SR No: 4/2019

BEFORE THE
ANDHRA PRADESH ELECTRICITY REGULATORY COMMISSION
FOR THE STATE OF ANDHRA PRADESH

FILE NO:

Petition No. 32 /2019

IN THE MATTER OF:

Seeking approval of the Hon'ble Commission for implementation of Utility driven Solar Roof Top (SRT) program devised under the Technical Assistance titled 'Power Sector Reform Program' supported by UK's Department for International Development (DFID). Following 2 Models are proposed for implementation under the said support;

Model 1:'Customer owned Solar Rooftop Program' on net metering basis with EMI partly shared by Discom on NPV neutral basis

Model 2: "Grid Connected Roof Top Solar PV Systems on Developer Model under Gross Metering".

AND

Eastern Power Distribution Company of Andhra Pradesh Limited- Petitioner

Affidavit

I, G. Sarath Kumar, Son of Late Sri. G. Rama Murthy, aged about 57 *Years*, residing at *Visakhapatnam* the deponent named above do hereby solemnly affirm and state on oath as under:-

1. That the deponent is the ***Chief General Manager/Energy Conservation*** of Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL) duly authorized by APEPDCL to make this affidavit on its behalf and the deponent is acquainted with the facts deposed below,

2. I, the deponent named above do hereby verify that the contents of the affidavit and those of the accompanying petition are true to my personal knowledge and verify that no part of this affidavit is false and nothing material has been concealed.

DEPONENT
Chief General Manager
Energy Conservation
Corporate Office
APEPDCL, Visakhapatnam

VERIFICATION.

The above named Deponent solemnly affirm at Visakhapatnam on this 19th day of January, 2019 that the contents of the above Affidavit are true to my knowledge no part of it is false and nothing material has been concealed there from.

DEPONENT
Chief General Manager
Energy Conservation
Corporate Office
APEPDCL, Visakhapatnam

Solemnly affirmed and signed before me

Andhra Pradesh Electricity Regulatory Commission
222
2019
576
Hyderabad

K.S.V.S. Sastry FCS8286
Company Secretary
CORPORATE OFFICE
Eastern Power Distribution
Company of A.P. Ltd.,
VISAKHAPATNAM

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Model 2: "Grid Connected Roof Top Solar PV Systems on Developer Model under Gross Metering"

AND

IN THE MATTER OF:

Eastern Power Distribution Corporation of Andhra Pradesh Ltd. (APEPDCL)-Petitioner

MOST RESPECTFULLY SHOWETH THE SUBMISSION:

1. The APEPDCL humbly submits following proposal to implement Utility driven Solar rooftop program under 2 Models;

   Model 1:'Customer owned Solar Rooftop Program' on net metering basis with EMI partly shared by Discom on NPV neutral basis

   a. Scheme involves installation of 'Customer Owned Solar Rooftop Systems' with EMI partly shared by Discom on NPV neutral basis for Domestic Category B Consumers having monthly consumption of 140 to 200 Units (SRT system size: 1-1.5 kWac). Utility shall lead the role of a facilitator in aggregating the consumer demand by obtaining a signed Consent Form from interested Consumer wherein Customer agrees to pay APEPDCL the EMI on his availed loan upto his/her present monthly electricity bill. Utility shall also discover the capital cost of a Solar Rooftop System per kWp basis. Utility shall facilitate consumer in availing loan from bank to meet the capital requirement post Central Financial Assistance (CFA) granted by Ministry of New and Renewable Energy (MNRE), by ensuring the collection and repayment of EMI of loan through consumer electricity bill. Consumer is expected to pay an amount equal to their present Utility bill towards his/her EMI during loan tenure and rest of EMI, if any, shall be shared by Discom. In case where Discom shares part of EMI, Consumer shall continue to pay his/her share of EMI for few more years beyond loan tenure so that EMI shared by APEPDCL during loan tenure is neutralized by amount paid by Consumer on NPV basis.

   b. As per the terms of this proposal, there is no direct capital investment requirement on Utility and Utility shall only contribute a part of EMI payable by consumer during the loan tenure. Once loan tenure is over, Utility shall continue to collect an amount equal to Consumer's share of EMI until it recovers an amount equal to EMI share paid by Utility's during the loan tenure on NPV neutral basis. The EMI share shall not exceed the cross subsidy allocated for such category of consumer as well.

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Model 2:"Grid Connected Roof Top Solar PV Systems on Developer Model under Gross Metering"

a. Under this Model, a Developer shall be selected through competitive bidding process based on tariff (INR/kWh) as bid parameter for supply of power under Gross Metering basis to APEPDCL for a tenure of 25 years utilizing the rooftop spaces of Consumer who are willing to share their rooftop space for SRT installation.

Setting the context:

i. The Govt. of India has put an ambitious plan to deliver 24x7 Power for All as well as a target of increasing renewable energy generation capacity to 175 GW by 2022 which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro-power. Of the 100 GW solar, 60 GW is targeted from ground mounted solar and 40GW from solar rooftop system.

ii. Even though regulatory and policy framework exist to support SRT implementation, progress made is not significant which is evident from the existing installed base of Solar Rooftop Projects which is meagre 1.9 GW.

iii. The ambitious plan of 175 GW of Renewable Energy by 2022 set by GoI translates to a 5 year target of 2000 MW for the State of Andhra Pradesh. Year wise target is shown below;

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	**Total**
Capacity (MW)	10	240	250	300	350	400	450	**2000**

iv. The installed capacity of solar rooftop project in the State of Andhra Pradesh is 47 MW as on 31stMarch 2018 which is not much impressive when compared to the target set.

v. The cost economics of rooftop solar projects are already attractive for certain high tariff paying category of consumers such as industrial, commercial and high end domestic segments. While industrial and commercial segments are gaining momentum owing to cost benefit and attractiveness of this consumer segment for developers/ financiers, the residential segment rooftop installations have not picked up. This has been due to variety of reasons including high upfront capital cost, weak business models, customer aggregation challenges, higher perceived default risk, lack of innovative financing mechanisms etc. Low-end domestic consumers would not be inclined to adopt solar until some innovative mechanism is in place as beneficiaries in this sector enjoy benefit of subsidized electricity rates.

vi. Under the guidance of Hon'ble Commission, APEPDCL has recently taken an important and innovative step to enable the penetration of solar rooftop systems for domestic Category B consumers in association with Andhra Bank. The program called **'AB Solar Rooftop Program'** kick-started in 2017.In this program, APEPDCL acts as a facilitator in aggregation of demand from consumers who are interested to have solar rooftop systems installed in order to meet their energy requirement through SRT and Andhra bank would fund the capital cost post 30% Central Financial Assistance (CFA)and 20% NREDCAP subsidy on Capex. While enrolling for the program, Utility would seek consumer to sign a Consent Form wherein he agrees to pay the monthly EMI on loan through his electricity bill and Utility would repay to the Bank. Consumer can choose any of the installation agencies empaneled by MNRE for design, supply, installation and commissioning of the system. Capex post subsidy would be credited to the account of installation agency in two tranches; one part when mobilization of work is started and second after successful commissioning of the system. Discom facilitates in availing necessary clearances required for installation such as issuing NoC after assessment of infrastructure, grid interconnections, metering etc.

vii. APEPDCL received widespread appreciation in implementing this innovative business model wherein risks specific to SRT such as high upfront capital cost, customer aggregation challenges, higher perceived default risk of loan etc. were addressed.

viii. So far, 212 installations have been completed and consumers are extremely happy as the cost of grid power have reduced in their electricity bill and they would be owning the system once the loan tenure ends and thereafter there would be significant savings in the electricity bill.

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ix. The number of beneficiaries turned up for enrolling in the 'AB Solar Rooftop Program' was limited due to the following reasons;
    1. High Capex of Solar Rooftop System and hence higher EMI burden compared to Consumer's Utility bill
    2. Word of mouth about marginal increase in the consumer bill due to an additional EMI component in the electricity bill during loan tenure
    3. Poor marketing, scalability and consumer awareness
    4. Lack of contribution from Utility in the EMI payable by consumer on loan taken during the loan tenure which Utility would have recovered during years beyond loan tenure.

x. In order for solar rooftop market potential to take off in a big way, it is important to garner support from utilities for the SRT programme. Further, tapping residential segment through the right business models is important for a wider scale up. Creating access to SRT solutions for this segment, especially the low end domestic consumers would also aid greatly in creating consumer empowerment through enabling energy security, greater energy affordability (by sheltering against future tariff increases), improving electricity reliability for this segment and above all, potential savings in the subsidy outgo of Government. This would also result in bringing tariff rationalization within subsidizing category of consumers.

About Department For International Development (DFID):

i. The UK's Department for International Development (DFID) has been supporting the power sector in India over the last two decades.
ii. To support the reforms process with sustainability, viability and modernization as design interventions, UK Government and Government of India have now approved a Technical Assistance titled 'Power Sector Reform Program' to be delivered over the next four years to support at national and state level.
iii. Work streams identified for this PSR Program are;
    1. Structural & Regulatory Reforms
    2. Power Markets
    3. RE Deployment & Grid Integration
    4. Utility Sustainability
    5. 24x7 Access & Stakeholder Welfare
iv. To enable solar rooftop off take, the PSR programme incorporates a work package on 'Utility driven SRT pilot' which aims to develop innovative business model options and a model framework for a utility driven solar rooftop model.
v. It is envisioned that a pilot scheme to implement utility driven solar rooftop model in one or two cities will help demonstrate the concept and the model. The information and the learning's can be disseminated across the country though workshops that can help promote rooftop market by demonstrating the following:
    1. Cost savings that can be achieved in roof top sector through utility driven model
    2. Utility driven model as a means of achieving an accelerated pace of roof top adoption by addressing key barriers and challenges preventing scale up
    3. How financing is enabled by lowering risks and also allowing a scalable opportunity for funds deployment
    4. Benefits of SRT adoption by low consuming residential consumer base - for consumers as well as utilities
vi. Once deployed, it will be first of its kind model in India in a public utility context demonstrating an implementable business model for utilities in SRT, adding net value to the sector as well as resulting in accelerated pace of adoption. The model will also demonstrate a feasible model of SRT adoption for low end residential consumer base.

Brief overview: Model 1- 'Customer owned Solar Rooftop Program' on net metering basis with EMI partly shared by Discom on NPV neutral basis

Overview:

Target consumers under the current scope of this program are consumers having monthly consumption of 140-200 units who falls within Category B (Annual consumption >900 &<=2,700 Units) domestic consumers.

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In the proposed model, Customer would be the owner of Solar Rooftop (SRT) system and Discom acts as an aggregator of customers and facilitates access to debt and collection of repayments from consumer. Discom would empanel installation agencies/Contractors for design, supply and commissioning of SRT systems with 5 year O&M. The SRT system shall be designed and supplied by Contractor in compliance with the Technical Standards prescribed by MNRE. CFA upto 30% of project cost shall be available for the project. Consumer shall fund remaining 70% of project cost in Debt to Equity ratio of 90:10. Discom would assist Consumer in availing loan from Bank. Consumer is expected to pay an amount equal to their present Utility bill towards his/her EMI on loan during loan tenure and rest of EMI, if any, shall be shared by Discom. In case where Discom shares part of EMI, Consumer shall continue to pay his/her share of EMI for few more years beyond loan tenure so that EMI shared by APEPDCL during loan tenure is neutralized by amount paid by Consumer on NPV basis.

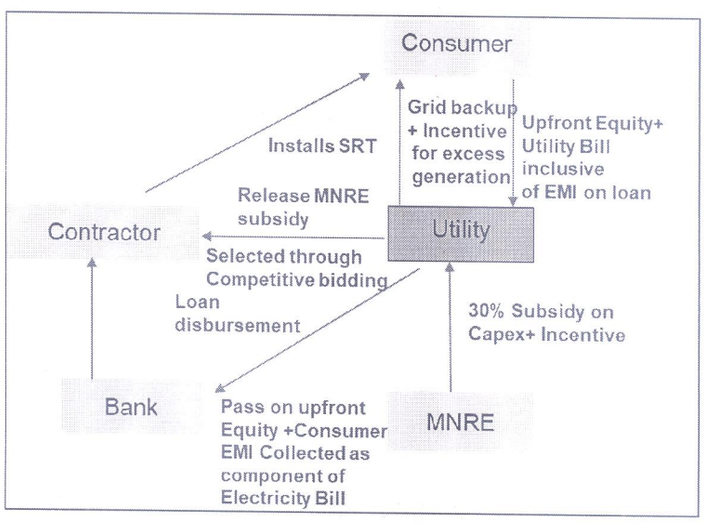
The generated solar power is primarily meant for consumer's own consumption designed on Net Metering basis and the surplus power, if any, will be fed to the grid.

Discom shall be performing following role:

1) Conduct consumer awareness workshops
2) Acting as an aggregator of consumer demand
3) Driving the vendor selection
4) Assisting in arranging financing for consumers
5) Collection of EMI from Consumer along with monthly Utility Bill and remit to Bank
6) Facilitate in availing applicable subsidy from Ministry of New and Renewable Energy (MNRE)

Financing of Capital costs:

- MNRE Capital Financial Assistance (CFA): 30%
- Customer share of Capex: 70% in ratio of D:E as 90:10
- Loan tenure for customers : 7 years



Customer owned Solar Rooftop - Schematic

Andhra Bank has conveyed it's willingness to offer following loan terms for funding Consumers;

- Loan tenure: 7 years
- Moratorium: 6 months (from the date of release of such upfront disbursal of loan or till the time first Utility Bill is generated under net metering billing system)
- Interest rate: 9.2%

Based on the loan terms mentioned above, following is the summary of total EMI on Consumer loan under optimistic and pessimistic scenarios and share of EMI which shall be borne by Discom on NPV neutral basis (same amount shall be collected from Consumer for additional years beyond loan tenure) for Consumers of monthly consumption of 140 and 200 units;

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Tender for 5MW pilot project is floated on 10th October 2018 by APEPDCL for selection of installation agencies for design, supply, installation and O&M for 5 years of Solar Rooftop Systems. Till the time Project cost and CUF are not finalized, following scenarios are prepared for determining the minimum and maximum EMI on Consumer loan amount and share of EMI required to be borne by APEPDCL;

Under Optimistic scenario, a project cost of INR 55,000/kW and CUF of 19% are considered for determining the EMI on Consumer loan amount. Similarly, a project cost of INR 60,000/kW and CUF of 16% are considered under pessimistic scenario for determining the EMI on Consumer loan amount.

Parameter	**Minimum SRT system Capacity**(to cater 140 Units consumption/Month)		**Maximum SRT system Capacity** (to cater 200 Units consumption/Month)	
	Optimistic scenario (Project cost: INR **55,000**/Kw, CUF: **19%**, Loan tenure: **7** years)	**Pessimistic scenario** (Project cost: INR **60,000**/Kw, CUF: **16%**, Loantenure:**7** years)	**Optimistic scenario** (Project cost: INR **55,000**/Kw, CUF: **19%**, Loantenure: **7** years)	**Pessimistic scenario** (Project cost: INR **60,000**/Kw, CUF: **16%**, Loantenure: **7** years)
Capacity of SRT System (kW)	**1**	1.2	1.5	**1.7**
Consumer Bill as per Tariff Order	404	404	620	620
EMI on loan	564	734	809	1048
Discom's share of EMI per consumer per month (INR/consumer/month)	**160**	330	189	**428**
Discom's share of EMI per consumer per unit per month (INR/unit/month/consumer)	1.6	3.3	1	2.14
Discom's share of EMI per consumer per year (INR/consumer/annum)	1,920	3,960	2,268	5,136
Discom's share of EMI per year for 5MW pilot project in (INR Crs) which would later be collected from Consumers on NPV Neutral basis	0.96	1.98	0.74	1.69
NPV of Discom's share of EMI shared during loan tenure for 5MW pilot project in (INR Crs) which would later be collected from Consumers on NPV Neutral basis	4.74	10	3.76	8.5

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Based on Consumer survey, it is observed that target Consumers are highly subsidized and hence are not willing to share any Capex in the form of upfront equity or pay an EMI higher than the Utility Bill. Hence support of APEPDCL for sharing part of EMI on Consumer loan on NPV Neutral basis is vital to make the scheme successful. Minimum and maximum EMI share of Utility shall be **INR 160** (for SRT system meeting consumption of 140 units/month) and **INR 428**(for SRT system meeting consumption of 200 units/month) respectively per consumer per month, under optimistic and pessimistic scenarios, as mentioned above. Depending upon the actual project cost discovered through tender, actual EMI may vary but within the range specified above and the same shall be considered.

Potential scalability

Total customer base size of Category B served by APEPDCL is approximately 17 lakh whose annual energy consumption was approximately 2885 MUs in FY2017. Assuming 12% of Category B customer base subscribe to the current solar rooftop scheme, SRT opportunity for the assumed metrics is ~ 85-90 MW.

Benefits to the consumers

1. Reduced costs of solar rooftop systems
2. Reduced default risks and improved confidence to financiers, thereby enable financing
3. Ensure quality and consumer confidence
4. Address implementation challenges such as interconnection delays, etc
5. Enable SRT adoption for consumer segments such as low end domestic consumers

Consumer shall get ownership of SRT system bearing only 10% of the Solar Roof Top cost. Once Loan tenure is over and additional years of EMI sharing is completed, Consumer shall meet electricity need equivalent to the Units generated from SRT system free of cost.

Benefits for the Discom

1. Reduced subsidy burden for low end domestic category of consumers

Currently Discoms are subsidizing low end domestic category of consumers. By meeting the consumption of subsidized category of consumers from Customer owned SRT systems under net metering basis, Discoms can reduce the subsidy burden and also bring down the overall power purchase cost.

A typical 1 kW Solar Rooftop System at 19% CUF would supply ~140 Units of energy on monthly basis. At present, Discom incur an average annual subsidy of INR 7,857[1] per Consumer on levelised basis while serving a Domestic Category B Consumer having average monthly consumption of ~140 units. On programmatic scale, assuming ~12% of Domestic Category B Consumers whose consumption lies within 100-200 units/month installs SRT system of 1 kW Capacity, subsidy savings shall be ~ INR 70 Crs.

In order to compute the savings under most pessimistic scenario, Consumption met from SRT shall be multiplied by the difference between Marginal Power Purchase Cost adjusted for T&D losses and Average Billing Rate which shall be the savings on Variable Cost alone. Average annual Savings under such scenario shall be INR 1711 per Consumer on levelised basis for 25 years. On programmatic scale, assuming ~12% of Domestic Category B Consumers whose consumption lies within 100-200 units/month installs SRT system of 1 kW Capacity, subsidy savings shall be ~ INR 15 Crs.

2. Better energy management

Peak demand sharing, easing of Distribution and Transmission constraints as well as capacity enhancement costs and avoiding purchase of expensive short-term power are other key drivers for a DISCOM entering the rooftop sector.

Brief overview: Model 2- "Grid Connected Roof Top Solar PV Systems on Developer Model under Gross Metering"

Chief General Manager
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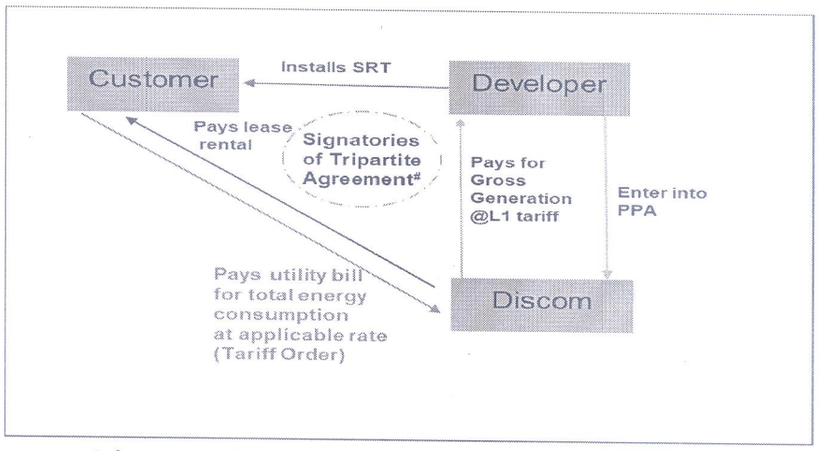
[1] Difference between Cost of Service and Bill Revenue on levelised basis for 25 years using a Discount Factor of 9%.

- Target Consumer shall be primarily domestic households or any Consumers having sufficient rooftop space.
- Utility shall aggregate rooftops of such Consumer willing to share their rooftop space for SRT installation.
- Developer to be selected through competitive bidding, shall set up Solar Rooftop (SRT) on gross metering basis on identified roof spaces so that generated power is primarily consumed locally.
- Bid parameter shall be the first year quoted tariff for supply of power. Tariff for remaining years shall be determined @3% escalation year on year.
- Utility shall pay Developer at quoted tariff (gross metering basis) and Consumers shall be incentivized for leasing their roof space in the form of lease rental (say INR 0.5/kWh) on gross generation.



Schematic of Gross Metering Model

For an SRT system of 1 kW Capacity, levelised cost of generation for 25 years is ~INR 3.19/kWh[2]. The first year if escalated at 3% annually for 25 years giving the same levelised cost of generation (~INR 3.19/kWh) is estimated at INR 2.52/kWh. The net tariff payable by Discom shall be INR 2.52 per kWh to Developer and a lease rental (say INR 0.5/kWh) on gross generation to Consumers as an incentive for leasing their rooftop which sums to INR 3.02/kWh for the 1st year of supply of Power. The Marginal Power Purchase Cost of APEPDCL for FY2018-19 is INR 3.58/kWh[3] and when adjusted for T&D loss[4]is INR 4.11/kWh.

Prayer

Thus, the APEPDCL humbly prays before the Hon'ble Commission to consider this petition and pass necessary orders on the following;

1. Allow APEPDCL to implement one pilot project, each of capacity 5 MW under the proposed Models (Model 1: 'Customer owned Solar Rooftop Program' on net metering basis with EMI partly shared by Discom on NPV neutral basis, Model 2: "Grid Connected Roof Top Solar PV Systems on Developer Model under Gross Metering")
2. Approve the mechanism of collecting the EMI on loan through consumer's electricity bills under Model 1 (Draft Consumer Consent Form and draft MoU to be entered with Andhra Bank)
3. Approve Utility's contribution in EMI repaymenton NPV neutral basis under Model 1
4. Pass necessary orders as deemed fit by the Hon'ble Commission

Place: VISAKHAPATNAM

Date: 19.01.2019

Chief General Manager
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[2] Project cost: INR 55,000/Kw, CUF: 19%, CFA: 30% of Project Cost, Debt: Equity ratio of remaining 70% Project Cost: 80:20, Loan tenure: 12 years, Interest rate: 9.2%, Developer RoE: 16%

[3] For Kudigi Power Station (211 MW)

[4] T&D loss of APEPDCL: 12.91%