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वित्तीय और वाणिज्यिक मूल्यांकन प्रभाग

Sewa Bhawan, New Delhi

10.10.2024

Subject: सरकारी भवनों पर रूफटॉप सोलर के लिए प्रति यूनिट बिजली शुल्क निर्धारित करने की पद्धति - संबंध में/ **Methodology to determine per unit Electricity Charges for Rooftop Solar on Government Buildings - reg.**

The undersigned is directed to refer to Joint Secretary, MNRE's DO letter no. 318/14/2024-GCRT dated 18.07.2024 on the above subject requesting CEA to frame the methodology to determine per unit Electricity Charges for Rooftop Solar on Government Buildings in "SIP owned deployment" mechanism prescribed in "Operational Guidelines for the Saturation of Government Buildings with Rooftop Solar under the PM Surya Ghar: Muft Bijli Yojana" issued by MNRE.

2. The matter has been examined in consultations with the identified System Implementation Partners, MNRE, SECI and MoP. Based on discussion, methodology to determine **per unit Electricity Charges for Rooftop Solar on Government Buildings** in "SIP owned deployment" mechanism has been finalised and the same is enclosed for information and necessary action please.

3. This issues with the approval of Chairperson, CEA.


(Chander Prakash)
Assistant Director

Shri Ajay Yadav
Joint Secretary
Ministry of New and Renewable
New Delhi

Copy to:

1. Joint Secretary (Distribution), Ministry of Power
2. CMD, NTPC Ltd
3. CMD, NHPC India Ltd
4. CMD, SJVN Ltd

5. CMD, THDC India Ltd
6. CMD, PGCIL
7. CMD, EESL
8. CMD, SECI
9. CMD, NEEPCO
10. CMD, DVC
11. CMD, REMC Ltd
12. CMD, NVVN Ltd

Methodology to determine per unit Electricity Charges for Rooftop Solar on Government Buildings

1. Background

1.1 The Government of India (GoI) has approved the "PM Surya Ghar: Muft Bijli Yojana" on February 29, 2024, with a financial outlay of ₹75,021 crore. The scheme aims to boost solar rooftop capacity and enable residential households to generate their own electricity. In addition to it, a key target under the scheme is to ensure that all government rooftops under the administrative control of Central government Ministries/ Departments, including autonomous bodies, subordinate offices etc., shall be saturated with roof top solar (RTS) to the extent that is technically feasible by 31st Dec 2025.

1.2 In line with the initiative, MNRE has issued Operational Guidelines for Saturation of Government Buildings with Rooftop Solar under the PM Surya Ghar: Muft Bijli Yojana vide Office Memorandum dated 03.07.2024. These guidelines outline the process for implementing rooftop solar systems on buildings at both the Central and State/UT government levels. MNRE has designated Central Public Sector Enterprises (CPSEs) as Scheme Implementation Partners (SIPs) to facilitate the deployment of rooftop solar on government buildings, with Ministries, Departments, States, and UTs assigned to them for this purpose.

1.3 The SIPs may create Special Purpose Vehicles or fully owned subsidiaries to undertake the work assigned in respect of Ministries/Departments/States/UTs. Central Ministries/State Departments can choose a SIP other than the assigned SIP or may undertake the rooftop solarisation itself. The SIP shall be the primary agency to assist the Ministry/Department assigned in achieving rooftop saturation and act as single point contact with MNRE.

1.4 The operational guidelines propose four mechanisms for achieving rooftop solar saturation in government buildings, one of which is the 'SIP-owned Deployment' mechanism.

1.5 In the **Mechanism-I- 'SIP owned Deployment'** model, the SIP shall undertake to invest its own resources as part of their capital expenditure plans to install, own and operate the rooftop solar plants for the Ministry/Department. The SIP may undertake its own Engineering, Procurement and Construction (EPC) contracts as it may deem fit, and install RTS plants in the sites. The power generated from these sites shall be sold by the

SIP to the concerned building unit connection (herein after referred as Procurer) at a particular per unit charge of electricity. The title to the solar power supplied by SIP shall pass to Procurer at the Delivery Point. Any surplus power generated by RTS Plants, which is not consumed by the Procurer, may be fed into the local DISCOM grid through appropriate metering arrangements.

1.6 In this mechanism, the SIP may either (1) undertake price discovery through EPC tenders or (2) undertake installation through its own pre-existing entities in which competitive rate discovery is not undertaken or only partly undertaken. In both cases, the SIP arranges the equity and debt financing for the implementation. CEA has been designated to establish a methodology to determine state-wise applicable per unit charges (single levelized charge for entire PPA period) of electricity for above two cases.

2. Consultations with stakeholders

2.1 Meetings were held on 30.08.2024 and 27.09.2024, under the chairmanship of Member (E&C), Central Electricity Authority (CEA) with representatives of Ministry of Power, Ministry of New & Renewable Energy and identified SIPs to get their inputs on the proposed methodology for determining per unit electricity charges for rooftop solar installations on government buildings under the **Mechanism-I- 'SIP owned deployment'** model.

2.2 In the meeting it was noted that most of the identified SIPs preferred the Mechanism-3: Process Management Consultant approach. PGCIL informed that they are preferring **Mechanism-3: Process Management Consultant** and **Mechanism-4: Turnkey Project** (Funding by Ministry/Department and maintenance by SIP for at least 5 years). NVVN informed that they are also offering **Mechanism-1: SIP Owned Development**.

2.3 It was also informed in the meeting that as per the guidelines, the choice of mechanism shall be mutually decided between the Ministry/ Department and the SIP, and the SIP shall present all feasible alternatives to the Implementing Ministry/State/UT in order for it to decide on its implementation plan. It was also pointed out that the mechanism for determining **per unit Electricity Charges** should be simple so that the roof/building owners could easily understand. However, it was noted that a methodology for Mechanism-I needed to be prepared as per the guidelines.

2.4 Based on the discussions in the meeting and input received from SIPs the methodology for **Mechanism-I 'SIP owned deployment'** has been finalized and the same is described in subsequent section.

3. Methodology for determination of per unit Electricity Charges under Mechanism-I SIP owned development

3.1 Principles for per unit Electricity Charges determination

(a) Price discovery through EPC tenders

In this mode, SIP will float tender for installation of RTS. The capital cost discovered through competitive bidding process will be taken as the capital cost. The SIP will make part-payment to EPC vendor during construction phase, and accordingly, 5% of capital cost will be taken as IDC component and the same will be added to capital cost.

Thereafter, the annual revenue requirement may be calculated based on cost recovery mechanism through five components viz. (1) Return on Equity (2) Depreciation, (3) Interest on loan , (4) O&M expenses and (5) Interest on working capital.

Thereafter, the estimated generation from the RTS is to be calculated based on agreed Capacity Utilisation Factor (CUF) between the SIP and the Procurer. The levelized **per unit Electricity Charges** may be calculated by discounting the **per unit Electricity Charges** for the life of the project (10-25 years) at an appropriate discount rate.

The applicable **per unit charge of electricity** shall include a 5% administrative overhead to the SIP exclusive of taxes.

(b) Installation through its own pre-existing entities in which rate discovery of any kind is not undertaken or partially undertaken

In this mode, SIP will undertake installation of RTS through pre-existing entities and cost discovery has not been envisaged. In such case, CEA is required to establish a methodology to determine the State-wise applicable per unit charge of electricity for a given aggregation of locations. The Guidelines have mentioned that in the methodology the following factors shall be considered:

1. Current indexed price of solar modules and expected capital costs of the SIP.
2. EPC tender rate discoveries for similar bids undertaken by other SIP for projects under PM Surya Ghar Scheme.

3. Level of clustering and distributed nature of installations and associated higher overhead costs.
4. Included components of special configurations (nature of inverters, battery storage and backup levels etc.)
5. Nature of location of Installation
6. Adequate returns on capital for SIP after accounting for all relevant costs incurred
7. The methodology should also lay out necessary conditions relating to grid outage and settlement of deemed generation, standards of service by installations and norms for automatic reporting and billing for generated energy by such installations.

It may be noted that, in this case there is no competitively determined capital cost and the methodology would need to specify a proxy for its estimation such as (1) Current indexed price of solar modules and expected capital costs of the SIP or (2) EPC tender rate discoveries for similar bids undertaken by other SIP for projects under PM Surya Ghar Scheme.

Based on discussion with SIPs and prevailing rate of Solar Project Cost, the capital cost shall be taken Rs 40,000/kW. The same would be reviewed every 6 months.

The SIP will make part-payment to EPC vendor during construction phase, and accordingly, 5% of capital cost will be taken as IDC component and the same will be added to capital cost

Based on the capital cost arrived, the levelized **per unit Electricity Charges** computation mechanism would be similar to the price discovery through EPC tender case.

3.2 Parameters to be adopted for determination of per unit Electricity Charges

The **term of PPA shall be** mutually agreed between the SIP and the Ministry/Department. Post PPA period, the owner of the roof top/building will be handed over the system free of charge. Various parameters to be used for determination of **per unit Electricity Charges** shall be considered as given in Table 1.

Table:1—Parameters for computation of per unit Electricity Charges

Sl. No	Parameter	Recommended values
1	Hard cost (including solar PV modules, inverters/PCUs, module mounting structures, array junction boxes, DC	Based on EPC tender Or

	distribution boxes, AC distribution boxes, protection systems (earthing, lightning, surge protection), cables, meters and other miscellaneous items)	Rs. 40000/kW [#] (when no cost discovery takes place through EPC tendering)
1A	IDC	5% of Capital Cost
1 B	Total Capital Cost	Sum of row (1)+ row (1A)
2	Debt	80%
3	Equity	20%
4	Return on Equity (to be Grossed up by effective tax rate) -RoE	14%
5	Depreciation	100% capital cost spread over 25 years as under: • 5.33% per year for 15 years and • 2% for balance 10 years
6	Salvage Value	Nil
7	Interest Rate on Loan (I_R)	SBI MCLR for one year +100 basis points
8	O&M rate	2.0% of Capital cost ; escalation @ 5.25% per year
9	Working Capital Requirement (WC)	1% of Project Cost @ interest rate of one year SBI MCLR +200 basis point
10	Discount Rate	WACC = $[(0.8 \times RoE) + [0.2 \times I_R \times (1 - T_c)]]$, where: • I_R= Interest Rate on loan • T_c = the current tax rate
11	Panel degradation factor (P_{DF})	0.7% per year
12	CUF	13.5% in case of special category states \$,

		15% for all other states
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Notes:

Capital cost of Rs. 40,000/kW is benchmark cost and shall be reviewed after every 6 months.

\$ Special category states - North Eastern States including Sikkim, Uttarakhand, Himachal Pradesh, UTs of Jammu & Kashmir, Ladakh, Lakshadweep, and Andaman & Nicobar Islands.

There may be variation in the parameters from the ones given in Table from State to State and from site to site. Therefore, the parameter values in the Table-1 including CUF values are for the guidance only. SIP and the Procurer may mutually decide any other parameter values.

3.3 Methodology to be adopted for determination of per unit Electricity Charges

PPA period has been considered as 25 years to determine the per unit electricity charges. With above capital cost, different components of **per unit Electricity Charges** will be determined as under:

Table 2: Computation of per unit Electricity Charges

1.A	Total Capital Cost	C_0
1.B	Installed Capacity	IC
2.A	RoE component	20% of C_0 x RoE as per Table 1
2.B	Interest on Loan (reducing balance)	I_R x average of opening and closing balances for a year
2.C	O&M Component (OM)	Applicable O&M rate x C_0
2.D	Interest of Working Capital Component (IWC)	1% of C_0 x working capital interest rate as per Table 1
2.E	Annual Depreciation	5.33% per year for 15 years and 2% for balance 10 years

3	Total Expenses for year (En)	Sum of Row 2.A+2.B+2.C+2.D+2.E
4	Annual Generation (nth year) (Gn)	IC x CUF (Table 3) x 8760 x Cumulative P _{DF}
5	Per unit Electricity Charges for year (Rs/kWh)	Row 3/ Row 4

The applicable **per unit Electricity Charges** for each year will be worked out based on the above mechanism.

Levelized **per unit Electricity Charges** to be charged during terms of the PPA will be as under:

$$= \frac{\sum_{n=1}^N En / [Gn * (1 + r)^{n-1}]}{\sum_{n=1}^N \frac{1}{(1 + r)^{n-1}}}$$

Where

r= Discount Rate= WACC

n = year

N = 25 years (term of the PPA)

As mandated in the Operational Guidelines, in case, the installation of RTS is done through EPC tender mode, 5% administrative overhead exclusive of taxes will be payable to the SIP.

SIP may charge a lower tariff based on mutual agreement with the Procurer. However, per unit charge of electricity to the Ministry/Department shall not be more than the DISCOM tariff applicable to the Ministry/Department during solar hours.

3.4 Sample Calculation

Based on parameters mentioned in Table -1, capital cost of Rs. 40,000 per kW, IDC @ 5% of capital cost, interest rate @ 9.65%, interest on working capital @ 10.65%, discount rate @ 8.58%, tax rate of 25.17%, the estimated levelized tariff of RTS works out to be as under:

CUF (15%)	Rs. 5.21 per unit
CUF (13.5%)	Rs. 5.79 per unit

The sample calculation sheet is attached at **Annex-I**.

3.5 Grid outage and settlement of deemed generation

The Procurer shall be liable for payment for likely generation, which could not be generated due to reasons solely attributable to Procurers. Deemed Generation shall be applicable in following situations:

- a) If any part of the capacity of the RTS is unable to operate at full capacity due to non-availability of load.
- b) RTS is capable of generating power more than the available load with the Procurer and the Procurer is not able to export the excess units generated, due to faults in the equipment of the Procurer e.g., Net meter cables, Equipment, etc.
- c) Procurer may carry out any activity requiring partial or complete temporary disassembly or movement of the System, resulting in a disruption or outage of System

In such cases, SIP shall inform the Procurer furnishing the calculation for loss in generation supported by the relevant data, which shall be approved by Procurer within one month of submission failing which SIP shall be entitled to Deemed Generation and shall claim provisional Deemed Generation till the issue is finally settled

However, the Procurer and the SIP may mutually decide the provisions regarding the deemed generation and applicable tariff for such deemed generation.

3.6 Standards of service by installations and norms for automatic reporting and billing for generated energy

The metering infrastructure shall be capable of automatic meter reading and alerts through SMS should be available. The installation and metering provisions shall adhere to all applicable rules and regulations issued by the Authority, Regulatory Commissions, etc.

For a specific Ministry/Department the SIP may aggregate the total bill for payment or may raise to each building occupier as the case may be depending upon the MoU terms. The SIP shall have appropriate software for automatic bill generation and aggregation. Billing and supply period shall generally be a month. The bills shall be raised within three days of the supply period and the same shall be payable by the Ministry/Department/Occupier within seven days of issue.
