

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

PRESENT:

Thiru M.Chandrasekar Chairman
Dr.T.Prabhakara Rao Member
and
ThiruK.Venkatasamy Member (Legal)

M.P. No.2 of 2020

Tamil Nadu Energy Development Agency (TEDA)
Represented by the General Manager
E.V.K. Sampath Maaligai, 5th Floor
No.68, College Road
Chennai – 600 006.

... Petitioner
(Thiru Sankara Narayanan
General Manager,

Representingfor the Petitioner) Versus

1. Tamil Nadu Generation and Distribution Corporation Limited
144, Anna Salai
Chennai – 600 002.
2. The Principal Secretary to Government
Finance Department
Chennai – 600 009
(impleaded vide order of the Commission dated 11-02-2020)

... Petitioners
(Thiru M.Gopinathan,
Standing Counsel for TANGEDCO)

Dates of hearing : 10-01-2020; 11-02-2020; 25-02-2020;

**02-06-2020; 28-07-2020; 18-08-2020;
and 06-10-2020**

Date of Order : 10-11-2020

The M.P.No.2 of 2020 came up for final hearing on 06-10-2020. The Commission upon perusal of the petition, counter and other connected records and after hearing the submissions of the petitioner hereby makes the following:-

ORDER

1. Prayer of the Petitioner in M.P. No.2 of 2020:-

The prayer of the Petitioner in M.P. No. 2 of 2020 is:

- (a) To accord approval for the proposed implementation of the KUSUM (Component C) Agricultural Solar Pump Scheme in 20,000 pump sets with 7.5 H.P load by installing 11 kW solar PV plant in each of the pump sets.
- (b) To approve a maximum / bench mark tariff of Rs.4.53 per unit (which includes Rs.1.00 incentive to farmer for net energy injected to the grid) for the gross unit generated by the proposed solar PV plant erected under this scheme.
- (c) To permit the TEDA, the RESCO for the project, to finalize the investment proposal or tariff based reverse bidding process and submit the final tariff rate for the approval of the Commission.
- (d) To approve to ensure “must-run” status by TANGEDCO to the solarised feeders of the scheme and keep such feeders ‘ON’ during

sunshine hours of daytime.

- (e) To approve required modification, improvement to the TANGEDCO network for successful implementation of the project and
- (f) To pass any other order as the Commission deems fit and appropriate considering the special nature of the project.

2. Submissions of the Respondent in M.P. No. 2 of 2020

The Respondent filed a counter affidavit on 02-06-2020 with the following submissions:

- (a) To accord approval for the proposed implementation of the KUSUM (Component-C) Agricultural Solar Pump Scheme in 20,000 pump sets with 7.5 HP load by installing 11 KW solar PV plant in each of the pump sets by TEDA.
- (b) To approve a maximum/bench mark tariff of Rs.3.08 per unit for the gross power generated by the proposed solar PV power plant erected under this scheme.
- (c) To approve the rate of Rs.1/- per unit to the farmers for the net energy exported to the grid.
- (d) To pass any other order as the Hon'ble Commission deems fit and appropriate considering the present nature of the project.

3. Facts of the Case

3.1 In July 2019, the Ministry of New and Renewable Energy (MNRE) released the guidelines for its new flagship program '*Pradhan Mantri Kisan*

Urja Suraksha evam Utthan Mahabhiyan' (KUSUM). KUSUM scheme promotes the introduction of distributed solar for agriculture and has three components. Component A promotes setting up of 10,000 MW decentralised ground / stilt mounted grid connected solar or other renewable energy based power plants. Component B promotes the installation of 17.50 lakh stand-alone solar agriculture pumps. Component C promotes the solarisation of 10 lakh grid connected agriculture pumps.

3.2 The KUSUM-C scheme is to be funded as follows:

- (a) Capital subsidy by Government of India: 30% of capital cost (applicable on the actual capital cost or the MNRE benchmark cost, whichever is lower);
- (b) Capital subsidy by Government of Tamil Nadu: 30% of capital cost (applicable on the actual capital cost or the MNRE benchmark cost, whichever is lower);
- (c) Contribution by participating Farmers: the net capital cost after subsidies.

3.3 Tamil Nadu Government passed an order vide G.O.(D) No.39 Energy (E1)Department dated 21-08-2019 for the implementation of Component 'C' of the KUSUM scheme. The G.O states that "*the Government after careful examination accord Administrative Sanction for production of Solar Energy by the Farmers in their own land for self-consumption and commercial sale to Tamil Nadu Generation and Distribution Corporation and other buyers in*

Tamil Nadu".

3.4 Tamil Nadu Government passed an order vide G.O.(Ms) No.69 dated 01-10-2019 in which it is stated that "The Government after careful examination designate the Tamil Nadu Energy Development Agency as the implementing agency for implementing 'Component C' (Solarisation of Grid Connected Agriculture Pumps) of the MNRE KUSUM scheme across the State of Tamil Nadu".

3.5 Ministry of New and Renewable Energy (MNRE), Government of India accorded sanction for solarisation of 20,000 numbers of grid connected agricultural pumps to Tamil Nadu Energy Development Agency (TEDA) under Component-C of the KUSUM scheme vide letter number F.No.32/54/2018-SPV Division dated 03-10-2019.

3.6 TEDA proposes that the net capital cost of 40% (gross capital cost minus subsidies) instead of being funded by the Farmers, will be funded by TEDA's financial partners or by developers.

3.7 TEDA has proposed two implementation options for the KUSUM-C scheme as follows:

i) Mode 1: Capex Model

TEDA shall play the role of Renewable Energy Service Company (RESCO) for executing this project by raising the balance capital (40% of the project cost) from financial partners such as Tamil Nadu Infrastructure Fund Management Corporation (TNIFMC).The solar energy generated under this scheme is proposed to be purchased by TANGEDCO on Gross generation basis through

a PPA at the appropriate tariff to be approved by the Commission. The project would further be executed through an EPC contractor. The contractor will carry out the detailed engineering design, procurement, operation & maintenance of the solar power plants.

ii) Mode 2: RESCO Model:

Under this model, TEDA shall play the role of the implementation agency in executing the project, but the balance 40% capital investment (except the contributions from Central and State Governments) shall be made by the developer. The developer shall be responsible for sourcing the balance capital investment, detailed engineering design, procurement, installation and operation & maintenance of the solar power plants. The payment to the developer will be made at a per unit basis discovered through tariff-based reverse bidding mechanism. The Capital subsidy share of MNRE and GoTN will be released to the developer on instalment basis.

3.8 The Commission notes that irrespective of the chosen model, a maximum solar energy tariff needs to be determined at which the RESCO sells the generated solar energy to TANGEDCO.

4. Solar Energy Tariff Determination

4.1 TEDA and TANGEDCO have in their respective prayers requested the Commission to approve a solar energy tariff for the gross solar energy that will be generated and sold by the RESCO to TANGEDCO under the proposed KUSUM-C scheme implementation in Tamil Nadu.

4.2 The Commission evaluated the proposals of TEDA and TANGEDCO in

this regard and floated a consultative paper for implementation of the KUSUM (Component C) Agricultural Solar Pump Scheme in 20,000 pump sets with a bench mark tariff fixed and invited comments from stakeholders, following the provisions in the Electricity Act 2003 and relevant Regulations of the Commission.

4.3It would be relevant to reproduce Regulation 4 of the Power Procurement from New and Renewable Sources of Energy Regulation, 2008, specifies as follows:

“(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.*
- c) issuing general / specific tariff order for purchase of power from new and renewable sources based generators.*

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

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

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

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

4.4 Other Legal provisions

4.4.1 Related Provisions of Electricity Act, 2003

4.4.1.1 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 63: Notwithstanding anything contained in section 62, the Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government.

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;”

4.4.2 Related Provisions of National Electricity Policy

4.4.2.1 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.”

4.4.3 Related Provisions of Tariff Policy

4.4.3.1 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.”

4.5 Considering the comments received from the stakeholders, that of the petitioner, TEDA and the respondent, TANGEDCO, Commission issues this order.

4.6 The tariff determined in a costplus scenario, would depend significantly on the following operating and financial parameters:

1. Capital cost
2. Debt-equity ratio.
3. Term of Loan and Interest
4. Capacity Utilisation Factor
5. Operation and maintenance cost
6. Insurance
7. Depreciation rate applicable
8. Interest on working capital
9. Life of plant and machinery

4.7 Each of the Tariff determinants are dealt below:

4.7.1 Capital Cost

4.7.1.1 TANGEDCO proposed a capital cost of INR 48,000 per KW, which is the benchmark cost of MNRE. TEDA has proposed a capital cost of INR 50,000 on the ground that metering and on-site wiring need to be provided. In the consultative paper, a cost Rs. 38,000/-per KW was adopted. TEDA has informed that the benchmark costs for solar rooftop recently released by MNRE for 2020-21 are not in particular applicable to KUSUM-C and that the benchmark cost of Rs.48000 per KW specified by MNRE remains valid for KUSUM-C as confirmed by MNRE. Another stakeholder has stated the benchmark cost of MNRE released for 2020- 21 are inclusive of metering, on-site wiring and commissioning expenses and therefore the additional cost of Rs.1000 per KW should be excluded. Further, it has been pointed out that in a recent IPGCL tender in Delhi, the price discovered in bidding is Rs.31,000 per KW and considering the relatively fragmented and remote nature of the pilot project a cost of Rs.37,000/ KW may be adopted.

4.7.1.2 GoTN vide G.O No.39 dt.18.8.2020 has accepted the proposal of TEDA to form a Special Purpose Vehicle for implementation of KUSUM –C scheme as also for any similar project and has accorded sanction for Rs.316.80 crores.Further, GoTN has issued a financial sanction for a sum of Rs.100 crores in the first instance.

4.7.1.3TEDA has requested for a higher tariff of Rs.3.08 per unit and to adopt

Rs.48,000 per KW and for the purpose of tariff calculation to adopt Rs.49,000 per KW so as to factor in the cost of installation of generation meter, a bi-directional service connection meter and interconnection wiring with the distribution board at the farm. For the aforementioned reasons, TEDA contends that capital cost for implementation of KUSUM-C solar PV system will be higher than other rooftop solar systems. Further, TEDA's bidding for the solar PV system under KUSUM - C scheme will be a system cost based bidding. Commission notes from the communication of MNRE provided by TEDA that in case of solarisation of grid connected pumps, in the absence of details of costs discovered for solarisation of pumps, Ministry has so far not decided on applicable benchmark cost of solarisation of pumps during 2020-21. MNRE has clarified that for the present the benchmark cost declared on 25.7.2019 i.e Rs.48,000 per KW is applicable.

4.7.1.4 With no visible tender costs in the case of solarisation of grid connected agriculture pumps, Commission decides to adopt Rs.48,000/KW which is the benchmark cost notified by MNRE in the office memorandum dt.25.7.2019.

4.7.1.5 MNRE's benchmark cost notified for 2020-21 for grid connected solar rooftop photo voltaic is an all inclusive system cost that includes cost of solar photo voltaic system, its erection, connectivity, cost of online monitoring, cost of meters, if any, other than net meters and excludes net metering and battery back up costs whereas the benchmark cost notified in the office memorandum dt.25.7.2019 for solarisation of grid connected agriculture pumps says that the cost is inclusive of total system cost and its installation,

commissioning, transportation, insurance, five year AMC/CMC and applicable fees and taxes without any details of components covered in the total system cost. The system cost for KW scale solar photovoltaic in the recent tenders are all below Rs.40,000/KW. In a tender floated by the Punjab State Power Corporation Limited for solar rooftop installation for residential sector, the discovered rate for the installation of Solar photovoltaic systems was Rs. 37,000 per KW. Therefore, Commission decides not to include the additional cost of Rs.1000/KW sought by TEDA for the purpose of metering and on line wiring.

4.7.2 Debt - Equity and Return on equity

4.7.2.1 TEDA and TANGEDCO proposed that the net capital cost (gross capital cost minus subsidies on eligible capital cost amount) may be funded with 1% equity. The Commission is of the view that typical capital cost funding for renewable energy projects comprises 30% equity and 70% debt. The Commission has considered 30% equity funding for the net capital cost.

4.7.2.2 TEDA and TANGEDCO has proposed a return on equity of 17.60%. Commission decides to adopt the return on equity of 16.96% as adopted in its renewable energy orders issued in the year 2020 which is also the rate adopted by CERC in its RE generic tariff order for 20-21.

4.7.3 Term of loan and interest

4.7.3.1 TEDA has proposed debt funding with a tenure of 10 years (plus one year moratorium) with an interest rate of 10.55%. TANGEDCO has

proposed debt funding with a tenure of 20 years (including one year moratorium) with an interest rate of 14.00%. The Commission decides to adopt a loan tenure of 11 years which includes a 1 year principal repayment moratorium and an interest rate of 9% considering the present 1 year tenor MCLR plus 200 basis points as adopted by CERC in its RE tariff order for 2020-21.

4.7.4 Capacity Utilisation Factor (CUF)

4.7.4.1 TEDA proposed a CUF (capacity utilization factor) of 15.00%. TANGEDCO proposed a CUF (capacity utilization factor) of 19.00% and additionally a grid availability factor of 90.00% and an average annual solar panel degradation factor of 1.00%. While offering views on the consultative paper hosted, TEDA has requested to consider CUF of 17.40% citing absence of any maintenance staff in the plant. Some of the stakeholders have requested to consider CUF of 18% with grid availability factor of 98%. The Commission has thus far worked with CUFs of 19% that factor in overall system efficiency and solar panel degradation. The Commission shares the view of TANGEDCO that grid availability for solar PV systems in rural areas will be lower than for utility scale systems connected to dedicated feeders or sub-feeders at 11KV or higher voltage levels. TANGEDCO undertakes monthly shut-downs at rural substations for maintenance. Additionally there are feeder shut downs, breakdowns and non-scheduled load shedding.

4.7.4.2 The Commission decides that for determining the Levelised cost of

Energy(LCOE), the CUF shall be taken as 19.00% and additionally a grid availability factor of 90.00% shall apply. There shall not be a separate solar panel degradation factor in the LCOE calculations.

4.7.5 Operation and Maintenance Cost

4.7.5.1 TEDA initially proposed 2.90% of the gross capital cost as O&M cost with an annual increase of 7.90%. TANGEDCO proposed an O&M cost equal to 2.00% of the gross capital cost with an increase of 5.72%. In the views offered to the consultative paper, TEDA has suggested to consider O&M cost at 1.8% of gross capital cost with an annual increase of 5.72%. Commission decides to adopt 1.40% of gross capital cost as the O&M cost with an annual increase of 5.72% as adopted in all its tariff orders on solar power.

4.7.6 Insurance

4.7.6.1 TEDA proposed insurance cost at 0.80% of the depreciated capital cost. TANGEDCO has proposed insurance cost of 0.50% of the depreciated capital cost. In the consultative paper, insurance at 0.35% of depreciated cost was proposed. Commission has observed that the KW scale benchmark cost of MNRE is inclusive of insurance. Therefore, Commission decides not to consider any separate component for insurance.

4.7.7 Depreciation

4.7.7.1 TEDA proposed an annual depreciation rate of 3.80% on the net capital cost, which results into a residual value of 5.00% at the end of an economic life of 25 years. TANGEDCO proposes an annual depreciation rate of 3.60% on the net capital cost, which results in a residual value of 10.00%. The Commission accepts the annual depreciation rate of 3.60% proposed by TANGEDCO, which will be applied on the net capital cost (gross capital cost minus subsidies) for the purpose of LCOE determination.

4.7.8 Interest on Working Capital

4.7.8.1 TANGEDCO and TEDA have both proposed working capital requirements of one month for O&M costs and two months for receivables with a working capital interest rate of 11.55%. The Commission has decided to adopt the working capital requirements of one month for O&M costs and two months for receivables with a working capital interest rate of 10.50% considering the present 1 year tenor MCLR plus 350 basis points as adopted by CERC in its RE tariff order for 2020-21.

4.7.9 Discount Factor

4.7.9.1 TEDA proposed a discount factor of 9.53% while TANGEDCO used a discount factor of 9.57% for their LCOE calculations. The Commission decides to adopt the discount factor of 8.57%.

4.7.10 Life of plant and machinery

4.7.10.1 Commission considers a life period of 25 years as adopted in its orders on Rooftop solar generation.

4.8 Tariff :

4.8.1 The financial and operational parameters adopted are tabulated below:

Tariff Components	Values
Capital cost	Rs. 5.39 Lakhs Gross (before MNRE and GoTN subsidy) Rs.2.222 Lakhs (after subsidy)
CUF	19.00%
Daytime Grid availability factor	90%
Operation and maintenance expenses	1.4% on Gross Capital cost with an escalation of 5.72%
Debt-Equity ratio	70:30
Life of plant and machinery	25 years
Return on Equity	16.96% (pre-tax)
Term of Loan	10 years with 1 year moratorium period
Interest on loan	9.00%
Depreciation	3.6% p.a
Working Capital components	one month O&M cost and two months receivables
Interest on working capital	10.50%
Discount factor	8.67%
Levelised Tariff	Rs.2.28

The above mentioned LCOE input parameters as decided upon by the Commission result in solar energy tariff of INR 2.28 per kWh (25 years fixed), which shall be the maximum solar energy tariff under the KUSUM-C scheme pilot project of 20,000 pumps. The tariff worksheet is in Annexure 1 of this Order.

4.8.2 The solar energy tariff determined herein applies only to solar PV systems installed at agricultural farms under the KUSUM-C scheme and is the maximum solar energy tariff permitted. The actual solar energy tariff shall be discovered through a tender process.

4.8.3 If TEDA opts for the “Capex Model” whereby TEDA acts as a RESCO as proposed in their petition (M.P. No. 2 of 2020), the following conditions shall apply:

- (a) The gross capital cost (capital cost before subsidies) shall be discovered through competitive bidding and shall not exceed the gross capital cost as assumed in the solar energy tariff determination in this Order and as detailed in Annexure 1 of this Order. As per MNRE guidelines, capital subsidies shall apply to the actual gross capital cost or the MNRE benchmark cost, whichever is lower;
- (b) The structure of the net capital cost funding adopted by TEDA shall not result in a reduction of tariff subsidy savings in the hands of the Government of Tamil Nadu or TANGEDCO;
- (c) The solar energy tariff at which the TEDA enters into a power purchase

agreement with TANGEDCO shall not exceed the solar energy tariff determined in this Order.

4.8.4 If TEDA opts for the “RESCO Model” whereby a developer acts as RESCO as proposed in their petition (M.P. No. 2 of 2020), the following conditions shall apply:

- (a) The solar energy tariff shall be discovered through competitive bidding and shall not exceed the solar energy tariff determined in this Order;
- (b) As per MNRE guidelines, capital subsidies shall apply to the actual gross capital cost or the MNRE benchmark cost, whichever is lower.
- (c) Capital subsidies shall be released to the developer / RESCO in instalments on the basis actual work progress.

4.8.5 Views of GoTN were sought on the consultative paper. GoTN has not furnished any views on the consultative paper but through the G.O No.39 dt.18.8.2020 has accorded financial sanction of Rs.100 crores.

The Government order in G.O No.39 is extracted below:

“8) The Government after careful examination accept the proposal of the Managing Director, Tamil Nadu Energy Development Agency and issue orders on the following for implementation of the Solar energy Producing Farmers programme (under the Component –C of KUSUM scheme):

- (a) Permit the Tamil Nadu Energy Development Agency to form a Special Purpose Vehicle or a new company, which can be used for other similar projects also in future.*
- (b) Accord sanction for a sum of Rs.316.80 crores (Rupees Three hundred and sixteen crore and eighty lakh only) as per the terms envisaged in the Administrative sanction issued vide G.O(D) No.39, Energy(E1) Department, dt.21-08-2019*

towards the State subsidy of 30%.Further the Government also issue a financial sanction for a sum of Rs.100.00 Crore(Rupees One hundred crore only) in the first instance during the current financial year 2020-2021.

- (c) To permit the Tamil Nadu Energy Development Agency to raise Capital from TNIFMC for arranging the 40% Project cost on behalf of Farmer's contribution over and above the 30% Subsidy to be provided by the GoI and the 30% subsidy by GoTN for the purpose of the implementation of the KUSUM scheme.*
- (d) Upon determination of maximum bench mark tariff for the gross power generated under this scheme by the TNERC and the proposed farmer's incentive for the net energy exported to the grid, the implementation details including operating procedures and payment schedules may be worked between TEDA and TANGEDCO before signing the Power Purchase Agreement.*
- (e) The maximum solar energy tariff determined herein shall apply to solar PV systems commissioned under the KUSUM-C scheme in Tamil Nadu during the period of implementation of the proposed pilot phase of the KUSUM-C scheme (the control period) and shall be valid for a period 25 years from the date of commissioning of each solar PV system (the tariff period).*

4.8.6 The Government of Tamil Nadu (GoTN) had issued policy directions under sub-section (1) of section 108 of the Electricity Act, 2003, for extension of free supply / concessional tariff to different categories of consumers and supply to agricultural category falls under this scheme. The Government has also committed to provide subsidy to TANGEDCO to meet the shortfall in revenue due to extension of free supply, under section 65 of the Electricity Act, 2003. The present tariff for agricultural category is Rs.3.22 as per Commission's Tariff order dt.11.8.2017. One of the aims of the KUSUM scheme is to reduce the subsidy burden.

4.8.7 Commission in the consultative paper proposed that GoTN may make payments to the petitioner, TEDA for the Gross energy generated under Component C of the KUSUM scheme. GoTN has not furnished any remarks for the proposal in the consultative paper. TANGEDCO has also not furnished any remarks.

4.8.8The implementation of the KUSUM scheme will result in a considerable savings in subsidy costs to GoTN. TANGEDCO always makes a provisional subsidy claim from GoTN and then files a reconciliatory statement to the Commission to obtain actual subsidy from GoTN. Therefore, on the issue of payments to be made to TEDA for the solar energy generated, Commission decides as follows:

(i) TANGEDCO shall claim advance charges for payment for solar energy generated under the KUSUM C scheme provisionally like claiming subsidy charges for agricultural services at the tariff rate of Rs.2.28 per unit at CUF of 19% for the capacity of solar power plants commissioned under the scheme, at the time of commissioning of the plants and subsequently at the beginning of each financial year. Following is the illustration to claim advance charges provisionally:

Charges for solar energy generation when say in 500 pumpsets solar PV plants are commissioned = $500 * 16478 (11 \text{ KW} * 365 * 24 * 19\% * 90\%) * 2.28$
= Rs.1,87,84,920/-

Until commissioning of the solar power plants, for the pumpsets covered under the KUSUM C scheme, subsidy charges as normally claimed may be made.

(ii) TANGEDCO shall make payments on monthly basis to the petitioner, TEDA, for the Gross energy generated under Component C of the KUSUM scheme. The data of generation, export/import energy obtained through online monitoring shall be shared by TEDA with TANGEDCO every month.

(iii) At the end of every financial year, TANGEDCO shall furnish

(I) data of solar energy generated by the Solar PV power plants in each of the grid connected agricultural pumpsets under the KUSUM C scheme and

(II) data of energy drawn by the farmer from TANGEDCO's grid over and above the generation from the solar power plants under this component C of KUSUM scheme to the Commission, and

(III) TANGEDCO shall claim actual subsidy charges for the energy drawn over and above the generation by the farmer from TANGEDCO's grid at the per unit tariff rate notified in the Commission's retail tariff order for agricultural category, and the actual tariff charges paid for the gross solar energy generated, through reconciliatory statements.

(iv) GoTN shall make payments for the gross solar energy generated under the KUSUM C scheme and the subsidy for any energy drawn by the farmer from TANGEDCO's grid over and above the generation from the solar power plant on passing of suitable orders by the Commission based on data furnished by TANGEDCO.

5. Incentive for Farmers

5.1 TEDA has further represented that the implementation of the KUSUM-C scheme in Tamil Nadu will include payment of an incentive to the participating Farmers which is designed such that running the pump on solar energy, export of surplus solar energy to the grid and minimizing import from the grid are incentivized.

5.2 TEDA has therefore proposed that the incentive may be based on the net exported energy of the service connection (active energy export minus active energy import) to encourage daytime use of the agricultural pump on solar energy and discourage night time grid power usage.

5.3 TEDA has further proposed that the participating Farmers will continue the existing free power for their agricultural pumps.

5.4 TANGEDCO has proposed that TOD (time-of-day) energy import and export factors may be introduced for the incentive calculation so that there is an incentive to import energy from the grid (when required) during off-peak hours.

5.5 The Commission is in agreement with this proposal of introducing energy import and export TOD factors for the reason given by TANGEDCO and for the additional reason that it allows for fine-tuning of the incentive mechanism so that it is, and remains, a beneficial proposition for the Farmer, TANGEDCO and the Government of Tamil Nadu. Commission emphasises that the energy import and export factors shall be determined such that solar energy consumption is incentivised while energy consumption from the

TANGEDCO grid must be disincentivised, particularly during peak hours.

5.6 In view of the above considerations, the Commission has decided that the following formula shall be used for the Farmer incentive mechanism:

$$\text{Incentive [INR]} = ((\text{Solar energy export [kWh]} \times \text{export TOD factor}) - (\text{Grid energy import [kWh]} \times \text{import TOD factor})) \times \text{Incentive rate [INR]}$$

5.7 If the formula results in a negative value (net import of energy instead of net export of energy) the result shall be taken as zero.

5.8 The initial energy import and export factors shall be set as follows:

Energy import factor during peak demand hours: 2.0

Energy export factor during peak demand hours: 1.0

Energy import factor during off-peak demand hours: 1.0

Energy export factor during off-peak demand hours: 1.0

5.9 These values may be changed subsequently by TANGEDCO for different time periods in the day and for different days in the week on the basis of grid conditions and field experience while ensuring that the Farmer incentive remains a beneficial proposition for all stakeholders.

5.10 It has been proposed by TANGEDCO and TEDA that the initial incentive rate may be fixed as INR 1.00 per kWh of net exported energy and that the Farmer incentive may be subject to minimum and maximum amounts. TEDA further proposed a minimum annual incentive amount of INR 3,000 and a maximum annual incentive amount of INR 15,000 per annum for a 7.5HP pump - 11KW solar system combination. TANGEDCO had stated in their

counter affidavit that the minimum incentive amount of INR 3,000 may be “reconsidered” by the Commission without stating whether TANGEDCO considers the proposed minimum amount too high or too low.

5.11 The Commission is of the view that the minimum incentive should be subject to the condition that the solar PV system is functional. A solar PV system installed at a farm shall be considered as “functional” if at least 50% of the generation potential of the solar PV system has been achieved during the period for which the minimum incentive is proposed to be paid. The generation potential shall be computed on the basis of the CUF and grid availability parameters used by the Commission in the LCOE calculation as given in clause 4.7.4 of this Order.

5.12 Subject to the provision of clause 5.11, the amount of minimum incentive shall initially be fixed at INR 3,000 per annum for a 7.5HP pump - 11kW solar PV system.

5.13 The amount of maximum incentive, instead of being fixed at INR 15,000 or any other amount, shall be based on the actual solar energy generation as follows: Maximum incentive [INR] = Solar energy generation [kWh] x 0.80 x Incentive Rate [INR].

5.14(i) The Commission notes that TEDA and TANGEDCO have not spelt out the source of funds for the incentive to the Farmer.

(ii) Regarding bearing the cost of payment towards incentive, the following was the proposal in the consultative paper:

‘TANGEDCO and TEDA in consultation with Government of Tamil Nadu may

decide on the payment of incentives. The benchmark tariff being less than the tariff of Rs.3.22 notified in the Commission's Tariff order of 2017 and which is the subsidy being paid by GoTN, the incentive may be paid by GoTN from the subsidy savings.'

Both the Government of Tamil Nadu and TANGEDCO have not offered any views on this issue.

5.15The implementation of the KUSUM-C scheme will result in a significant reduction in subsidy costs to the Government of Tamil Nadu. On payment of incentives, Commission decides as follows

(i)The incentive rate shall initially be set at INR 0.50 per kWh for the net exported energy (computed with the export and import energy TOD factors as per the formula given in clause 5.6) for a 7.5HP pump - 11kW solar PV system combination. The incentive cost shall be such that the solar tariff added to the incentive is always less than the per unit tariff subsidised by GoTN for the agricultural category. The rate of incentive may be at intervals that may be decided by TANGEDCO and can reach upto a maximum of Rs.1 per kWh

(ii) Since TANGEDCO already has a service provider relationship with the Farmer in the form of an electricity service connection, TANGEDCO shall administer the disbursement of the incentive to the Farmer on behalf of the Government. TANGEDCO shall make the advance claim of charges to be paid towards incentive along with the advance tariff charges ordered in para 4.8.8 of this order and subsequently claim as per actuals. The claim in advance for

incentives shall be for 40% of total generation at the adopted CUF of 19% at the adopted incentive rate, which is 50 paise per unit initially. Following, is the illustration to claim incentive charges in advance:

$$\begin{aligned}\text{Incentive} &= 500 * 16478 * 40\% * 0.50 \\ &= \text{Rs.}16,47,800/-\end{aligned}$$

5.16 Government shall reimburse TANGEDCO for the actual Farmer incentives disbursed.

5.17 The Farmer incentive may be disbursed by TANGEDCO to the Farmers annually within 30 days from the end of each financial year by bank transfer.

5.18 TANGEDCO shall develop and implement a mobile phone and web application (App) whereby the Farmer gets access to the status of the incentive credit and can keep track of incentive payments due and paid. For any practical difficulties in implementing the incentive mechanism as per the formula notified in this order, TANGEDCO/TEDA may approach the Commission.

6. Energy Metering

6.1 Two energy meters are required for each farm solar PV system:

(a) An energy meter to record the gross solar energy generation. This meter is to be installed immediately after the solar grid inverter. This shall be a digital four-quadrant vector summation energy meter configured for bidirectional energy display so that self-consumption by the solar PV system, if any, can be accounted for. Payment by TANGEDCO to the RESCO for energy generated shall be on the basis of the readings of this

solar energy generation meter.

(b) A service connection energy meter to record the energy import from the TANGEDCO grid and energy export to the TANGEDCO grid. This shall be a digital four quadrant vector summation energy meter configured for bidirectional energy measurement whereby both imported and exported active energy readings are shown in the display.

6.2 The service connection energy meter shall have programmable TOD (time- of-the-day) registers with a minimum of four energy import TOD registers and four energy export TOD registers.

6.3 Both energy meters shall be provided with remote reading facilities for which specifications shall be drawn up in consultation with TANGEDCO.

6.4 Energy meters shall be of class 1.0 accuracy and shall comply with applicable CEA (Central Electricity Authority) and BIS (Bureau of Indian Standards) standards.

6.5 The solar energy generation meter shall be maintained by the RESCO while the service connection energy meter shall be maintained by TANGEDCO.

6.6The solar energy generation meter shall be sealed jointly by TANGEDCO and the RESCO. The service connection meter shall be sealed by TANGEDCO.

6.7 TANGEDCO and the RESCO shall include provisions in their power purchase agreement which deal with the (joint) (remote) reading of the solar energy generation meter and the maintenance of that meter.

7. Technical Requirements

7.1 The solar PV system and the interconnection with the TANGECCO grid shall comply with all applicable regulations and standards of the Central Electricity Authority (CEA), and the Tamil Nadu Electricity Distribution Code with latest amendments.

7.2 A distribution board shall be installed to which the TANGEDCO service connection mains, the AC output of the solar grid inverter and the agricultural pump are connected as shown in the single line diagram enclosed in Annexure 2 of this Order.

7.3 All equipment such as the solar grid inverter, distribution board and energy meters shall be installed inside weatherproof enclosures with IP 65 or better protection.

7.4 The total capacity of solar PV systems connected to a distribution transformer shall not exceed 100% of the distribution transformer.

8. Feeder Status

8.1 The Commission accepts the proposal of TANGEDCO and TEDA that HT feeders with solar PV systems installed at agricultural farms must be given the “Must-Run” status in the daytime (sunrise to sunset) subject to grid safety measures that may have to be taken occasionally. It is important that there is no grid outage in the daytime so that the grid-connected solar PV systems can operate.

9. Selection of Agricultural Farms

9.1 The Commission directs that only farms where active farming takes place throughout the year and where solar PV systems can be installed with adequate safety and security shall be selected for the KUSUM-C scheme. The main purpose of the scheme would be defeated if solar PV systems are installed at farms with little or no agricultural activity.

10. Agreement

10.1 TANGEDCO shall enter into an agreement with the Farmer, or farm land owner, whereby the Farmer or farm land owner agrees to the installation and operation of the solar PV system on his land under the terms and conditions of that agreement, which shall include a provision for water supply for solar panel cleaning. Before entering into a PPA, TEDA and TANGEDCO shall work out the implementation details including operating procedures and payment schedules and the same shall be included in the PPA.

11. Convergence with micro-irrigation schemes

11.1 Convergence with micro-irrigation schemes may be explored and encouraged by TANGEDCO and TEDA in consultation with the Government of Tamil Nadu so that water and energy consumption can be further reduced.

12.0 Applicability of this Order

12.1 This Order shall come into force on from the date of issue i.e from 10-11-2020. The maximum solar energy tariff determined herein shall apply to solar PV systems commissioned under the KUSUM-C scheme in Tamil Nadu during the period of implementation of the pilot phase of the KUSUM-C scheme (the control period) i.e for the sanctioned 20000 nos. of grid

connected agricultural pumps vide Ministry of New and Renewable Energy, Government of India Letter Number F.No.32/54/2018-SPV Division dated 03-10-2019 and shall be applicable for a period of 25 years from the date of commissioning of each solar PV system (the tariff period).

(Sd.....)
(K.Venkatasamy)
Member (Legal)

(Sd.....)
(Dr.T.PrabhakaraRao)
Member

(Sd.....)
(M.Chandrasekar)
Chairman

/True Copy /

Secretary
Tamil Nadu Electricity
Regulatory Commission

Annexure 1 - LCOE calculation

Assumptions		Unit	Value
1	Solar PV system capacity	kW	11.00
2	MNRE benchmark cost	INR / kW	48,000
3	Capital cost	INR / kW	48,000
4	MNRE subsidy	%	30.00%
5	Government of Tamil Nadu subsidy	%	30.00%
6	Equity (% of net capital cost after subsidies)	%	30.00%
7	Return on equity	%	16.96%
8	Interest on loan	%	9.00%
9	Loan tenure (including moratorium)	Year	11
10	Loan principle payment moratorium	Year	1
11	Solar PV system CUF	%	19.00%
12	Daytime grid availability (rural feeder)	%	90.00%
13	O&M (percentage of gross capital cost)	%	1.40%
14	O&M annual increase	%	5.72%
15	Annual depreciation rate on netcapital cost	%	3.60%
16	Working Capital - O&M	Month	1
17	Working Capital - receivables	Months	2
18	Interest on Working Capital	%	10.50%
19	Discount factor	%	8.67%
20	Economic life of system	Years	25
LCOE		INR / kWh	2.28

Continued on next page.

Funding			
MNRE benchmark cost for installed capacity	528,000	INR	
Gross capital cost before subsidy	528,000	INR	
Capital cost eligible for subsidy	528,000	INR	
MNRE subsidy (INR)	158,400	INR	
Capital cost after MNRE subsidy	369,600	INR	
Government of Tamil Nadu subsidy	158,400	INR	
Capital cost after MNRE subsidy and GoTN subsidy	211,200	INR	
Equity	63,360	INR	
Loan	147,840	INR	

Total Funding Check - % of <u>Gross</u>Capital Cost			
MNRE contribution	30.00%	%	
Tamil Nadu Government contribution	30.00%	%	
Equity	12.00%	%	
Loan funding	28.00%	%	
Total Funding (% of gross capital cost)	100.00%	%	

Total Funding Check - % of <u>Net</u>Capital Cost			
Equity	30.00%	%	
Loan funding	70.00%	%	
Total Funding (% of net capital cost)	100.00%	%	

Solar Energy Generation											
Year-->	1	2	3	4	5	6	7	8	9	10	11
Solar energy generation (kWh)	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478

Cost of Solar Energy Generation											
Return on equity	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746
Interest on Loan	13,306	13,306	11,975	10,644	9,314	7,983	6,653	5,322	3,992	2,661	1,331
Operation and Maintenance (O&M)	7,392	7,815	8,262	8,734	9,234	9,762	10,321	10,911	11,535	12,195	12,892
Insurance	-	-	-	-	-	-	-	-	-	-	-
Depreciation	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603
Interest on O&M Working Capital	65	68	72	76	81	85	90	95	101	107	113
Sub-total	39,111	39,538	38,658	37,804	36,978	36,180	35,413	34,678	33,977	33,312	32,685
Interest on Receivables Working Capital	684	692	677	662	647	633	620	607	595	583	572
Total cost	39,796	40,230	39,335	38,466	37,625	36,813	36,032	35,285	34,571	33,895	33,257

Total cost per kWh	2.42	2.44	2.39	2.33	2.28	2.23	2.19	2.14	2.10	2.06	2.02
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Levelised cost of Energy											
Discount Factor	1.00	0.92	0.85	0.78	0.72	0.66	0.61	0.56	0.51	0.47	0.44
Present Value	2.42	2.25	2.02	1.82	1.64	1.47	1.33	1.20	1.08	0.97	0.88
Levelised cost of Energy	2.28per kWh										

Year-->	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Solar energy generation (kWh)	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478	16,478

Return on equity	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746	10,746
Interest on Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	13,630	14,409	15,234	16,105	17,026	18,000	19,030	20,118	21,269	22,486	23,772	25,132	26,569	28,089
Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603
Interest on O&M Working Capital	119	126	133	141	149	158	167	176	186	197	208	220	232	246
Sub-total	32,098	32,885	33,716	34,595	35,524	36,507	37,545	38,643	39,804	41,031	42,329	43,701	45,151	46,684
Interest on Receivables Working Capital	562	575	590	605	622	639	657	676	697	718	741	765	790	817
Total cost	32,660	33,460	34,306	35,200	36,146	37,146	38,202	39,320	40,501	41,749	43,070	44,465	45,941	47,501

Total cost per kWh	1.98	2.03	2.08	2.14	2.19	2.25	2.32	2.39	2.46	2.53	2.61	2.70	2.79	2.88
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Discount Factor	0.40	0.37	0.34	0.31	0.29	0.26	0.24	0.22	0.21	0.19	0.17	0.16	0.15	0.14
Present Value	0.79	0.75	0.71	0.67	0.63	0.60	0.56	0.53	0.51	0.48	0.46	0.43	0.41	0.39

Depreciation calculation	Year-->	1	2	3	4	5	6	7	8	9	10	11
Depreciation on gross capital cost	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008
Depreciation on gross capital cost - cumulative	19,008	38,016	57,024	76,032	95,040	114,048	133,056	152,064	171,072	190,080	209,088	
Depreciation on net capital cost after subsidies	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603
Depreciation on net capital cost after subsidies - cumullative	7,603	15,206	22,810	30,413	38,016	45,619	53,222	60,826	68,429	76,032	83,635	

Year-->	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Depreciation on gross	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008	19,008

capital cost															
Depreciation on gross capital cost - cumulative	228,096	247,104	266,112	285,120	304,128	323,136	342,144	361,152	380,160	399,168	418,176	437,184	456,192	475,200	
Depreciation on net capital cost after subsidies	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	7,603	
Depreciation on net capital cost after subsidies - cumulative	91,238	98,842	106,445	114,048	121,651	129,254	136,858	144,461	152,064	159,667	167,270	174,874	182,477	190,080	

Working Capital Calculation											
Year-->	1	2	3	4	5	6	7	8	9	10	11
O&M Working Capital	616	651	688	728	770	814	860	909	961	1,016	1,074
Interest on O&M Working Capital	65	68	72	76	81	85	90	95	101	107	113
Receivables Working Capital	6,519	6,590	6,443	6,301	6,163	6,030	5,902	5,780	5,663	5,552	5,447

Interest on Receivables Working Capital	684	692	677	662	647	633	620	607	595	583	572
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Year-->	12	13	14	15	16	17	18	19	20	21	22	23	24	25
O&M Working Capital	1,136	1,201	1,269	1,342	1,419	1,500	1,586	1,677	1,772	1,874	1,981	2,094	2,214	2,341
Interest on O&M Working Capital	119	126	133	141	149	158	167	176	186	197	208	220	232	246
Receivables Working Capital	5,350	5,481	5,619	5,766	5,921	6,084	6,258	6,441	6,634	6,839	7,055	7,283	7,525	7,781
Interest on Receivables Working Capital	562	575	590	605	622	639	657	676	697	718	741	765	790	817

Debt Servicing											
Year -->	1	2	3	4	5	6	7	8	9	10	11
Debt opening balance	147,840	147,840	133,056	118,272	103,488	88,704	73,920	59,136	44,352	29,568	14,784
Debt repayment	-	14,784	14,784	14,784	14,784	14,784	14,784	14,784	14,784	14,784	14,784
Debt closing balance	147,840	133,056	118,272	103,488	88,704	73,920	59,136	44,352	29,568	14,784	-
Interest	13,306	13,306	11,975	10,644	9,314	7,983	6,653	5,322	3,992	2,661	1,331
Total debt service	13,306	28,090	26,759	25,428	24,098	22,767	21,437	20,106	18,776	17,445	16,115

Year -->	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Debt opening balance	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt repayment	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt closing balance	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annexure 2 - Typical single line diagram for solar PV systems installed at agricultural farms

