



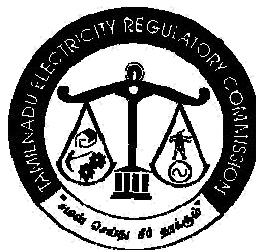
# TAMIL NADU ELECTRICITY REGULATORY COMMISSION

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## Comprehensive Tariff Order on SOLAR POWER

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Order No.2 of 2017 dated 28-03-2017



**BEFORE THE TAMIL NADU ELECTRICITY REGULATORY COMMISSION**

**PRESENT:**                      **Thiru S. Akshaya Kumar**    -    **Chairman**  
   **Thiru G. Rajagopal**            -    **Member**  
   **Dr.T.Prabhakara Rao**        -    **Member**

**Order No. 2 /2017, dated 28-03-2017**

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**In the matter of : Comprehensive Tariff Order on Solar Power**

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In exercise of the powers conferred by Sections 181, 61 (h), 62 and 86 (1) (e) of the Electricity Act 2003, (Act 36 of 2003), read with the National Electricity Policy, the Tariff Policy and Commission's Power Procurement from New and Renewable Sources of Energy Regulations, 2008, the Commission, after issuing a consultative paper for public view on "Comprehensive Tariff Order on Solar Power" inviting comments from stakeholders and after examining the views of all stakeholders, the views expressed by the Members of the State Advisory Committee (SAC) on the Consultative Paper in the meeting held on 20/3/2017, and on consideration of the views of the stakeholders and the SAC Members on the Consultative Paper, passes this suo motu Comprehensive Tariff Order on Solar Power.

This order shall take effect on and from the 1<sup>st</sup> of April, 2017.

Sd./-  
(T.Prabhakara Rao)  
Member

Sd./-  
(G.Rajagopal)  
Member

Sd./-  
(S.Akshaya Kumar)  
Chairman

(By Order of the Tamil Nadu Electricity Regulatory Commission)

Sd./-  
(S.Chinnarajalu)  
Secretary

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# **TAMIL NADU ELECTRICITY REGULATORY COMMISSION**

## **“Comprehensive Tariff Order on Solar Power”**

### **1. Introduction**

#### **1.1 The importance of Solar Energy**

1.1.1 Solar energy is a clean source of energy found in abundance. It is ecologically acceptable and helps combat the greenhouse effect caused by the use of fossil fuels. The country has a massive potential of solar energy resource. Tamil Nadu has reasonably high solar insolation of 5.5 to 6 kW/m<sup>2</sup> with around 300 clear sunny days in a year. With substantial solar insolation in the state, and an emerging market for solar energy at competitive rates, it is considered essential to utilize this major source of renewable energy.

#### **1.2 Commission’s initiative in promoting renewable energy**

1.2.1 To promote generation from renewable energy sources, the Commission has so far issued fifteen Tariff orders in respect of various renewable sources of energy in accordance with section 86(1)(e) of the Electricity Act, 2003. The Government of India through the Ministry of New and Renewable Energy launched the Jawaharlal Nehru National Solar Mission (JNNSM) in 2009 to promote the grid connected and off grid solar power generation. In pursuance of the above, the Commission, in order No. 1 and 2 dated 27/5/2010 & 8/7/2010 respectively, determined the tariff for Solar Photo Voltaic (PV) and Solar Thermal power under the Jawaharlal Nehru National Solar Mission .

### **1.3 Need for the Order on Solar Power**

1.3.1 The Government of Tamil Nadu launched the Tamil Nadu Solar Energy Policy 2012 to promote solar energy. The Electricity Act, 2003, mandates the State Electricity Regulatory Commissions to promote generation of electricity from renewable sources of energy. Government of India, in 2015, enhanced the target of solar capacity from 20,000 MW to 100,000 MW. In view of the above, Ministry of New and Renewable Energy fixed a Solar Renewable Purchase Obligation of 8% to be achieved by 2019 and required the Distribution companies to absorb additional solar power.

1.3.2 Commission had earlier issued two tariff orders on Solar power viz. Order No.7 of 2014 dt.12.9.2014 and Order No.2 of 2016 dt.28.3.2016, determining the preferential tariff for solar power in the State and to deal with other related issues on the matter, in accordance with the provisions of the Electricity Act, 2003, the Electricity policies issued by the Government of India and the Commission's Power Procurement from New and Renewable Sources of Energy Regulations, 2008. The control period of the Order No.2 of 2016 dt.28.3.2016 is until 31.3.2017.

1.3.3 In the Order No.2 of 2016, Commission permitted the distribution licensee to procure solar power through competitive bidding following Government of India guidelines if better rates than that determined by the Commission could be realized. Commission also accorded approval to the distribution licensee to proceed with reverse bidding for a capacity of 500 MW on two occasions, the first with a ceiling price of Rs.5.10 which was the solar PV tariff fixed in the

order no.2 of 2016, and the second bidding process at a ceiling price of Rs.4.50 which was the bid price obtained in the first bidding. The distribution licensee obtained a capacity of about 240 MW through the reverse bidding process.

1.3.4 The Government of India has given a huge thrust to promote renewable energy especially solar power. In line with the mandate of the Act for promotion of renewable energy and the various policies to promote clean energy, Commission decides to have a feed in tariff in place for the next control period that would serve as a benchmark price. In case the utility is not able to generate enough capacity through bidding process, as a fall back it can contract the necessary balance capacity at this feed in tariff. This would also serve as the applicable tariff for developers of projects who have signed energy purchase agreements under earlier tariff orders which could not be commissioned within the last control period.

1.3.5 Therefore, the Commission issues this “Comprehensive tariff order on solar power” for the next control period for purchase of solar power by distribution licensee from the solar power generators and to deal with other related issues.

1.3.6 This “Comprehensive Tariff Order on Solar Power” for purchase of solar power by distribution licensee from the solar power generators and to deal with other related issues, is based on the provisions of the Electricity Act,2003, policies of the Government and provisions of Commission’s regulation on “Power Procurement from New and Renewable Sources of Energy



Regulations, 2008” notified on 8.02.2008 and its subsequent amendments.

## **2. Technology**

2.1.1 Photovoltaics (PV) is the direct method of converting sunlight into electricity through a device known as the “Solar Cell”. Many different solar cell technologies such as mono-crystalline and poly-crystalline silicon, thin films such as amorphous silicon, micromorph, cadmium telluride, copper indium gallium selenide and concentrator-based high-efficiency III-V, etc. are available in the market today. Further, substantial R&D efforts are also underway globally for enhancing efficiencies, developing novel cell technologies that entail in reduction of costs of these solar cells.

2.1.2 Solar thermal technologies, also known as concentrated solar thermal (CST) technologies, typically concentrate on the direct component of sunlight to attain high temperatures and consequently generate electricity. The concentration is achieved typically through various reflection methodologies, which define these technologies. Parabolic trough, linear Fresnel, central receiver and parabolic dish are the primary solar thermal technologies. In addition to different types of construction of reflectors, these technologies also differ based on reliability, maturity, and economics.

## **2.2. Standards**

2.2.1 Each of these technologies have different cost implications based on their efficiency, reliability, mounting, tracking, land, water and other requirements. The

final selection of the technology shall be left to the Solar Power Developers. The minimum technical requirements would be as per the regulations/specifications issued by the Central Electricity Authority and Ministry of New and Renewable Energy and the developers shall adhere to them. Building of a solar power plant within the committed schedule and achieving optimal performance over its life period depends on choice of various factors by the developer.

### **3. Legal provisions**

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

3.1.1 Relevant provisions of Electricity Act, 2003 are reproduced below:

*“Section 3(1): The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilisation of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy.*

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

- .....
- (h) the promotion of cogeneration and generation of electricity from renewable sources of energy;*
  - (i) the National Electricity Policy and tariff policy*

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

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

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

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

*Section 86(1)(e): The State Commission shall promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;”*

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

3.2.1 Relevant provisions of National Electricity Policy are reproduced below:

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

*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.”*

### **3.3. Related Provisions of Tariff Policy**

3.3.1 Relevant provisions of Tariff Policy, 2016 are reproduced below:

*“Para 6.4 “(1) Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage of the total consumption of electricity in the area of a distribution licensee for purchase of energy from renewable energy sources, taking into account availability of such resources and its impact on retail tariffs. Cost of purchase of renewable energy shall be taken into account while determining tariff by SERCs. Long term growth trajectory of Renewable Purchase Obligations (RPOs) will be prescribed by the Ministry of Power in consultation with MNRE.*

.....

*(i) Within the percentage so made applicable, to start with, the SERCs shall also reserve a minimum percentage for purchase of solar energy from the date of notification of this policy which shall be such that it reaches 8% of total consumption of energy, excluding Hydro power, by March 2022 or as notified by the Central Government from time to time.*

.....

*(iii) It is desirable that purchase of energy from renewable sources of energy takes place more or less in the same proportion in different States. To achieve this objective in the current scenario of large availability of such resources only in certain parts of the country, an appropriate mechanism such as Renewable Energy Certificate (REC) would need to be promoted. Through such a mechanism, the renewable energy based generation companies can sell the electricity to local distribution licensee at the rates for conventional power and can recover the balance cost by selling certificates to other distribution companies and obligated entities enabling the latter to meet their renewable power purchase obligations. The REC mechanism should also have a solar specific REC.*

*(iv) Appropriate Commission may also provide for a suitable regulatory framework for encouraging such other emerging renewable energy technologies by prescribing separate technology based REC multiplier(i.e granting higher or lower number of RECs to such emerging technologies for the same level of generation).Similarly, considering the change in prices of renewable energy technologies with passage of time, the Appropriate Commission may prescribe vintage based REC multiplier(i.e granting higher or lower number of RECs for the same level of generation based on year of commissioning of plant).*

*(2) States shall endeavor to procure power from renewable energy sources through competitive bidding to keep the tariff low, except from the waste to energy plants. Procurement of power by Distribution Licensee from renewable energy sources from projects above the notified capacity, shall be done through competitive bidding process, from the date to be notified by the Central Government.*

*However, till such notification, any such procurement of power from renewable energy sources projects, may be done under Section 62 of the Electricity Act, 2003.”*

#### **4. Applicability of this order**

4.1 This Order shall come into force from 01.04.2017. The tariff fixed in this order shall be applicable to all solar power plants commissioned during the control period of the Order. The tariff is applicable for purchase of solar power by Distribution Licensee from Solar Power Generators(SPGs). The open access charges and other terms and conditions specified shall be applicable to all the SPGs, irrespective of their date of commissioning.

## 5. Tariff Determination Process

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

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

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

5.2 In line with the above regulation, the Commission prepared a consultative paper on “Comprehensive tariff order on Solar Power”, and hosted the same on 15/2/2017 in the Commission’s website inviting comments and suggestions from stakeholders. The consultative paper was also presented in the State Advisory Committee (SAC) meeting held on 20/03/2017 and discussed. The abstract of the comments received from the stakeholders is annexed with this order as Annexure II. The views of the Members of the SAC presented in the meeting dt.20/03/2017 is enclosed as Annexure III. Taking into account the important comments/suggestions received from the stakeholders and the SAC Members, parameters adopted by other State Electricity Regulatory Commissions, Central Electricity Regulatory Commission(CERC) and deliberations on all issues, the Commission issues this “Comprehensive Tariff Order on Solar Power” .

## **6. Tariff / Pricing Methodology**

6.1 Tariff / Pricing Methodology specified in Regulation 4 of the Power Procurement from New and Renewable Sources of Energy Regulations, 2008 is reproduced below:

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

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

*(3) The Commission shall, by a general or specific order, determine the tariff for the purchase of power from each kind of new and renewable sources based generators by the distribution licensee. In case of small hydro projects with a capacity of more than 5 MW but not exceeding 25 MW capacities, Commission decide the tariff on case to case basis.*

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

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

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

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

### **6.2. Project specific or Generalized Tariff**

6.2.1 A generalized tariff mechanism would provide incentive to the investors for use of most efficient equipment to maximize returns and for selecting the

suitable site while a project-specific tariff would provide each investor, irrespective of the machine type, the stipulated return on equity which, in effect, would shield the investor from the uncertainties involved. This order mainly provides for power purchase by distribution licensees to meet their Renewable Purchase Obligation as specified in the Commission's Regulations. The solar power plants commissioned in the state have mostly adopted similar technology with minor modifications. Hence, the Commission decides to issue a generalized tariff order for Solar Photovoltaic and Solar Thermal projects.

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

6.3.1. Two part tariff is generally adopted when the variable component is significant. In the case of solar energy generation, no variable cost like fuel cost is involved. Operation, maintenance and insurance cost could be taken care of by adopting suitable parameters. Therefore, the Commission has decided to continue with the single-part tariff for solar energy generation.

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

6.4.1 Regulation 4(6) of "Power Procurement from New and Renewable Sources of Energy Regulations, 2008" empowers the Commission to adopt "appropriate tariff methodology" to determine the tariff for solar power. Cost-plus tariff determination is a more practical method. It can be easily designed to provide adequate returns to the investor and a surety of returns will lead to larger investment in solar power plants. Commission in the last two tariff orders issued for solar power adopted cost plus single part levelled tariff taking into account

the Accelerated Depreciation (AD) benefit as done by CERC and many other SERCs. The Commission decides to adopt the same in this tariff order.

## **7. Tariff Components**

7.1 The tariff determined in a cost plus scenario, would depend significantly on the following operating and financial parameters:

1. Capital Cost
2. Capacity Utilisation Factor
3. Operation and Maintenance expenses
4. Insurance cost
5. Debt – Equity ratio
6. Term of Loan and Interest
7. Discount factor
8. Life of plant and machinery
9. Interest on Working Capital
10. Return on Equity
11. Depreciation
12. Auxiliary consumption

### **7.2 Capital Cost**

7.2.1 The capital cost is one of the most important parameters for Solar Photovoltaic(PV)/ Solar Thermal power projects for tariff determination. The main components of a photovoltaic power plant are the photo voltaic modules, inverters, module mounting structures, cables, control panels, switchyard etc.



Apart from the above, cost of capital cost includes cost of land, civil works, evacuation infrastructure and replacement of capital equipment if any during the life time.

7.2.2 Suggestions from stakeholders show stark variations in capital cost. Commission had accounted for a 14% decrease in the price of modules, decrease in price of inverters and other factors like advancements in technology, higher capacity utilization factor as well as the impact of taxes/duties on solar power plants etc. while proposing the capital cost at Rs.4.70 crores/MW in the consultative paper floated. The generic tariff fixed by many of the State Electricity Regulatory Commissions (SERCs) are for the financial year 2016-17. CERC in the draft Terms and Conditions for determination of tariff for Renewable Energy Sources issued on 16<sup>th</sup> February 2017 has not specified capital cost for Solar PV and Solar Thermal power projects.

7.2.3 The Commission observes that biddings across the country has brought a significant reduction in solar power price. The bidding in this state has attracted a price of Rs.4.40 per unit. The prices of modules with high efficiency have shown significant reduction. Similarly reports suggest that with advancement in technologies there is a decrease in price of other equipments associated with the solar photo voltaic plant. Therefore, the Commission decides to retain the capital cost of Rs.4.70 crores per MW in respect of Solar Photovoltaic power projects as proposed in the consultative paper. The Commission decides to adopt a Capital Cost of Rs.11.6 crores per MW for Solar Thermal power projects. The Capital cost is inclusive of all capital works i.e plant and machinery, auxiliaries,

costs towards changing inverter during the life-time, land, civil work, erection and commissioning, financing and interest during construction, and evacuation infrastructure. The capital cost fixed for solar PV is inclusive of cost of module degradation. It is upto the developer to identify the appropriate land based on solar insolation and cost. Achieving optimal performance depends on selection of technology and factoring in various parameters that influence the performance of the power plant.

### **7.3 Capacity Utilisation Factor(CUF)**

7.3.1 The CUF considered in the earlier tariff orders on Solar power issued by the Commission was 19% for Solar PV power plant and 23% for Solar Thermal power plant. These CUFs are considered taking into account the efficiency factors of equipments, deration etc. and fast developing technology. The Commission has adopted the capital cost taking into account the cost of replacement of modules in respect of degradation during its lifetime. Most of the SERCs have adopted a CUF of 19% for Solar PV and 23% for Solar thermal power plants. Commission decides to adopt a CUF of 19% for Solar PV projects and a CUF of 23% for Solar Thermal power projects.

### **7.4 Operation and Maintenance(O&M) expenses**

7.4.1 In the consultative paper, the Commission proposed O&M expenses at 1.4% of capital cost with an escalation of 5.72% from the second year. Stakeholders have requested not to link the O&M cost with capital cost and to provide for escalation of O&M expenses at the rate of 7%.

7.4.2 CERC by an amendment issued to the Terms and Conditions for determination of tariff from Renewable Energy Sources Regulations 2012 had fixed the operation and maintenance expenses at Rs.7 lakhs per MW for the year 2016-17 after having fixed it at Rs.11 lakhs per MW in the year 2012. The O&M cost of CERC is inclusive of cost of insurance.

7.4.3 The Commission in its last two orders on Solar Power, adopted O&M expense of 1.4% of capital cost of solar projects with an escalation of 5.72% from the second year. Commission's Tariff regulations stipulate a rate of escalation of 5.72% to arrive at permissible operation and maintenance expenses for the relevant years of tariff period. The Commission decides to adopt O&M expense of 1.4% of capital cost of solar projects with an escalation of 5.72% from the second year.

## **7.5 Insurance cost**

7.5.1 In the last two tariff orders for Solar power issued by the Commission, 0.35% of net asset value as insurance cost was adopted by the Commission. The Commission decides to adopt the same in this order.

## **7.6. Debt-Equity ratio**

7.6.1 The Tariff Policy lays down a debt equity ratio of 70: 30 for power projects. The Commission decides to adopt this ratio as specified in its Tariff Regulations 2005 and the earlier Orders on new and renewable power.

## **7.7 Term of Loan and Interest**

7.7.1 The distribution licensee, Tamil Nadu Generation and Distribution Corporation Ltd.(TANGEDCO) has suggested an interest rate of 10.75% per annum and a loan tenure of ten years with one year moratorium. In reply to the letter addressed to the Indian Renewable Energy Development Agency Limited (IREDA) by the Commission, IREDA has informed that interest rates ranges from 10.20% to 11.40% per annum for Solar PV with additional rebates for external rating, if applicable, and timely payment rebates too. CERC and other State Electricity Regulatory Commissions adopted interest rates ranging from 12.54% to 12.76% for the FY 2016-17. Interest rates have softened from the beginning of this year and is expected to reduce further. The CERC in its draft regulations on determination of tariff for renewable energy,2017 has proposed a normative interest rate of two hundred basis points above the average State Bank of India MCLR (one year tenor) prevalent during the last available six months .

7.7.2 The prevalent lending rate being the marginal cost of funds based lending rate at which the bank prices all its loans, Commission decides to adopt the latest MCLR rate of 1 year of 8% notified by the State Bank of India in March 2017 plus 300 points which is 11 % as proposed in the consultative paper.

7.7.3 The Commission decides to adopt a term of 10 years with 1 year

moratorium as adopted by the Commission in its previous orders on Wind, Bagasse, Bio-mass power and Solar.

## **7.8 Discount factor**

7.8.1 The Commission adopts a discount factor of 9.24% equal to the post tax weighted average cost of the capital on the basis of normative debt: equity ratio (70:30) for the purpose of levelised tariff computation as proposed in the consultative paper.

## **7.9 Life of Plant and machinery**

7.9.1 The Commission adopts a life period of 25 years for Solar power projects as adopted by CERC and other SERCs and all its earlier orders on Solar power.

## **7.10 Interest and components of Working Capital**

7.10.1 In the Order on Renewables by the CERC, the components of working capital have been taken as O&M expenses for one month, receivables for two months and maintenance of spares at 15% of the O&M expenses. The Interest on Working Capital was fixed at interest rate equivalent to the average State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points. In the draft regulations on determination of tariffs for renewable energy of CERC, interest on working capital has been proposed at 300 basis points above the average State Bank of India MCLR(one year tenor) prevalent during the last available six months. Few stakeholders have requested to consider inclusion of 15% of O&M expenses towards spares.

7.10.2 The Commission decides to adopt an interest rate of 11.5% as proposed in the consultative paper. As to the components of working capital, the Commission decides to adopt one month operation and maintenance cost and two months receivables for the solar power projects as followed in the previous orders of the Commission on solar power.

### **7.11 Return on Equity**

7.11.1 The CERC in its draft regulations on determination of tariffs for renewable energy, 2017 has proposed 14% normative Return on Equity (RoE) to be grossed up by MAT as on 1<sup>st</sup> April of previous year for the entire useful life period. The Tariff Regulations of the Commission stipulate 14% post tax RoE for conventional fuel based generating stations. The Commission in its orders issued in 2012 related to determination of tariff for NCES power, adopted a RoE of 19.85% without linking it to MAT and IT. In the previous two tariff orders issued for solar power and other orders on renewable energy, Commission considered RoE of 20% (pre tax). It is decided to adopt a RoE of 20% (pre-tax) per annum for SPG without linking it to MAT and IT as done in the previous orders of the Commission on renewable energy.

### **7.12 Depreciation**

7.12.1 CERC adopted the normative depreciation rate of 5.83 % per annum for initial period of 12 years i.e. equivalent to the loan tenure and the remaining depreciation to be spread over the remaining useful life of the project from the

13<sup>th</sup> year in its order dt.29.4.2016 on determination of generic tariff for renewable energy. In the draft regulations on determination of tariff for renewable energy,2017, CERC has proposed 5.28% per annum for first 13 years and the balance depreciation to be spread over the remaining useful life of the project considering salvage value as 10% of project cost. The Commission in its Orders on Wind, Bio-mass and Bagasse based energy issued during the year 2012 has depreciated the value of plant and machinery to 90% of the initial value for the life period using the straight line method which translates to 3.6% per annum. The same method was adopted in the tariff orders issued for solar power. Depreciation was calculated on 95% of the capital investment in the last two orders on solar power. The Commission decides to adopt the same method for the life period of 25 years

### **7.13. Auxiliary consumption**

7.13.1 Stakeholders have requested to consider auxiliary consumption of 0.5% to 1% for solar PV power plants. Many of the State Electricity Regulatory Commissions have considered auxiliary consumption as NIL in the case of Solar PV power plants. As done in the previous two tariff orders of Solar power, Commission decides not to take into account the auxiliary consumption for determination of tariff for Solar PV plant. However, Commission fixes an auxiliary consumption of 10% for the Solar Thermal projects considering the auxiliaries involved in such projects.

## 7.14. Tariff Determinants

7.14.1 The financial and operational parameters in respect of Solar Photovoltaic and Solar Thermal power projects adopted in this order are tabulated below:

Tariff Components	Solar PV	Solar Thermal
Capital Cost	Rs.4.70 crores per MW	Rs.11.6 crores per MW
CUF	19%	23%
Operation and Maintenance expenses	1.4% of Capital cost with escalation at 5.72% p.a from second year	1.4% of Capital cost with escalation at 5.72% p.a from second year
Insurance cost	0.35% of net asset value	0.35% of net asset value
Debt-equity ratio	70:30	70:30
Term of loan	10 years + 1 year Moratorium	10 years + 1 year Moratorium
Interest on Loan	11%	11%
Working capital components	One month O&M cost and Two months Receivables	One month O&M cost and Two months Receivables
Interest on Working capital	11.5%	11.5%
Return on Equity	20% pre tax	20% pre tax
Depreciation	3.6% on 95% of Capital cost	3.6% on 95% of Capital cost
Auxiliary consumption	Nil	10%
Discount rate	9.24%	9.24%
Levelling Tariff without AD	Rs.4.50 per unit	Rs.10.19 per unit
Levelling Tariff with AD	Rs.4.41 per unit	Rs. 9.98 per unit

## 8. Solar Power Tariff

8.1. Solar power tariff is computed with reference to the determinants listed above. The tariff works out to Rs. 4.50 per unit for Solar PV projects and



Rs.10.19 per unit for Solar Thermal projects without Accelerated Depreciation(AD) benefit. The AD benefit component of the tariff is Rs.0.09 per unit for Solar PV and Rs.0.21 per unit for Solar Thermal. The tariff for the developers/generators availing AD benefit will be the tariff arrived at after deduction of AD benefit from the tariff as determined above. The respective working sheets are enclosed in Annexure IA and IB.

**9. Other issues related to power purchase by distribution licensee from SPGs.**

1. Quantum of power purchase by the Distribution licensee
2. Plant capacity limitations
3. CDM benefits
4. Billing and Payments
5. Energy Purchase Agreement
6. Tariff Review Period / Control Period

**9.1 Quantum of power purchase by the distribution licensee**

9.1.1 The distribution licensee can purchase solar power at the rate determined by the Commission from SPG to meet the RPO requirement on “first come first served basis”. It is open to the Distribution licensee to procure the same through competitive bidding route following the guidelines of Government of India if it can realize a more competitive rate than the one determined by Commission’s order. For any procurement in excess of RPO, specific approval shall be obtained from the Commission.

## **9.2 Plant Capacity limitations**

9.2.1 The Commission in the last tariff order for solar power had limited the purchase by the distribution licensee from solar power plants of 1MW capacity and above. The Commission decides to adopt the same in this order also.

## **9.3 CDM Benefits**

9.3.1 In the earlier orders issued on renewable energy, the Commission adopted the following formula for sharing of CDM benefits as suggested by the Forum of Regulators (FOR).

*“The CDM benefits should be shared on gross basis starting from 100% to developers in the first year and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developer and the consumer in the sixth year. Thereafter, the sharing of CDM benefits will remain equal till such time the benefits accrue.”*

9.3.2 The Commission decides to adopt the same formula in this order also. The distribution licensee shall account for the CDM receipts in the next Aggregate Revenue Requirement filing.

## **9.4 Billing and payment**

9.4.1 When a solar generator sells power to the distribution licensee, the generator shall raise the bill every month for the net energy sold after deducting the charges for power drawn from distribution licensee, reactive power charges etc. The distribution licensee shall make payment to the generator within 60 days of receipt of the bill. Any delayed payment beyond 60 days is liable for interest at the rate of 1% per month. One of the stakeholders has suggested to incorporate appropriate payment security mechanism in the EPA to ensure timely payment

for the power procured and to consider interest rate of 1.5%. Commission in its orders on renewable energy issued in 2009, 2012 and 2016 has not considered payment security mechanism. TANGEDCO has suggested to waive the interest charges for delayed payment considering the utility's financial commitment. However, the Commission adopts 1% interest per month for any delayed payment by the distribution licensee beyond 60 days.

## **9.5 Energy Purchase Agreement**

9.5.1 The format for Energy Purchase Agreement (EPA) shall be evolved as specified in the Commission's regulation on Power Procurement from New and Renewable Sources of Energy Regulations, 2008 and as amended from time to time. TANGEDCO in their comments have stated that they may execute EPA with solar power generators after finalizing power evacuation. The agreement shall be valid for 25 years. The distribution licensee shall execute the Energy Purchase Agreement or convey its decision in line with this order within a month of receipt of the proposal from the generator for selling power. In case of refusal to purchase power, valid reason in line with this order shall be communicated to the SPG by the distribution licensee. The agreement fees are governed by the Commission's Fees and fines regulation.

## **9.6 Control period / Tariff Period**

9.6.1 Regulation 6 of the Power Procurement from New and Renewable Sources of Energy Regulations, 2008 of the Commission specifies,

*“The tariff as determined by the Commission shall remain in force for such period as specified by the Commission in such tariff orders and the control period may ordinarily be two years.”*

9.6.2 The Commission decides to retain the control period as one year from the date of coming into force of this order, and the tariff period shall be 25 years.

## **10. Issues related to open access**

1. Open access charges and Line losses
2. Cross subsidy surcharge
3. Reactive power charges
4. Grid availability charges
5. Energy Accounting and Billing Procedure
6. Energy wheeling agreement and fees
7. Security Deposit
8. Power factor disincentive
9. Metering
10. Connectivity and evacuation of power
11. Harmonics
12. Parallel Operation charges

### **10.1 Open access charges and line losses**

10.1.1 Regarding Open access charges and line losses, one stakeholder, citing the Tariff Policy, 2016 which says that no inter State transmission charges and losses may be levied till such period as may be notified by the Central

Government on transmission of the electricity generated from solar and wind sources of energy through the inter-state transmission system for sale has requested to waive intra state transmission, wheeling charges and losses for solar power. TANGEDCO has sought to levy 50% in each of the transmission, wheeling and scheduling and system operation charges. The cost of Transmission, Wheeling and Scheduling & System Operation charges are generally regulated by the Commission's Tariff regulations, Open access regulations and Commission's order on open access charges issued from time to time. However, as a promotional measure, under section 86(1) (e) of the Act, the Commission decides to adopt 30% in each of the transmission, wheeling and scheduling and system operation charges as applicable to the conventional power to the Solar power. Apart from these charges, the SPGs shall have to bear the actual line losses in kind as specified in the respective orders of the Commission and as amended from time to time. In respect of the plants availing Renewable Energy Certificates (REC), 100% of the respective charges as specified in the relevant orders shall apply.

## **10.2. Cross subsidy surcharge**

10.2.1 The Commission in its earlier tariff orders related to different renewable power and in the orders for solar power, has ordered to levy 50% of the cross subsidy surcharge for third party open access consumers. Commission decides to adopt the same for Solar power generators.

### **10.3. Reactive Power Charges**

10.3.1 Commission decides to adopt the reactive power charges as specified in its Order on Open Access charges issued from time to time.

### **10.4. Grid Availability Charges**

#### **10.4.1 Charges for the start-up power supplied by the distribution licensee**

10.4.1.1 The question of start up power does not arise for Solar PV generators. However, the Solar PV generator may require power for maintenance of power station especially during night hours. In case of Solar Thermal generators, the start-up may be frequent. Therefore, the drawal of such energy by the Solar Thermal Generator from the distribution licensee shall be adjusted against the generated energy for every billing period. This is applicable both for the Solar Thermal Generators selling power to the distribution licensee and for open access consumers.

#### **10.4.2. Stand by charges**

10.4.2.1 If the drawal by the captive user or third party buyer exceeds generation, the energy charges and demand charges shall be regulated as per the Commission's Open Access regulation and Commission's Order on ABT and other relevant orders.

## **10.5. Energy Accounting and Billing Procedure**

10.5.1 The energy accounting shall be regulated by the Commission's Regulations on open access, Order on open access and Order on Availability Based Tariff(ABT). Till such time the ABT is implemented in the State, if a solar power generator utilizes power for captive use or if he sells it to a third party, the distribution licensee shall raise the bill at the end of the billing period for the net energy supplied. The licensee shall record the slot wise generation and consumption during the billing period. Slot wise adjustment shall be for the billing period. Peak hour generation can be adjusted to normal hour or off peak hour consumption of the billing period and normal hour generation can be adjusted to off peak hour consumption of the billing period. Excess consumption will be charged at the tariff applicable to the consumer subject to the terms and conditions of supply. After the billing period, the balance energy may be sold at the rate of 75% of the respective solar tariff fixed by the Commission in the respective orders to the generators.

## **10.6. Energy Wheeling Agreement and fees**

10.6.1 The format for Energy Wheeling Agreement, application and agreement fees, procedure and terms & conditions shall be governed by Commission's following regulations in force and as amended from time to time:

1. Tamil Nadu Electricity Regulatory Commission's Grid Connectivity and Intra State Open Access Regulations, 2014
2. Power Procurement from New and Renewable Sources of Energy Regulations, 2008.

## **10.7 Security deposit**

10.7.1 As regards the security deposit to be paid by captive /third party user, the Commission decides to retain the present arrangements i.e. charges corresponding to two times the maximum net energy supplied by the distribution licensee in any month in the preceding financial year shall be taken as the basis for the payment of security deposit.

## **10.8. Power Factor disincentive**

10.8.1 Power factor disincentive may be regulated for the power factor recorded in the meter at the consumer /user end as specified in the relevant regulations/orders in force.

## **10.9. Metering**

10.9.1 The metering and communication shall be in accordance with the following regulations in force:

- (1) Central Electricity Authority (Installation and Operation of Meters) Regulations 2006 and as amended from time to time.
- (2) Tamil Nadu Electricity Distribution and Supply Codes
- (3) Tamil Nadu Electricity Grid Code
- (4) Tamil Nadu Electricity Regulatory Commission's Grid Connectivity and Intra State Open Access Regulations, 2014

Metering procedure shall be also governed by any specific orders of the Commission on metering and ABT as and when issued.



## **10.10. Connectivity and Evacuation of power**

10.10.1 The provisions contained in Central Electricity Authority(Technical Standards for Connectivity to the Grid) Regulations,2007 and Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations,2013, and its amendments shall be complied with. The connectivity and power evacuation system shall be provided as per the Act/ Codes/ Regulations/orders in force.

## **10.11. Harmonics**

10.11.1 The SPGs shall follow the CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations, 2013 in respect of harmonics. It is the responsibility of the generator to provide adequate filtering mechanism to limit the harmonics within the stipulated norms. It shall be done before connecting the generator to the grid and the harmonics shall be measured by the respective distribution licensee during the commissioning. If the SPGs inject the harmonics beyond the stipulated limit, they shall pay a compensation of 15% of applicable generation tariff rate to the distribution licensee in whose area the plant is located till such time it is reduced within the stipulated limit. The distribution licensee is responsible for measurement of harmonics with standard meters and issue notices for payment of compensation charges if the harmonics is beyond the stipulated limit. A minimum of 15 days notice period shall be given for payment of compensation charges.

## **10.12 Parallel operation charges**

10.12.1 TANGEDCO has requested to levy 100% of applicable parallel operation charges to generators under REC schemes who opt only for parallel operation as well as who wheel power under open access and to levy 30% of applicable parallel operation charges to non REC generators with captive loads who opt for paralleling with the grid under HT or LT connectivity. Commission in its open access regulations has fixed parallel operation charges to captive generating plants who avail parallel operation with the grid without availing open access. Commission retains the provisions made in the earlier tariff orders for solar power i.e SPGs who consume power for their captive loads but wish to avail REC may opt for paralleling their generators with the grid without wheeling power. Such generators shall pay 30% of applicable parallel operation charges to the distribution licensee as specified in relevant regulations.

## **11. Directions**

11.1 Quarterly reports on the quantum of energy wheeled from the solar generators for captive consumption and third party sale shall be furnished to the Commission by Tamil Nadu Transmission Corporation(TANTRANSCO)/State Load Despatch Centre(SLDC). Similar report on the solar energy purchased shall be furnished by the distribution licensee.

## 12. Acknowledgement

12.1 The Commission acknowledges with gratitude the contribution of the officers and staff of the Commission, the valuable guidance provided by the SAC members and the efforts taken by the stakeholders in offering their suggestions. The Commission is indebted to the valuable inputs offered by the Tamil Nadu Generation and Distribution Corporation Ltd.

Sd./-  
(T.Prabhakara Rao)  
Member

Sd./-  
(G.Rajagopal)  
Member

Sd./-  
(S.Akshaya Kumar)  
Chairman

(By order of Tamil Nadu Electricity Regulatory Commission)

Sd./-  
(S.Chinnarajalu)  
Secretary  
Tamil Nadu Electricity Regulatory Commission





## **Annexure II**

### **Abstract of comments received from various stakeholders on “Consultative Paper on Comprehensive Tariff Order for Solar Power”**

#### **1. Applicability of the order**

**Thiru S.Narayanasamy, Member/Generation(Rtd.)**

TANGEDCO has already called for offers for setting up of solar power projects in Tamil Nadu under competitive bidding process and the need for going in for the proposed order is not clear. Commission may clarify that this order may not interfere with the competitive bidding offers received by TANGEDCO.

**TANGEDCO**

Proposal of Commission accepted.

#### **2. Project specific tariff**

**Citizen consumer and civic Action Group**

Project specific tariff may be adopted for solar plants of 50 MW and above taking into concern environmental considerations.

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

**Neyveli Lignite Corporation Limited**

Tariff for solar power may be made as two part tariff so that in the event of backing down of generation as per the instructions of SLDC, the solar generators will at least receive the fixed component.

#### **4. Cost plus tariff determination**

**TANGEDCO**

Commission in the last two tariff orders has adopted cost plus single part levelised tariff taking into account accelerated depreciation. Commission may consider adopting the same.

## **5. Capital cost/MW in Crores**

### **Thiru S.Narayanasamy, Member/Generation(Rtd.)**

Solar module price has significantly come down in the past year. The crystalline module price came down to Rs.29.19 per watt in December 2016 in European and South Asian market registering a drop in price of 15% from that of January 2016. The Union budget of 2017-18 has made it duty free for solar tempered glass and the duty on raw materials used in solar materials have come down to 6% from 12.5%. It is reported that Rewa Ultra Mega Solar Power park was awarded at tariffs of Rs.2.970, Rs.2.974 and Rs.2.979 to three parties and the levelised tariffs works out to Rs.3.30, Rs.3.304 and Rs.3.309. Hence, the capital cost of Rs.4.70 crores per MW proposed may be reduced. Solar thermal power project is costlier and therefore the tariff for the same need not be provided.

### **M/s. Adani Green Energy Limited**

i) Module price - Para 8.2.8 of consultative paper says that prices of modules have shown significant reduction. The main components of a photovoltaic power plant are the photo voltaic modules, invertors, module mounting structures, cables, control panels, switchyard etc. Apart from the above, erection of power plant involves cost of land, civil works and evacuation infrastructure. Hon'ble Commission has considered only imported module cost whereas the domestic manufacturers cost has not been considered. In the recent bidding process domestic content was kept mandatory for 25% of total capacity on offer. Indian made modules are 17% higher than the cost of Chinese modules. DC size of the plant is always higher than the AC size. Due to higher size, developer needs to purchase higher module quantity. Commission may consider module requirement for 1 MW AC project at 1.1 -1.2 MWp and arrive at the module cost.

ii) Exchange rate - Central Commission considered exchange rate based on average of daily exchange rate for 6 month period. The currency future market data from NSE may be taken as the basis for determination of benchmark rate. The proposed order is applicable from 1.4.2017, and most of the procurement will commence from October 2017. It is suggested that exchange rate of Rs.68.55 against US dollar may be considered.

iii) Land cost - CERC while determining capital cost as Rs.530.02 Lakhs/MW considered land price of Rs.25 Lakhs/MW. This land cost is not practically possible in the State of Tamil Nadu and for promoting technologies like motorized

trackers, seasonal tilt, thin film etc. the land area should be 6 acres/MW. Therefore, land cost may be considered as Rs.36 lakhs/MW.

iv) Mounting structures and civil works – Development of solar projects across various geographic & climatic conditions entails wide variations in cost of civil works. Cost of mounting structures depends on soil conditions, prices of raw materials. Civil works depend on skilled labour, manpower cost, access and logistics for movement of materials, fuel price for construction equipment etc. Cost of module mounting structure may be considered as Rs.50 Lakhs/MW and total civil and general cost as Rs.50 Lakhs/MW.

v) Power conditioning unit - Invertors are available from reputed manufacturers at Rs.25 – 30 Lakhs/MW. Most of the invertors need major overhaul/replacement in the 10<sup>th</sup> to 12<sup>th</sup> year of operation. Inverter cost may be considered at Rs.50 Lakhs/MW.

vi) Preliminary/pre operative expenses and financing costs may be considered as 10% of the corresponding project cost.

vii) Evacuation infrastructure cost – Central Commission in its RE tariff regulations, 2012 has defined 'inter connection point' as the HV side of the project pooling sub station. It has not considered the cost of transmission infrastructure from interconnection point to nearest sub station. Evacuation cost beyond the project switchyard should be considered. Such distances vary from project to project depending on the voltage at which evacuation needs to be carried out. Commission may consider such cost while determining capital cost.

viii) Additional cost impact due to CEA technical connectivity standard – CEA has proposed second amendment to the CEA(Technical standards of Connectivity to the Grid) Regulations,2007 which insists on operation in specified frequency range, LVRT,HVRT protection, ramp up rates, to provide frequency response. All the technical requirements proposed by CEA has a huge cost impact. Besides, implementation of forecasting and scheduling system requires additional investments.

Considering all the above, Commission may consider a capital cost of Rs.550 Lakhs/MW for solar PV projects without trackers and Rs.600 Lakhs/MW for solar power projects with trackers without considering the tariff quoted by the two bidders in the bidding conducted by TANGEDCO.



## **TANGEDCO**

A capital cost of Rs.4.60 crores per MW for solar PV power plants may be considered.

### **Citizen consumer and civic Action Group(CAG)**

CERC attempts to use a capital cost indexation formula which takes into account the inflationary effects of various inputs to set up the unit. TNERC may adopt a standard mechanism to harmonise capital costs by taking into consideration CERCs capital indexation formula.

### **Indian Renewable Energy Development Agency Limited**

Average capital cost for Solar PV projects is Rs.5.87 crores/MWp.

## **6. Capacity Utilisation Factor**

### **M/s. Adani Green Energy Limited**

GHI level in Tamil Nadu is much better than even the state of Gujarat. This leads to a thought that CUF should be better in Tamil Nadu than Gujarat. But the same is not true. Radiation received is the major factor that governs generation. Diffused radiation and direct normal radiation govern generation. Direct component of radiation received by Tamil Nadu is 12% lower than that received by Gujarat and 4% lower than that in Rajasthan. The solar project developers put 1.2 to 1.3 MWp DC modules to generate more energy. Capital cost incurred by such projects are quite higher. CERCs benchmark capital cost fixed is considering DC/AC ratio as 1. Commission may consider CUF at 18% and determine the solar PV generic tariff.

Module degradation - Additional capital cost for module degradation would compensate only for interest on loan, depreciation and return on equity. O&M expenses and interest on working capital are not dependent on capital cost. Commission may consider a module degradation factor of 0.70% per annum by reducing the PLF over the operating life of the plant.

## **TANGEDCO**

Considering the prevailing conditions in the state, a CUF of 19% for Solar PV and 23% for Solar thermal may be considered.

## **Neyveli Lignite Corporation Limited**

The degradation of solar cells that range from 0.66% to 3% is to be taken into account in the computation of tariff. CERC in its order for 2016-17 has included a module degradation cost of Rs.9.89 Lakhs /MW in the capital cost by considering a module degradation of about 0.6%. If the Commission does not provide for appropriate module degradation cost in the capital cost, it may be considered in the tariff computation by way of progressive reduction in capacity utilization factor.

### **7. Operation and Maintenance expenses**

#### **M/s. Adani Green Energy Limited**

Low O&M cost proposed by Central Commission is not a reality as most of this cost is human resource related. Hon'ble APTEL passed judgment in Appeal No.75 of 2012 dt.17.4.2013 filed by Solar Energy Society of India vs Gujarat ERC to re-determine O&M charges based on fixed parameters instead of a percent of capital cost. Commission may consider escalation of 7% and fix O&M charges at Rs.13.24 lakhs/MW for FY 2017-18. CERC in the statement of objects and reasons dt.20.1.2009 issued along with CERC (Terms and Conditions of Tariff) Regulations, 2009 stated that the escalation rate for the tariff period was arrived at 5.72% after considering inflation data for the period 2003-04 to October 2008. The CAGR for the period from 2006 to 2015 works out to 7%. Based on the above, an escalation rate of 7% may be considered.

#### **TANGEDCO**

Operation and maintenance cost at 0.75% of capital cost with an escalation of 5.72% from second year may be considered.

#### **Neyveli Lignite Corporation Limited**

Linking of O&M cost as a percentage of capital cost is not rational particularly in the context of falling solar prices. Labour cost is on the increase. Therefore, O&M expenses may not be linked with project cost.

### **8. Insurance cost**

#### **TANGEDCO**

Proposal of Commission accepted.

### **Citizen consumer and civic Action Group**

CERC is bundling the insurance costs with operation and maintenance costs. The rationale for separating the insurance cost may be stated.

#### **9. Debt – equity ratio**

##### **TANGEDCO**

Debt – equity ratio of 70:30 may be adopted.

#### **10. Term of Loan**

##### **TANGEDCO**

Term of loan of 10 years with one year moratorium may be adopted.

### **Citizen consumer and civic Action Group(CAG)**

A loan period of 13 years may be considered as proposed by CERC for the control period 2017-2020.

#### **11. Rate of interest**

##### **TANGEDCO**

Rate of interest of 10.75% may be adopted.

### **Indian Renewable Energy Development Agency Limited**

10.20% to 11.40% per annum with additional rebates for external rating, if applicable, and timely payment rebates of 15 bps.

#### **12. Discount factor**

##### **M/s. Adani Green Energy Limited**

Choice of discount factor is significant in levelisation of cash flows. Incidentally the Central Commission had a provision in its 2009 RE wherein the discount factor was taken as pre-tax weighted average cost of capital. The fact that WACC varies on year on year basis has been recognised by the Hon'ble commission. Uttarakhand ERC has also allowed different discount factors for each year. It is suggested to compute pre-tax WACC for each of the 25 years of the project life.

### **Citizen consumer and civic Action Group(CAG)**

An explanation of calculation of discount factor may be given.

### **13. Life of plant and machinery**

#### **TANGEDCO**

Proposal of Commission concurred with.

### **14. Interest on working capital**

#### **TANGEDCO**

Proposal of Commission accepted.

### **M/s. Adani Green Energy Limited**

Commission may include provision of maintenance of spares at 15% of the O&M expenses. TNERC's Tariff regulations allows maintenance spares at 1% of the capital cost for the first year escalated at 6% per annum for conventional generating stations.

### **Citizen consumer and civic Action Group(CAG)**

Interest on working capital as proposed by CERC in the draft RE tariff regulations may be adopted i.e normative interest rate of three hundred basis points above the average State Bank of India MCLR(one year tenor).

### **Neyveli Lignite Corporation Limited**

Commission may consider inclusion of 15% of O&M expenses towards spares in the working capital as considered by CERC.

### **15. Return on Equity**

### **M/s. Adani Green Energy Limited**

Commission may address whether post tax rate of return on equity is preferential in nature and whether RoE of 20% is derived through grossing up of income tax or MAT. Renewable energy projects need a higher return as the project comprises higher risk. Commission may specify RoE on pre-tax basis as done by CERC i.e 20% for first 10 years and 24% from 11<sup>th</sup> year onwards.

## **TANGEDCO**

Proposal of Commission accepted

### **16. Depreciation**

#### **M/s. Adani Green Energy Limited**

Commission failed to appreciate that the loan tenure of the debt component of the capital cost is 10 years and the loans are to be fully serviced by the solar generators during the said 10 years. Depreciation at 3.6% has been done based on the life period of 25 years and 90% value of depreciable assets. Since depreciable assets have been taken as 95% of the capital cost, cost recovery of only 85.5% has been permitted. Effective rate of depreciation on capital cost allowed is only 3.42 %. At this rate the loan would be serviced in 21 years. MPERC, MERC have allowed 7% for the first 10 years and 1.33% from 11<sup>th</sup> year for a loan tenure of 10 years. GERC has allowed 6% for first 10 years and 2% from 11<sup>th</sup> year for a loan tenure of 10 years. Commission may allow a depreciation rate of 7% for first 10 years and 1.33% for remaining period of useful life.

## **TANGEDCO**

Depreciation of 3.6% per annum may be adopted.

### **17. Auxiliary consumption**

#### **Thiru S.Narayanasamy, Member/Generation (Rtd.)**

Auxiliary consumption of 1% may be considered. Nowadays solar modules with morning, evening tracking systems are erected.

#### **M/s. Adani Green Energy Limited**

Solar power plant meets its auxiliary consumption during day time from its generation and at night time draws from the grid. A solar PV plant unlike solar thermal consumes minimal energy for running its auxiliaries viz. air conditioning in inverter and control room, cleaning, security lighting, office lights, fans. Commission may consider at least 0.5% of total energy generated as auxiliary consumption.

## **TANGEDCO**

Proposal of Commission accepted.

### **18. Solar power tariff**

**Thiru S.Narayanasamy, Member/Generation(Rtd.)**

Accelerated depreciation is only a deferred payment of tax. Reduction in tariff to developers claiming accelerated depreciation may be deleted.

## **TANGEDCO**

In the solar e-tender floated by TANGEDCO vide specification CE/NCES/OT.No.3/ 2016-17, the lowest rate of Rs.4.40 per unit has been obtained for the procurement of solar power for a combined capacity of 224 MW from 16 bidders.

### **19. Quantum of solar power purchase by the distribution licensee**

## **TANGEDCO**

The distribution licensee can purchase solar power at the rate determined by the commission from SPG for their RPO requirement on 'first come first served basis' in all aspects.

### **20. Plant capacity limitations**

## **TANGEDCO**

Proposal of Commission concurred with.

### **21. CDM benefits**

## **TANGEDCO**

Proposal of Commission accepted

### **Citizen consumer and civic Action Group(CAG)**

A Comptroller and Auditor General report has pointed out that CDM benefits are not being utilized by TANGEDCO. Commission may ensure that TANGEDCO utilises CDM benefits.

## **22. Billing and payment**

### **TANGEDCO**

Levy of interest at the rate of 1% for the delayed payment may be waived, considering the financial commitment of TANGEDCO and tariff payable to the generator.

### **Neyveli Lignite Corporation Limited**

Appropriate payment security mechanism may be incorporated in the Energy Purchase Agreement (EPA) to ensure timely payment for the power purchased. A payment priority clause enabling adjustment of receipts first towards late payment interest, thereafter towards arrears, statutory levies, taxes and duties and lastly against power dues may be included in the EPA as a payment security mechanism. Also an interest rate of 1.5% may be considered.

## **23. Energy Purchase Agreement**

### **TANGEDCO**

EPA may be executed with the SPG after finalizing power evacuation.

## **24. Control period/Tariff period**

### **M/s. Adani Green Energy Limited**

It is difficult to execute the solar project in less than 12 months if the project PPA is signed in the last quarter of the year of the control period. At least seven months are required for financial closure and other activities and after that the developer has to initiate the process of implementation of the project. CERC's tariff regulations on renewable energy, 2012 has a provision that if the PPA is signed before 31<sup>st</sup> March of the control period, the determined tariff for Solar PV projects will also be applicable for the next year. MNRE in the draft guidelines for Tariff based competitive bidding for Grid connected solar PV has stipulated commissioning schedule of 15 months from the date of execution of PPA. Provisions of CERC RE tariff regulations, 2012 which states that if PPA is signed before 31<sup>st</sup> March of the control period, the tariff determined will be applicable for the next year may be considered.

### **TANGEDCO**

Views of Commission accepted.

## **Neyveli Lignite Corporation Limited**

If the control period is restricted to one year, a situation emerges where a project tendered during the fag end of the year spills over to the next control period when the benchmark capital cost of the project and the tariff would have declined. The solar developer will not be assured of a tariff commensurate with the investment made. The draft CERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2017 dt.16.2.2017 specifies a control period of three years. Commission may extend the control period to three years. The tariff determined during a control period may be made applicable to the next year if PPA for the project is signed before the end of the control period.

### **25. Open access charges and line losses**

#### **TANGEDCO**

50% (in each) of Transmission, Wheeling, Scheduling and System Operating charges as applicable to the conventional power may be adopted for solar power. 100% of the respective charges may be adopted for the plants availing REC.

## **Neyveli Lignite Corporation Limited**

Clause 6.4.6 of Tariff Policy 2016 stipulates that in order to encourage renewable sources of energy, no inter state transmission charges and losses may be levied on transmission of electricity generated from solar and wind sources of energy. Proposed intra state transmission and wheeling charges and losses may be waived for solar power.

### **26. Cross subsidy surcharge**

#### **TANGEDCO**

50% of the cross subsidy surcharge for third party open access consumers may be adopted as applicable for other renewable energy sources.

## **Neyveli Lignite Corporation Limited**

Revised Tariff Policy stipulates that cross subsidy surcharge should not exceed 20% of the tariff applicable to the consumers seeking open access. The Electricity Amendment Bill 2014 tabled in the Lok Sabha proposes to exempt cross subsidy charges for power purchase from renewable power. Cross subsidy



charges may either be limited to 10% of the applicable tariff or waived completely.

**27. Reactive power charges**

**TANGEDCO**

Proposal of Commission accepted.

**28. Grid availability charges**

**TANGEDCO**

Proposal of Commission accepted.

**29. Energy accounting and billing procedure**

Considering the financial commitment of TANGEDCO, the balance energy after the billing period, may be considered to be sold at the rate of 50% of respective solar tariff fixed by the Commission in the respective orders.

**30. Energy wheeling agreement and fees**

**TANGEDCO**

Proposal of Commission accepted.

**31. Security deposit**

**TANGEDCO**

Proposal of Commission accepted.

**32. Power factor disincentive**

**Thiru S.Narayanasamy, Member/Generation(Rtd.)**

According to para 2.87 and para 2.134 of TNERC's Tariff order No.8 of 2014 dt.11.12.2014, Commission has ordered that generators are to be penalized for kVArh drawal. TANGEDCO is not charging this penalty from Central Generating stations. Tariff orders of Rajasthan and Gujarat Regulatory Commissions make no mention of charging solar power plants on low power factor. Commission may exempt solar power plants from paying penalty for kVArh drawal.

## **TANGEDCO**

Proposal of Commission accepted.

### **33. Metering**

## **TANGEDCO**

Proposal of Commission accepted.

### **34. Connectivity and evacuation of power**

## **TANGEDCO**

Proposal of Commission accepted.

### **35. Harmonics**

## **TANGEDCO**

Proposal of Commission accepted.

### **36. Parallel operation charges**

## **TANGEDCO**

100% of the respective charges as specified in the relevant orders shall be applicable to all the REC generators i.e. REC generators under open access for wheeling the power and REC generators for parallel operation without wheeling of power.

SPGs who consume power for their captive loads without REC benefit may also opt for paralleling their generators with the grid irrespective of connectivity i.e HT or LT, without wheeling of power. Such generators shall pay 30% of applicable parallel operation charges to the distribution licensee.

### **37. Other issues**

#### **Deemed generation**

#### **M/s. Adani Green Energy Limited**

Existing developers are facing issues of delayed payments and backing down. MNRE has issued a letter on 2.8.2016 to CERC with copy to the Principal Secretary of all states stating that solar power plants should not be given

instructions to back down. In view of various statutory provisions and regulations to promote renewable energy, generation loss due to unavailability of grid or issue of backing down instructions may be considered as deemed generation and payments made at the tariff rates of signed PPAs.

### **Renewable Purchase Obligation**

#### **Thiru P.Muthusamy**

Installed solar capacity in the State is 1500 MW. Along with 7500 MW of wind power, the penetration of infirm/variable power of Tamil Nadu will increase to 10000 MW. The SLDC should handle more than 60% of variable power at least for 5 months per annum. As per the total sales, TANGEDCO should buy 2500 MW of solar power to satisfy 5% RPO for the year 2017-18. The RPO may be reduced to 2.5%.

**Annexure III**  
**MINUTES OF THE 30<sup>th</sup> STATE ADVISORY COMMITTEE (SAC)**  
**MEETING OF TAMIL NADU ELECTRICITY REGULATORY**  
**COMMISSION HELD ON 20<sup>th</sup> March 2017 AT HOTEL SAVERA,**  
**CHENNAI**

**Members Present:**

1. Thiru. S. Akshaya Kumar, Chairman, TNERC
  2. Thiru. G. Rajagopal, Member, TNERC
  3. Dr. T. Prabhakara Rao, Member, TNERC
  4. Dr. M. Saikumar, CMD, TNEB Ltd. & TANGEDCO Ltd. and  
Chairman, TANTRANSCO Ltd.
  5. Thiru. K. Alagu, Member, SAC
  6. Dr. A.S. Kandasamy, Member, SAC
  7. Dr. K. Selvaraj, Member, SAC
  8. Thiru. C. Babu, Member, SAC
  9. Thiru. K. Kathirmathiyon, Member, SAC
  10. Thiru. G.S. Rajamani, Member, SAC
  11. Thiru. M.R. Krishnan, Member, SAC
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**Chairman, TNERC** welcomed the members of the State Advisory Committee(SAC). He introduced the new members of SAC. He stated that there are two agenda for discussion, one on the tariff for Municipal Solid Waste (MSW) based power plants and the other on the Comprehensive tariff order on Solar power. He gave brief details about both the agenda issues. There are multi various methods and technologies available to be adopted to convert Municipal Solid Waste to energy such as mass incineration, gasification, pyrolysis,

biomethanation, RDF etc. However, Commission has all along been following the method of having a generic tariff and better to leave the choice of the technology to the promoter and follow the same here also. On Tariff redetermination for Solar Thermal and Solar Photovoltaic (SPV), though Solar Thermal technology had not come up in a big way, but real fireworks are going on in the photovoltaic arena. With successive biddings on SPV based projects in various parts of the country finding new low rates, it was thought of whether at all there exists any need to fix a feed in tariff. In such situation, where the Utility is opting for bidding route the feed in tariff may serve as a benchmark. TANGEDCO has gone for bidding route and got rates lesser than the benchmark rate but they did not get sufficient quantum. In case they are not able to garner sufficient quantum through tender route, they might have to fall back on the feed in tariff. Also there may be cases where some promoters who have signed PPA in earlier regime of Tariff order could not achieve the COD within the control period. In such cases there is need for feed in tariff applicable beyond the control period.

(i) Deputy Director/Tariff made the presentation on the issues dealt in the consultative paper on tariff determination on Power procurement from MSW.

Chairman/TNERC requested the members to offer their views on the various issues on power procurement from MSW. The views expressed by the members of the SAC are as follows:

**Thiru. M.S. Rajamani**—Managing the MSW is a complex subject and the use of correct type of technology in India is necessary. He thanked the Commission for proposing a reasonable Tariff for Power procurement from MSW. He added that the MSW shall be segregated at the source. He suggested providing early bird incentive at some paise/unit to the power generators from MSW who starts commercial production within a specified period say 6 months or 1 year etc. While determining the tariff for MSW, the Commission shall consider the tariff determined by the neighbouring States so that investors are attracted.

**Thiru. M.R. Krishnan** – He raised a query whether land cost is included in the Capital Cost and land filling doesn't contaminate the nearby water body.

**Chairman, TNERC** – The capital cost proposed is inclusive of all requirements including land cost. The land is usually provided by the urban municipality which includes the place for receiving, segregating etc. at a very low cost say Re.1 p.a. as lease rent.

**Dr.M.Saikumar, CMD/TANGEDCO**- TNERC's job is fixing tariff and TANGEDCO has to buy the power at that price. There ends the matter. The Urban Local Municipality normally invites tender. The bidder quotes the lowest amount, keeping in mind the tariff fixed by the Commission. As far as TANGEDCO is concerned, it procures the power from MSW generators at the tariff determined by the Commission. The tariff should be reasonable since it has a bearing on the overall power procurement cost of TANGEDCO and ultimately the retail consumers will have to pay for it.

**Dr. A.S. Kandasamy**—The Fair Life Period of MSW power plants should be reduced so that the depreciation will be high. He also suggested that the income derived from sale of by-product such as fertilizer, avoidance of waste disposal cost etc. shall also be considered while generating the electricity from MSW. The tariff derived by the Commission is acceptable in the National interest.

**Thiru. K. Kathirmathiyon**—A reasonable tariff to MSW project is important at the same time cost implication to distribution licensee is also equally important. Therefore, the tariff determined should be a balanced one.

**Dr.M.Saikumar, CMD/TANGEDCO**— The method of providing Viability Gap Funding (VGF) may be resorted to by the Urban Local Body (ULB) to solve the problem associated with the cost of transportation etc. from the households to the dumping yard, segregation etc. so that the TANGEDCO is not penalized by factoring that cost into tariff as any way ULB has to pay for disposing of the MSW.

**Thiru. M.S. Rajamani** —As per the Electricity Act, 2003, the State Commission, inter alia, has the duty to promote cogeneration and generation of electricity from renewable sources of energy. As a promotional measure, TNERC may provide early bird incentive for power generation from MSWs.

**Thiru. M.R. Krishnan** – He wanted to know about the target for Renewable Purchase Obligation (RPO) for MSW like RPO for Solar.

**Dr.M.Saikumar, CMD/TANGEDCO**– Since MSW is in nascent stage, there is no target RPO for MSW. If there is a target RPO for MSW and no project comes in, then we will end up with buying Renewable Energy Certificates (REC), which will have a cost implication and as such will reflect in the ARR and ultimately the retail tariff consumers will end up with paying higher tariff.

**Thiru. K. Kathirmathiyon** – The local bodies should take care of for the disposal of waste.

**Thiru. G. Rajagopal, Member, TNERC**– It is seen from the presentation that Tariff fixed for MSW by CERC is Rs.7.04 per unit, Telangana Rs.5.90, MP Rs.6.39. Gujarat Rs.7.03, Chattisgarh Rs.7.22, Haryana Rs.7.05 whereas the tariff now proposed for TN is Rs.5.79/unit. He has raised a point whether in any other State the tariff for MSW power plants is lesser than the tariff proposed by this Commission in the consultative paper. He said that the Tariff for the MSW should be reasonably higher considering the alternative cost of its disposal and its hazardous effect on the health of the public who will end up paying higher health cost if the MSW is not properly disposed off.

**Thiru.K.Alagu** - The tariff is reasonable. If privatization is encouraged for collection of waste, there will be more employment opportunities. Local Bodies should encourage collection of waste.

**Dr. K. Selvaraj**– The viability of the project is to be seen rather than tariff or cost. Land, transportation, segregation of MSW at source level are important. The projects will be of small capacities. Therefore



initially, it is to be leveraged. Whether project will happen at this tariff, covering the related costs is to be seen. We should support the developers.

**Dr. A.S. Kandasamy**– The health aspect should be considered. Public will inhale carbon monoxide. The local bodies should encourage investors to set up power generation from MSW. Hence, the viability of the investors who undertake this project needs to be supported by way of reduction in transport cost, cost of segregation of MSW etc. Also, the procurement of power generation from MSW will not be a major source of energy for TANGEDCO and as such the fixing of higher power procurement cost for MSW will not affect much in the TANGEDCO's power purchase cost. The discussion will not be fruitful unless the investors are satisfied with the viability of the MSW project.

**(ii)** Deputy Director (Engineering), TNERC presented the discussion paper on the revision of tariff for power procurement from solar.

**Thiru M.S. Rajamani** – Suggestions given initially after the presentation for Municipal Solid Waste plants are in general applicable for both the consultative papers. He said that on TANGEDCO's views on the paper, he leaves it to the Commission's considered views. Further, he stated that since the State has considerable solar insolation setting up of mini solar plants could be considered. Such plants would electrify villages where there is no reach of electricity or where the end voltage is poor. Karnataka has mini plants in few places. Commission and TANGEDCO could make a study on installation of mini solar projects.

**Thiru A.S.Kandasamy** – Solar thermal and Solar photo voltaic work under the principle of sunshine. When power generated from solar photovoltaic plant is available at a cheaper price, Solar thermal plants need not be thought of. In U.S.A. there is only one demonstrative plant for Solar thermal. He further stated that the tariff proposed by the Commission for solar PV is reasonable which if further lowered would not attract projects. This is to be viewed in the context of depleting fossil fuels and promotion of renewable power and clean energy. He further added that TANGEDCO would be in a dilemma in encouraging renewable power that is infirm and will have a tendency to contract firm power. He suggested that some form of subsidy could be given to TANGEDCO as otherwise it would be difficult for them to match infirm power with firm power. Ultimately there is a requirement for a pollution free environment.

**Dr.M.Saikumar, CMD/TANGEDCO** – The rate discovered through their tender is Rs. 4.40 per unit and so it is a better rate. The next time when the utility goes for reverse bidding, Rs.4.40 per unit would be the ceiling.

**Thiru. G. Rajagopal, Member, TNERC** – The response to the tender of the TANGEDCO and the quantity contracted should be sufficient as otherwise the utility would not be able to fulfil the solar purchase obligation.

**Dr.M.Saikumar, CMD/TANGEDCO**– If that is the case, Solar RECs are available at Rs.3.30 per unit. Solar Purchase Obligation could be fulfilled by purchase of power at such a rate.

**Thiru K.Kathirmathiyon** – He agreed that solar power should be encouraged and further stated that the tariff of Rs.4.50 per unit is reasonable and this tariff could serve as the benchmark price. He further sought to be clarified on the slot to slot adjustment made in the energy accounting and billing procedure.

Chairman/TNERC explained in detail how the slot wise adjustment of energy is done.

**Dr. T. Prabhakara Rao, Member, TNERC** – TN has the highest RE capacity penetration currently among all states. Challenges of RE on the grid have to be taken note of and adequate measures to balance demand and supply need to be put in place. As regards Mini solar plants, Micro grids were tried in remote areas in some States by Private developers, but due to poor collections, the attempts were not further expanded. However, latest PV technology has minimized the degradation to a reasonable extent. As regards the Municipal Solid Waste based power plants local bodies should take initiative to encourage such plants by removing bottlenecks in the implementation and by sensitizing public about the need to encourage solid waste management.

**Thiru. G. Rajagopal, Member, TNERC**– Thanked all the SAC members for their participation and valuable suggestions made and assured that all information given would be considered by the Commission.