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PUBLIC NOTICE

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In the matter of : Petition for implementation of the KUSUM (Component C) Agricultural Solar Pump Scheme in 20,000 pump sets by installing 11 kW solar PV plant in each of the pump sets in Tamil Nadu and approval of benchmark tariff .

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1)   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 PM KUSUM scheme vide letter number F.No.32/54/2018-SPV Division dated 03-10-2019.

2)   Under this Component C, individual farmer having grid connected agriculture pump will be supported to solarise the pump. Solar PV capacity up to two times of pump capacity in kW is allowed under the scheme, so that the farmer will be able to use the generated solar power to meet the irrigation needs and get additional income by selling surplus solar power to DISCOMs.

3)   Tamil Nadu Energy Development Agency (TEDA) filed a petition in M.P No.2 of 2020 inter alia to accord approval for the 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 and to

approve a maximum / bench mark tariff of Rs.4.53 per unit that is inclusive of incentive of Rs. 1.00 per unit to the farmer for net energy injected to the grid. TANGEDCO, the Respondent, has also requested to accord approval for implementation of the KUSUM (Component C) Agricultural Solar Pump scheme but with a benchmark tariff of Rs.3.08 per unit.

4) Commission, after hearing the petitioner and the respondent, TANGEDCO, in due discharge of the mandate under section 86(1)(e) of the Electricity Act 2003 and the Power Procurement Regulations from New and Renewable Energy Sources has evolved a consultative paper for 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 with a bench mark tariff fixed.

Comments/suggestions of the stakeholders on the consultative draft proposal enclosed are invited by 02.10.2020. Comments may be sent by hard and soft copies(mail id tnerc@nic.in).

(By order of the Tamil Nadu Electricity Regulatory Commission)

Secretary
Tamil Nadu Electricity Regulatory Commission

TAMIL NADU ELECTRICITY REGULATORY COMMISSION

Consultative Paper on "Determination of Tariff for purchase of power from solar energy generated under 'Component C' of KUSUM scheme "

1.0 Need for the consultative paper

1.1 Ministry of New and Renewable Energy, Government of India launched the Pradhan Mantri Kisan Urja Suraksha evem Utthan Mahabhiyan (PM KUSUM) scheme for farmers and released guidelines providing broad implementation framework of the scheme. The scheme involves three components of which one is Component C on Solarisation of 10 lakh Grid connected agriculture pumps. 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 PM KUSUM scheme vide letter number F.No.32/54/2018-SPV Division dated 03-10-2019.

1.2 Under this Component C, individual farmer having grid connected agriculture pump will be supported to solarise the pump. Solar PV capacity up to two times of pump capacity in kW is allowed under the scheme, so that the farmer will be able to use the generated solar power to meet the irrigation needs and get additional income by selling surplus solar power to DISCOMs. Component-C of PM KUSUM Scheme is a new initiative from the Government of India aimed at ensuring reliable day time power supply for irrigation, reducing subsidy burden on State Government and providing additional sources of income to the farmers.

1.3 Tamil Nadu Energy Development Agency (TEDA) filed a petition in M.P No.2

of 2020 inter alia to accord approval for the 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 and to approve a bench mark tariff. Commission in the hearing held on 18.8.2020 directed to take steps to invite stakeholder's comments within a time limit of one month.

1.2 Accordingly, a consultative paper has been prepared to elicit the views of stakeholders.

2.0 Mechanism of implementation

2.1 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.

2.2 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.

2.3 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*".

2.4   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 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".

2.5   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.

2.6   TEDA proposed 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. GoTN vide letter dt.18.8.2020 have approved the issues as detailed below for implementation of Component C of KUSUM scheme for which a G.O is being issued:

(a) Permitted Tamil Nadu Energy Development Agency to form a Special Purpose Vehicle or a new company which can be used for other similar projects in future..

(b) Accorded approval for financial sanction and allocating fund amounting to Rs.316.8 Crores as envisaged in the Administrative sanction accorded vide G.O

(D)No.39,Energy(E1) Department dt.21.8.2019.

(c) Permitted 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 Government of India and the 30% subsidy by Government of Tamil Nadu for the purpose of implementation of KUSUM scheme.

(d) Upon determination of maximum bench mark tariff for the gross power generated under the scheme by TNERC and the proposed farmers incentive for the net energy exported to the grid, the implementation details including operating procedures and payment schedules may be worked out between TEDA and TANGEDCO before signing the PPA.

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

"<u>Mode 1: Capex Model</u>

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 Hon'ble TNERC. The project would further be executed through an EPC contractor. The contractor will carry out the detailed engineering design, procurement, operations & maintenance of the solar power plants.

<u>Mode 2: RESCO Model</u>:

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".

2.8   The Commission is of the view 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.

3.1 Legal framework:

3.1.1   Related Provisions of Electricity Act, 2003

3.1.1.1 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;"

3.1.2. Related Provisions of National Electricity Policy

3.1.2.1 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."

3.1.3. Related Provisions of Tariff Policy

3.1.3.1 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."

3.1.4   Regulation 4 (2) of the Power Procurement from New and Renewable Sources of Energy Regulation, 2008, specifies as follows:

"(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."

4.0 Applicability of proposed order

4.1   This order shall come into force from the date of its issue. The tariff determined shall be applicable for the sanctioned capacity of 20,000 numbers of grid connected agricultural pumps by Ministry of New and Renewable Energy 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 and is applicable for a life period of 25 years from the date of commissioning of each solar PV system.

5.0 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 Regulation, 2008 is reproduced below:

'The Commission shall follow the process mentioned below for the determination of tariff for the power from new and renewable sources based generators, namely;-
a) initiating the process of fixing the tariff either suo motu or on an application filed by the distribution licensee or by the generator.
b) inviting public response on the suo motu proceedings or on the application filed by the distribution licensee or by the generator.
c) issuing general / specific tariff order for purchase of power from new and renewable sources based generators.

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

5.2   Tariff / Pricing Methodology

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

"(*2*) *While deciding the tariff for power purchase by distribution licensee from new and renewable sources based generators, the Commission shall, as far as possible, be guided by the principles and methodologies specified by:*
(a) Central Electricity Regulatory Commission
(b) National Electricity Policy
(c) Tariff Policy issued by the Government of India
(d) Rural Electrification Policy
(e) Forum of Regulators (FOR)
(f) Central and State Governments

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

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

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

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

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

6.0 Tariff Components and determination

6.1   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.

6.2   The Commission has evaluated the proposals of TEDA and TANGEDCO in this regard and has carried out a detailed analysis of the existing policies/procedures and commercial mechanisms in respect of power generation from solar power plants-rooftop. 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

Each of the parameters are dicussed below:

6.3 Capital Cost

6.3.1 TANGEDCO has 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 for. MNREs benchmark capital cost for Grid-connected Rooftop Solar Photo Voltaic Systems for the financial year 2020-21 for capacities greater than 10 KW and upto 100 KW is Rs.38,000 per KW. The Commission proposes to adopt a capital cost of INR 39,000 per kW. With this capital cost rate there is a provision of INR 1,000 per kW (or INR 11,000 for an 11 kW solar system) for metering and on-site wiring.

6.4 Debt - Equity and Return on equity

6.4.1 TEDA and TANGEDCO has 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.

TEDA and TANGEDCO has proposed a return on equity of 17.60%. Commission proposes to adopt the same return on equity of 17.60%.

6.5 Term of loan and interest

6.5.1 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 proposes to adopt a loan tenure of 11 years which

includes a 1 year principal repayment moratorium and an interest rate of 10.55%.

6.6 Capacity Utilisation Factor (CUF)

6.6.1   TEDA has proposed a CUF (capacity utilization factor) of 15.00%. TANGEDCO has 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%. The Commission has thus far worked with CUFs 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.

The Commission proposes to consider CUF of 19% and additionally a grid availability factor of 90.00%.

6.7 Operation and Maintenance Cost

6.7.1   TEDA has proposed 2.90% of the gross capital cost as O&M cost with an annual increase of 7.90%. TANGEDCO has proposed an O&M cost equal to 2.00% of the gross capital cost with an increase of 5.72%. Commission proposes to adopt 1.50% of gross capital cost as the O&M cost with an annual increase of 5.72%.

6.8 Insurance

6.8.1   TEDA has proposed insurance cost of 0.80% of the depreciated capital cost. TANGEDCO has proposed insurance cost of 0.50% of the depreciated capital cost. The Commission considers 0.35% of depreciated gross capital cost as insurance cost for tariff determination.

6.9 Depreciation

6.9.1 TEDA proposes 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 tariff determination.

6.10 Interest on Working Capital and components

6.10.1 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 proposes 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 11.55%

6.11 Discount Factor

6.11.1 TEDA has proposed a discount factor of 9.53% while TANGEDCO used a discount factor of 9.57% for their Levelised Cost Of Energy calculations. The Commission proposes to adopt a discount factor of 9.44%.

6.12 Life of plant and machinery

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

7.0 Tariff rate

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

Tariff Components	Values
Capital cost	Rs. 4.18 Lakhs Gross (before MNRE and GoTN subsidy) Rs.1.782 Lakhs (after subsidy)
CUF	19.00%
Daytime Grid availability factor	90%
Operation and maintenance expenses	1.5% on Gross Capital cost with an escalation of 5.72%
Insurance	0.35% on Gross Capital Cost for the first year and to be reduced at depreciated value.
Debt-Equity ratio	70:30
Life of plant and machinery	25 years
Return on Equity	17.60% (pre-tax)
Term of Loan	10 years with 1 year moratorium period
Interest on loan	10.55%
Depreciation	3.6% p.a
Working Capital components	one month O&M cost and two months receivables
Interest on working capital	11.55%
Discount factor	9.44%
Levellised Tariff	Rs.2.09

7.2   The tariff computed with the adopted parameters above result in solar energy tariff of **INR 2.09** per kWh (25 years fixed), which shall be the maximum solar energy tariff under the KUSUM-C scheme pilot project of 20,000 pumps. A summary of the input parameters for tariff determination and the worksheet for the levelised cost of energy(LCOE)   have been provided in Annexure 1 of this proposal.

7.3   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.

7.4 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 RESCO enters into a power purchase agreement with TANGEDCO shall not exceed the solar energy tariff determined in this Order.

7.5 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 of actual work progress.

7.6 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).

7.7 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. Therefore, Commission proposes that GoTN may make payments to the petitioner TEDA for the Gross energy generated under Component C of the KUSUM scheme. GoTN shall continue to pay subsidy to TANGEDCO for any energy drawn from TANGEDCO's grid over and above the consumption from solar power plants by the 20,000 numbers of grid connected agricultural pumpsets under this Component C of KUSUM scheme.

8.0   Incentive for Farmers

8.1   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.

8.2   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.

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

8.4   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. 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

8.5   The proposed scheme is with no cost impact to the farmer. Few other State Electricity Regulatory Commissions have provided incentive to the farmers but in these cases the farmer bears the balance cost of the rooftop system after the given subsidy. The Component C scheme of MNRE, GoI also does not envisage any payment of incentive. If still payment of incentive is considered to be a beneficial proposition, considering the fall in rates of solar rooftop power, Commission proposes that an incentive anywhere from Rs.0.50 per unit to Rs.1.00 per unit may

be paid for the net energy exported.

8.6 The Commission notes that TEDA and TANGEDCO have not spelled out the source of funds for the incentive to the Farmer. 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.

8.7 If all three entities converge on payment of incentive, the formula and methodology specified below may be adopted.

8.7.1 Formula to be used for the Farmer incentive mechanism:

> Incentive [INR] = ((Solar energy export [kWh] x export TOD factor) - (Grid energy import [kWh] x import TOD factor)) x Incentive rate [INR]

8.7.2 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.

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

(a) Energy import factor during peak demand hours: 2.0

(b) Energy export factor during peak demand hours: 1.5

(c) Energy import factor during off-peak demand hours: 1.0

(d) Energy export factor during off-peak demand hours: 1.0

8.7.4 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.

8.7.5   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.

8.7.6   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 in Tariff determination in para 6 above of this proposal.

8.7.7   Subject to the provision of clause 8.7.6, the amount of minimum incentive shall initially be fixed at INR 3,000 per annum for a 7.5HP pump - 11kW solar PV system.

8.7.8   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].

8.7.9   The incentive rate may initially be set at the per kWh rate to be adopted as per para 8.5 for the net exported energy (computed with the export and import energy TOD factors as per the formula given in clause 8.7.1) for a 7.5HP pump - 11kW solar PV system combination.

8.7.10 Since TANGEDCO already has a service provider relationship with the Farmer in the form of an electricity service connection, TANGEDCO may administer

the disbursement of the incentive to the Farmer on behalf of the Government. Government shall reimburse TANGEDCO for the actual Farmer incentives disbursed.

8.7.11 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.

8.7.11 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.

9.0 Energy Metering

9.1 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 GoTN to the Implementing agency(TEDA) 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.

9.2 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.

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

9.4   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.

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

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

9.7   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.

10.0   Technical Requirements

10.1   The solar PV system and the interconnection with the TANGEDCO 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.

10.2   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.

10.3   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.

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

11.0 Feeder Status

11.1 The 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.

12.0 Selection of Agricultural Farms

12.1 The Commission proposes 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 Component C of KUSUM- scheme.

13.0 Agreement with Farmer / Land Owner

13.1 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.

14.0 Convergence with micro-irrigation schemes

14.1 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.

(By order of the Tamil Nadu Electricity Regulatory Commission)

Secretary
Tamil Nadu Electricity Regulatory Commission

Annexure 1 - Tariff calculation

Assumptions		Unit	Value
1	Solar PV system capacity	kW	11.00
2	MNRE benchmark cost	INR / kW	38,000
3	Capital cost	INR / kW	39,000
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	%	17.60%
8	Interest on loan	%	10.55%
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)	%	1.50%
14	O&M annual increase	%	5.72%
15	Insurance (percentage of depreciated gross capital cost)	%	0.35%
16	Annual depreciation rate on *net* capital cost	%	3.60%
17	Working Capital - O&M	Month	1
18	Working Capital - receivables	Months	2
19	Interest on Working Capital	%	11.55%
20	Discount factor	%	9.44%
21	Economic life of system	Years	25
Levelised Cost of Energy		INR / kWh	**2.09**

	Funding		
	MNRE benchmark cost for installed capacity	418,000	INR
	Gross capital cost before subsidy	429,000	INR
	Capital cost eligible for subsidy	418,000	INR
	MNRE subsidy (INR)	125,400	INR
	Capital cost after MNRE subsidy	303,600	INR
	Government of Tamil Nadu subsidy	125,400	INR
	Capital cost after MNRE subsidy and GoTN subsidy	178,200	INR
	Equity	53,460	INR
	Loan	124,740	INR

	Total Funding Check - % of Gross Capital Cost		
	MNRE contribution	29.23%	%
	Tamil Nadu Government contribution	29.23%	%
	Equity	12.46%	%
	Loan funding	29.08%	%
	Total Funding (% of gross capital cost)	**100.00%**	**%**

	Total Funding Check - % of Net 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**	**12**	**13**
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

Cost of Solar Energy Generation													
Return on equity	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409
Interest on Loan	13,160	13,160	11,844	10,528	9,212	7,896	6,580	5,264	3,948	2,632	1,316	-	-
Operation and Maintenance (O&M)	6,435	6,803	7,192	7,604	8,039	8,498	8,984	9,498	10,042	10,616	11,223	11,865	12,544
Insurance	1,502	1,447	1,393	1,339	1,285	1,231	1,177	1,123	1,069	1,015	961	907	853
Depreciation	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415
Interest on O&M Working Capital	62	65	69	73	77	82	86	91	97	102	108	114	121
Sub-total	**36,983**	**37,300**	**36,323**	**35,368**	**34,437**	**33,532**	**32,652**	**31,801**	**30,980**	**30,189**	**29,432**	**28,711**	**29,342**
Interest on Receivables Working Capital	712	718	699	681	663	645	629	612	596	581	567	553	565
Total cost	**37,695**	**38,018**	**37,022**	**36,049**	**35,100**	**34,177**	**33,281**	**32,413**	**31,576**	**30,771**	**29,999**	**29,263**	**29,907**
	-	-	-	-	-	-	-	-	-	-	-	-	-
Total cost per kWh	**2.29**	**2.31**	**2.25**	**2.19**	**2.13**	**2.07**	**2.02**	**1.97**	**1.92**	**1.87**	**1.82**	**1.78**	**1.81**

Levelised cost of Energy													
Discount Factor	1.00	0.91	0.83	0.76	0.70	0.64	0.58	0.53	0.49	0.44	0.41	0.37	0.34
Present Value	2.29	2.11	1.88	1.67	1.48	1.32	1.18	1.05	0.93	0.83	0.74	0.66	0.61

Solar Energy Generation													
Year-->	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	**Total**
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	411,939

Cost of Solar Energy Generation													
Return on equity	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	9,409	235,224
Interest on Loan	-	-	-	-	-	-	-	-	-	-	-	-	85,540
Operation and Maintenance (O&M)	13,261	14,020	14,822	15,670	16,566	17,514	18,515	19,575	20,694	21,878	23,129	24,452	339,441
Insurance	799	745	691	637	583	529	474	420	366	312	258	204	21,321
Depreciation	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	160,380
Interest on O&M Working Capital	128	135	143	151	159	169	178	188	199	211	223	235	3,267
Sub-total	**30,012**	**30,724**	**31,479**	**32,281**	**33,132**	**34,035**	**34,992**	**36,008**	**37,084**	**38,225**	**39,434**	**40,716**	**845,173**
Interest on Receivables Working Capital	578	591	606	621	638	655	674	693	714	736	759	784	16,270
Total cost	**30,590**	**31,315**	**32,085**	**32,903**	**33,770**	**34,690**	**35,666**	**36,701**	**37,798**	**38,961**	**40,193**	**41,500**	**861,443**

Total cost per kWh													
	1.86	**1.90**	**1.95**	**2.00**	**2.05**	**2.11**	**2.16**	**2.23**	**2.29**	**2.36**	**2.44**	**2.52**	52.28

Levelised cost of Energy													
Discount Factor	0.31	0.28	0.26	0.24	0.22	0.20	0.18	0.16	0.15	0.14	0.13	0.11	0.42
Present Value	0.57	0.54	0.50	0.47	0.44	0.42	0.39	0.37	0.35	0.32	0.31	0.29	0.87

Levelised cost of energy INR	2.09	*per kWh*	

Depreciation calculation

Year-->	1	2	3	4	5	6	7	8	9	10	11	12	13
Depreciation on gross capital cost	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444
Depreciation on gross capital cost - cumulative	15,444	30,888	46,332	61,776	77,220	92,664	108,108	123,552	138,996	154,440	169,884	185,328	200,772
Depreciation on net capital cost after subsidies	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415
Depreciation on net capital cost after subsidies - cumullative	6,415	12,830	19,246	25,661	32,076	38,491	44,906	51,322	57,737	64,152	70,567	76,982	83,398

Depreciation calculation

Year-->	14	15	16	17	18	19	20	21	22	23	24	25	Total
Depreciation on gross capital cost	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	15,444	386,100
Depreciation on gross capital cost - cumulative	216,216	231,660	247,104	262,548	277,992	293,436	308,880	324,324	339,768	355,212	370,656	386,100	386,100
Depreciation on net capital cost after subsidies	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	160,380
Depreciation on net capital cost after subsidies - cumulative	89,813	96,228	102,643	109,058	115,474	121,889	128,304	134,719	141,134	147,550	153,965	160,380	160,380

Working Capital Calculation

Year-->	1	2	3	4	5	6	7	8	9	10	11	12	13
O&M Working Capital	536	567	599	634	670	708	749	792	837	885	935	989	1,045
Interest on O&M Working Capital	62	65	69	73	77	82	86	91	97	102	108	114	121

Receivables Working Capital	6,164	6,217	6,054	5,895	5,740	5,589	5,442	5,300	5,163	5,032	4,905	4,785	4,890
Interest on Receivables Working Capital	712	718	699	681	663	645	629	612	596	581	567	553	565

Working Capital Calculation													
Year-->	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	**Total**
O&M Working Capital	1,105	1,168	1,235	1,306	1,381	1,459	1,543	1,631	1,725	1,823	1,927	2,038	28,287
Interest on O&M Working Capital	128	135	143	151	159	169	178	188	199	211	223	235	3,267
Receivables Working Capital	5,002	5,121	5,247	5,380	5,522	5,672	5,832	6,001	6,181	6,371	6,572	6,786	140,862
Interest on Receivables Working Capital	578	591	606	621	638	655	674	693	714	736	759	784	16,270

Debt Servicing													
Year -->	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Debt opening balance	124,740	124,740	112,266	99,792	87,318	74,844	62,370	49,896	37,422	24,948	12,474	-	-
Debt repayment	-	12,474	12,474	12,474	12,474	12,474	12,474	12,474	12,474	12,474	12,474	-	-
Debt closing balance	124,740	112,266	99,792	87,318	74,844	62,370	49,896	37,422	24,948	12,474	-	-	-
Interest	13,160	13,160	11,844	10,528	9,212	7,896	6,580	5,264	3,948	2,632	1,316	-	-
Total debt service	**13,160**	**25,634**	**24,318**	**23,002**	**21,686**	**20,370**	**19,054**	**17,738**	**16,422**	**15,106**	**13,790**	**-**	**-**

Debt Servicing													
Year -->	14	15	16	17	18	19	20	21	22	23	24	25	Total
Debt opening balance	-	-	-	-	-	-	-	-	-	-	-	-	124,740
Debt repayment	-	-	-	-	-	-	-	-	-	-	-	-	124,740
Debt closing balance	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	-	-	-	-	-	-	-	-	-	-	-	-	85,540
Total debt service	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**210,280**

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

Typical Single Line Diagram for Solar PV System at agricultural farm