.

Mr.R.Varadharajan, Deputy General Manager, M/s.DCW Ltd., during the public hearing has suggested that tariff can be determined on the basis of MNES guidelines allowing percentage increase and without any freezing at any stage. He has suggested that the present increase shall take 1994-95 base and assume the 5% increase that ought to have been given for these years and fix the tariff for the current years ie. the amounts left out in the earlier years are to be considered for the increase in the current year. He has also suggested that it should be made mandatory for the increase of 5% automatically each year.

Mr.Debasish Majumdar, Managing Director, Indian Renewable Energy Development Agency Ltd.,(IREDA) in his written submission has suggested that suitable incentives should be extended to Renewable Energy Projects since they are high risk investment business proposition and the power generated is infirm due to uncertainties and dependency on nature. He has also suggested that the MNES Guidelines of 1993 should form the basis of fixation of tariff.

Mr.T. Varadarajan , M/s.M.N. Dastur Consultants during the public hearing has stated that viability of new project depends on the energy cost and with energy cost at Rs. 4.47 and with high cost of water, plants are not viable.

Mr. T.C.Dayalan, Hon. General Secy, M/s.TANSTIA in their written submission has stated that 50% of the pollution control cost may be added to the cost of production of the plant.

He has also suggested to fix the cost plus separate rates for the renewable energy generators such as biomass users, cogen plants, municipal waste users and wind mills and further suggested that the incentive allowed by Government need be factored in the tariff and for arriving at the capital cost, the subsidy and concessions may be deducted.

TNEB's Reply:

Chairman, TNEB during the 5th SAC Meeting has stated that for the existing projects, the rate was fixed on adhoc basis based on MNES guidelines at Rs.2.70. He has further stated that since there is no mention in the Agreement that the rates will be revised after a few years, the rate cannot be revised after few years. He has also stated that the present tariff fixed based on MNES guidelines is on the higher side. He has further added that with all the benefit of renewable energy on environment, the renewable energy is in no way a substitute for the energy from conventional fuel and that they can only supplement the conventional energy and the entire demand has to be met with the power generated with fossil fuel. Hence, he has suggested that the existing rate of Rs.2.70 for 2002-04 may be continued at the contracted level upto 2006.

Member / Generation, TNEB during the public hearing has stated that Tamil Nadu Government and TNEB have consistently encouraged the promotion of NCES and the capacity addition during the last year will prove this. He has also stated that the rate of Rs.2.70 is more than the average cost of power purchase.

TNEB has also submitted the following:

(a) Wind Energy: TNEB has followed MNES guidelines for 5 years from 1995 i.e. base tariff of Rs.2.25 with annual escalation of 5%. However in September 2001, TNEB has deviated MNES guidelines and Rs.2.70 unit was fixed for next

5 years without escalation since the technology was successful and more private developers were investing in this sector. At present around 5000 windmills to the tune of 2400 MW capacity are available in Tamil Nadu State indicating that the price fixed by TNEB is reasonable for private windmill developers.

TNEB has stated that differential tariff based on project specific and existing/proposed is not suggested to avoid any disparity and non-standard price among private windmill developers. Hence the cost plus and single part tariff has been suggested for the policy on determination of tariff. Based on the above and assumptions made by TNERC viz.CUF, capital investments etc., TNEB has suggested the following:

Consequent to the economic reforms in the country, money market is competitive and cost of debt is very less. Therefore , it has been suggested that the rate of interest shall be chosen so that the price per unit is very much economical to Board and lesser the Board's burden towards the purchase of windmill power. The average per unit cost works out Rs.2.60 & Rs.2.58 respectively for the interest rate of 9% instead of 10.5% and ROE of 14% for the CUF of 24.69% and 25.5%.

Also the capital investment at Rs.4.5 Crores /MW seems to be on the higher side. It has been stated that this is equivalent to per MW cost of setting up of a Thermal Station which has Boiler, Turbine, Generator and many other auxiliaries like coal, oil and Ash Handling Systems, Boiler, Turbine and Plant C&I systems, Cooling water systems etc., when comparing to a single wind Turbine & Generator. Therefore TNEB has suggested that cost plus single part tariff with reasonable investment cost, interest rate & ROE may be followed and corresponding unit rate be fixed.

(b) Bio mass: Even though average cost of power works out to Rs.2.25/unit, TNEB is having a purchase price of Rs.3.15/unit for the current year and thus

TNEB is incurring a loss of 90 paise/unit. Therefore, TNEB has suggested that ways & means have to be studied in order to minimize the cost, input and selection of boiler etc. so as to bring the cost of production to Rs.2.00 to Rs.2.25 so that TNEB can limit the loss due to purchase of NCES power.

TNEB has recommended that PLF of 80% O&M expenses at 4% with 4% escalation as followed by APERC and interest rate & ROE of 9% & 14% or less respectively shall be considered for arriving at the per unit cost.

(c) Solar energy: No comments.

(d) Bagasse based co-generation plant. TNEB has stated that they have been paying Rs.3.15/unit for the power purchased from bagasse based co-generation sugar mills during crushing season and Rs.3.01/unit during non-crushing season i.e. CPP rate is adopted as the fuel used is bagasse plus other fuels.

Orders of other commission on NCES Tariff

(1) Wind Energy

(a) Maharastra

(i) Group I Projects: Wind power projects commissioned before 27th December 1999, i.e. before the Commission notified its Regulations.

For Sale to MSEB and other Utilities/ Licensees in the State

The purchase price shall be Rs. 2.25 per unit in the base year 1994-95. The purchase rate shall be increased at 5% every year for the first ten years from the date of commissioning, no increase in rate for the next three years and 5% increase in rate every year for the next 7 years. Based on the above, the rate payable per unit for this Group of projects with effect from 01.04.2003 works out to Rs. 3.24 per kWh.

Adjustment for Self-use and Sale to Third Party

From 1st April, 2003 onwards, net energy delivered to the grid for self use or for sale to third party shall be adjusted at the rate of prevailing base HT energy tariff.

(ii) Group – II Projects: For wind power projects commissioned during the period from 27th December 1999 to 31st March 2003 (which were eligible for sales tax incentive)

Purchase of Energy by MSEB/ Utilities/ Licensees

The purchase rate shall be increased at 5% per year (simple rate). The validity of EPA shall be only 8 years. Based on the above, the rate payable per unit for this group of projects, with effect from 01st April 2003 works out to be Rs. 3.24 per kWh.

Adjustment for Self-use and Sale to Third Party

From 01st April 2003 onwards, net energy delivered to the grid for self use or for sale to third party shall be adjusted against the consumption made as per the TOD tariff time slots.

(iii) Group III Projects: For wind power projects to be commissioned after 01st April 2003 during the balance period of the 10th Plan ending 31st March 2007.

Purchase of Energy by MSEB/ Utilities/ Licensees

For Sale to MSEB and other Utilities/ Licensees in the State Rs. 3.50 per unit for the first year from the date of commissioning of the project. The purchase rate shall be increased at 15 paise per unit every year for a period of thirteen years from the date of commissioning of the project.

Adjustment for Self-use and Sale to Third Party

Net energy delivered to the grid for self use or for sale to third party shall be adjusted against the consumption made as per the TOD tariff time slots.

(b) Madhya Pradesh

For New Projects

The Commission sets the tariff for generation from a 1 MW new wind energy project for its project life of 20 years in the manner shown below:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Tariff (Rs./unit)	3.97	3.80	3.63	3.46	3.30	3.14	2.98	2.83	2.67	2.52
	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Tariff (Rs./unit)	2.43	2.44	2.46	2.48	2.50	2.51	2.53	2.55	2.58	2.60

For Existing projects

For Existing projects the rate is **Rs. 2.87 / unit which is the** average price of 20 years payable to the new projects.

(c) Andhra Pradesh

Energy purchase rate: Base unit price of Rs. 2.25 as on 1.4.1994 and a simple escalation index of 5% p.a. The base price as on 01-04-2004 will be Rs. 3.37/kwh. The tariff is frozen for a period of five years. (Date of order 20-03-2004).

(2) Biomass Energy

(a) Andhra Pradesh

The fixed cost tariff for the Biomass Power Projects is as follows:

Year of operation **(n^{th} year)**	**Fixed Cost Rs / Unit**
1st	1.61
2^{nd}	1.57
3^{rd}	1.53
4^{th}	1.49
5^{th}	1.45
6^{th}	1.41
7^{th}	1.37
8^{th}	1.33
9^{th}	1.26
10^{th}	0.87

The variable cost tariff for Biomass based projects is as follows:

Financial Year	Variable Cost Rs / Unit
2004-2005	1.27
2005-2006	1.33
2006-2007	1.40
2007-2008	1.47
2008-2009	1.54

(3) Bagasee cogeneration

(a) Andhra Pradesh

Fixed cost tariff for Bagasse Based Co-generation Plants is as follows:

Year of operation (n^{th} year)	Fixed Cost Rs / Unit
1st	1.72
2nd	1.67
3rd	1.63
4th	1.59
5th	1.55
6th	1.51
7th	1.47
8th	1.43
9th	1.35
10th	0.90

The variable cost tariff for bagasse based projects is as follows:

Financial Year	Variable Cost Rs / Unit
2004-2005	1.02
2005-2006	1.07
2006-2007	1.12
2007-2008	1.18
2008-2009	1.24

Commission's Views / Decisions

A detailed analysis on different methods and factors adopted for fixing tariff for different NCES based power generation has been dealt with in section 9. Most of the suggestions / objections mentioned above have been discussed and taken in to account in the above analysis. The left out points are discussed below:

It is very complex and difficult to calculate the per unit environmental benefit for the generation of clean power from wind and other renewable energy sources. However, the Commission have compensated this benefit to the NCES based generators by advantageously fixing the other factors like, transmission and wheeling charges, banking provisions etc.

As per clause 4.2.4 of Commission's tariff order dated 15-3-2003, the quantum of energy to be procured from 'Must Run' stations such as nuclear stations (KAPS, MAPS), infirm power sources such as co-generation, captive, wind and other States, is outside the purview of merit order dispatch.

Regarding fixing of minimum power penetration from NCES, the following important factors have to be considered.

- Total quantum of energy required
- Total potential for renewable energy generation in the State
- Quantum of renewable energy being generated
- Power purchase tariff for renewable energy
- Commercial and technical impact of purchase of renewable power on retail tariffs

Based on TNEB's data, the aggregate generation from wind mills for the year 2005-06 is 3444.28 MU. Generation from cogeneration plants and bio mass plants is 935.61 MU for the year 2005-06. TNEB's total consumption for the year 2005-06 is 43795 MU. Therefore, the percentage of penetration by NCES sources is 10.00% for the year 2005-06. Out of which, the purchase of TNEB from NCES sources constitutes only 35% of the total NCES power injection into

the Tamil Nadu Grid. Therefore, the total purchase of TNEB from NCES power constitutes 1532.96 MU for the year 2005-06. This constitutes 3.5 % out of its total consumption. Considering the above facts, the Commission fixes 10% as the minimum percentage of power each distribution licensee shall purchase from NCES sources out of his total consumption in his area of supply in Tamil Nadu as required by Section 86 (1) (e) of the Act.

With regard to the suggestion given by Mr.Manickam from M/s.Sakthi Sugars in connection with defining of season and off season, the Commission is of the view that ,in the absence of any other proof, the certificate issued by the GoTN regarding crushing or non crushing season may be accepted. However, the apt criteria shall be the type of fuel used by the plant taking into account the eligibility criteria of MNES as discussed in issue number 1 of this section. All relevant fuel used data shall be furnished by the generator to the distribution licensee every month for verification. The generator shall permit the distribution licensee for any field and document verification.

Issue No. 4 : Tariff Review Period/Control Period:

Mr.K.Venkatachalam, Chief Advisor, M/s.Tamil Nadu Spinning Mills Association in his written submission has stated that the proposed tariff review period/control period of 3 years is acceptable.

M/s.TNPPA in their written submission for the public hearing has stated that the control period may be fixed as 2 years with escalation clause for next 10 years. Similar views have been expressed by **M/s.Raghu Rama Renewable Energy Ltd. and The Director, M/s.Goyal Ispat Ltd.**

Mr. Raman, M/s.South Indian Sugar Mills Association in his written submission for the public hearing has stated that the tariff review period may be increased to 10 years and the same has been recommended by **Mr.Debasish Majumdar, MD, IREDA.**

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that tariff review period may be considered as 5 years. He has also suggested that any revision in tariff after each control period may be made applicable for new projects only and not for existing projects.

.**Thiru T.B.Chikkoba, Former Member (Gen.),** TNEB in the 7th State Advisory Committee meeting has stated that the control period may be five years instead of 3 years.

Mr. Giri, M/s.Indian Wind Turbine Manufacturers' Association during the public hearing has stated that PPA and wheeling agreements may be for 20 years with a control period of 5 years. He has also suggested a firm policy of 5 years, with a buy back period of 9 to 10 years since long term agreement with assured buy back price may reduce the risk of the project.

Mr. T.C.Dayalan, Hon. General Secy, M/s.TANSTIA in their written submission has stated that uniform period may be fixed for all renewable generators with varying wheeling charges but banking period may be fixed as one year for all.

Orders of other commission on control period

For wind energy tariff, Maharastra has adopted a control period of 4 years or addition of 750 MW from 1-4-2003 whichever earlier.

Commission's Views / Decisions

The enactment of EA 2003 brought out far reaching changes in the Indian power sector scenario and it introduced special impetus to reform process in every direction. Radical changes have been introduced in power policies, the impact of which is yet to be felt and studied. It is a transition period for Indian power sector. At this stage, the Commission is of the opinion that it is not appropriate to bring out an order which has long term impact. As far as NCES sector is concerned

new technology with higher capacity and efficient generators are coming up. The interest rate on loan is also coming down. Hence, the Commission desires to have a medium term control period . However a short period like one or two years may create uncertainties in the minds of investors. Therefore the Commission have decided to adopt a control period of 3 years. Since the agreement period proposed in this order is twenty years, the terms and conditions including the purchase rate, ordered now will continue to be applicable till the end of agreement period. When the Commission revisits the tariff and allied issues after the control period, the revisions will be applicable only to the generators of renewable energy sources commissioned after such revised order.

Issue No. 5 : Demand Charges / Grid Availability Charges:

Mr. M.Palaniappan, IWEA has stated that grid availability charges has not been mentioned in the concept paper. He has requested that it should be included now itself and NCES may be exempted from such charges.

Mr.Raman, SISMA , during the public hearing held has stated that Cogen may be treated on par with IPP and the demand charges are not to be imposed for start up and maintenance power. He has also suggested that energy charges may be adjusted in the power exported.

Mr. T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer), during the public hearing has stated that MD charges for start up power may be waived because only 40 hrs of start up power is needed in a year.

M/s.Tamilnadu Power Producers Association in their written submission have stated that for the category of NCES no demand charge is permitted for the energy generated by them. However, they have suggested that it is natural justice to give a reasonable demand to the WEG to the captive user with reference to the installed capacity. Similar view has been expressed by **the**

Director, M/s.Goyal Ispat Ltd. and M/s. M/s.Raghu Rama Renewable Energy Ltd.

Mr. T.V.Swaminathan, Joint President (Operations) M/s.India Cements Ltd., in his written submission has suggested that with regard to Demand charges payable to licensee by the user when the power generated is wheeled for own use, definitely there should be consideration for concession for demand charges. He has also stated that even though there is a wide variation of computation of demand made at various slots of time interval, TNEB is certainly availing the benefit of additional demand. Hence, he has requested that 100% Generation/Wheeling from wind farm should be taken into consideration based on 0.9 power factor to work out the demand concession for the wheeling industry.

Mr. Vetrivelan, M/s.Tamil Nadu Spinning Mills Association, (TNSMA) during the public hearing has stated that grid availability is considered as 95%. But it is only 80 to 85% during the last 2 years in high wind season. TMSMA in their written submission have stated that installation permission shall not be issued by TNEB unless the evacuation facilities are intact so as to ensure maximum grid availability and enhance the CUF. They have also stated that TNEB should be obligated to pay compensation of providing lesser grid availability and towards this target, a minimum grid availability percentage shall be fixed by TNERC.

M/s. RaghuRama Renewable Energy Ltd. during the public hearing have stated that start up power require unit to unit adjustment.

Chairman, TNEB during the 5th SAC Meeting has suggested that as recommended by TNERC, for start up power for bio mass plants, instead of demand charges, energy charges may be fixed at the prevailing HT commercial category tariff plus 20% or 30%. Mr. Kathiresan / CFC, TNEB during the public hearing has stated that Board is incurring fixed cost because Board is supposed to supply CPP, Cogen or NCES plant whenever supply is required by them.

Hence the CPP, Cogen or NCES plants shall pay the demand charges @ Rs.300/-.

Commission's Views / Decisions

The grid support / grid availability charges, have been fixed by the Commission in its order on transmission and wheeling charges etc.,. wherein, the following conditions and the applicable charges for the same are specified. They are applicable for Bio mass and cogen generators..

1. Outage of generator conditions and providing start up power
2. When scheduled generation is not maintained and / or when the drawal by the consumer is in excess of the schedule.

For wind energy generators , the Commission decides the following:

1. Outage of generator conditions and providing start up power by the Licensee is a routine and frequent necessity. This shall be dealt with under unit to unit adjustment basis.
2. When scheduled generation is not maintained by WEG and / or when the drawal by the user (captive user or third party user) is in excess of the schedule, energy charges and deemed demand charges shall be regulated as follows:

a) Applicable Energy Charges: When the generator is synchronized with the Grid, energy charges shall be payable by the wind energy user, for the units supplied by the Distribution Licensee (i.e. balance units arrived at after subtracting the units supplied by the generator from the total consumption of the user during the billing month) at the applicable rate for that category. The time of day consumption (TOD) shall be charged for the nett consumption only (deducting the generated energy from the energy consumed during the respective time slots).

b) Applicable Demand charges : In addition to energy charges stipulated above, the wind energy user shall pay applicable demand charges as below:

There are 2880 time blocks of 15 minutes interval in a billing month. It is not

feasible to segregate precisely the quantum of demand supplied in each time block in the billing month to the wind energy user by the generator and by the licensee distinctly. This segregation may be computed by matching the demand recorded in each time block at the generator end (A) with the demand recorded in the corresponding time block at the wind energy users end (B) then

Case 1: If (B) is lesser than (A), it means there is no supply of demand by the licensee to the wind energy user.

Case 2: If (B) is greater than (A), it means that there is supply of demand by the licensee in that respective time block.

As per the tariff order dated 15-3-2003, a demand charge in a billing month by any HT consumer is 90% of sanctioned demand or recorded demand which ever is higher. As the demand is recorded at every 15 minutes time block, the recorded demand will show the maximum demand recorded in any of the 15 minutes time block in that billing period of one month.

The probability of occurrence of case 1 is zero and the probability of licensee supplying the demand in any one of the time blocks in a billing month as in case 2 is 100 percent. In such a scenario, whether the licensee is entitled to receive the demand charges in full, even though the generator is also injecting the demand into the grid continuously, needs to be addressed. It is no doubt that, all the fluctuation in the generator end and user end is met by the licensee. However, the percentage of the demand, injected by generator is also to be taken for consideration and to that extent, the demand charges receivable by the Licensee is to be restricted.

Till a mechanism is put in place to ascertain the relation between the demand generated in each of the 2880 fifteen minutes time blocks and the demand recorded at the consumer end in the related time blocks, a reasonable approximation has to be followed to arrive at the demand supplied by the generator. Since the variation in meeting the demand of the wind energy user by

the two parties involved, is possible in the full range of 0 to 100 % and only the actual energy generated is available at the generation end, it is considered prudent to convert 16.897 % of the energy generated for the wind energy user, into an equated demand with reasonable approximations as the deemed demand supplied by the generator as detailed below :

CUF for Group I	25.29%
CUF for Group II	26.70%
Average CUF	25.995%

In Tamil Nadu, out of total wind energy generated, about 65% of energy is being adjusted for own use and 35% is being sold to TNEB. Therefore the proportionate CUF for adjustment of energy for own use is:

25.995 X 0.65 = 16.897%

The demand supplied by the wind energy generator = 16.897 / 0.9

= 18.77%

Where 0.9 is the power factor to be maintained by the user

The demand charges payable by wind energy user will be calculated as below:

Total generated units consumed by the user divided by (30 X 24 X Actual PF recorded during the billing month) A

Recorded demand (or) 90% of sanctioned demand ,whichever is higher B

The demand supplied by the Licensee (B – A) C

The demand charges payable by wind energy user = (A X 81.23% of applicable demand charges) + (C X applicable demand charges)

For the present tariff applicable to HT Industry =(A X 0.8123 X 300) + (C X 300)

In line with such an approximation, a deemed demand concept is proposed.

The demand charges for a wind energy user shall, accordingly, be 81.2% percentage as for the **"deemed demand"** supplied by the generator plus 100% of the applicable demand charges for that category of user for the balance demand supplied by the Distribution Licensee.(i.e. The difference between the

maximum demand recorded and the deemed demand subject to the tariff order issued then and there on demand charges).

For the issue raised by Mr.Vetrivelan, TNSMA on payment of compensation for providing substandard grid availability by the Distribution Licensee / STU, the Commission has addressed this issue under evacuation facilities

Issue No. 6 : Banking :

Mr. V.R. Sreekumaran, M/s.NEG Micon during the public hearing has stated that PPA for 20 years and wheeling & banking at 5% is a win-win situation for all. The company in their written submission have requested to continue the existing arrangement of wheeling and banking of power and also extend the benefit to all HT Tariff I consumers such as IT Industry, Hotel Industry, educational Institutions, etc.

Mr.R.Varadharajan, Deputy General Manager, M/s.DCW Ltd., during the public hearing has suggested that wheeling charges @ 2% and banking of energy up to 1 year as per MNES Guidelines are to be implemented.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA in his written submission has stated that the minimum limit of power purchase may be fixed as 25%. He has also stated that linking banked energy with ToD generation and consumption is agreeable. He has requested that the wheeling charges including line losses may be retained at 5%, the banking charges at 5% may also be retained and the Banking period may be continued to be annual. The IWPA have also stated that a developer generates energy with some expenditure involved in that and he takes every effort to consume the banked energy before 31st March. If for some extraneous reasons, he is not able to adjust before 31st March, the unutilized units should not be allowed to be lapsed as TNEB has already sold the energy to some other consumer and collected money for the same very much earlier to 31st March. They have suggested that this is an arbitrary move and credit to be given

for the unutilized units at a rate to be fixed. They have also stated that TNEB, as a public body cannot arbitrarily allocate free power to itself at the cost of the developer and TNEB have to pay at a fixed cost for the power that is sold by it from out of the developers wind mills. They have further added that TNEB appropriating to itself free power is violative of Article 14 of the Constitution whereas the windmill owners are the only sufferers of such methods**.** The Association in their letter dated 28/3/2006 have also appealed to the Commission to issue orders to TNEB to buy the unutilized banked units at the end of each financial year at a suitable price or to allow additional 3 months time to the developers for consuming the unutilized units.

Mr.Giri, M/s. Indian Wind Turbine Manufacturers Association has stated that Wind energy generation, due to technical limitation require wheeling and banking provisions. Bankable policy is required and the policy should be for five years. He has also stated that a uniform banking period of one year may be extended to all renewable energy sources. The banking policy should be on a long term, say 20 years with a control period of the policy for five years. Banked energy may be linked with ToD generation to net of the consumption.

Mr. K. Venkatachalam ,M/s.Tamil Nadu Spinning Mills Association during the public hearing has stated that the actual banking charges of 5% can be reduced.

Mr.Sriramamurthy, Member, APERC during the round table conference has stated that banking may be permitted

Chairman, TNEB during the 5th SAC Meeting has suggested that there is no provision in the Act for banking. He has also stated that banking of wind energy has to be dispensed with. He has further added that once meter is fixed, there is no need for banking and the extra energy generated may be sold to the Board at Rs.2.70.

TNEB's Reply :

The Commission has not touched upon another concession given to the private developers, namely banking of wind energy with a nominal banking charge of 5%. It is to be pointed out to the Commission that there is no mention about banking of energy in the new Electricity Act 2003. By allowing banking facility, Board faces huge loss.(i.e) whenever the wind mills generate energy the same is absorbed by the Board's grid without any backing down. Sometimes, Board is forced to neglect cheaper power available from other sources and from neighboring States / Region. Hence, Board absorbs the wind power neglecting the cheap power. Since the wind energy is seasonal and mostly available from May to September, Board has to supply to its developers to compensate the banked units, by purchasing costlier power, ranging up to Rs.4 to Rs.4.50, from IPPs and through other power traders. Hence, the Commission is requested to dispense with the banking facility for future projects.

Orders of other commission on banking Charges.

Banking has been permitted in almost in all the states. MNES prescribes a banking period up to one year.

- Existing practice in Tamil Nadu
  - Banking period = 12 months (April to March)
  - Banking Charges = 5%
- Other States
  - Banking period
    - Madhya Pradesh, Andhra, Karnataka, Maharashtra & Rajasthan = 12 months
    - Kerala, Gujarat & West Bengal = 6 months
  - Banking charges
    - Madhya Pradesh, Andhra, Karnataka & Rajasthan = 2%

Commission's Views / Decisions

As followed by most of the other States, the Commission retains the existing practice of one year (from April to March) banking period of TNEB, for the NCES based wind electric generators who are feeding "infirm power" to the grid. However, for the NCES based biomass and bagasse based cogen generators banking provisions shall not apply.

TNEB have reported that the distribution licensee may have to purchase at higher rate and supply to the wind energy users during non season. Considering this fact, the Commission decides to retain the existing banking charges of 5%. However, the Commission accepts the views of Mr.K.Kasthurirangaian, Vice Chairman, IWPA in regard to unutilized energy after 31st March. The unutilized portion of the banked energy as on 31st March may be treated as sold to distribution licensee at the rate fixed by the commission and due credit shall be given to the generators / captive user.

Regarding fixing of rate for unutilized power, the Commission considered the views expressed by TNEB. The distribution licensee has the obligation to supply the power continuously to the NCES captive user buying even at higher price during shortage of power. Further these generators are primarily generating power for their own use and they are selling only the unutilized portion, which they could not consume. The distribution licensee cannot make any planning based on this power. Considering the above facts and the time value of power generation, the Commission decides a rate of 75% of normal purchase rate for purchasing the unutilized portion of energy banked by the NCES based wind electric generators. The suggestion for extending the banking period (incase of unutilized energy) is not acceptable.

Slot wise banking is permitted to enable unit to unit adjustments for the respective slots towards rebate/ extra charges. However, the unutilized portion at the expiry of banking period will not be distinctly dealt with for adjustment. Such unutilized portion is eligible only for the 75 % rate

Issue No. 7 : Transmission & Wheeling charges and line losses

Mr. V.R. Sreekumaran, M/s. NEG Micon has stated that PPA for 20 years and wheeling & banking at 5% is a win-win situation for all. Mr.Ramesh Kymal, of the Company in his written submission has requested to continue the existing arrangement of wheeling and banking of power and also extend the benefit to all HT Tariff I consumers such as IT Industry, Hotel Industry, educational Institutions, etc.

Mr. Palaniappan, of IWEA during the public hearing has stated that in the concept paper, only 5% of wheeling charges has been proposed while in TNEB's Transmission Charges Petition higher percentage has been proposed. He has suggested that this shall not be applicable to NCES power and only 5% wheeling charges shall be made applicable to wind power.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that the generators may be permitted to sell their power to third party purchaser with wheeling charges less than that applicable for conventional energy sources and the wheeling charges remains unaltered for a period of 20 years. He has requested that the wheeling charges including line losses may be retained at 5%. He has further added that wheeling may be allowed for LT and HT commercial also on unit to unit adjustment basis and the wheeling agreement should be firm for 10 years and the wheeling charges should be 5 % for all captive consumption and 10 % for third party sales. He has also suggested that for the wheeling charges / surcharge and banking the present 5% may be kept for another 10 years.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have stated that the transmission & wheeling charges proposed in the concept paper is reasonable. Similar view has been expressed by t**he Director, M/s.Goyal Ispat Ltd.** in his written submission.

The SISMA in their written submission have stated that the proposed transmission and wheeling charges of 2% within 25 kms usage is acceptable, while for distance beyond 25 kms, it should be linked with voltage level of transmission lines used as detailed below:

Voltage level	Transmission Losses
33 KV	2%
66 KV	5%
110 KV and above	7%

They have also stated that the present practice of deduction of 2% of the power exported for line losses may be discontinued or the same should be considered in arriving at the tariff.

Mr. T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer) , during the public hearing has stated that it is not known how the tie line charges of 2% and wheeling charges of 10% are calculated.

Mr.R.Varadharajan, Deputy General Manager & Mr. M.Thyagamoorthy, M/s.DCW Ltd., during the public hearing have suggested that wheeling charges @ 2% and banking of energy up to 1 year as per MNES Guidelines are to be implemented. They have also suggested that the wheeling charges should be exempted for power sold to TNEB.

Mr. T.V.Swaminathan, Joint President (Operations) M/s.India Cements Ltd., in his written submission has suggested that transmission and wheeling charges of 5% for wind power is on the higher side which may be brought down to the earlier level of 2%.

M/s.Tamilnadu Power Producers Association in their written submission have stated that the transmission & wheeling charges for the waste heat recovery based cogen plants shall be as follows:

Within 25 Kms usage : 2%
Beyond 25 Kms usage : 7%

M/s. Indian Wind Turbine Manufacturers Association have stated that open access policy in respect of NCES should be different, considering the technical limitations of these projects. They have stated that wheeling charges in respect of wind energy should be less than conventional sources, considering the factors like distributed generation, avoidance of pollution, low line loss etc. They have also stated that wheeling charges should be fixed for a long term, say 10 years. Mr. Giri, of IWTMA during the public hearing has stated that regarding open access, wind energy generation due to technical limitations requires wheeling and banking. He has also suggested that wheeling to commercial sector and sale to third party may be permitted and that 5% wheeling charges may be adopted for all captive consumption for both HT and LT.

Mr. Shanmugavelayudam, M/s.TANSTIA during the public hearing has stated that LT consumers can form association and put up wind mills and wheeling may be allowed for them.

Mr. K. Venkatachalam, M/s.Tamil Nadu Spinning Mills Association during the public hearing has stated that actual wheeling charges has to be reduced and retained at 2%.

Ms.A.Jeyarani, Mayor, City Municipal Corporation, Tirunelveli in her written submission has suggested that in places like Tirunelveli which is in the windy area and wherein their wind power plant is strengthening the Grid, concessional tariff for wheeling should be provided while in places where there are no power stations, such as areas around Tenkasi and Kayathar there is no justification for levying wheeling charges.

Thiru T.B.Chikkoba, Former Member (Generation.), TNEB in the 7th State Advisory Committee meeting has stated that wheeling charges for Muppandal belt may be fixed at 7% and may be retained at 5% for all other areas.

Mr.T. Varadarajan , M/s.M.N. Dastur Consultants during the public hearing has suggested that wheeling charges be continued as in vogue and some formula is to be spelt out to calculate wheeling charges.

M/s.SAS Hotels and Enterprises Ltd. in their written submission has stated that renewable sources of energy generated through wind generators for captive use should be allowed to adjust the power generated at the destination of use on a unit-to-unit basis irrespective of the tariff. Hence, they have requested to use the captive power to their destination of use with adjustment on unit-to-unit basis subject to levy of transmission charges.

Mr.Debasish Majumdar, Managing Director, IREDA in his written submission has submitted that wind mill projects are usually located in remote and rural areas often at the tail end of the transmission system and they help in supplementing the local need of power and hence to that extent reducing the transmission of power from generating ends or indirectly the transmission losses.

Mr.G.V.Ramanan, M/s.Avangaurd Consulting and Engineering (P) Ltd, during the public hearing has stated that for co-gen 2% for line loss upto 25 km is agreeable but beyond that, it shall be linked to voltage level and that will promote the cogen plants.

Member / Generation, TNEB during the public hearing has stated that the actual wheeling cost is more than the wheeling charges collected. He has also stated that wheeling the power is the onerous task of TNEB and TNEB is doing this with huge investment.

Chairman, TNEB during the 5th SAC Meeting has suggested that as the HT consumers are paying energy charges only for the net energy, the present practice of allowing incentive, after deducting wheeled energy may be continued. He has also suggested that since commercial services are far away from generating stations and also as their consumption is only during peak hours, separate charges are to be fixed.

TNEB in their written reply have submitted the following:

In the earlier years 2% wheeling charges and subsequently, from September 2001 onwards when installed capacity was 830 MW, 5% wheeling charges are being collected. Now the installed capacity is 2400 MW, which means power has to be transported to long distances, and hence wheeling charge @ 15% is suggested since the Commission has indicated T&D loss of 18% in the Tariff order. Also at present 70% of wind mill power is wheeled to industries and hence 80 paise/unit is loss to TNEB since HT tariff IA is Rs.3.50 as per tariff order.

At present wheeling is allowed only to HT industries under HT Tariff I category. In the draft discussion paper, it has been suggested that if wind energy is adjusted to tariff higher than that of HT Tariff I, the difference in rates will be charged to the consumer for the units wheeled. In this regard the Hon'ble Commission is requested to limit the wheeling to HT services only and not to LT services. In the draft paper no mention has been made about the type of service, whether LT or HT. If LT adjustment is allowed, the accounting procedure will be made more cumbersome, since LT billing is done at Division office whereas HT billing is done at Circle office.

Moreover, if wheeling to other HT industries is allowed, (i.e. for HT commercial / Educational etc.,) with a condition that the company should pay the difference in tariff, then the percentage of wind energy wheeled will come to 85% to 90% from the present 70%. Moreover, if third party sale is permitted there won't be any developer left out under 'entire energy sale category'. Hence if wheeling charges

is fixed at the present rate of 5% wheeling charges itself, there will be huge revenue loss to Board. Hence, under the above circumstances the Hon'ble Commission is requested to enhance the wheeling charge from 5% to at least 15%.

For Biomass and Co-generation plants, wheeling charges are fixed at 10%. The tariff for biomass co-generation plants are already high i.e.Rs.3.15 for biomass and the Rs.3.15 for co-generation during the crushing season. The rate of realization is much lower. The line losses are in the order of 18%. TNEB cannot bear both the losses due to tariff and wheeling. Hence wheeling charges for biomass and co-generation plants may be levied at the rate of 15%. Therefore the Commission may fix 15% wheeling charges uniformly for all generation through NCES such as windmill, biomass and bagasse based Co-generation.

Guidelines of MNES and orders of other Commissions on Transmission and Wheeling Charges.

- MNES Guideline is 2 % of the energy fed into the grid
- TNEB's existing charges is 5%
- Charges in other States
  - UP, MP, Maharashtra and West Bengal - 2 %
  - Gujarat - 4 %
  - Rajasthan -10 %
  - UP – 12.5%
  - Andhra 50 paise / unit as network charge and 28.4 % of energy.

Commission's Views / Decisions

The contention that wind energy generation is distributed and helps the grid as distributed generation is no longer valid as far as Tamil Nadu is concerned. There is a phenomenal growth of wnd Energy generators in Tamil Nadu and they are mostly concentrated in Palghat, Shencottah and Aralvoimozhi passes.

These areas are considered to be “poor load / demand regions” and most of the power generated in these places have to be evacuated to the far off load centres.

Regarding the transmission and wheeling charges, the existing practice (which includes the line losses in kind) is given below:

Wind Energy Generators	5 %
Biomass	10%
Co-generation	Within 25 KM usage – 2% Beyond 25Km usage – 10%

Total transmission and wheeling charges including transmission and distribution losses for various voltage levels of injection and drawal have been specified in the orders of the Commission on transmission and wheeling charges against the petition of TNEB in TP1/2005. As per that order, if the point of injection and point of drawal is at 33 KV level, the total transmission and wheeling charges will be very much less than the existing 10% mentioned above. Also the transmission and wheeling charges fixed by the Commission for fossil fuel based Co-generation in another order is 7%. To give encouragement for promotion of renewable energy and Co-generation, the Commission decides the following transmission and wheeling charges which include the line losses in kind :

Wind Energy Generators	5 % of energy
Biomass	Within 25 KM usage : 3 % Beyond 25 KM usage : 6 %
Co-generation	Within 25 KM usage : 3 % Beyond 25 KM usage : 6 %

The transmission and wheeling charges fixed as above will get reduced , if the voltage level at the point of injection and at the point of drawal is equal to or more than 110 kV. The reduction will be based on the Commission’s order against the petition no TP1/2005 from TNEB. As an example, if the injection

voltage by the NCES generator is at 110 kV and the drawal for captive usage is also at 110 kV , the transmission charges specified by the Commission in the above said order will work out to around 5.80 % . Such cases shall be specifically brought to the Commission and the rate revised.

Regarding the captive usage for LT consumers, Commission accepts the difficulties expressed by TNEB . Further, since the LT services do not have ToD metering arrangement, it may not be possible to uniformly implement the various provisions covered in this order. Hence it is decided to restrict the captive usage to HT services only for the present.

The third party sale is permitted subject to the Commission's regulation on open access.

Issue No 8 : Phasing out of Open Access.

Mr. M. Palaniappan, IWEA, during the public hearing has stated that in open access regulations, NCES are treated in similar lines with conventional energy for applicable charges. He has stated that the 10 MW restriction provided in open access regulations may not be applicable for renewable energy sources. He has also pointed out that though OA permits to carry captive power to any category, TNEB does not permit to carry captive power to HT commercial units as against HT Industrial units. The IWEA in their written submission have requested to consider permitting open access to renewable energy generators immediately without any limitation on load of 5MW, 10MW, etc.

Mr. Satishkumar, M/s. Saheli Exports Pvt. Ltd. , during the public hearing has also stated that it may be explicitly made clear that the 10 MW restriction provided in the open access regulation is not applicable for NCES**.**

Commission's Views / Decisions

The Commission will adopt the following provisions of its open access regulation in respect of phasing out of open access for the power produced from NCES.

(i) 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 in a HT supply (for the reasons explained in item 7 above) , irrespective of the contract demand

(ii) 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 regulations for intra state open access.

Issue No. 9 : Reactive Power Charges:

Mr. M.Palaniappan, IWEA, during the public hearing has stated that KPTCL is charging on one time basis Rs.37,000/- per MW towards installation of capacitors of adequate capacity as fixed charges. He has suggested that instead of levying reactive power charges for wind mills, the one time payment adopted by KPTCL may be followed.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that the charges for supply of reactive power by the wind mills may be the same as that levied by the utility viz. TNEB for drawal of reactive power. He has also stated that reactive power drawal below 10% not to be charged. He has further added that the present unscientific calculation of PF may be dispensed with and the export of reactive power for improving the grid condition to be paid at the same rate. The association recommends the following approach in pricing the reactive power:

- The existing pricing policy of flat disincentive is too simplistic and may even send wrong signals under some conditions. It is essential to establish the monetary value of the reactive power to reflect the actual cost.
- While unwanted reactive power outflow is penalized, the grid should also encourage reactive power inflow, whenever the grid condition needs reactive power support. The avoided cost by the utility due to the support

extended by WEG should be factored into the cost. In a similar way, the improved stability margin due to the reactive power support from the capacitors provided at windmills should also be taken into costing.

Views expressed in this regard by some of the wind power producers and their associations are :

- Rate per unit of kVArh consumption should remain constant for the entire period of project life.
- KVArh consumption from the grid to be paid for should be on net reactive energy basis i.e. import minus export, and that the SEB should pay for the excess kVArh exported to the grid by wind power producers

Chairman, TNEB during the 5th SAC Meeting has suggested that the existing policy of levying compensation charges may be continued and that no incentive need be given. He has suggested that no such norms be fixed either for IPPs or for central generating stations or for Board's generating stations. He has also stated that generating VAR and maintaining voltage is old concept. He further added that developers should not draw reactive power and need not pump reactive power into the grid and all the incentives for renewable source of energy should come from Government.

TNEB Practice on Reactive power

- Reactive power charges - Rs 1.00 / KVARh

Practice followed in other States

- Andhra — 10 paise / kVARh
- Karnataka — 40 paise / kVARh
- Madhya Pradesh — 27 paise / kVARh
- Maharashtra — 25 paise / kVARh with escalation provision

Commission's views/decisions

The Commission feels that reactive power management is the responsibility of each and every user of the grid / electrical system. It is not enough to erect the adequate capacitors. Maintenance of capacitors is also equally important and it shall be done by every user of the network in the interest of stable grid and for maintenance of quality supply.

The Installed capacity of wind power in Tamil Nadu is 2931 MW as on 31-03-2006. Due to its high penetration, the influence of wind power in Tamil Nadu grid is very high. Wind turbines are prone to draw more reactive power from the grid due to its inherent design if adequate capacitors are not provided. This high penetration makes Tamil Nadu grid more vulnerable for grid instability when adequate reactive power injection is not maintained. This specific feature of Tamil Nadu grid is totally different from other States where the wind power penetration is less and so also its influence in the grid. Therefore, the wind energy generators (WEG) shall maintain their own capacitors and shall not draw reactive power as far as possible. Therefore the Commission have decided to charge 25 paise / kVARh for the WEGs who are drawing reactive power up to 10% of net active energy generated. The Commission also would like to curtail the WEGs who are drawing more than 10% of net active energy generated. For drawing more than 10% of net active energy generated, as a deterrent, the Commission fixes a charge of 50 paise per kVARh for the total drawal, considering its negative impact on the grid.

For other NCES generators (other than WEGs), the conditions and charges as provided in the Tamil Nadu Electricity Grid Code and the Commission's order on Transmission, wheeling and other charges will apply.

Issue No. 10 : Evacuation Facilities:

Mr. Vetrivelan, M/s.Tamil Nadu Spinning Mills Association has stated that TNEB may be requested to provide the evacuation facilities before the next season.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that grid disturbances have to be minimized by way of strengthening proper evacuation facilities in 230/11 KV networks before May 2006 when the next wind season starts. He has also stated that installation permission shall not be issued by TNEB unless the evacuation facilities are intact so as to ensure maximum grid availability and enhance the CUF.

Dr.Pramod Deo, Chairman, MERC during the round table conference has stated that the State Transmission Utility should be responsible for evacuation and Grid connectivity.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that TNEB has to strengthen the infrastructure for evacuation including transmission lines for which necessary funds may be raised by levying 4 paise per unit as cess on Industrial & commercial Consumer categories so that fund could be used for strengthening of infrastructure of renewable energy or alternatively investors choosing to invest in high CUF areas where transmission lines are choked may be asked to pay more towards evacuation and transmission facilities. He has also suggested that suitable incentives may be allowed in the form of higher tariff or lesser infrastructure development charges to attract investment in other potential but unexploited areas as to make better use of available infrastructure in those areas and relieve congestion in proven areas and disperse the location of wind mills.

TNEB's Reply: Power Evacuation for Co-generation Power Plants

The cost of power evacuation in respect of co-generation power plants is borne and executed by the Board. The power evacuation works for bio-mass power project is executed by TNEB after collecting the necessary charges from the promoter on DCW basis. The same is followed for captive power plants also. Similarly, in respect of wind energy also the cost of power evacuation works is collected from the developer on DCW basis and executed by the Board.

In the draft discussion paper, it was indicated that the power evacuation for captive power plants has to be done by TNEB on DCW basis only. Hence, it is suggested that the same may be extended to Co-generation power plants also that the cost of power evacuation works may be collected from them on DCW basis and executed by the Board as in the case of Bio-mass, Captive Power Plants and Wind Energy Generation.

Commission's Views/Decisions

The Commission accepts the views of Chairman, MERC and it is the responsibility of the STU to have enough spare capacity in all the transmission corridors for free power flow and ensure maximum grid availability. It is understood that TNEB / STU is unable to evacuate power from the proposed wind energy farms due to transmission constraints. The Commission directs the TNEB / STU to create enough transmission infrastructures in those areas on a war footing and send a report on the contingency plan with target date to the Commission within 45 days of this order.

Regarding the interconnection network up to the point of grid connection to be executed as DCW work by the TNEB and the procedure for application and to obtain evacuation facilities etc., it is dealt separately in this order.

Issue No. 11 : Third Party Sale :

Mr. V.R. Sreekumaran, M/s.NEG Micon, during the public hearing has stated that third party sale may be allowed.

Mr.R.Varadharajan, Deputy General Manager & Mr.M.Thyagamoorthy, M/s.DCW Ltd., have also suggested that third party sale shall be allowed and remunerative price be fixed on indicative basis with a band of low and high price.

Mr. K. Venkatachalam, M/s.Tamil Nadu Spinning Mills Association during the public hearing has stated that permission for third party sale can be granted to sell excess power and Commission may fix rate for third party sales.

Commission's views / decisions

The suggestion for third party sale is accepted by the Commission. But the rate of purchase of NCES power by the third party consumer is not within the purview of the Commission. Third party sale through the grid will be as specified by the Commission's regulation on Open Access and order on Transmission and other charges. ToD / Special energy meters shall be installed by the generators as well as the third party consumers at the receiving end.

Issue No. 12 : Peak & off Peak power, unit to unit adjustment:

Mr. M.Palaniappan, M/s.Indian Wind Energy Association, during the public hearing has stated that the wind energy generation during peak hours and non-peak hours shall be adjusted during the respective periods.

Mr.Venkat Sundaram, Secretary, IWEA in his written submission has stated that ToD benefit to be made available for wind energy projects by levy of peak hour tariff only on net consumption.

Mr.Manish Agarwal, Head – Power Practice, CRISIL during the round table conference has stated that benefit of TOD could be considered.

Dr.K.Selvaraju, Secretary, SISMA in his written submission has requested to reduce the peak hour charges to 10% or increase the rebate for lean hour charges to atleast 10% so that the cost of the electricity would be neutralized.

Mr. K. Venkatachalam, M/s.Tamil Nadu Spinning Mills Association during the public hearing has stated that actual night time rebate of 5% is not allowed.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that to record the generation during peak hours, ToD meters to be fixed on a time bound manner. He has also stated that linking banked energy with ToD generation and consumption is agreeable.

Chairman, TNEB during the 5th SAC Meeting has suggested that the existing policy of TNEB may be continued. Otherwise arrangements may be made to provide meters to record blocks of consumption and generation and allow charges accordingly for each block.

Commission's views / decisions

Since all the generators and the tied up users shall be provided with TOD meters, the adjustment of energy shall be done on slot to slot basis within monthly billing cycle as follows for Biomass and bagasse based Cogeneration ..

(i) peak hour generation with peak hour consumption
(ii) off-peak hour generation with off-peak hour consumption and
(iii) the normal hour generation with normal hour consumption.

It should be noted that units generated during a higher tariff ToD-slot could be consumed in a lower tariff ToD slot at the option of generators/users, but the reverse would not be allowed (i.e.units generated during a lower tariff ToD-slot cannot be drawn by the CGP Holder during a higher tariff ToD-slot). No carry over is allowed for the next month.

Regarding the WEG, since banking is permitted , it is necessary to maintain a slot to slot banking account and adjust in the same way as above against peak / off peak/ normal consumptions. Beyond the banking period , the unutilized portion of the banked energy as on 31st March will be treated as sold to distribution licensee at the rate fixed by the commission and slot to slot adjustment will not be applicable for such unutilzed portion . Excess drawal at any point of time will be charged under respective tariff applicable to the user.

The peak hour extra charges and off peak hour rebate shall be on net energy consumption after deducting captive generation during the respective period.

Issue No. 13 : Energy Purchase Agreement :

Mr. V.R. Sreekumaran, M/s.NEG Micon**,** during the public hearing has stated that PPA for 20 years and wheeling & banking at 5% is a win-win situation for all.

Mr. M.Palaniappan, IWEA, during the public hearing has stated that the agreement period may be fixed as 10 years or 20 years as fixed by Maharashtra ERC.

Mr.Venkat Sundaram, Secretary, IWEA in his written submission has requested that PPA tenure of 10 years or 13 years as followed by KERC and MERC respectively may be applied as against 20 years proposed in the concept paper.

M/s.Indian Wind Turbine Manufacturer Association have stated that agreement may be for 20 years with a control period of five years, which means any agreement which gets signed within five years will get a tariff for twenty years. Firm policy is required for five years. Long term agreement with assured buy back will reduce the risk of the project.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that agreement period should be higher i.e. 20 years or a minimum of 10 years.

Mr.Debashish Majumdar, Managing Director, IREDA during the Round Table conference has stated that there should be a clause in PPA to safeguard the financial institutions**.** He has also suggested that there should be comfort to lenders and the PPA should have a provision to repay the loan to the financial institutions by the Electricity Board if the investor fails to repay the loan.

Mr.Manish Agarwal, Head – Power Practice, CRISIL during the round table conference has stated that the tenure may be 13 to 14 years

M/s. RaghuRama Renewable Energy Ltd. during the public hearing have stated that Commission may honour the PPAs signed already (2002).

Mr.T.B.Chikkoba, Retd. Member, TNEB during the round table conference has stated that the agreement should be for 20 years with stable policy.

Chairman, TNEB during the 5th SAC Meeting has suggested that the agreement period can be uniform for the renewable energy project for 15 years.

Commission's views / decisions

As suggested by most of the participants, the agreement period for power purchase shall be maximum 20 years. The agreements already signed by the distribution licensee with the generators shall be honoured .The Licensee shall send a copy of the draft agreement format to the Commission for vetting and approval

Issue No. 14 : Payment of Security Deposit:

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that payment of ASD may be fixed as 1 ½ months average on net consumption.

Mr. K. Venkatachalam, M/s.Tamil Nadu Spinning Mills Association during the public hearing has requested that for calculation of ACCD, net energy charges may be taken instead of gross energy charges.

Chairman, TNEB during the 5th SAC Meeting has suggested that the generation in wind mill is only for 6 months and for the balance 6 months they depend on Board for supply of electricity. Hence the collection of security deposit may be continued as at present.

Commission's views / decisions

The security deposit of two times of the average consumption is governed by the Tamil Nadu Electricity Supply code. Since majority of the NCES power in Tamil Nadu is "infirm" and they have banking provision, the Commission proposes two times of the maximum net energy supplied by the distribution licensee in a month in the previous banking period may be taken as the basis for the payment of security deposit by the user to the distribution licensee .

Issue No. 15 : Cross Subsidy Surcharge:

Mr. M.Palaniappan, IWEA during the public hearing has stated that Levy of surcharge and additional surcharge for NCES shall not be applicable as followed for captive power. **Mr.Venkat Sundaram, Secretary, IWEA** in his written submission has requested to consider renewable energy sources of generation on par with captive generation and exempt purchase of power from wind energy generation from the levy of surcharge and additional surcharge in case of open access transactions (3rd party sales).

Mr. V.R. Sreekumaran, M/s.NEG Micon and Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing have suggested that wind power projects may be exempted from scheduling, cross subsidy and other surcharges and unit to unit adjustment may be permitted for HT commercial category also.

Chairman & Managing Director, M/s. TNPL in his written submission has stated that levy of cross subsidy surcharge shall be as follows:

Exports up to 50% of captive consumption : No cross subsidy

Exports beyond 50% of captive consumption: 25 paise / unit of power sold to 3rd parties.

Dr.Pramod Deo, Chairman, MERC during the round table conference has stated that the power utilized for captive use from wind power should be exempted from cross subsidy surcharges.

Manish Agarwal, Head – Power Practice, CRISIL during the round Table conference has stated that exemption from cross subsidy to be considered.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the power utilized for captive use from wind power should be exempted from cross subsidy surcharges.

Mr. Giri, M/s. Indian Wind Turbine Manufacturers' Association in his written submission has stated that no surcharge or additional surcharge to be levied for renewable energy sources.

Commission's views / decisions

As stipulated in section 42.2 of the Act, power for captive use is exempted from payment of cross subsidy surcharges. Third party sale is governed by the Open Access Regulations and Commission's orders on cross subsidy surcharges on the petition filed by the TNEB.

Issue No.16 : Adjustment of Wheeled Energy :

Mr. V.R. Sreekumaran, M/s.NEG Micon, during the public hearing has stated that wind power shall be adjusted with any tariff category and not restricted to HT Tariff I (industrial). **Mr.Ramesh Kymal, M/s. NEG Micon** in his written submission has requested to continue the existing arrangement of wheeling and banking of power and also extend the benefit to all HT Tariff I consumers such as IT Industry, Hotel Industry, educational Institutions, etc.

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that Small Industries (Low Tension Consumers) may also be permitted to adjust their generation.

Mr. Giri, M/s.Indian Wind Turbine Manufacturers' Association in their written submission has stated that set off rates to be in line with the purpose for the power is used and not arbitrarily restricted to HT (Industrial) tariff.

Ms.A.Jeyarani, Mayor, City Municipal Corporation, Tirunelveli in her written submission has stated that in the initial stages of wind power establishment, the captive wind power was adjusted with any tariff category, LT or HT. However, now this has been restricted to HT power for industrial purpose only. Hence, the present policies of TNEB are most advantageous to private industrialists and are not friendly to Corporations and Govt. owned organizations with the only exception being the TNPL, the Govt. Enterprise in Tamil Nadu which has been benefited by captive wind power plant. She has requested to rectify the anomaly and extend all benefits of captive wind power generation to Corporations and Govt. Organizations so that they get similar encouragement and support from TNEB. She has also stated that Corporations could be benefited only by combining all service connections including LT for adjustments against wind power generated from captive wind power.

Commission's views / decisions

Act does not provide any restrictions for self use of energy by a generator in regard to service category. Therefore, the generator can adjust the energy on unit-to-unit basis for self use in any HT service.

Issue No 17 : Payment of Security for Power Purchase by Distribution licensee :

Mr.M.Palaniappan, IWEA, during the public hearing has stated that the payment security mechanism proposed is acceptable.

Mr. K.N.Rathnavelu, Secretary, SISMA in his written submission has stated that the payment security for wind energy should also be extended for Co generation projects also.

Commission's views / decisions

Section 6.2 of the Tariff Policy requires to ensure adequate and bankable payment security arrangements to the generating companies. In the same line Commission proposes that a bankable security in favour of the generator for an amount equivalent to an average monthly bill shall be opened by the distribution licensee, in case an EPA is signed for power purchase between distribution licensee and the generator.

Issue No 18 : Billing and Payment to NCES generator by Distribution licensee :

Mr.Vetrivelan, M/s.Tamil Nadu Spinning Mills Association, during the public hearing has stated that submitting of invoices for billing may be avoided. The existing procedure followed by TNEB may be continued. TNEB may be advised to provide a meter card in the generating point also.

K.N.Rathnavelu, Secretary, SISMA in his written submission has stated that the settlement mechanism for wind energy should also be extended for Co generation projects also.

Mr.R.Varadharajan, Deputy General Manager, M/s.DCW Ltd., during the public hearing has suggested that the payment date of 30 days is acceptable and in case of delay, interest should be paid by TNEB.

Commission's views / decisions

In case of captive use, the distribution licensee shall raise the bill after accounting for the net energy supplied at the end of each monthly billing cycle.

Meter reading should be taken on the same day at NCES generator end and captive user / third party purchaser end. The generation at generator end shall be communicated to all the circles of the captive users / third party purchaser within two days so as to facilitate for matching generation with consumption in the same billing month. This adjustment will be done on slot to slot basis taking into account the (i) peak (ii) off peak and (iii) normal generation / consumption within monthly billing cycle /banking period. No carry over is allowed for the next month in case of Bio mass and bagasse based cogen. In case of WEG, no carry over is allowed beyond the banking period. Excess generation in a monthly billing cycle / banking cycle can be sold to the Licensee at the rate fixed by the Commission. Excess drawal will be charged under respective tariff applicable to the user. The distribution licensee shall raise the bill to the user after accounting for generation and consumption at the end of each monthly billing cycle subject to recovery of transmission and wheeling charges in cash and losses in kind.

In case of NCES generators selling power to distribution licensee, the generator will raise the bill every month for the net energy supplied after adjusting to the start up power, reactive power charges, etc as per this order.

The payments to the generators in respect of the energy supplied shall be made by the distribution licensee within the same period as provided by the distribution licensee to recover payments from its HT industrial consumers.

Issue No 19 : Sales Tax , Customs Duty & Registration cost :

Mr.R.Varadharajan, Deputy General Manager, M/s.DCW Ltd., during the public hearing has suggested that the lands purchased for windmills should be exempted from stamp duty / registration fee or given at concessional rate.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that if any concessional import duty on spare parts of wind generator the same is not allowed to be enjoyed by the buyer of wind turbine generator. He has also stated that customs duty should

be exempted to consumers who consume spares captively. Further, he has stated that sales tax should be exempted for the spares / accessories consumed at windmills captively. He has also suggested during the public hearing that the actual tax levied on captive consumption may be exempted / deferred. He has also stated that the new levy of 10 Paise/unit levied on the energy generated through WEGs as introduced by Act 12 of 2003 shall be exempted.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the TNERC may make a recommendation to State Government to exempt the tax of 10 paise per unit for power generated from wind farms. He has also suggested that wind power and other renewable energy projects may be exempted from generation tax or other taxes both captive and sale categories to encourage renewable energy.

Dr.K.Selvaraju, Secretary, SISMA in their written submission has requested that HT consumers may be exempted from payment of captive power generation tax (10 paise per unit) during summer (March to June)

Commission's views / decisions

Sales tax , customs duty, registration cost and generation tax are not under the purview of the Commission.

Issue No 20 : Capacity Utilization Factor and load factor

Mr.K.Kasthurirangaian, Vice Chairman, IWPA, during the public hearing has stated that CUF proposed is acceptable. He has also stated that in Tamil Nadu the CUF is 22.5%.

Mr. Raman, SISMA, during the public hearing has stated that for bagasse based plant a PLF of 50% may be considered instead of 55%. **Mr.K.N.Rathnavelu, Secretary, SISMA** in his written submission has stated that the PLF has been

considered as 55% with a basis of 230 days operation with the plant running at 90% capacity. He has also suggested that this should be considered at 50% since the PLF will be only in the range of 80% to 85% due to varying fuel parameters.

Mr.R.Varadharajan, Deputy General Manager & Mr. M.Thyagamoorthy, M/s.DCW Ltd., during the public hearing have suggested that CUF should be around 15% to 20%. They have also suggested that if the CUF is pegged at a higher value, the existing units should be given soft loans and incentives for upgrading their machines as they were the people who had made initial investments in windmill arena in the initial stages and took risk.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that the CUF shall be fixed at 21% as against the proposed value of 24.69%

M/s.Tamilnadu Power Producers Association in their written submission has stated that a minimum CUF 20% with derating of 1% every year is reasonable.

The Director, M/s.Goyal Ispat Ltd. in his written submission has stated that CUF of 25.5% with derating of 1% every year is reasonable

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have stated that for bio mass energy, PLF @ 70 % may be fixed.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the CUF of 25% is not uniform for all areas. It depends upon capacity of the machines, location and age of the machines. He has suggested two categories of tariff, one with higher tariff for lower CUF area & lower capacity machines and second with lower tariff for higher CUF area and large size

machines. He has also stated that the CUF for old machines is about 20% only while for new machines it ranges from 25-30%

Thiru T.B.Chikkoba, Former Member (Gen.), TNEB in the 7th State Advisory Committee meeting has stated that CUF has been computed based on annual energy output of all makes of wind generators for all monitoring station. He has added that wind power density of station on the sea cost is very low and many of the small capacity machines are not in the market. He has suggested that the CUF may be computed excluding the location having wind power density less than 300 W/sqm and the machines that are not in the market. He has further suggested that as Muppandal is saturated average energy output in locations in Palghat and Shencottah pass may be considered for computing the CUF.

Mr. Giri, M/s.Indian Wind Turbine Manufacturers' Association during the public hearing has stated that capacity utilization is low (it is 18% in Tamil Nadu) and suggested a capacity utilization factor of 26% with installation of higher capacity wind energy turbine.

Orders of other commissions on CUF

(1) Wind Energy

Karnataka Commission has adopted a CUF of 26.50 % and MP Commission has adopted a CUF of 22.50 %.

(2) Bio Mass plants

Uttar Pradesh Commission has adopted 60% PLF, Karnataka Commission has adopted 75 % PLF and Andhra Pradesh Commission has adopted 80 PLF%

(3) Bagasse based cogeneration

Uttar Pradesh Commission has adopted 60 % PLF, Karnataka Commission 60 % PLF and Andhra Pradesh Commission 55 % PLF.

Commission's views / decisions

(1) Wind Energy

The CUF depends on several factors such as wind velocity, air density, Power Law Index, the quality, capacity and age of machines, height of the hub, and length of blade (swift area). The calculation of CUF has been done based on the practical data obtained from Tamil Nadu Energy Development Agency (TEDA), one of the authorities for the reliable data related to wind energy. The wind data of Tamil Nadu as provided by TEDA is shown in Annexure – VII(A). The CUF value for each of the passes is shown in Annexure VII(B1), VII(B2) and VII(B3). The average CUF values calculated for two different categories taking into account the capabilities of the machines installed during that period are given below:

Description of the project	CUF
1. Group I Projects: (a) Wind power projects Commissioned, and to be commissioned based on agreements executed prior to the date of this order.	25.29
Group II Projects: Wind power projects to be commissioned based on future agreements after the date of this order.	26.7

(2) Bio Mass plants.

PLF of 80% is proposed as threshold for fixed cost coverage.

(3) Bagasse based cogeneration

In case of bagasse based Co-generation plants, the PLF depends mostly on availability of bagasse in the crushing season. Assuming that the projects can run for 130 days during the crushing season and another 100 days during non-crushing season (with the stored bagasse and other biomass fuels), the average PLF that can be achieved is around 55% when the project runs at a capacity of 90%. Hence a threshold level of PLF at 55% worked out on the basis of the availability of fuel is reasonable**.** If the PLF achieved in any financial year is more than 55%, then the rate for the excess energy produced over and above the 55%

shall be equivalent to the rate fixed by the Commission for the fossil fuel based cogeneration.

Issue No 21 : Capital Investment :

Mr.Arvind Gupta, M/s.Tamil Nadu Power Producers Assn., during the public hearing has stated that in the concept paper, the capital cost of wind mill has been assumed as Rs.4.5 Crores / MW while the equipment manufacturers quote Rs.5.5 Crores / MW. In their written submission they have recommended a capital investment of Rs. 5.5 Crores /MW.

K.N.Rathnavelu, Secretary, SISMA in his written submission has stated that the project cost for bagasse based cogen shall be considered as Rs.4.00 Crores./MW as against Rs.3.5 Crores/MW proposed.

Mr.Raman, SISMA , during the public hearing has stated that Cogen plant needs more steam and processed water than conventional plant. Hence the capital cost is also higher than conventional plant.

Mr.T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer), during the public hearing has stated that the Cost of project may be fixed as 5 Crores / MW for Biomass plant.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that the proposed capital cost of Rs.4.5 Crores/MW for WEGs is highly unrealistic and not supported by facts and figures.

The Director, M/s.Goyal Ispat Ltd. in his written submission has stated that capital investment may be considered as Rs. 5 Crores/MW.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have suggested a capital cost of Rs.4.25 Crores/MW for bio mass energy.

Mr.T.B.Chikkoba, Retd. Member, TNEB during the round table conference has stated that the capital cost of WEGs have gone up in spite of improvement in technology and increase in size of windmill. He has stated that in 1990 it is only 3.5 Crores /MW, while today the price has gone up to 5.00 Crores/MW which is not reflecting the true cost. He has added that the cost has gone up due to heavy demand for the WEGs and it has become the seller's market and suggested that the proposed capital cost of 4.5 Crores /MW is on the higher side.

Mr.K.Varahala Rao, General Manager-Power Division, M/s.Nuziveedu Seeds Ltd. in his written submission has stated that Rs.5 Crores/MW is a reasonable estimate for project cost**.**

Mr. Giri, M/s.Indian Wind Turbine Manufacturers' Association during the public hearing has stated that Cost / MW is Rs.4.5 Crores at present.

TNEB's Reply : As suggested earlier, the Commission is to form an expert committee to arrive at the capital investment (i.e) per MW rate of the windmill, before finalizing the tariff for wind power.

Other Commissions order on Capital Investment

(1) Wind Energy

Karnataka Commission has adopted Rs.4.25 Crores/MW whereas the MP Commission have adopted Rs 4.5 Crores/MW.

(2) Bio mass projects

Uttar Pradesh Commission has adopted Rs 3.5 Crores/MW, Karnataka Commission has adopted Rs 4.00 Crores/MW and Andhra Pradesh Commission has adopted Rs 4.00 Crores/MW.

(3) Bagasse based cogeneration

Uttar Pradesh Commission has adopted Ra 3.50 Crores / MW , Karnataka Commission 3.0 Crores / MW and Andhra Pradesh Commission Rs 3.25 Crores /MW.

Commission's views / decisions

(1) Wind Energy

There is a wide variation in the project cost estimated by different agencies / entities for investment in wind power projects. The range is from Rs. 3.5 Crores to Rs. 5.5 Crores per megawatt. The commission have proposed the following capital cost per megawatt for different categories of projects commissioned in different periods.

Description of the Project	Capital cost in Crores per MW
Group I Projects: (a) Wind power projects Commissioned, and to be commissioned based on agreements executed prior to the date of this order.	4.5
Group II Projects: Wind power projects to be commissioned based on future agreements after the date of this order.	5.0

(2) Bio mass Project

The capital cost of Rs 4.00 Crores/MW has been proposed for biomass projects.

(3) Bagasse based cogeneration

An amount of Rs. 3.50 Crores / MW is assumed as the project cost for bagasse based Co-generation projects without distinguishing between old and new projects

Issue No 22 : Life of plant and salvage value :

Mr.Vetrivelan, (TNSMA) during the public hearing has stated that 500 to 600 trippings per year is occurring in a wind mill. This reduces the life of the machine. Hence lifetime of 15 years may be considered instead of 20 years. **Mr.K.Venkatachalam, Chief Advisor, TNSMA** in his written submission has also stated that the life of WTG has been taken as 20 years whereas it would be more reasonable if it is reduced to 12 to 15 years taking into account the life of

the various components involved such as the electrical & mechanical components, lubricants, etc.

Dr.Pramod Deo, Chairman, MERC during the round table conference has stated that the life span for wind mill may be taken as 20 years.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the life of the machines may vary and it could be 15 years based on the level of performance. He has suggested that the average effective life may be considered as 15 years, since the efficiency tends to decline every five years with efficiency of power generation falling by 5% after 5 years.

Other Commissions order on life of a power plant.

Andhra Pradesh and Maharashtra, have assumed the plant life to be 20 years

Commission's views / decisions

Generally the plant/project life of a generator is considered as 20 years for tariff determination process. International experience also suggests that the expected project life for a wind energy project can be 20 years. Based on these inputs and experiences elsewhere, the Commission considers the plant life of 20 years as reasonable for tariff determination purposes.

Issue No 23 : Depreciation Rate Applicable :

Mr. V.R. Sreekumaran, M/s.NEG Micon, during the public hearing has stated that a depreciation of 20% may be considered.

Mr. Arvind Gupta, M/s.Tamil Nadu Power Producers Assn. , during the public hearing has stated that common depreciation rate may be adopted for all types of NCES machines.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that the depreciation rate of 80% is not a reality. He has also stated that considering the estimated lifetime of 15 years, leaving a residual value of 10%, the rate of depreciation shall be fixed at 6% per annum on SLM basis.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that depreciation rate was adopted at 4.5% keeping 10% as residual value. He has also stated that taking into account the life span as 15 years, the depreciation could be 6% per annum.

Mr.Sriramamurthy, Member, APERC during the round table conference has stated that wind energy stations are being established to avail depreciation benefit.

Other Commissions order on Capital Investment

(1) Wind Power

Karnataka Commission has adopted 7% and MP Commission has adopted 4.50% .

(2) Biomass and bagasse based power plants

Uttar Pradesh Commission has adopted 7.00 %, Karnataka Commission 7.00 % and Andhra Pradesh Commission 7.84 %

Commission's views / decisions

(1) Wind Power

The Income Tax (Twenty Fourth Amendment) Rules, 2002 allow accelerated depreciation for windmills up to a maximum of 80% of the asset value in a year. However, for the purpose of tariff determination, it is prudent to assume depreciation on a 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 of 20 years. This translates to an SLM depreciation of 4.50 % per annum.

(2) Biomass and bagasse based power plants

The depreciation rate of 7.84% is as per the rates approved for Independent Power Producers (IPPs) so that this amount can be used for repayment of loans. A uniform rate of depreciation could be allowed both for existing as well as new projects, at the rate of 7.84% per annum till the depreciation allowed accumulates to 90% of the project cost.

Issue No 24: Operation and Maintenance Expenses

Mr. M.Palaniappan, IWEA, during the public hearing has stated that O & M expenses @ 1.25% is less. He has suggested the O & M expenses @ 2% inclusive of insurance in the first year with an escalation percentage of 5% from the 2nd year.

Mr. T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer), during the public hearing has stated that O & M cost in case of diesel generator (bio diesel) is very high. Hence he has requested that 8% may be considered instead of 5%.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that the O&M expense has to be increased to 2.65% as against 1.25% proposed with an escalation @7.5%.

M/s.Tamilnadu Power Producers Association in their written submission has recommended an O&M cost of 2.5% for the first 5 years which can be increased thereafter with a simple escalation of 6% per year.

The Director, M/s.Goyal Ispat Ltd. in his written submission has suggested O&M expenses @1.5 for first five years which can be increased thereafter with an escalation of 6% per year.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have suggested for bio mass energy, O&M expenses @ 6% with escalation of 6% every year.

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that O & M expenditure may be 1.75% to 2% so as to factor major overhaul every five years.

Mr.T.B.Chikkoba, Retd. Member, TNEB during the round table conference has stated that for 30 MW plant, the O & M expenses is only around Rs.60.00 lakhs. He has suggested that fixing O & M expenses at 2% is very high and 1.25% with 0.5% escalation is very reasonable.

Mr.K.Varahala Rao, General Manager-Power Division, M/s.Nuziveedu Seeds Ltd. in his written submission has stated that O&M charges @ 2% of capital cost of the project is more reasonable.

Other Commissions order on O & M Expenses

(1) Wind Energy

Karnataka Commission has adopted 1.25 % with 5% escalation every year and MP Commission has adopted 1 % for the first five years and 5 % escalation every year thereafter.

(2) Biomass plants

Uttar Pradesh Commission has adopted 2.5 % with 4 % escalation, Karnataka Commission has adopted 4 % with 5 % escalation and Andhra Pradesh Commission has adopted 4 % with 4 % escalation .

(3) Bagasse based cogeneration.

Uttar Pradesh Commission has adopted 2.5% with 4.00 % escalation, Karnataka Commission 3.00 % with 5.00 % escalation and Andhra Pradesh Commission

3.00 % with 4.00 % escalation.

Commission's views / decisions

(1) Wind Energy

O&M expenses comprise of manpower expenses, spares and repairs, consumables and other expenses (statutory fees, etc). Considering various factors, the Commission feels that it is appropriate to propose 1.10% of the capital cost of the project as O&M expense for the first five years, which can be increased thereafter with a simple escalation of 5% per year.

(2) Biomass plants

It needs to be recognized that there are no guidelines of CEA for the operating norms for the NCE Projects. Considering the fact that the biomass based projects are labour-intensive, still in the development stage and the technology is to be further perfected, it is reasonable to fix the O & M expenditure as 4.5 % with 5% escalation every year.

(3) Bagasse based cogeneration

For thermal projects, the O & M expenditure allowed as per CEA guidelines is 2.5% per annum. But bagasse based co-generation projects are very small in capacity and are under emerging technology. These cannot therefore be compared to bigger projects of advanced technologies. At the same time it is a fact that the O & M of the steam generator cannot be totally apportioned to power generation as part of the steam generated is utilized for the industry. The O& M expenditure of 4.5 % per annum seems reasonable. Escalation of 5 % every year on O & M expenditure is reasonable as it falls in line with the rate of inflation.

Issue No 25: Fuel Cost:

K.N.Rathnavelu, Secretary, SISMA in his written submission has stated that the fuel price of bagasse should be considered as Rs. 900/- per MT as against Rs. 575/- per MT proposed. He has also suggested that a specific fuel consumption of 1.85 Kg/kWh may be considered as against 1.6kg/kWh proposed. He has

further stated that the usage of fossil fuel to the extent of 25% of the total heat supplied to the plant may be permitted as per MNES recommendations.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have stated that for bio mass energy, cost of fuel may be fixed at Rs.1200 per MT with an escalation of 5% per annum. They have also stated that the fuel consumption of biomass is 1.6 kg per kWh.

Ms.Kalaivani, Chennai in her written submission has stated that the heat rate for bagasse based cogen shall be atleast 10 to 20% lower than that of biomass plants

Mr.T.R. Krishnaswamy, M/s.Evergreen Power Ltd. (Bio Diesel Power Plant Manufacturer), during the public hearing has stated that an increased fuel cost of Rs.1500/- instead of Rs.1000/- may be proposed for biomass fuel.

Other Commissions order on fuel cost

1) Biomass plants

Karnataka and Andhra adopt a station heat rate of 3700 kcal / kWh and fuel calorific value of 3200 kcal / kg, which corresponds to a fuel consumption of 1.16 kg / kWh.

Uttar Pradesh Commission has adopted Rs 740 / MT and 4 % escalation , Karnataka Commission and Andhra Pradesh Commission have adopted Rs1000/ MT with 5 % escalation.

(2) Bagasse based cogeneration

Uttar Pradesh Commission has adopted Rs 740 / MT with 4.00 % escalation, Karnataka Commission Rs 800 / MT with 5.00 % escalation and Andhra Pradesh Commission Rs 575 / MT with 5.00 % escalation.

Commission's views / decisions

1) Biomass plants

(i) Specific fuel consumption

Non-conventional power projects should improve the operational efficiency, notwithstanding the fact that they are under the privileged category of power projects for promotion. The burden of higher fuel consumption by the power projects resulting in higher costs cannot be passed on to the consumers. Considering the fact that the technology is in a development stage, we can provide for a station heat rate of 3700 kcal / kWh and fuel calorific value of 3200 kcal / kg, which corresponds to a fuel consumption of 1.16 kg / kWh.

(ii) Fuel Cost

Cost of fuel is the most important parameter that determines the cost of generation in a biomass power plant. The biomass plant uses a mix of fuels like rice husk, woody biomass, cotton stacks, chilly stacks etc. and to some extent coal, as permitted by MNES. The price of rice husk may vary depending on the season. The prices of other biomass fuels are also variable in nature depending on the seasons. A mix of 50-60% rice husk and balance from other fuels has been assumed. Considering the weighted average price of rice husk and other materials (60:40), the price of fuel works out to about Rs. 1000 / MT. The current rate of inflation is around 4% per annum but as the fuel is procured from unorganized sector, the escalation of fuel price may be fixed at the rate of 5%.

(2) Bagasse based cogeneration

(i) Specific fuel consumption

The fuel consumed in the Co-generation plant will cater to

- Production of steam to process plant.
- Supply of power to the sugar industry (Captive consumption) during crushing season.
- Delivery of power to Licensees.

The consumption of fuel intended for supply of power to licensees needs to be considered and rated. Station Heat Rate (SHR) at 3700 Kcal / Kwh for bagasse projects has been assumed. Based on this SHR, 1.60 Kg / Kwh is the rated average of specific fuel consumption during crushing and non-crushing season. Karnataka and Andhra have also adopted 1.60 kg / unit as the specific fuel consumption.

(ii) Fuel Cost

The power is basically generated out of the bagasse produced by crushing of sugar cane in the manufacture of sugar. The price of Bagasse is the key parameter influencing the project economics and determination of tariff. The fuel for the Co-generation plant during crushing season is virtually free. However, if Co-generation plant does not exist, the bagasse will fetch some price. As such the issues like calorific value of bagasse, Station Heat Rate (SHR) and its linkage to sugar cane prices need to be addressed adequately. As Co-generation is an efficient process where the cycle efficiency is high, it needs to be encouraged. In such a context, gross calorific value of 2300 Kcal / Kg is reasonable for price determination of bagasse.

There cannot be any relationship between price of sugar cane that is being fixed by Govt., and the price of bagasse. Bagasse is also in demand by other industries like paper, cattle feed etc., and accordingly market forces determine the price of bagasse. For determination of bagasse price, equivalent heat value of coal can be adopted. The pit head cost and calorific value of coal have been considered to arrive at the fuel price linked to heat content. The fuel price in terms of Rupee / tonne equivalent to gross calorific value of 2300 kcal / kg works out to around Rs. 562 / MT. Therefore Rs. 575 / MT is considered as a reasonable and fair price for bagasse. The current rate of inflation is around 4% per annum but as the fuel is procured from un-organized sector, escalation for fuel price at the rate of 5% is assumed

Issue No 26 : Debt - Equity Ratio :

Mr.Ram Thiagarajan, of SISMA , during the public hearing has stated that the proposed debt - equity ratio at 70:30 may be relevant to wind energy but for Co-gen 50:50 is requested.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have stated that the proposed debt - equity ratio may be retained.

Commission's views / decisions

Debt-equity ratio is mainly determined by the financial institutions for approving project loans. As these projects are mainly financed by IREDA / Financial Institutions and they insist on debt-equity ratio of 70: 30, a debt-equity ratio of 70: 30 is assumed. Further all the Commissions adopt this ratio only.

Issue No 27: Interest Costs on Debt (cost of loan / debt) :

Mr. Ram Thiagarajan, SISMA, during the public hearing held has stated that interest rate of 10.5% proposed may be retained.

Mr.M.Palaniappan, IWEA has stated that interest rate of 9% may be considered as against 10.5% proposed in the concept paper.

Mr.K.Venkatachalam, Chief Advisor, M/s. Tamil Nadu Spinning Mills Association in his written submission has stated that soft loans from IREDA are not available at any concessional rate of interest and the rate of interest on bank loans is either equal or little lower.

Mr.Pramod Deo, Chairman, MERC during the round table conference has stated that the IREDA term loans are available for 10 years

Thiru T.B.Chikkoba, Former Member(Gen.), TNEB in the 7th State Advisory Committee meeting has stated that the interest on loan may be revised as 9% based on the interest rate of IREDA.

Other Commission's order on Interest Costs

Uttar Pradesh Commission has adopted 10.25 %, Karnataka Commission has adopted 11.00 % and Andhra Pradesh Commission has adopted 12.00 %

Commission's views / decisions

Interest on term loan is assumed as 9 % for all the categories (both existing and new) projects as per IREDA norms for renewable. The investor can be allowed the freedom to avail a cheaper loan.

Issue No 28: Return on Equity :

Mr. M.Palaniappan, IWEA, during the public hearing has stated that the ROE of 16% (pre tax) may be made as 16% post tax. Similar request has been made by **Mr. Ram Thiagarajan of SISMA, and by M/s.Tamilnadu Power Producers Association .**

Mr.K.Allaudin, IAS, Chairman & MD, TEDA during the round table conference has stated that the ROE may be retained at 16%. Similar request has been made by **M/s.Raghu Rama Renewable Energy Ltd**. in their written submission.

Mr.T.B.Chikkoba, Retd. Member, TNEB during the round table conference has stated that ROE could be 16% pre tax which is very reasonable. He has also stated that it is approximately double of the bank's interest and 16% post tax is on the higher side. He has suggested that if we allow post tax, then 14% may be allowed.

Other Commissions order on Interest Costs

Most of the Commissions have adopted 16 % ROE.

Commission's views / decisions

The investors perceive a high risk in having a long pay back period in such project and therefore there should be an adequate return to the investor. Accordingly the ROE may be fixed at the rate of **16% pre-tax**, taking into consideration, the payment security ensured under this order.

Issue No 29: Auxiliary Consumption

Mr. Raman, SISMA, has stated that even with variable frequency drive, 12% of auxiliary consumption is required in bagasse based cogen.

M/s.Raghu Rama Renewable Energy Ltd. in their written submission have suggested auxiliary consumption @ 10% for bio mass energy.

Other Commissions order on Auxiliary Consumption

(1) Biomass plants

Uttar Pradesh Commission has adopted 8.5 %, Karnataka Commission 9 % and Andhra Pradesh Commission also 9 %

(2) Bagasse based cogeneration

Uttar Pradesh Commission has adopted 8.50 %, Karnataka Commission 8% and Andhra Pradesh Commission 9%.

Commission's views / decisions

(1) Biomass plants

Till such time these plants are properly audited and operated efficiently to minimize losses and maximize production as enunciated by the Energy Conservation Act, the auxiliary consumption is considered as 9%.

(2) Bagasse based cogeneration

As discussed for biomass plants, the Commission proposes an auxiliary consumption of 9% for bagasse based cogeneration.

Issue No 30: General :

The following general issues were raised during the hearing

1 MNES guidelines need not be adopted for Tamil Nadu because wind energy generation is saturated in Tamil Nadu.
2 TNEB may consider improving the protective system to help the consumers from possible damage to their new plants.
3 Interfacing of 100 KW machines may be permitted.
4 TNERC shall suggest means of research in solar energy in the southern districts where there is huge potential for tapping solar energy for 10 months in a year. The Government can research in these areas in collaboration with industry without any charges being levied, besides giving incentive to the industry willing to collaborate with the project. Such a measure will help in developing new equipments and the overall saving would be more.
5 PF incentive is given only on net charges. This may be given on gross energy charges. Lapsed energy may be allowed to be used by TNEB with a deduction of 25%.
6 Consumers may be asked to purchase and install ToD meters.
7 All the basic assumptions of the draft discussion paper shall be revised on the realistic appraisals.
8 The investment in wind mill was high because of other benefits. There should be a privileged treatment to renewable energy sources.
9 There should be regulatory certainty and consistency for renewable energy
10 The utility should not be saddled with tariff which is not sustainable because it will only be passed on to the consumer.

11 There should be an incentive for replacing the old machines with higher capacity machines. Retrofitting either by replacement or by installing additional row may be considered to make fuller utilization of wind resource potential.

12 To overcome the unsteady nature of wind, prediction modules are used in certain countries to forecast the wind a day ahead which makes the wind power as a predictable power and helps the load dispatch centre (LDC) to schedule the power in advance. Clubbed with this prediction module, the LDC shall have a SCADA to control and supervise the local wind mills. The local SCADA for wind mills costs around Rs 5 lakhs per MW which in turn shall be connected with the LDC's SCADA system so as to reschedule the generation and consumption of the system. To encourage the developer to install SCADA system, accelerated depreciation benefit may be allowed for the future WEGs and for the existing WEGs, 2% reduction in wheeling charges may be allowed for installing SCADA. For the WEGs who are selling to distribution licensee, 10 paise raise in tariff may be allowed for installing SCADA.

13 Wind mills are over crowded in certain areas and also industrial units are migrating away from utilities and more units may go away in the future. When there is too much of wind power in the generation mix, the financial health of the distribution licensee will be affected and hence enough care shall be taken for allocation/distribution of wind farms to discoms appropriately at the time of unbundling of TNEB.

14 Investors in the wind sector could be divided in 3 groups.

- those who have recovered the cost - 1st group
- those who are yet to recover the cost - 2nd group
- future investors - 3rd group

Existing tariff may be continued for the first two groups

Commission's view / decisions.

Regarding connectivity for 100 KW machines as requested by M/s Evergreen

Power Ltd, the Commission directs the TNEB to study the feasibility of interfacing such machines with the grid and report to the Commission within 45 days of this order.

The Commission will consider on merit and encourage any proposal for research for harnessing solar energy in Tamil Nadu.

Power factor incentive / disincentive : As per section 7.17, part 1 (1.0) of the Commission's tariff order dated 16-03-2003, pf incentive / disincentive is applicable to the consumer **as a percentage of current consumption charges**. In the same line, the pf incentive / disincentive is applicable to all the users on the current consumption charges bill prepared based on the gross energy and applicable demand as per this order. However, the average pf recorded by the meter will be the reference for calculation of pf incentive / disincentive.

ToD Meter / Special Energy Meter shall be provided both at the generator and user ends. Consumers will be allowed to buy meters subject to specification prescribed by the CEA and Commissions regulations and Codes.

As suggested by Thiru. T.B.Chikkoba, Member (Retired) TNEB, the TNEB is directed to study the proposal of installation of wind pattern prediction module and SCADA for wind farms by the developers and interconnecting the same to the LDC's SCADA. Since this facility will help to bring the "infirm" wind power under ABT regime, the TNEB is directed to study and submit a detailed report for the implementation of the above proposal within two months of this order.

9.0 COMMISSION'S ANALYSIS AND ITS RULING ON TARIFF AND RELATED ISSUES

9.1 Tariff Determination Process

The tariff determination mechanism could be a Cost-plus, Market Driven, Long Run Marginal Costing and Avoided Cost of Generation. The latter two are difficult to estimate accurately and require extensive data. Hence they have not been

considered.

In a free market, where there is perfect competition, market determines the price. However, there is a good reason that the market driven pricing mechanism may be difficult to apply in the case of renewables. Under market determined prices, the buyer of power would go in for merit-order dispatch and purchase power from the cheapest source. However, renewable power is comparatively a costlier source when compared to conventional sources of power. Adopting merit order dispatch may lead to renewable power not getting dispatched at all.

The ABT mechanism provides for marginal price determination wherein the marginal price of power depends on the current frequency of the grid. Furthermore, wind power, which is the main renewable source in Tamil Nadu, is infirm in nature and it cannot be precisely dispatched depending on the conditions of the grid with present technology. Wind power is mainly dependent on wind seasons and flow patterns. These factors make market pricing of power purchase from renewable, difficult to implement.

9.2 Cost-Plus Tariff Determination

Cost-plus tariff determination is a more practicable method. It can be easily designed to provide adequate return to the investor and a surety of return will lead to larger investment in renewable power.

9.3 Single Part vs Two Part Tariff

Two part tariff is applied in order to recover fixed and variable costs through the fixed and variable components of tariff. Since wind energy is not amenable (with the existing technology) to merit order dispatch principles because of infirm nature, and all the costs of wind electric generators are fixed, the single part tariff is considered more suitable for wind power. For the biomass and co-generation, taking into consideration, their contribution to the total generation handled by the State grid, single part tariff appears appropriate.

9.4 Project Specific or Generalized Tariff

A Generalized tariff mechanism would provide an incentive to the investors for use of most efficient equipment to maximize returns and for selecting the most efficient site while an individual tariff determination (Project Specific tariff) would provide each investor, irrespective of the machine type and the site selected, the stipulated return on equity which, in effect, would shield the investor from the uncertainties involved in CUF due to machine type and the site location. With nearly 5566 wind mills in Tamil Nadu, project specific tariff may not be the correct choice. In general, the tariff determination mechanism must promote efficiency in the use of machines, in identification of good sites, and in operational ease. In view of this, the method of setting up of a single tariff for wind energy projects seems to be a preferable option if computed with due consideration to all factors.

9.5 Tariff Computation

The tariff, if determined in a cost-plus scenario, would depend significantly on the assumptions on investment costs, operating and financing costs and other key drivers . These parameters for tariff determination, as discussed and decided in section 8 of this order are :

Key Driver description	Windmills		Biomass Plants	Bagasse based Co-generation
	Group 1	Group 2		
Capital Cost	4.50 Crores / MW	5.00 Crores / MW	4.00 Crores / MW	4.00 Crores / MW
CUF / PLF	25.29% with de-rating at 1% every year after 10 years	26.70% with de-rating at 1% every year after 10 years	80.00%	55.00 %
Life of plant	20 years	20 years	20 years	20 years
Depreciation Rate	4.50% under SLM upto 90%	4.50% under SLM upto 90%	7.84% under SLM upto 90%	7.84% under SLM upto 90%
O & M Expenses	1.10% of capital cost and 5% escl. Every year after 5 years	1.10% of capital cost and 5% escl. Every year after 5 years	4.50% of capital cost and 5% escl. Every year	4.50% of capital cost and 5% escl. Every year
Debt Equity Ratio	70 : 30	70 : 30	70 : 30	70 : 30
Term of loan and Interest on Loan	10 years with one year moratorium and 9% interest	10 years with one year moratorium and 9% interest	10 years with one year moratorium and 9% interest	10 years with one year moratorium and 9% interest
ROE	16% pre tax	16% pre tax	16% pre tax	16% pre tax
Insurance Cost	0.75% on the projects for 5 years and reduction of 0.5% every year	0.75% on the projects for 5 years and reduction of 0.5% every year	0.75% on the projects for 5 years and reduction of 0.5% every year	0.75% on the projects for 5 years and reduction of 0.5% every year
Working Capital	Nil	Nil	Two months stock of fuel and two months O & M Expenses	Two months stock of fuel and two months O & M Expenses
Interest on W/C	Nil	Nil	11 %	11%
Fuel Consumption			Heat rate of 3700 kcal / kWh and calorific value of 3200 kcal /kg to a consumption of 1.16 kg / kWh	Heat rate of 3700 kcal / kWh and calorific value of 2300 kcal /kg to a consumption of 1.60 kg / kWh
Auxiliary consumption			9.00 %	9.00 %

Taking into account the technical and financial parameters as above the single part cost plus tariff have been computed and enclosed in annexure 7-A to annexure 10, which are self explanatory with footnotes. The purchase of power from the NCES generators shall be at the rates as below :

No	NCE Source	Tariff rate per KWHr
1	WEG :Group 1	Rs 2.75
2	WEG: Group 2	Rs 2.90
3	Bio Mass	Rs 3.15
4	Bagasse based Co- Generation	Rs 3.15

9.6 Tariff for Solar Energy

The quantum of grid connected solar system in Tamil Nadu is at present only 0.165 MW and that of India is 47 MW. The capital cost required for installing a solar generating station is 30 times more than that of the conventional generating station. Technical advancements are being achieved in the field of tapping of solar energy. The number of grid connected solar generators is yet to take off to the desired level. Hence, the Commission can specify the cost of purchase of solar energy separately.

10. OTHER GENERAL ISSUES

10.1 Minimum purchase requirements

As discussed in Section 8 under issue (3) of this order, the Commission fixes 10% as the minimum percentage of power each distribution licensee shall purchase from NCES sources out of his total consumption in his area of supply in Tamil Nadu as required by Section 86 (1) (e) of the Act.

10.2 Control period

As discussed in section 8 under issue 4 of this order, the Commission have decided to adopt a control period of 3 years. Since the agreement period proposed in this order is twenty years, the terms and conditions including the

purchase rate, ordered now will continue to be applicable till the end of agreement period. When the Commission revisits the tariff and allied issues after the control period, the revisions will be applicable only to the generators of renewable energy sources commissioned after such revised order.

10.3 Demand Charges / Grid Availability Charges

The grid support / grid availability charges, have been fixed by the Commission in its order on transmission and wheeling charges etc.,. wherein, the following conditions and the applicable charges for the same are specified. They are applicable for Bio mass and cogen generators..

a) Outage of generator conditions and providing start up power

b) When scheduled generation is not maintained and / or when the drawal by the consumer is in excess of the schedule.

For wind energy generators , the Commission decides the following:

a) Outage of generator conditions and providing start up power by the Licensee is a routine and frequent necessity. This shall be dealt with under unit to unit adjustment basis.

b) When scheduled generation is not maintained by WEG and / or when the drawal by the user (captive user or third party user) is in excess of the schedule, energy charges and deemed demand charges shall be regulated as follows:

a) Applicable Energy Charges: When the generator is synchronized with the Grid, energy charges shall be payable by the wind energy user, for the units supplied by the Distribution Licensee (i.e. balance units arrived at after subtracting the units supplied by the generator from the total consumption of the user during the billing month) at the applicable rate for that category. The time of day consumption (TOD) shall be charged for the nett consumption only (deducting the generated energy from the energy consumed during the respective time slots).

b) Applicable Demand charges : In addition to energy charges stipulated above, the wind energy user shall pay applicable demand charges as detailed in

issue 5 under section 8 of this order. Accordingly, it will be 81.2% percentage for the **"deemed demand"** supplied by the generator plus 100% of the applicable demand charges for that category of user for the balance demand supplied by the Distribution Licensee.(i.e. The difference between the maximum demand recorded and the deemed demand subject to the tariff order issued then and there on demand charges).

10.4 Banking

As followed by most of the other States, the Commission retains the existing practice of one year (from April to March) banking period of TNEB, for the NCES based wind electric generators . However, for the biomass and bagasse based cogen generators, banking provisions shall not apply.

The Commission fixes the banking charges as 5% for WEG . The Licensee shall pay at a rate of 75% of normal purchase rate for the unutilized portion of energy banked by the NCES based wind electric generators.

Slot wise banking is permitted to enable unit to unit adjustments for the respective slots towards rebate/ extra charges. However, the unutilized portion at the expiry of banking period will not be distinctly dealt with for adjustment. Such unutilized portion is eligible only for the 75 % rate

10.5 Transmission & Wheeling charges and line losses

As discussed in section 8 under issue 7 the Commission fixes the following transmission and wheeling charges which include the line losses in kind :

Wind Energy Generators	5 % of energy
Biomass	Within 25 KM usage : 3 % Beyond 25 KM usage : 6 %
Co-generation	Within 25 KM usage : 3 % Beyond 25 KM usage : 6 %

The transmission and wheeling charges fixed as above will get reduced , if the voltage level at the point of injection and at the point of drawal is equal to or more than 110 kV. The reduction will be based on the Commission's order against the petition no TP1/2005 from TNEB. As an example, if the injection voltage by the NCES generator is at 110 kV and the drawal for captive usage is also at 110 kV , the transmission charges specified by the Commission in the above said order will work out to around 5.80 % . Such cases shall be specifically brought to the Commission and the rate revised.

10.6 Reactive Power Charges

The Commission have decided to charge 25 paise / kVARh for the WEGs who are drawing reactive power up to 10% of net active energy generated. The Commission would also like to curtail the WEGs who are drawing more than 10% of net active energy generated. For drawing more than 10% of net active energy generated, as a deterrent, the Commission would like to impose a charge of 50 paise per kVARh considering its negative impact on the grid.

For other NCES generators (other than WEGs), the conditions and charges as provided in the Tamil Nadu Electricity Grid Code and the Commission's order on Transmission, wheeling and other charges will apply.

10.7 Evacuation Facilities:

The interconnecting network up to the point of grid connection may be executed as DCW work by the TNEB. The procedure for application and to obtain evacuation facilities is given below.

a. STU shall within 30 days of receipt of application from NCES 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 NCES generators shall be intimated within ninety days of such request of NCES generators

c. Feasibility based on the system studies shall be established at the earliest possible but not later than six months.

d. Clearances, approvals, certificate, if any, required by NCES generators shall be issued within a month time.

e. The cost of interfacing lines, switch gear, metering and protection arrangement shall have to be borne by the owner of NCES generators, but the work will be executed by distribution licensee on Deposit Contribution Work basis.

f. When the owner of the NCES generators happens to be a consumer and when the power fed to the distribution licensee grid is less than 2 MVA, dedicated line from the location of the NCES generators to near by distribution licensee substation will not be required. The service line itself will cater to the need to export the power to the distribution licensee grid.

g. When the owner of the NCES generators happens to be a consumer and when the power fed to the distribution licensee grid is more than 2 MVA, then a dedicated feeder to a nearby substation will be required. If already the consumer is availing himself of supply through a dedicated feeder and if the capacity of the feeder is adequate to carry the quantum of export of power, then the same feeder can be used for export of power and no additional installation is required.

h. In case the dedicated feeder is not adequate to carry the power exported, then the existing dedicated feeder has to be strengthened or a new line has to be erected.

i. For a non-consumer (user) the new interfacing line of appropriate capacity and voltage shall be at his cost and will be executed by distribution licensee.

j. No compensation shall be provided to the NCES generators or the third party purchaser by the distribution licensee for deemed generation benefits in case the distribution licensee fails to evacuate power due to failure of the Transmission facility. However, the distribution licensee shall have to

maintain the standards as per Commission's regulation on distribution standard of performance.

10.8 Adjustment of Peak / off Peak power

Since all the generators and the tied up users shall be provided with TOD meters, the adjustment of energy for biomass and bagasse based Co-gen generators shall be done on slot to slot basis within monthly billing cycle as follows. For WEGs it shall be done within the banking period.

I. peak hour generation with peak hour consumption
II. off-peak hour generation with off-peak hour consumption and
III. the normal hour generation with normal hour consumption.

The peak hour extra charges and off peak hour rebate shall be on net energy consumption after deducting captive generation during the respective peak hour block and off peak hour block.

10.9 PF incentive / disincentive.

As per section 7.17, part 1 (1.0) of the Commission's tariff order dated 15-03-2003, pf incentive / disincentive is applicable to the consumer as a percentage of current consumption charges. In the same line, the pf incentive / disincentive is applicable to all user on the current consumption charges bill prepared based on the gross energy and applicable demand as per this order. However, the average pf recorded by the meter will be the reference for calculation of pf incentive / disincentive.

10.10 Energy Purchase Agreement (EPA)

The NCES generator shall sign an EPA with distribution licensee for a peiod of twenty years for sale of power. It is not intended that the Commission would approve EPA for each CGP holder individually. The distribution licensees shall draft EPA taking cognizance of the tariff provisions and EPA related principles

elaborated in this order.

The distribution licensee should sign the EPA within 1-month from the date of submission of the application with all relevant details for such agreement by the NCES generators.

TNEB will frame and file a model EPA for approval of the Commission. This should include a clause for penalty in case the developer winds up his operation before the 20 year power purchase agreement period.

10.11 Energy Wheeling Agreement (EWA)

The NCES generators / third party buyer of power and the concerned distribution licensee shall sign an EWA for the purpose of wheeling of power from the NCES generators to the third party buyer of CGP power. It is not intended that the Commission would approve EWA for each NCES generator individually. The distribution licensees shall draft EWA taking cognizance of the energy wheeling principles elaborated in this order.

The tenure of the EWA shall be same as that of the EPA signed with the CGP holder / third party buyer of CGP power.

The distribution licensee should execute the EWA within 1-month from the date of submission of application with all relevant details for such agreement by the NCES generators or the third party purchaser of power, as the case may be.

10.12 Payment of Security Deposit

The security deposit of two times of the average consumption is governed by the supply code. Since majority of the NCES power in Tamil Nadu is “infirm” and they have banking provision, the Commission proposes 2 times of the maximum net energy supplied by the distribution licensee in a month in the previous banking period may be taken as the basis for the payment of security deposit by the user to the distribution licensee

10.13 Adjustment of Wheeled Energy

Act does not provide any restrictions for self use of energy by a generator in regard to service category. Therefore, the generator can adjust the energy on unit-to-unit basis for self use in any HT service.

10.14 Payment of Security for Power Purchase by Distribution licensee

Section 6.2 of the Tariff Policy requires to ensure adequate and bankable payment security arrangements to the generating companies. In the same line Commission proposes that a bankable security in favour of the generator for an amount equivalent to an average monthly bill shall be opened at the option of the generator by the distribution licensee, in case an EPA is signed for power purchase between distribution licensee and the generator.

10.15 Billing and Payment to NCES generator by Distribution licensee

In case of captive use, the distribution licensee shall raise the bill after accounting for the net energy supplied at the end of each monthly billing cycle. Meter reading should be taken on the same day at NCES generator end and captive user / third party purchaser end. The generation at generator end shall be communicated to all the circles of the captive users / third party purchaser within 2 days so as to facilitate for matching generation with consumption in the same billing month. This adjustment will be done on slot to slot basis taking in to account the (i) peak (ii) off peak and (iii) normal generation / consumption within monthly billing cycle /banking period. No carry over is allowed for the next month in case of firm power supply. In case of infirm power, no carry over is allowed beyond the banking period. Excess generation in a monthly billing cycle / banking cycle can be sold to the Licensee at the rate fixed by the Commission. Excess drawal will be charged under respective tariff applicable to the user. The distribution licensee shall raise the bill to the user after accounting for generation and consumption at the end of each monthly billing cycle subject to recovery of

transmission and wheeling charges in cash and losses in kind.

In case of NCES generators selling power to distribution licensee, the generator will raise the bill every month for the net energy supplied after adjusting to the charges for start up power, reactive power charges, etc as per this order.

The payments to the generators in respect of the energy supplied shall be made by the distribution licensee within the same period as provided by the distribution licensee to recover payments from its HT industrial consumers.

12. Conclusion

The Commission acknowledges the efforts of all the officers, staff and consultants of the Commission for their contribution in the detailed analysis of various issues. The coordinated efforts from the TNEB side and the contribution from the members and special invitees of SAC are commendable . The Commission would like to record its appreciation and sincere thanks to all the special invitees who participated in the round table meet held exclusively on this subject .The suggestions / comments/ objections received in response during the pre- publication process, have helped the Commission to address many issues with a special focus. The Commission is confident that the present order for the non conventional energy sources generation and co-generation will provide the required environment, encouragement and impetus to the wind energy generators, biomass and bagasse based cogenerators , to exploit these sources of energy more vigorously in the State and Tamil Nadu will continue to lead the Nation in this area.

By order of the Commission

R. Balasubramanian

Secretary

Annexure – I

SAC Meeting held on 24-11-2004

Members and Special invitees present

Sl. No.	Name
1	Mr.A.Balraj I.A.S (Retd) Chairman / TNERC
2	Mr.S.Thangarathnam, Member / TNERC
3	Mr.B.Jeyaraman Member / TNERC
4	Mr. K.Skandan IAS, Chairman /TNEB
5	Mr R.Mohandoss CEE/Southern Railways
6	Mr. V.Sethuraman, CGM/NLC
7	Mr. S.Ramakrishnan IAS, Secretary Co-operation, Food and Consumer Protection
8	Mr T.M.Varadaraj, President Grape Growers Association
9	Mr. G.N.Periyasamy, Agriculturist
10	Mr.K.M.Sundaram, Agriculturist
11	Mr.D.Kumaravelu, Retired Chief Engineer / TNEB
12	Mr.P.Duraisingam, President/FEDCOT
13	Mr.M.Nandagopal, Managing Director/Saga Sugars
14	Mr.T.B.Chikkoba, Former Member (Gen)/TNEB
15	Mr.Ramakrishnan

Annexure – II

Public Hearing held on 18-05-2005

List of Stakeholders who have expressed their views

Sl No	Name / Organization
1	Mr Giri , Indian Wind Turbine Manufacturers Association
2	Mr. T.Varadarajan , M.N.Dastur Consultants
3	Mr Palaniappan
4	M/s Raghu Rama Renewable Energy Ltd
5	Mr Shanmugavelayudam, TANSTIA
6	Mr. K.Venkatachalam, Tamil Nadu Spinning Mills Association
7	R.Manickam, Joint Secretary, Tamil Nadu Electrical Wireman Association
8	Mr. Kasturi Rangayan, Indian Wind Power Association

Annexure – III

Public Hearing held on 18-05-2005

List of Stakeholders who have communicated their views through written submission

SlNo	Name and Organization
1	M/s SAS Hotels and Enterprises Ltd
2	Indian Wind Power Association
3	Centre for Wind Energy Technology
4	The India Cements Ltd
5	Indian Wind Turbine Manufacturers Association
6	M/s NEG Micon
7	M/s KSK Energy Ventures Ltd
8	Tamil Nadu Power Producer's Association
9	Tamil Nadu Spinning Mills Association
10	Dr.P.Rajamani Chief Engineer/Operation, TNEB (Retd)
11	M/s Raghu Rama Renewable Energy Ltd
12	Yarn and Spinning mills Association, Dindigul

Annexure – IV

SAC Meeting held on 11-11-2005

Members and Special invitees present

Sl No	Name
1	Mr.A.Balraj I.A.S (Retd) Chairman / TNERC
2	Mr.B.Jeyaraman Member / TNERC
3	Mr. Hans Raj Verma IAS, Chairman /TNEB
4	Mr A.K.Singhal CEE/Southern Railways
5	Mr. K.Sekar, CGM/NLC
6	Mr. K.Venkatesan IAS (Retd)
7	Mr. A.M.Swaminathan, IAS (Retd)
8	Mr.T.B.Chikkoba, Former Member (Gen)/TNEB
9	Mr. M.S.Parthasarathy President / NCSI
10	Mr K.V.Shetty, MD IP Rings Ltd
11	Dr. U.Shankar Professor Madras School of Economics
12	Mr. G.N.Periyasamy, Agriculturist
13	Mr.D.Kumaravelu, Retired Chief Engineer / TNEB
14	Mr.P.Duraisingam, President/FEDCOT

Annexure – V

Public Hearing held on 23-12-2005

List of Stakeholders who have expressed their views

Sl No	Name / Organization
1	Mr.G.V.Ramanan / M/s Avangaurd Consulting and Engineering (P) Ltd
2	Mr Kathiresan, CFC/TNEB
3	Mr. D.A. Prabakar / Tirunelveli District Consumer Protection Association
4	Mr.V.R.Sreekumaran / M/s NEG Micon
5	Mr. Velliangiri / Ms Tamil Nadu News Print & Papers Ltd
6	Mr Arvind Gupta, Tamil Nadu Power Producers Association
7	Mr.M.Palaniappan, Indian Wind Energy Association
8	Mr.K.Kasthuri Rangaian, Indian wind power association
9	Mr. Manickam, The South Indian Sugar Mills Association
10	Mr. RamThiagrajan, The South Indian Sugar Mills Association
11	Mr. Raman, The South Indian Sugar Mills Association
12	Mr Vetrivelan, Tamil Nadu Spinning Mills Association
13	Mr. T.R.Krishnaswamy Evergreen Power Ltd
14	Mr Manickkam, M/s Sakthi sugars
15	Mr. Satishkumar, M/s Saheli exports Pvt Ltd
16	Chairman / TNEB

Annexure – VI

Public Hearing held on 23-12-2005

List of Stakeholders who have communicated their views through written submission

Sl No	Name / Organization
1	The India Cements Ltd
2	Mr.P.Janakiraman
3	M/s Nuziveedu Seeds Ltd
4	Tmt A.Jeyarani Mayor City Municipal Corporation Tirunelveli
5	Tmt Kalaivani, Chennai
6	M/s Tamil Nadu Newsprint and Papers Ltd
7	M/s DCW Ltd
8	Tamil Nadu Spinning Mills Association
9	Cogeneration Association of India
10	Indian Renewable Energy Development Agency Ltd
11	The South Indian Sugar Mills Association
12	Tamil Nadu Power Producers Association
13	Indian Wind Energy Association
14	M/s Raghu Rama Renewable Energy Ltd
15	M/s Suzlon Energy Ltd
16	M/s Goyal Ispat Ltd
17	Indian Wind Power Association

Annexure - VII-A
Wind Data for Tamil Nadu

Location	Latitude	Longitude	Mean Sea Level	Mast	Power Law Index	Air Density	Wind Power Density /50
	deg N	deg E	(m)	(m)		(g/cum)	(w/sqm)
Muppandal Pass							
Kanan Kulam	8.20	77.58	20	25	0.22	1169	374.6
Sankaneri	8.2	77.7	28	25	0.2	1168	387.7
Muppandal	8.25	77.55	42	20	0.22	1152	712.3
Shenbaka Raman Pudur	8.27	77.52	40	20	0.17	1152	475.7
Kumara Puram	8.27	77.58	158	25	0.17	1155	407.8
Kattadi Malai	8.28	77.53	35	20	0.16	1167	488.1
Panakudi	8.3	77.58	140	20	0.11	1147	469.2
Puliyamkulam	8.35	77.73	10	20	0.23	1152	342.9
Shencotta Pass							
Nettur	8.25	77.55	100	20	0.1	1151	419.3
Thalayuthu	8.78	77.65	125	20	0.12	1149	422.1
Gangaikondan	8.85	77.77	60	20	0.17	1155	338.4
Alagia Pandipuram	8.9	77.65	70	20	0.2	1154	487.2
Ottapidaram	8.9	78.02	15	20	0.19	1160	377.8
Kayattar - II	8.92	77.73	90	25	0.12	1151	356.3
Kayattar - I	8.95	77.77	105	20	0.11	1145	413.7
Achankutam	8.97	77.47	120	20	0.18	1159	437.3
Onamkulam	8.97	77.85	100	25	0.1	1151	291.9
Ayakudi	9.02	77.33	182	20	0.23	1153	536.1
Mangapuram	9.05	77.37	196	20	0.12	1152	422.8
Palaghat Pass							
Myvadi	10.6	77.32	341	20	0.18	1127	376
Andiyur	10.6	77.17	392	20	0.18	1122	270.6
Pucharipatti	10.67	77.12	380	25	0.19	1123	254
Pulavadi	10.75	77.27	390	20	0.2	1115	444.9
Arasan Pallayam	10.82	77.05	385	20	0.15	1123	291.1
Edayarpalayam	10.9	77.05	445	20	0.14	1117	398.2
Kethanur	10.9	77.28	404	20	0.14	1121	375.6
Mettukadai	10.92	77.33	365	20	0.17	1119	280.7
Pongalur	10.93	77.38	365	20	0.16	1125	309.4
Tennerpandal	10.97	77.32	380	20	0.35	1123	
Sea Coast							
Rameswaram	9.28	79.33	4	20	0.24	1167	604.4

Annexure - VII-B1

Estimated Annual Generation for New Machines (With Type Certificate)

Corrected for Air Density, Array Efficiency, Grid & Machine Availability and Internal Losses

Location	SUZLON	NEPC	NEG	NEG	ENERCON	ENERCON	GE WIND	VESTAS	PIONEER
	1250 KW	225 KW	750 KW	1650	330 KW	800 KW	1500 KW	500 KW	850 KW
Muppandal Pass									
Kanan Kulam	3202827	523096	1628924	4900636	902869	2324592	3750857	1405414	2243687
Sankaneri	3451177	566542	1765938	5268364	975489	2479825	4047019	1518963	2428292
Muppandal	4416505	686704	2327682	6430864	1155467	2925402	5225924	1783381	3022393
Shenbaka Raman Pudur	3403383	522159	1747313	5130744	901816	2244734	4003455	1405509	2386181
Kumara Puram	3076372	510635	1577788	4745571	877621	2188508	3596618	1373158	2212365
Kattadi Malai	3896682	598355	1991109	5884891	1035250	2560094	4586386	1620590	2760132
Panakudi	3189564	521623	1712959	4687561	865196	2078638	3754403	1331932	2180030
Puliyamkulam	2963237	435902	1488895	4632268	767849	2005287	3478559	1202142	2112725
Average	3449968.375	545627	1780076	5210112.375	935194.625	2350885	4055402.63	1455136.125	2418225.6
For 1000 KW	2759975	2425009	2373435	3157644	2833923	2938606	2703602	2910272	2844971
Average for 1 MW for this Pass			**2771937.44**						
CUF for this Pass			**31.64**						
Shencotta Pass									
Nettur	2883763	477916	1539787	4082584	803514	1927777	3413688	1222158	1871505
Thalayuthu	2483619	409811	1349360	3545611	676762	1645517	2908854	1024369	1670574
Gangaikondan	2413543	399531	1276316	3463406	674498	1672915	2826705	1025033	1622014
Alagia Pandipuram	3191647	500438	1705083	4576922	842849	2111923	3774362	1278716	2098925
Ottapidaram	2458097	380540	1283910	3673186	650910	1648313	2867679	996468	1687623
Kayattar - II	2446798	407977	1292001	3545060	685722	1663319	2864417	1044275	1652756
Kayattar - I	2676459	429464	1426675	3852424	723892	1748321	3141089	1102622	1780353
Achankutam	2774557	438726	1482849	3884339	734798	1828975	3275966	1116876	1812064
Onamkulam	2278005	380005	1201180	3378972	650658	1558255	2659469	994963	1570374
Ayakudi	3710023	568603	1960292	5343643	967629	2455231	4399755	1471073	2411729
Mangapuram	3291703	524250	1740286	4763848	885449	2142199	3875167	1360406	2216306
Average	2782564.909	447023.7273	1477976.273	4009999.545	754243.7273	1854795	3273377.36	1148814.455	1854020.3
for 1000KW	2226052	1986772	1970635	2430303	2285587	2318494	2182252	2297629	2181200
Average for 1 MW for this Pass			**2208769.33**						
CUF for this Pass			**25.21**						
Palaghat Pass									
Myvadi	2820648	438877	1482499	4087443	747757	1868172	3314212	1142472	1886054
Andiyur	2597233	394530	1325478	3981544	689317	1737005	3028128	1069599	1821364
Pucharipatti	2406758	384795	1199719	3848077	681581	1744199	2786040	1069373	1794121
Pulavadi	3229658	499718	1704126	4694174	850155	2137694	3814840	1294612	2147500
Arasan Pallayam	2680715	410859	1353577	4169738	720571	1782634	3114481	1127645	1974238
Sulthanpet	1647412	275915	883735	2495628	471239	1001161	1902474	740221	1268045
Edayarpalayam	3101280	483064	1612606	4564045	829404	2031763	3628343	1270972	2116766
Kethanur	2854378	444650	1482807	4209905	764415	1874809	3337265	1171010	1958520
Mettukadai	2318485	353181	1188819	3493407	618246	1549612	2713844	947782	1615268
Pongalur	2522864	388530	1305183	3747482	671445	1674493	3582486	1028132	1728159
Average	2617943.1	407411.9	1353854.9	3929144.3	704413	1740154.2	3122211.3	1086181.8	1831003.5
for 1000KW	2094354	1810720	1805140	2381300	2134585	2175193	2081474	2172364	2154122
Average for 1 MW for this Pass			**2089916.89**						
CUF for this Pass			**23.86**						

Machine Availability - 95%
Array Efficiency - 95%
Internal Losses - 2%

Abstract

Muppandal Pass	500 MW	
Average CUF		31.64
Shencotta Pass	700 MW	
Average CUF		25.21
Palaghat Belt	500 MW	
Average CUF		23.86

Weighted Average CUF	**26.7**

Annexure - VII-B2

Estimated Annual Generation for Higher Capacity Machines

Corrected for Air Density, Array Efficiency, Grid & Machine Availability and Internal Losses

Location	SUZLON	NEG	ENERCON	NEG	GE WIND	PIONEER	CHIRANJEEVI
	1250 KW	750 KW	600 KW	1650 KW	1500 KW	850 KW	750 KW
	H=65 D=64 (Pitch)	H=55 D=48.2 (Stall)	H=56.85 D=44 (Pitch)	H=78 D=82 (Stall)	H=65 D=70.5 (Pitch)	H=65 D=58 (Pitch)	D=51.5 (pitch)
Muppandal Pass							
Kanan Kulam	3202827	1628924	1413537	4900636	3750857	2243687	1815119
Sankaneri	3451177	1765938	1534391	5268364	4047019	2428292	1974110
Muppandal	4416505	2327682	2008363	6430864	5225924	3022398	2537671
Shenbaka Raman Pudur	3403383	1747313	1521325	5130744	4003455	2386181	1971061
Kumara Puram	3076372	1577788	1366113	4745571	3596618	2212365	1772374
Kattadi Malai	3896682	1991109	1739243	5884891	4586386	2760132	2262984
Panakudi	3189564	1712959	1496650	4687561	3754403	2180030	1900182
Puliyamkulam	2963237	1488895	1299903	4632268	3478559	2112725	1660821
Average	3449968.375	1780076	1547440.625	5210112.4	4055402.63	2418226.3	1986790.25
For 1000 KW	2759974.7	2373434.67	2579067.708	3157643.9	2703601.75	2844972.1	2649053.667
Average for 1 MW for this Pass			**2723964.1**				
CUF for this Pass			**31.10**				
Shencotta Pass							
Nettur	2883763	1539787	1334233	4082584	3413688	1871505	1736118
Thalayuthu	2483619	1349360	1148912	3545611	2908854	1670574	1476699
Gangaikondan	2413543	1276316	1097937	3463406	2826705	1622014	1407021
Alagia Pandipuram	3191647	1705083	1467419	4576922	3774362	2098925	1862494
Ottapidaram	2458097	1283910	1105469	3673186	2867679	1687623	1418032
Kayattar - II	2446798	1292001	1118003	3545060	2864417	1652756	1451907
Kayattar - I	2676459	1426675	1228974	3852424	3141089	1780353	1597984
Achankutam	2774557	1482849	1274840	3884339	3275966	1812064	1627636
Onamkulam	2278005	1201180	1037596	3378972	2659469	1570374	1369770
Ayakudi	3710023	1960292	1705997	5343643	4399755	2411729	2148317
Mangapuram	3291703	1740286	1503391	4763848	3875167	2216306	1953105
Average	2782564.909	1477976.27	1274797.364	4009999.5	3273377.36	1854020.3	1640825.727
for 1000KW	2226051.927	1970635.03	2124662.273	2430302.8	2182251.58	2181200.3	2187767.636
Average for 1 MW for this Pass			**2186124.5**				
CUF for this Pass			**24.96**				
Palaghat Pass							
Myvadi	2820648	1482499	1278269	4087443	3314212	1886054	1643671
Andiyur	2597233	1325478	1148805	3981544	3028128	1821364	1492636
Pucharipatti	2406758	1199719	1042219	3848077	2786040	1794121	1357393
Pulavadi	3229658	1704126	1472185	4694174	3814840	2147500	1877340
Arasan Pallayam	2680715	1353577	1177056	4169738	3114481	1974238	1553446
Edayarpalayam	3101280	1612606	1396831	4564045	3628343	2116766	1826691
Kethanur	2854378	1482807	1284010	4209905	3337265	1958520	1678917
Mettukadai	2318485	1188819	1034378	3493407	2713844	1615268	1343508
Pongalur	2522864	1305183	1130500	3747482	3582486	1728159	1782474
Tennerpandal	3138104	1585320	1424141	4189769	3714576	2010198	1760478
Average	2767012.3	1424013.4	1238839.4	4098558.4	3303421.5	1905218.8	1631655.4
for 1000KW	2213609.84	1898684.53	2064732.333	2483974.8	2202281	2241433.9	2175540.533
Average for 1 MW for this Pass			**2182893.8**				
CUF for this Pass			**24.92**				

Grid Availability - 95%
Machine Availability - 95%
Array Efficiency - 95%
Internal Losses - 2%

Annexure - VII-B3

Estimated Annual Generation for Lower Capacity Machines

Corrected for Air Density, Array Efficiency, Grid & Machine Availability and Internal Losses

Location	FLOVEL	KENETECH	REPL	ELECON	NORDIAMK	NORDEX	DIS	AMTL	NEPC	NEPC	TTG	VESTAS
	600 KW	**410 KW**	**320 KW**	**300 KW**	**300 KW**	**250 KW**	**250 KW**	**250 KW**	**250 KW**	**225 KW**	**250 KW**	**225 KW**
	H=50 D=43	H=36.5 D=33	H=40 D=33	H=40 D=30	H=30.5 D=31	H=41 D=29.7	H=36.5 D=27	H=31 D=25	H=30 D=27.6	H=30 D=28.6	H=31.3 D=28.5	H=31.5 D=27
Muppandal Pass												
Muppandal	1793548	1097326	986339	863386	812355	763110	711487	706244	693338	674343	648863	631790
Shenbaka Raman Pudur	1326347	773446	749727	638331	593847	579479	530000	530566	514493	528973	475953	477255
Kumara Puram	1520882	909909	856744	732338	689150	657973	610959	610108	591544	592263	550402	545825
Kattadi Malai	1509551	876004	864536	730670	684190	663574	606376	608007	589153	610868	544468	548362
Puliyamkulam	1114730	602073	619179	509991	451426	479521	428251	422035	394335	410902	366718	373795
Average	1453011.6	851751.6	815305	694943.2	646193.6	628731.4	577414.6	575392	556572.6	563469.8	517280.8	515405.4
For 1000 KW	2421686	2077442.927	2547828.13	2316477.3	2153978.67	2514925.6	2309658.4	2301568	2226290.4	2504310.222	2069123.2	2290690.67
Average for 1 MW for this Pass			**2311164.96**									
CUF for this Pass			**26.38**									
Shencotta Pass												
Nettur	1239343	851844	701972	640585	631163	539740	524657	534332	548431	523383	504212	485481
Thalayuthu	1067387	700631	583809	524618	519566	469938	446261	458411	446954	416747	419616	400568
Alagia Pandipuram	1329145	842678	715439	647306	606857	564341	532974	526572	526766	507790	488786	473955
Kayattar - II	1113012	720406	623240	553819	535559	488422	464740	471349	467272	454689	431612	421637
Onamkulam	944893	590668	544105	463951	448796	427887	399268	413616	398093	397448	366619	364121
Ayakudi	1516391	937430	819639	735298	671488	636263	594594	582926	581682	572867	540035	592574
Average	1201695.2	773942.8333	664700.667	594262.83	568904.833	521098.5	493749	497867.67	494866.333	478820.6667	458480	456389.333
for 1000KW	2002825.3	1887665.447	2077189.58	1980876.1	1896349.44	2084394	1974996	1991470.7	1979465.33	2128091.852	1833920	2028397.04
Average for 1 MW for this Pass			**1988803.4**									
CUF for this Pass			**22.7**									
Palaghat Pass												
Poosaripatti	995652	514289	549584	447028	393360	437936	383756	382388	346465	369574	323513	334196
Pulavadi	1318345	815095	711483	637690	591218	561474	524749	517735	516278	505986	477495	467040
Arasan Pallayam	927563	508890	540453	435432	411582	428776	382903	394966	363219	387871	336025	345778
Sulthanpet	723072	443169	444840	363830	374917	350640	325335	347441	330615	347774	300750	306304
Edayarpalayam	1255051	761940	695775	609163	565704	550212	506078	512631	498449	502304	461414	458744
Kethanur	1194692	732914	662809	581457	546352	525251	487484	491953	480034	481730	444365	4401230
Mettukadai	906025	521977	499106	427842	394769	397180	360614	359771	347125	357140	319468	321266
Pongalur	937276	579352	539373	466395	435890	428491	393730	369454	381084	385827	352862	352917
Average	1032209.5	609703.25	580427.875	496104.63	464224	459995	420581.125	422042.38	407908.625	417275.75	376986.5	873434.375
for 1000KW	1720349.2	1487081.098	1813837.11	1653682.1	1547413.33	1839980	1682324.5	1688169.5	1631634.5	1854558.889	1507946	3881930.56
Average for 1 MW for this Pass			**1859075.56**									
CUF for this Pass			**21.22**									

Grid Availability - 95%
Machine Availability - 95%
Array Efficiency- 95%
Internal Losses - 2%

Abstract

Muppandal Pass

CUF for Large Machine	31.1		
CUF for Small Machine	26.38	Weighted Average CUF	27.17
Average CUF	28.74	using CUF for Larger machine	

Shencotta Pass

CUF for Large Machine	24.96	Weighted average CUF	
CUF for Small Machine	22.7	using CUF for small machince	23.42
Average CUF	23.83		

Palaghat Belt

		Weighted average CUF	25.29
CUF for Large Machine	24.92	using average CUF	
CUF for Small Machine	21.22		
Average CUF	23.07		

Average CUF	**25.29**

Annexure - VIII

Wind Energy Average Tariff for existing units

1	Project Cost	**4.50 Crs**
2	O & M Charges	1.10% with 5% escl.every year after five year
3	Insurance	0.75% with reduction of 0.5% every year after five years
4	Interest On Loan	9.00%
5	Loan Repayment	10 years with one year moratorium
6	Depreciation	4.5% in SLM
7	ROE	16%
8	CUF	25.29% with de-rating @ 1% for every year after ten years
9	Average Tariff Rate	**2.74**

Wind Energy Average Tariff for Future units

1	Project Cost	**5.0 Crs**
2	O & M Charges	1.10% with 5% escl.every year after five year
3	Insurance	0.75% with reduction of 0.5% every year after five years
4	Interest On Loan	9.00%
5	Loan Repayment	10 years with one year moratorium
6	Depreciation	4.5% in SLM
7	ROE	16%
8	CUF	26.70% with de-rating @ 1% for every year after ten years
9	Average Tariff Rate	**2.90**

Annexure - VIII

Average Unit Cost (Wind Energy) based on cost

(For Existing Units)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
O & M Charges 1.10% with 5% escl.every year after five year	495000	495000	495000	495000	495000	519750	545738	573024	601676	631759
Insurance 0.75% and reduction of 0.5% every year after five years	337500	337500	337500	337500	337500	335813	334133	332463	330800	329146
Interest On Loan 9.00%	2835000	2835000	2551500	2268000	1984500	1701000	1417500	1134000	850500	567000
Depreciation 4.5%	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500
ROE 16%	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000
Total Cost	7650000	7650000	7366500	7083000	6799500	6539063	6279871	6021987	5765476	5510406
Generation Units (25.29%) de-rating @1% for every year after ten years	2215404	2215404	2215404	2215404	2215404	2215404	2215404	2215404	2215404	2215404
Per Unit Cost	3.453	3.453	3.325	3.197	3.069	2.952	2.835	2.718	2.602	2.487

	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
O & M Charges 1.10% with 5% escl.every year after five year	663347	696515	731340	767907	806303	846618	888949	933396	980066	1029069
Insurance 0.75% and reduction of 0.5% every year after five years	327501	325863	324234	322613	321000	319395	317798	316209	314628	313055
Interest On Loan 9.00%	283500									
Depreciation	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500	1822500
ROE 16%	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000	2160000
Total Cost	5256848	5004878	5038074	5073020	5109803	5148513	5189247	5232105	5277194	5324624
Generation Units (25.29%) de-rating @1% for every year after ten years	2193250	2171317	2149604	2128108	2106827	2085759	2064901	2044252	2023810	2003572
Per Unit Cost	2.397	2.305	2.344	2.384	2.425	2.468	2.513	2.559	2.608	2.658

The Sum of the per unit cost for 20 years = 54.753

The average per unit cost = 2.74

Annexure - VIII

Average Unit Cost (Wind Energy) based on cost

(For future unit)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
O & M Charges 1.10% with 5% escl.every year after five year	550000	550000	550000	550000	550000	577500	606375	636694	668528	701955
Insurance 0.75% and reduction of 0.5% every year after five years	375000	375000	375000	375000	375000	373125	371259	369403	367556	365718
Interest On Loan 9.00%	3150000	3150000	2850750	2551500	2252250	1953000	1653750	1354500	1055250	756000
Depreciation 4.5%	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000
ROE 16%	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000
Total Cost	8500000	8500000	8200750	7901500	7602250	7328625	7056384	6785597	6516335	6248673
Generation Units (26.70%) de-rating @1% for every year after ten years	2338920	2338920	2338920	2338920	2338920	2338920	2338920	2338920	2338920	2338920
Per Unit Cost	3.634	3.634	3.506	3.378	3.250	3.133	3.017	2.901	2.786	2.672

	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
O & M Charges 1.10% with 5% escl.every year after five year	737053	773905	812600	853231	895892	940687	987721	1037107	1088962	1143410
Insurance 0.75% and reduction of 0.5% every year after five years	363890	362070	360260	358459	356666	354883	353109	351343	349586	347838
Interest On Loan 9.00%	456750									
Depreciation 4.5%	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000	2025000
ROE 16%	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000
Total Cost	5982692	5560975	5597860	5636689	5677558	5720570	5765830	5813450	5863549	5916249
Generation Units (26.7%) de-rating @1% for every year after ten years	2315531	2292375	2269452	2246757	2224290	2202047	2180026	2158226	2136644	2115277
Per Unit Cost	2.584	2.426	2.467	2.509	2.553	2.598	2.645	2.694	2.744	2.797

The Sum of the per unit cost for 20 years = 57.927

The average per unit cost = 2.90

Annexure - IX

Tariff - Biomass Plants

0.0425 0.0075 0.005

Year	Interest 9% for 10 years & One year Moratorium	O&M Exp (4.5% with 5% escl	Insurance 0.75% for five years and reduction of 0.5% every year thereafter	Depreciation 7.84%	ROE 16%	Fuel Consumption 1.16kg/unit	Fuel Cost (Rs.1000/Mt with 5% escl)	Interest on Working Capital 11.0 %		
								O & M (Two Months)	Fuel (Two Months)	Total
1	2520000	1800000	300000	3136000	1920000	8129280	8129280	33000	149037	182037
2	2520000	1890000	300000	3136000	1920000	8129280	8535744	34650	156489	191139
3	2268000	1984500	300000	3136000	1920000	8129280	8962531	36383	164313	200696
4	2016000	2083725	300000	3136000	1920000	8129280	9410658	38202	172529	210730
5	1764000	2187911	300000	3136000	1920000	8129280	9881191	40112	181155	221267
6	1512000	2297307	298500	3136000	1920000	8129280	10375250	42117	190213	232330
7	1260000	2412172	297008	3136000	1920000	8129280	10894013	44223	199724	243947
8	1008000	2532781	295522	3136000	1920000	8129280	11438713	46434	209710	256144
9	756000	2659420	294045	3136000	1920000	8129280	12010649	48756	220195	268951
10	504000	2792391	292575	3136000	1920000	8129280	12611181	51194	231205	282399
11	252000	2932010	291112	3136000	1920000	8129280	13241741	53754	242765	296519
12		3078611	289656	1504000	1920000	8129280	13903828	56441	254904	311345
Total	16380000	28650828	3558417	36000000	23040000		129394778	525265	2372238	2897503

1. Interest	16380000
2.O & M Expenses	28650828
3.Insurance	3558417
4. Depreciation	36000000
5. RoE	23040000
6. Fuel Cost	129394778
7. Interest on WC	2897503
8. Total	239921526
9. Average	19993461
10. Generation	6377280
11. Average cost per unit	3.14

Project Cost	Rs. 4.00 Crs
PLF	80%
Generation units	7008000
Aux.consumption 9%	630720
Net Generation	6377280

Annexure - X

Tariff - Bagase Based Co-generaion Plants

Year	Interest 9% for 10 years & one year moratorium	O&M Exp (4.5% with 5% escl	Insurance 0.75% for five years and reduction of 0.5% every year thereafter	Depreciation 7.84%	ROE 16%	Fuel Consumption 1.6kg /kWh	Fuel Cost (Rs.575/Mt with 5% escl.	Interest on Working Capital 11.0 %		
								O & M (Two Months)	Fuel (Two Months)	Total
1	2205000	1575000	262500	2744000	1680000	7708800	4432560	28875	81264	110139
2	2205000	1653750	262500	2744000	1680000	7708800	4654188	30319	85327	115646
3	1984500	1736438	262500	2744000	1680000	7708800	4886897	31835	89593	121428
4	1764000	1823259	262500	2744000	1680000	7708800	5131242	33426	94073	127499
5	1543500	1914422	262500	2744000	1680000	7708800	5387804	35098	98776	133874
6	1323000	2010143	261188	2744000	1680000	7708800	5657195	36853	103715	140568
7	1102500	2110651	259882	2744000	1680000	7708800	5940054	38695	108901	147596
8	882000	2216183	258582	2744000	1680000	7708800	6237057	40630	114346	154976
9	661500	2326992	257289	2744000	1680000	7708800	6548910	42662	120063	162725
10	441000	2443342	256003	2744000	1680000	7708800	6876355	44795	126067	170861
11	220500	2565509	254723	2744000	1680000	7708800	7220173	47034	132370	179404
12		2693784	253449	1316000	1680000	7708800	7581182	49386	138988	188374
Total	14332500	25069474	3113615	31500000	20160000		70553618	459607	1293483	1753090

1. Interest	14332500
2.O & M Expenses	25069474
3.Insurance	3113615
4. Depreciation	31500000
5. RoE	20160000
6. Fuel Cost	70553618
7. Interest on WC	1753090
8. Total	166482298
9. Average	13873525
10. Generation	4384380
11. Average cost per unit	3.16

Project Cost	Rs. 3.50 Crs
PLF	55%
Generation units	4818000
Aux.consumption 9%	433620
Net Generation	4384380