MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

Maharashtra State Electricity Distribution Co. Ltd.
(A Govt. of Maharashtra Undertaking)
CIN : U40109MH20005SGC153645

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PLOT No. G-9, PRAKASHGAD
Prof. ANANT KANEKAR MARG
BANDRA (East)
MUMBAI-400051

No. SE/OA/Petition /Net metering/ 01921 Date: 19 JAN 2019

To,

The Secretary,

Maharashtra Electricity Regulatory Commission,

13th Floor, World trade Centre, Cuffe parade, Culaba,

Mumbai- 400005.

Sub: Petition for removal of difficulties in implementation under Regulation 14, 15 and 16 of the MERC (Net Metering For Roof-Top Solar photo Voltaic System) Regulation, 2015.

Respected Sir,

Please find enclosed herewith the MSEDCL's Petition for removal of difficulties in implementation under Regulation 14, 15 and 16 of the MERC (Net Metering For Roof-Top Solar photo Voltaic System) Regulation, 2015.

Thanking You!

Yours faithfully,

Superintending Engineer (Open Access)

Copy S.w.r. to:-

1) The Director, (Commercial), MSEDCL, Mumbai.

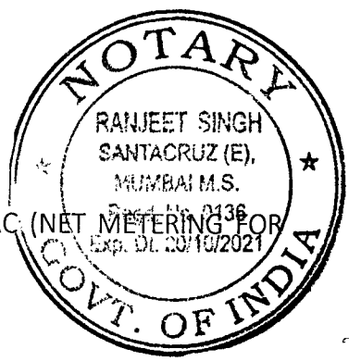
Copy to:

1) Prayas (Energy Group), Amrita Clinic, Athawale Corner, Deccan Gymkhana Karve Road, Pune 411 004.
2) Mumbai Grahak Panchayat, Grahak Bhavan, Behind Cooper Hospital, Vile Parle (West), Mumbai 400 056.
3) The General Secretary, Thane Belapur Industries Association, Robale Village, Post Ghansoli, Navi Mumbai 400 701.
4) Vidarbha Industries Association, 1st Floor, Udyog Bhavan, Civil Line, Nagpur 440 001.
5) Chamber of Marathwada Industries & Agriculture, Bajaj Bhavan, P-2, MIDC Industrial Area, Railway Station Road, Aurangabad – 431005
6) Maharashtra Chamber of Commerce, Industries & Agriculture, Oricon House, 6th Floor, 12 K, Dubash Marg, Fort, Mumbai – 400001.

BEFORE THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION,MUMBAI

FILING NO:

CASE NO:



IN THE MATTER OF

PETITION FOR REMOVAL OF DIFFICULTIES IN IMPLMENTATION OF MERC (NET METERING FOR ROOF-TOP SOLAR PHOTO VOLTAIC SYSTEMS) REGULATIONS, 2015

AND

IN THE MATTER OF

REGULATION 14, 15 and 16 OF THE MERC (NET METERING FOR ROOF-TOP SOLAR PHOTO VOLTAIC SYSTEMS) REGULATIONS, 2015

AND

IN THE MATTER OF

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED –
THE PETITIONER

Maharashtra State Electricity Distribution Company Ltd. respectfully submits as under:

1. Background

1.1. Maharashtra State Electricity Distribution Co. Ltd. (hereinafter to be referred to as "MSEDCL" or "the Petitioner") has been incorporated under Indian Companies Act, 1956 pursuant to decision of Government of Maharashtra to reorganize erstwhile Maharashtra State Electricity Board. The Petitioner submits that the said reorganization of the MSEB has been done by Government of Maharashtra pursuant to "Part XIII – Reorganization of Board" read with section 131 of The Electricity Act 2003. The Petitioner has been incorporated on 31.5.2005 with the Registrar of Companies, Maharashtra, Mumbai has obtained Certificate of Commencement of Business on 15th Sep 2005. The Petitioner is a Distribution Licensee under the provisions of the Electricity Act, 2003 (EA, 2003) having license to supply electricity in the State of Maharashtra except some parts of city of Mumbai.

1.2. The Petitioner is a Company constituted under the provisions of Government of Maharashtra, General Resolution No. PLA-1003/C.R.8588/Energy-5 dated 25th January 2005 and is duly registered with the Registrar of Companies, Mumbai on 31st May 2005.

1.3. The Petitioner is functioning in accordance with the provisions envisaged in the Electricity Act, 2003 and is engaged, within the framework of the Electricity Act, 2003, in the business of Distribution of Electricity to its consumers situated over the entire State of Maharashtra, exceptMumbai City & its suburbs (excluding Mulund&Bhandup). Petitioneris serving role of both Supply and Wire Licensee.

1.4. It is most respectfully submitted that the Hon'ble Commission has issued the MERC (Net

Metering for Roof-top Solar Photo Voltaic Systems Regulations), 2015 vide its No. MERC/Legal/2015/639 on 10th September 2015 ("Hereinafter to be referred as Net Metering Regulations 2015"). The Net metering Regulations 2015 were applicable for the consumers installing a Roof-top Solar PV system below 1 MW only.

1.5. Subsequently, the Hon'ble Commission issued the 1st Amendment to the Net Metering Regulations 2015 on 21st July 2017. The said Amendment has broadened the ambit of existing Net Metering Regulations, 2015 by encompassing all approved RE sources and a combination thereof i.e. hybrid systems.

1.6. Considering the exponential growth in the Solar Roof-top Connection affecting the financial viability of the Distribution Licensee and resulting in additional burden on the consumers tariff, Petitioner hereby files its petition under clause 14, 15 and 16 of MERC (Net Metering for Roof-top Solar Photo Voltaic Systems Regulations), 2015 requesting the Hon'ble Commission for review of the regulations considering the issues and difficulties submitted in the Petition.

1.7. It is submitted that the petitioner is revenue neutral considering the impact of the Net Metering Regulations as any change in sales and revenue mix will be a pass through which is subsequently reimbursed by the petitioner through tariff from the consumers. However, it has direct impact on the consumers of the petitioner which results in higher effective rate for electricity consumed by the consumers and increase in cross subsidy impact on the subsidized consumers.

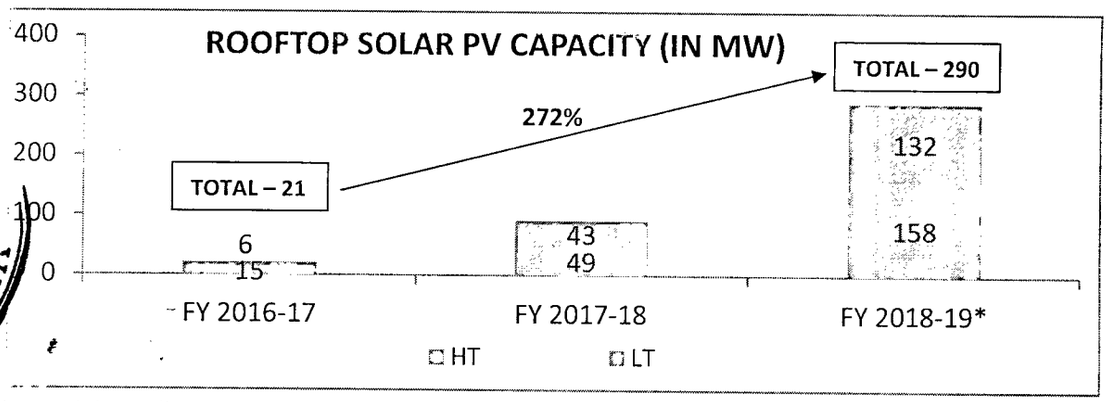
1.8. The specific grounds on which the review of the clause of the MERC (Net Metering for Roof-top Solar Photo Voltaic Systems Regulations), 2015 is being sought have been identified in the subsequent paragraphs.

2. Replace Net Metering with Gross Metering

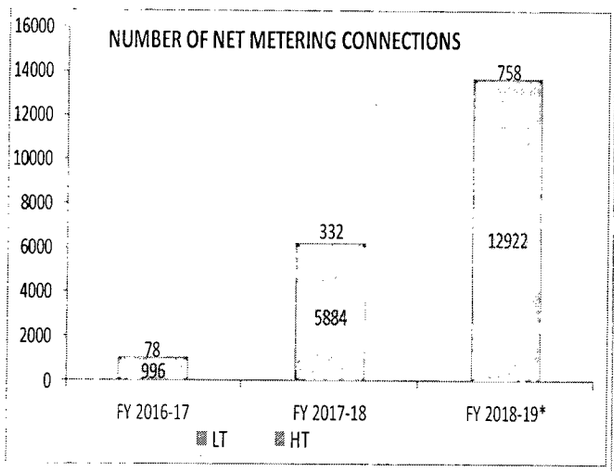
2.1. The Petitioner submits that Net Metering is growing rapidly as a large number of consumers (Residential, Commercial, Industrial, etc.) are installing rooftop renewable energy systems. Further, the primary objective of Net Metering is to harness renewable energy (especially solar) by way of captive generation and the primary philosophy is to incentiviseconsumers. Also, Net metering is a tool that has been used to meet various policy objectives such as Promoting distributed generation energy and Promoting solar and/or other renewables source of energy.

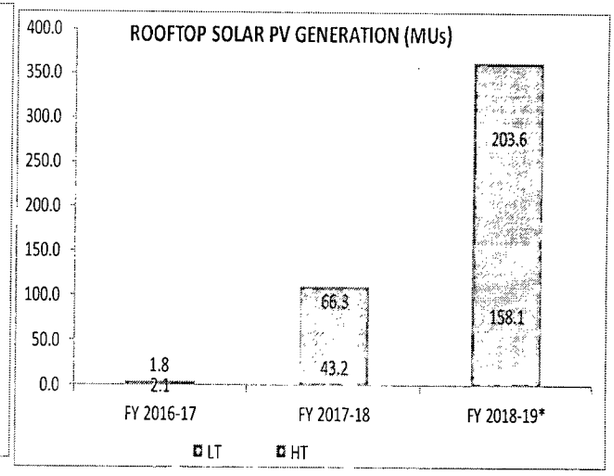
2.2. Net-metering is commonly known as a practice by which owners of Renewable generation units may offset their electricity consumption from the grid with their captive generation. The increasing number of prosumers (consumers that both produce and consume electricity) with solar photovoltaic (PV) generation combined with net-metering results in reduced revenue and impacting cross subsidy for many Distribution Licensee worldwide. Consequently, this pushes utilities to increase tariff in order to recover costs. For non-PV owners, this could result into inequality issues due to the fact that also non-PV owners have to pay higher chargers for their electricity consumed to make up for netted costs of PV-owners. Accordingly this petition is filed to highlight the inequality issues caused by net-metering and the effects on cross-subsidies.

2.3. MSEDCL submits that an exponential growth has been witnessed in Rooftop Solar PV installations in Maharashtra with the cumulative capacity installation rising 10 times i.e. from 20.44 MW (1074 net metering connections) in FY2016-17 to 207.49 MW (10570 net metering connections) till October month of FY 2018-19. A graphical representation of the steep rise in rooftop solar PV capacity installations and net metering connections has been depicted in the graphs below:



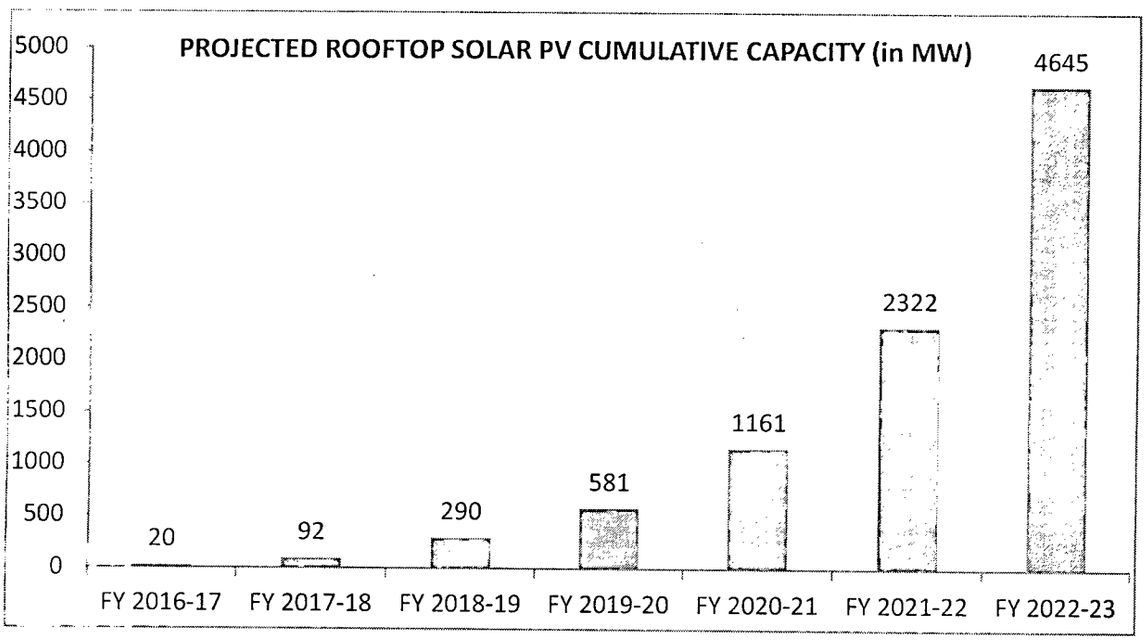
*Actual data till October 2018 projected till March 2019on pro-rata basis





*Calculated in pro-rata basis to MW addition

2.4. The implementation of Rooftop Solar has witnessed an exponential growth from 20 MW to 207 MW (as on October 2018) in just 3 years resulting in CAGR of 376%. However, considering that such growth may not be witnessed in future, but still considering the 100% growth per year, the expected MW which will be converted under such Net Metering Regulations and enjoying the benefit of saving at the cost of the consumers of Distribution licensee will be around 4645MW in FY 2022-23 which will have a major impact on the Grid as well as financial stability of the Distribution Licensee and additional burden on the consumers.



2.5. Also, considering the current situation whereby the growth in rooftop solar PV systems has been significant and around 100 MUs is being generated which is adversely impacting

MSEDCL. Of the energy consumed, maximum energy is consumed by HT Consumers who are subsidising consumers and in event of any decrease in consumption from Distribution Licensee will have a direct impact on additional burden by way of increase in tariff on Subsidised consumers. Also, under LT segment, usually the high end residential consumers opt for Solar Roof-top which results in lower consumption from grid and gets the subsidised rate of bill for that power consumed as the telescopic impact gets reduced. This results in injustice to the low end residential consumers as the subsidised rate benefit is not been availed by High end Residential consumers. Accordingly, if distribution licensee increase rates to cover such shortfalls due to loss of cross subsidy, customers without solar end up paying more while solar owners continue to offset through net-metering.

2.6. Envisaging such huge growth in the Solar Roooftop installation, the impact on the cross subsidy and direct burden on the end subsidised consumers of MSEDCL will be huge. The Petitioner submits that Net Metering of rooftop solar PV generation is severely impacting the financial position of MSEDCL since a major component of the total costs that needs to be recovered by Distribution Utilities from consumers through tariffs is the fixed cost. Net metering consumers buy less power from the distribution utilities since part of the consumer's demand is met through the energy generated from their solar PV systems and therefore they contribute less towards recovery of MSEDCL's fixed costs as these fixed costs are part of the marginal charge for the electricity they buy. This has led to utilities increasing their tariff rates to cover this shortfall and eventually the consumers without rooftop solar PV end up paying more whereas the consumers with rooftop solar PV continue to offset their expenses through net-metering. Considering the exponential growth of rooftop solar PV systems and the projected rooftop solar capacity till FY 2022-23 as discussed in the previous section, the impact of net metering on distribution utility will be appalling along with various technical problems.

2.7. The Petitioner has made an effort to calculate the loss of cross subsidy from the date of the implementation of Net Metering Regulations and the resultant impact of such on the balance consumers of MSEDCL. It is submitted that the distribution cost being aobligatory cost which is already been incurred or have to incur irrespective of the load / demand, the basic premise on which the cross subsidy loss is calculated is based on the additional revenue foregone against the incremental marginal power cost to be incurred. Therefore, the Cross subsidy has been calculated considering the Revenue loss with respect to energy charges (as the capacity charges will still be recovered) against the expected marginal power purchase cost which is considered @Rs. 2.80 per unit. The impact of the loss of cross subsidy from FY 2015-16 onwards is highlighted in the following table:

Table 1: Impact on cross subsidy on consumers of Distribution Licensee

Financial Year	Tariff Category	Solar generation (MU)	Energy Charges (Rs/kWh)	Marginal Power Purchase (Rs/kWh)	Cross Subsidy (Rs/kWh)	Impact in Rs. Cr.
CATEGORY WISE IMPACT - HT CONSUMERS						
2016-17	HT_COMMERCIAL	0.27	12.17	2.80	9.37	0.26
	HT_INDUSTRIAL	0.32	7.95	2.80	5.15	0.16
	HT PUBLIC SERVICE OTHERS	0.93	9.82	2.80	7.02	0.65
	HT SEASONAL	0.16	8.65	2.80	5.85	0.09
	Total	1.68				1.17
2017-18	HT AG/ SP AG/POULTRY	2.07	5.39	2.80	2.59	0.54
	HT_COMMERCIAL	7.42	12.23	2.80	9.43	7.00
	HT GROUP HOUSING (RES)	2.37	6.65	2.80	3.85	0.91
	HT_INDUSTRIAL	46.94	7.90	2.80	5.10	23.94
	HT PUBLIC SERVICE OTHERS	6.43	9.93	2.80	7.13	4.58
	HT SEASONAL	1.12	8.50	2.80	5.70	0.64

Financial Year	Tariff Category	Solar generation (MU)	Energy Charges (Rs/kWh)	Marginal Power Purchase (Rs/kWh)	Cross Subsidy (Rs/kWh)	Impact in Rs. Cr.
	Total	66.35			-	37.61
	Total Revenue Loss under HT Category					38.78
CATEGORY WISE IMPACT - LT CONSUMERS						
2016-17	RESI	0.83	12.35	2.80	9.55	0.80
	COMMR	0.75	11.17	2.80	8.37	0.62
	Industrial	0.12	7.68	2.80	4.88	0.06
	PUBLIC_SERVICES - Others	0.36	8.09	2.80	5.29	0.19
	Total	2.06				0.72
2017-18	RESI	9.62	12.41	2.80	9.61	9.24
	COMMR	11.97	11.19	2.80	8.39	10.04
	Industrial	1.75	7.60	2.80	4.80	0.84
	STR_LIGHT	0.00	6.60	2.80	3.80	0.00
	PUBLIC_SERVICES - Others	19.90	8.11	2.80	5.31	10.56
	Total	43.23				30.69
	Total Revenue Loss under LT Category					31.41
	Total Loss of Incremental Revenue					70.19

* - Energy Charges considered from 3rd November 2016 Tariff Order whereby Energy charges considered are:

a. For LT Residential – consumption slab of 500 and 1000 consumption
b. For LT II Commercial - LT II (B) > 20 kW and ≤ 50 kW
c. For LT V (B) Industrial - Above 20 kW
d. For HT Category Energy Charges for 22 KV is taken in consideration

2.8. As can be envisaged from the table above, within 2 years, the Petitioner has already lost the revenue of Rs. 70.19crswhich already has to some extent and will be pass on to the balance consumers of Distribution Licensee by way of additional tariff burden. The Petitioner submits that this may be consider as tip of the iceberg as considering the enormous growth in the Solar Rooftop Installation, the additional burden can be gigantic and may result in tariff shock for the consumers. Hence Petitioner feels that it will be right point at present to switch over the Net Metering Regulations with Gross Metering Regulations which ensures consumers with offset of units injected into the grid at APPC rate and also ensure Distribution Licensee to bill consumer in line with the tariff schedule which prevents any revenue loss.

2.9. Tariff difference between consumer tariff and levelised cost of energy generated is major driving factor for adoption of Net Metering. As retail Tariff for low end residential and agricultural consumers is low, there is no incentive for them to opt for Net Metering. Gross Metering provides level playing field to all consumers for installation of roof top systems and since more than 80% consumers are subsidised, gross metering will help reaching them.

2.10. Also, it is being observed that the commercial interests of some consumers and third party service providers through various modelsis completely defeating the very objective of net metering as Consumers with rooftop solar power projects generate energy far more than is required for their own consumption (captive consumption). Consumer's prima-facie seems to opt for Net Metering in order to fulfil their commercial interests by generating energy more than their captive requirement and selling such surplus energy to the distribution utilities at APPC Rate which is much higher than the installation cost. The summary of the consumers whose export is higher than the consumption is highlighted below:

Table 2: Details of Consumers exporting power more than Consumption

Details of LT Consumers			
	No. of Consumers		
% Range of Export higher than consumption	16-17	17-18	18-19
0%-30%	60 (6%)	375 (7%)	794 (8%)
30%-60%	101 (10%)	673 (12%)	1253 (12%)
>60%	472 (48%)	2737 (50%)	4493 (45%)
Total Consumers Exporting higher than consumption	633	3785	6540
Total Consumers	987	5522	10061
% of Consumers availing benefit	64%	69%	65%
Details of HT Consumers			
	No. of Consumers		
% Range of Export higher than consumption	FY 16-17	FY 17-18	FY 18-19 (Till Oct 2018)
0%-30%	1 (1%)	9 (3%)	11 (2%)
30%-60%	1 (1%)	14 (4%)	17 (3%)
>60%	4 (5%)	12 (4%)	28 (6%)
Total Consumers Exporting higher than consumption	6	35	56
Total Consumers	74	318	505
% of Consumers availing benefit	8%	11%	11%

2.11. As can be observed from the table above, ~65% of LT consumers and 11% of HT Consumers are availing the commercial benefit of Net Metering which predominantly defeats the objective. Such installation though needs to be for captive consumption, the consumers are availing this benefit for commercial interest whereby export is more than consumption to take undue advantage of the tariff of APPC and cost of installation.

2.12. Therefore this practice has led to exploitation of net metering concept for commercial interests and eventually defeating the whole idea of harnessing solar power and also promoting rooftop solar projects in order to meet the captive demand.This is not only adversely impacting the Distribution Licensee financially but technicallyalso (disturbance in Distribution Network).

2.13. Currently it is also being observed that Net Metering is being preferred by the consumers whose consumption falls in the higher tariff slabs such as Residential, Commercial & Industrial etc. i.e. the 'subsidizing consumers'. After installing solar roof top power projects, such consumers move down to lower consumption slabs and become a part of the 'subsidized tariff' category. This is adversely impacting the consumers of MSEDCL who do not have rooftop RE systems as more and more consumers are becoming subsidized consumers instead of being the subsidizing consumers. This is also hampering the financial position of MSEDCL.

2.14. Also, considering the current business scenario and financial principle, it is very much clear that rate of Return depends on the risk whereby higher the risk, the higher is the rate of return and vice versa. Usually the rate of return depends on the risk free return plus the risk within the business. Accordingly, the Hon'ble Commission has provided the Return of Equity (RoE) of 17.5% for supply business compare to 15.5% in Generation, Transmission and Distribution business as the risk in supply business is on the higher side. However, it is submitted that the 15.5% and 17.5% RoE for any unregulated business may be on a higher side considering the competition in the market as well as the economic situation. In the case of net metering, whereby the consumer install the solar rooftop in their own premises and earn credit on the same, the risk of such business model is relatively nil or low and therefore on the principle of equality and natural justice, the reward for such consumer's needs to be within the limit of Risk Free Return i.e. ~8% (Government based bond) plus certain premium. However, it has been observed that due to net metering regulations, the

return for such consumers is higher than 25% which itself is too high and at present is not availed by any business in this country unless the same. The same is highlighted from the table below:

Table 3: Net Saving to Consumers due to Net Metering

Category of Consumers	Capacity as on Oct 2018	Solar Offset units	Bill Before Net Metering	Bill Post Net Metering	Benefit		Cost of Solar Generation *	Banked Units	Surplus units Purchased	Net Saving	
	MW	Mus	Rs. Crs	Rs. Crs	Rs. Crs	%	Rs. Crs	MUS	Rs. Crs	Rs. Crs	%
	94.29	39.83	136.51	88.36	48.15	35%	14.60	1.871	0.67	34.23	25.1%

* Cost of solar Generation considered @Rs. 3.5/kwh

2.15. Considering the above enormous return at the cost of the consumers of Distribution Licensee, Petitioner proposes to introduce the Gross Metering Regulations whereby Consumer who implement Solar Rooftop is also rewarded with the returns by saving in their bill by way of reimbursement of the cost power injected in the grid and also the consumers of Distribution Licensee is not affected by loss of cross subsidy and additional cost burden.

2.16. The Petitioner submits that Andhra Pradesh have provided an option of Gross Metering to the consumers, In Karnataka residential, schools and hospitals can opt for Gross Metering whereby the energy generated through roof top system is exported to the Grid and in Uttar Pradesh, for third-party owners entering into a commercial agreement for the rooftop in the premises of the consumers will have to go via a gross-metering method with the DISCOM. Also, Delhi has provided an option of Gross Metering in their Draft Regulations.

2.17. Also, Germany is the most well-known example of a successful propagation of the gross metering concept. The recent trend in Japan has been to progressively move towards a gross metering model with Feed in Tariff (FiT) mechanism. The international scenario has been discussed in detail in subsequent section of this Petition.

2.18. In light of the above issues, MSEDCL humbly proposes to the Hon'ble Commission to introduce Gross Metering in the State wherein all the electricity generated by the Rooftop RE System shall be exported to the grid and all the electricity required for consumption by the consumer shall be continued to be imported from the grid as earlier and the consumers are paid a Feed-in Tariff (FiT) for the electricity exported to the grid.

3. Effect of Rooftop Solar/Renewable Generation System on Distribution network

3.1. The Petitioner submits that at present the consumers with rooftop RE systems i.e. the consumers under Net Metering have been exempted from the application of Wheeling Charges and Losses. However, it is submitted that the Hon'ble Commission in its "PRACTICE DIRECTIONS" issued on 30th September 2016 has recognized the impact of wheeling charges and the same has been reproduced below:

"The Supply Licensee shall pay the Wheeling Charges, as approved by the Commission for a particular financial year and corresponding to the unadjusted net credited Units of electricity at the end of that year, to the Wires Licensee."

3.2. The Petitioner humbly submits that in the case of MSEDCL, which is both the wire and supply licensee, it needs to recover such wheeling charges from its consumers. As the Wheeling Charges are determined based on the sales recorded at different voltage levels i.e. energy sales to consumers at various voltage levels, the sales under Net Metering are not reflected in the Total Sales thereby resulting in higher Wheeling Charges. Hence the consumers not availing Net Metering are therefore paying such increased wheeling

charges. Therefore the Petitioner submits to the Hon'ble Commission to make Wheeling Charges and Losses applicable on the total consumption of power.

3.3. The Petitioner further submits that since the distribution infrastructure is created for the consumers considering their connected load, the load of the consumers availing net metering is automatically considered while planning and creating the distribution infrastructure. It is therefore submitted that wheeling charges and losses be made applicable to consumers availing net metering for recovery of distribution infrastructure cost.

3.4. Additionally, the Petitioner submits that distribution licensee is required to wheel the energy for compensating the units banked by the Net Metering Consumers. As such banking mechanism involves wheeling of power; therefore Wheeling Charges and Loss should be made applicable on the Net Metering Consumers on the total banked units for recovery of distribution infrastructure cost.

3.5. MSEDCL submits that most of the distribution network costs incurred by a distribution licensee arise from the fixed investments in distribution infrastructure in order to cater to the peak demand of consumers. While determining this peak demand, the demand of Net Metering Consumers is also considered since during monsoon season, the generation from rooftop solar is lower than that during rest of the year. Therefore, the Petitioner prays to the Hon'ble Commission to make Wheeling Charges & Losses applicable to Net Metering Consumers.

3.6. With large number of rooftop solar power systems, it has become difficult for distribution utilities to maintain the stability of the local grid as Utilities have to maintain the distribution voltage within specified limits to provide reliable power to their consumers. However, conventional grids were not designed considering the rooftop solar power systems and other characteristics of RE power such as intermittent output and safety-triggered circuit trips. Such typical characteristics of RE power have aggravated the issue of voltage instability in the Grid. It is further submitted to the Hon'ble Commission that there are a number of technical barriers due to Net Metering which will result into more operation & maintenance and augmentation of the distribution system. Some of the common technical challenges faced due to net metering have been discussed below –

a) Fluctuation and Imbalance in voltage

The solar energy produced by a photovoltaic system is largely dependent on the availability of sunlight. The power generated can vary drastically because of many reasons. This leads to rapid voltage fluctuations that can impair the transmission network, and in some cases overheat the power lines. Inverters are designed to regulate the PV system voltage. Voltage fluctuations can take place due to improper functioning of the inverter and can be a problem if the fluctuations move outside the specified values. To avoid any such scenario, voltage fluctuations need to stay within specific limits beyond which the system is required to automatically disconnect from the grid.

b) Electrical disturbance by loads

Electrical disturbances, generating harmonics is created by the presence of non-linear components in the system. It can overload equipment, interfere with the telephone circuit and lead to metering errors. The total, individual and current harmonic disturbances produced by a PV system should not be allowed to exceed 5%, 3% and 8% respectively so that it does not affect the quality of the power in the grid.

c) Transmission of unwanted current in the grid

The current which is supplied for end use is alternating current and the one generated by the solar power system is direct current. There is a possibility that the PV inverter passes unwanted DC current into the AC driven network of the grid, which can lead to overheating of distribution power transformers, power losses or damages.

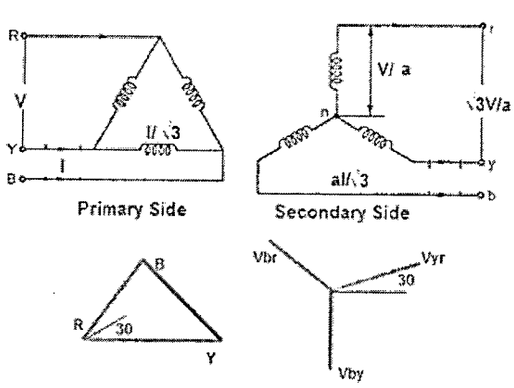
d) Unintentional islanding

This occurs when the solar power system continues to supply electricity to the power station even when the grid power is no longer present. This leads to safety issues as the power line that is considered off may still be powered. This is a common problem and people prefer systems that are automatically disconnected from the grid in the event of a power outage.

e) Reverse Power Flow

High levels of PV penetration lead to reverse power flow. This takes place in cases of long or weak networks, voltage rising when the consumption at the consumer's end is low and the power fed is high. In such a case, voltage increase may cause the electricity to change the direction and flow through the transformer to the higher voltage leading to heating up the transformer and transmission lines. The details of the same is explained below:

- Rooftop renewable systems installed are of Single Phase and Three Phase Systems as per the requirement of consumer.
- Single phase rooftop renewable systems (230/240V) are installed up to 8KW/40A, Whereas, Three phase rooftop renewable systems i) (400/415V) up to 150KW/187KVA and ii) for 11KV & above voltage it is less than 1000 KVA.
- The Delta-Star configuration is used in distribution system, wherein, Delta side is connected to HT(11KV, 22KV, 33KV) which is primary side and Secondary side (LV) is Star connected which is 3 Phase 4 wire (R,Y,B phase and Neutral-earthed).
- Single phase and three phase consumers are connected on the LV side of a distribution transformer. They are distributed on the LV side as a balance load on distribution transformer.



- Whenever the load is unbalanced the currents in the three phases of LV side are unbalanced. This unbalanced current finds its way to the neutral which is grounded / earthed. This causes Energy loss in the system. Hence, to avoid this, loads (single phase connections especially) are distributed on 3 Phase 4 Wire side to create a balanced load on distribution transformer.
- Now, Rooftop Renewable Energy Systems are acting as Energy generating Systems installed for captive purpose. When Energy generation at a particular time is more than the requirement of consumer, the surplus energy is transferred to the LT Distribution network. If we consider a Three Phase Rooftop RE generator, the surplus energy will flow in all the three phases and when we consider a Single

Phase Rooftop RE generator, the surplus energy will flow in that particular phase on which it is connected.

- This surplus energy from the RE generators flowing through the LV side distribution network will divert to the other load connected on the systems which are active/ON at that time. And, during the flow, it will contribute to the line loss of the distributed network.
- When a single phase Rooftop RE generator supplies surplus energy on a connected phase is unutilized at that moment due to non-availability of sufficient load, it will create unbalance and unbalance current will flow through the neutral of the LV side of the transformer which is grounded / earthed results in loss of energy in addition to line loss.
- To avoid this situation it is necessary that the total power generated through Rooftop RE generator is utilized locally. Any excess generation if not utilized may contribute to the line loss.
- Also, Renewable energy is infirm in nature due to availability of Sunlight, wind etcie they are intermittent in nature which causes voltage fluctuation and voltage unbalance (Rise/Fall). And voltage change of the distribution system is sensitive to short term fluctuations.
- Unnecessary voltage increase in the LV distribution feeder can cause harmful effects on household equipment especially electronic devices. In a 3 phase network, voltage unbalance happens if the voltage magnitude of every phase is not same or if there is a difference in phase angle between whichever 2 phase voltages. It is stated that 1% of the voltage unbalance is able to produce 6–10 times current unbalance.

3.7. Due to the above technical barriers, the cost of O&M and system augmentation has also increased which is adversely impacting the financial position of MSEDCL.

3.8. The independent study undertaken by ADB in Srilanka assessing the impact of Rooftop Renewable Generation on Distribution Network is also highlighted in the subsequent section whereby International Scenario has been discussed.

3.9. Considering all the above submissions, the Petitioner prays to the Hon'ble Commission to make Wheeling Charges and Losses applicable on the total consumption of power / Banked Units by Net Metering Consumers for recovery of distribution infrastructure cost and such increased system O&M and augmentation cost.

3.10. Also, considering the enormous growth of Solar Rooftop installation and envisaging its impact on the distribution network, many States in India such as Madhya Pradesh and Haryana and also internationally some of the countries like Germany and UK has proposed a cap on installation for distribution licensee which is highlighted as below:

- Madhya Pradesh – The Distribution Licensee shall provide to the Eligible Consumer net metering for such period that the cumulative capacity (in MW) does not exceed the target capacity of 10 MW
- Haryana – The maximum installed capacity (Roof top PV) is restricted to 200 MW in the area of supply of each licensee.
- Punjab –The distribution licensee shall provide net metering arrangement to eligible consumers as long as the total capacity (in MW) of rooftop solar systems does not exceed the target capacity determined by the Commission.
- Germany –Target of 52 GW for whole country
- UK –The FiT rate for various categories changes as often as every 3 months depending on the achievement in capacity addition.

4. International Studies - Effect of Rooftop Renewable Generation System on Distribution network

a) A case study on Sri Lanka by Asian Development Bank (ADB):

The Asian Development Bank (ADB)presented a study report on 'Potential Technical Impacts of Rooftop Solar Generation on Low Voltage Distribution Networks' on the distribution network of Lanka Electricity Company Limited (LECO) and Ceylon Electricity Board (CEB). As per the study conducted and reported in the report, Sri Lanka experienced a rapid growth in installed rooftop solar photovoltaic capacity with the introduction of the net-metering scheme in 2008 and the growth further increased with the introduction of the two new schemes - net accounting and net plus in September 2016.The study examined the present status as well as impacts at future solar photovoltaic penetration levels. The study has analyzed the impacts of solar photovoltaic power generation on the low voltage distribution network in terms of impacts on

i. distribution transformer loading level,
ii. distribution feeder loading level,
iii. distribution feeder voltage level,
iv. distribution losses, and
v. harmonic level.

The results of the case studies on the two distribution networks indicate that the impact of solar photovoltaic penetration on low voltage distribution network depends on the characteristics of loads, the Point of Connection and the capacity of solar photovoltaic systems. When most of the customers are in the high electricity consuming groups, negative impacts on transformer loading level, feeder loading level and feeder voltage level due to solar photovoltaic power generation can be expected only when solar photovoltaic penetration level is extremely high. Further, when solar photovoltaic capacity is increased above an optimum level, high reverse power flows are observed for longer periods, increasing the total low voltage losses. Further, the results indicate that increase in system losses can be expected if the solar photovoltaic system is located at the end of the feeder making the mid-day voltage rise along the feeder the main issue of concern.

b) Germany

It is one of the first countries to roll out a large scale PV integration scheme. The rooftop solar photovoltaic system has been growing rapidly in Germany since as early as the 1990's. The German government introduced the country's first Feed-in-Tariff (FiT) programme in the early 1990's wherein Solar PV generators were eligible for FiT payment at 90% of retail electricity rate. In order to further incentivize installation of rooftop solar PV systems, the country launched the '100,000 Roof-top' program wherein the government offered a rebate of 70% on the Solar PV system cost long with low-interest financing. These incentives resulted in 67 MW of Solar PV systems being installed in the country in just a decade i.e. by the end of the year 1999. The Government had also introduced a 'Volume Management Strategy'which involved capacity 'caps'that were triggered by the amount of renewable energy in each utility service area. The FiT payments were made through funds / policy costs that were created through the local distribution utilities.With the rapid growth in solar PV installation, the burden of FiT rate payment on the ratepayers was increasing. In the following years, the Government made efforts to set cap on the rooftop solar program and projects in order to control the impact on ratepayers by introducing national rates for FiT. As the rooftop solar PV penetration level increased more than the anticipated levels which were also technically hampering

the grid system, the Government further removed the 'caps' on the capacity installation and introduced new FiT rates (lower than earlier) depending on the system size and application.

After around two decades of development of rooftop solar PV systems in the country which resulted in exponential growth (~ 40 GW capacity installed by 2010) in rooftop solar PV installation due to which the network of the distribution utilities was also getting affected, the Government in the year 2008 introduced 'Corridor' or 'Flexible' digression system. In this system the FiT rate would decrease each year by a certain percentage based on the volume of MW installed during the previous year. Further, in the year 2010 the Government brought in additional cuts beyond the digression that immediately decreased FiT rates for building-mounted systems by 13%.

In the year 2012, the German government introduced 'Floating Cap' system in which the FiT rate was reduced for small rooftop Solar PV systems by almost 20%. In order to alleviate the adverse impact of rooftop solar PV system on the network, the Government, in the same year, further introduced a 'Cap' in capacity addition which was limited to 2.5 to 3.5 GW per year. In addition to yearly 'Caps' there was an 'Absolute cap' of 52 GW for the total installed capacity of Solar in Germany.

Thereafter in the year 2014, Germany withdrew the government support wherein in rooftop solar PV installations beyond the target of 52 GW would not receive any funding through FiT rate payments.

As can be seen from the case of Germany which has witnessed exponential growth in solar PV systems including rooftop systems, the government had to gradually withdraw its support to solar PV systems in the form of incentives and rebates in order to control the solar PV installation in the country which was not only adversely affecting the distribution utilities but also affected the network grid technically. Maharashtra hasalso witnessed a similar exponential growth in the rooftop solar PV installations in the last few years as discussed in the above sections.

c) Japan

The development of solar PV systems including rooftop systems in Japan begun prior to 1990. In the year 1994, government of Japan introduced incentives to promote installation of solar systems by providing capital subsidy at 50% of the system costs. In around a decade, solar PV installations in the country grew rapidly which was adversely impacting the utilities network technically. Therefore, in 1999 the government reduced capital subsidy to 33% as an effort to normalize the growth in solar PV installations. With the continued government support, rooftop solar PV system installation saw further growth over the next decade which increased the negative impact on the distribution network grid compelling the government to terminate the market support on the national level in 2007-2008.

Until mid of 2012, the cumulative Solar PV capacity in Japan stood at 5.6 GW primarily added by small-scale residential solar PV systems. As the rooftop solar PV capacity installation observed an exponential growth in the country, the Government introduced a 'National FiT' program in which the focus shifted from the traditional residential segment to non-residential by providing incentives to the latter. The Government was making

various efforts to alleviate the adverse technical impact of rooftop solar PV systems on the distribution network. During the period July 2012 to June 2014, a staggering 10.5 GW of new solar PV capacity was installed in Japan, out of which 30% was from residential installations. As the funds for FiT were created by the government through Renewable Energy Surcharge per kWh on customers, it was also increasing the financial burden on distribution utilities and eventually the customers without rooftop solar PV installations. In FY 2017-18, the purchasing costs of solar rooftop for utilities was Japanese Yen 3.1 trillion, of which 75% was to be borne by their customers and in order to reduce this financial burden, the Government proposed to more than halve the country's solar power FiT by around the mid-2020s. This move aims at reducing the public burden of electricity bills, which include part of the costs of power companies' mandatory solar power purchases from households and other companies under the system.

Similar to Germany, Japan has also witnessed exponential growth in rooftop solar PV installations which was not only technically affecting the distribution network but also financially burdened the distribution utilities and eventually the end consumers.

d) California State (USA)

California is currently the leading state in PV integration in the United States of America with the majority of PV being roof mounted. It is an interesting case as the diversityof distribution grid structures resembles the Indian case more closely than any other country. California has been an early adopter of solar PV generating systems in the world. The rooftop solar PV system has developed tremendously in California over the years. Unusual for an early adopter of PV, California employs a feed-in tariff system as the main incentivewith other subsidies supporting it. Currently, California offers the consumer's choice between a granted feed-in tariff or an investment subsidy and a net metering scheme.

According to some of the studies carried out on Californian grid it has been found that rooftop solar PV systems have significantly impacted the grid and some grid areas havedisplayed increased wear on tap changing transformers,indicating frequent switching operationsto be necessary for voltage control. The issues encountered by Californian distribution grid operators included load imbalances due tothe primarily single phase connections of load and PV generation and protection issues causedby reverse power flows, which should also be considered in Indian grids due to the similarity

In California the majority of solar PV generating units have been installed in upper middle class suburban areas, similar to the development in India where majority of the rooftop solar PV installation have been done by well – off consumers i.e. the subsidizing consumers which is eventually increasing the burden on the subsidized consumers.

Recently, California introduced Time of Day (ToD) rate i.e. variable pricing for residential customers, whererates are lower during times of high supply and low demand, and vice versa. Such measures taken by the government clearly indicate that rooftop solar PV systems have grown rapidly in the state and are significantly impacting network components and its operations. Further, there is a 'Net Metering Cap' in California in which the net metering program allows a maximum of 5% of peak electricity demand (the net metering "cap") to come from solar panels.

5. Other Submission

5.1. Metering arrangement- Use of ABT Compatible Meters thereof...

- Petitioner submits that ABT compliant meters should be mandatorily used for Industrial and Commercial category consumers utilizing the energy generated from Rooftop RE Systems towards fulfilling their RPO targets. Further, for the purpose of energy accounting and settlement, the net electricity exported/imported during the billing period shall be adjusted in 15 minutes time block.
- Petitioner further submits that for rooftop installations having capacity more than 10KW, the main meter shall be of 0.2s class accuracy and with facility for recording meter readings using Meter Reading Instrument (MRI) or wireless equipment. Further, the check meters must be mandatory for Rooftop RE systems having capacity more than 20 KW. Similar provisions are also available in GERC Regulations for Net Metering Rooftop Solar PV Grid Interactive system, 2016. The cost of new/additionalmeter(s) shall be borne by the eligible net metering consumers and such meter(s) shall be tested and installed by the Distribution Licensee.

5.2. No Approval of Net Metering Connection in case of arrears

- Petitioner submits that the said MERC (NET METERING FOR ROOF-TOP SOLAR PHOTO VOLTAIC SYSTEMS) REGULATIONS, 2015 is silent on the provisions in relations to approval of Net Metering Connection to the consumers whose arrears are still pending with the Distribution Licensee. It is submitted that certain cases has been experienced whereby consumers are applying for net metering in line with the clause 3.1 of the Regulations, even when the arrears are pending:

  "Net Metering arrangement shall be permitted by the Distribution Licensee on a non-discriminatory and 'first come, first serve' basis to Eligible Consumers who have installed or intend to install a Roof-top Solar PV System connected to the Network of such Distribution Licensee :

- The Petitioner humbly request that the Regulations needs to be amended by adding the following provisio which allows the implementation of Net Metering arrangement only if the arrears with the Distribution Licensee is been paid:

  "Provided that such Net Metering arrangement shall be permitted by the Distribution Licensee only in case the no arrears are pending of the said consumers with the Distribution Licensee.."

5.3. Testing of Installation:

- Petitioner submits that the tests as per EN 50160 and as per distribution licensee's standard shall be carried out by the Chief Electrical Inspector to ensure the quality of power generated from the Rooftop RE System.

6. Comparison of Regulations with Other States

6.1. Many other progressive States have catered to the issues raised hereinabove and have provided for a more balanced Regulations. Provisions under the Rooftop Solar Regulation in other states are as under:

Sate	Provision
Gujarat	• Cap on individual capacity (except Residential Consumers): 50% of consumer's sanctioned load/contract demand; Provided that the installed capacity shall not be less than 1 kW and shall not exceed 1 MW

Sate	Provision
	• Banking of energy shall be allowed within one billing cycle of the consumer (For Industrial, Commercial and Other Consumers except Residential and Government) • For Industrial, Commercial & Other (Other than Residential & Government) using energy attribute for RPO compliance, Excess energy injected during the billing period after adjustment of consumption in 15Min time block is purchased by Distribution Licensee at the APPC rate determined by the Commission. • For Industrial, Commercial and Other Consumers utilizing the 'energy attribute' and utilizing the 'renewable attribute' for REC. - Excess energy injected during the billing period after adjustment of consumption in 15Min time block is purchased by Distribution Licensee at the 85% APPC rate determined by the Commission.
Madhya Pradesh	• The Distribution Licensee shall provide to the Eligible Consumer net metering for such period that the cumulative capacity (in MW) does not exceed the target capacity of 10 MW
Karnataka	• Option for Gross metering is provided. • For Gross Metering- Exclusive line to be laid from Solar Plant to Distribution System for which cost to be borne by consumer. • For Gross Metering, if import energy is recorded, it will be charged at higher rate out of a) Tariff agreed in to PPA approved by commission or b) Prevailing retail supply tariff.
Telangana	• Option for Gross metering is provided. • Gross metering&Net metering is not allowed in same premises. • Option to choose Gross metering at 11KV & Above at average rate or price from latest Solar PPA by Distribution licensee approved by commission.
Haryana	• The maximum installed capacity (Roof top PV) is restricted to 200 MW in the area of supply of each licensee.

7. Regulatory Provisions

7.1. That Petitioner has also submitted the need for shifting from net-metering to gross-metering in it's MTR Petition Case No. 195 of 2017. Hon'ble Commission while most graciously noting the concerns of petitioner has ruled that the submissions of Petitioner cannot be addressed under the present MTR process initiated in pursuance of the MYT Regulations, 2015. The said ruling is reproduced as below:

Commission's Rulings

The Commission has taken a note of the Petitioner's submission regarding the issues pertaining to Net-metering arrangement. Commission observes that, the above highlighted issue is specifically linked to the provisions stipulated under the MERC (Net-Metering for Solar-Rooftop Photo Voltaic System) Regulations, 2015 and the entails modification/review of Net Metering framework upon due regulatory consultation process. Thus, the submissions of Petitioner cannot be addressed under the present MTR process initiated in pursuance of the MYT Regulations, 2015.

7.2. Considering the Order of the Hon'ble Commission, the Petitioner hereby submits the separate petition for modification/review of Net Metering framework. The Petitioner humbly submits that the Hon'ble commission has the powers to amend and to issue orders and remove the difficulties in implementation MERC (Net Metering for Roof-top Solar Photo Voltaic Systems) Regulations, 2015.

7.3. The Petitioner submits that the Regulation 14 of the Net Metering Regulations, 2015 provides inherent power to the Hon'ble Commission to issue any orders and practice directions for implementation. The relevant Regulation is reproduced below:

14. Issue of Orders and Practice Directions

Subject to the provisions of the Act, the Commission may from time to time issue Orders and Practice Directions with regard to the implementation of these Regulations.

7.4. The Petitioner submits that the Regulation 15 of the Net Metering Regulations, 2015 provides for powers to amend. The relevant Regulation is reproduced below:

15. Power to amend

The Commission may, at any time, vary, alter, modify or amend any provisions of these Regulations, for reasons to be recorded in writing.

7.5. The Petitioner further submits that the Regulation 16 of the Net Metering Regulations, 2015 provides for powers to remove difficulties. The relevant Regulation is reproduced below:

16. Power to remove difficulties

If any difficulty arises in giving effect to the provisions of these Regulations, the Commission may, by general or specific Order, make such provisions not inconsistent with the provisions of the Act as may appear to it to be necessary for removing such difficulty.

7.6. The Petitioner most respectfully submits that Hon'ble Commission has sufficient powers to deal with the matter and issue orders on any matter as deemed appropriate.

7.7. The Petitioner craves leave of this Hon'ble Commission to file additional affidavit, reply/documents etc. in case need arises at a subsequent stage with the prior permission of this Hon'ble Commission.

7.8. Therefore it is submitted that Petitioner has not filed any other proceedings arising out of the present matter claiming similar reliefs before any court or forum.

8. Prayers

8.1. The Petitioner therefore, based on the submissions made in the foregoing paragraphs, most earnestly prays to the Hon'ble Commission:

a) To admit the Petition as per the provisions of the Regulation 14, 15 and 16 of the MERC (Net Metering for Roof-Top Solar Photo Voltaic Systems) Regulations, 2015;

b) To provide necessary amendment in the Net Metering Regulations 2015 by replacement of Net Metering with Gross Metering system for the consumers to safeguard any additional burden on the consumers.

c) To make applicable the wheeling charges and losses on the banked units of Energy by Net Metering Consumers for recovery of distribution infrastructure cost.

d) To make a mandatory provision for installation of ABT compatible meters for Industrial and Commercial Category consumers.

e) To include the provision in the Regulations for non-applicability of net metering Regulations to the consumers whose arrears are pending.

f) To pass any other order as the Hon'ble Commission may deem fit and appropriate under the circumstances of the case and in the interest of justice.

g) To condone any error/omission and to give opportunity to rectify the same.

h) To permit the Petitioner to make further submissions, addition and alteration to this Petition as may be necessary from time to time.

It is prayed accordingly.

Date: 19/01/2018

Place: Mumbai

MSEDCL

Superintending Engineer (Open Access)
M.S.E.D.C.L. Prakashgad, 5th Floor,
Prof. Anant Kanekar Marg,
Bandra (E), Mumbai-400 051.

NOTARY
RANJEET SINGH
SANTACRUZ (E),
MUMBAI M.S.
Regd. No. 9136
Exp. Dt. 20/10/2021
GOVT. OF INDIA

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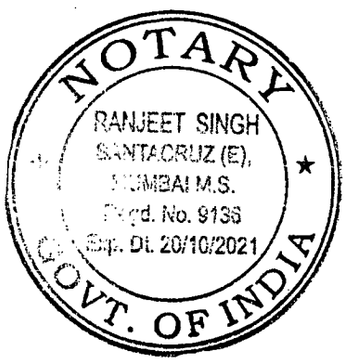

BEFORE THE MAHARASHTRA ELECTRICITY REGULATORY COMMISSION, MUMBAI

FILING NO:

CASE NO:

IN THE MATTER OF

PETITION FOR REMOVAL OF DIFFICULTIES IN IMPLMENTATION OF MERC (NET METERING FOR ROOF-TOP SOLAR PHOTO VOLTAIC SYSTEMS) REGULATIONS, 2015

AND

IN THE MATTER OF

REGULATION 14, 15 AND 16 OF THE MERC (NET METERING FOR ROOF-TOP SOLAR PHOTO VOLTAIC SYSTEMS) REGULATIONS, 2015

AND

IN THE MATTER OF

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED – THE PETITIONER

AFFIDAVIT ON BEHALF OF PETITIONER (MSEDCL)

1. I, Anil Mahajan, aged 50 Years, son of Vasudeo Mahajan, having my office at 5th Floor, Prakashgad, Bandra (East), Mumbai-400051 do solemnly affirm and say as follows:

2. I am the Superintending Engineer of Maharashtra State Electricity Distribution Co. Ltd., the Petitioner in the above matter and am duly authorized as the Respondent to make this affidavit.

3. The statements made in the enclosed submission are based on the information received from the concerned officers of the Company and I believe them to be true.

I solemnly affirm at Mumbai on this 19 day of January 2019 that the contents of this affidavit are true to my knowledge, no part of it is false and nothing material has been concealed there from.

Deponent

Superintending Engineer (Open Access)
M.S.E.D.C.L. Prakashgad, 5th Floor,
Prof. Anant Kanekar Marg,
Bandra (E), Mumbai-400 051.

Identified before me

BEFORE ME

RANJEET SINGH
M.Sc.LL.B
NOTARY
MAHARASHTRA
GOVT. OF INDIA
19 SEP 2018

NOTARY RANJEET SINGH SANTACRUZ (E), MUMBAI M.S. Regd. No. 9136 Exp. Dt. 20/10/2021 GOVT. OF INDIA NOTARIAL

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