Agility Care Integrity Excellence Collaboration Trust Respect

Urban Rooftop PV Projects

3rd April 2012

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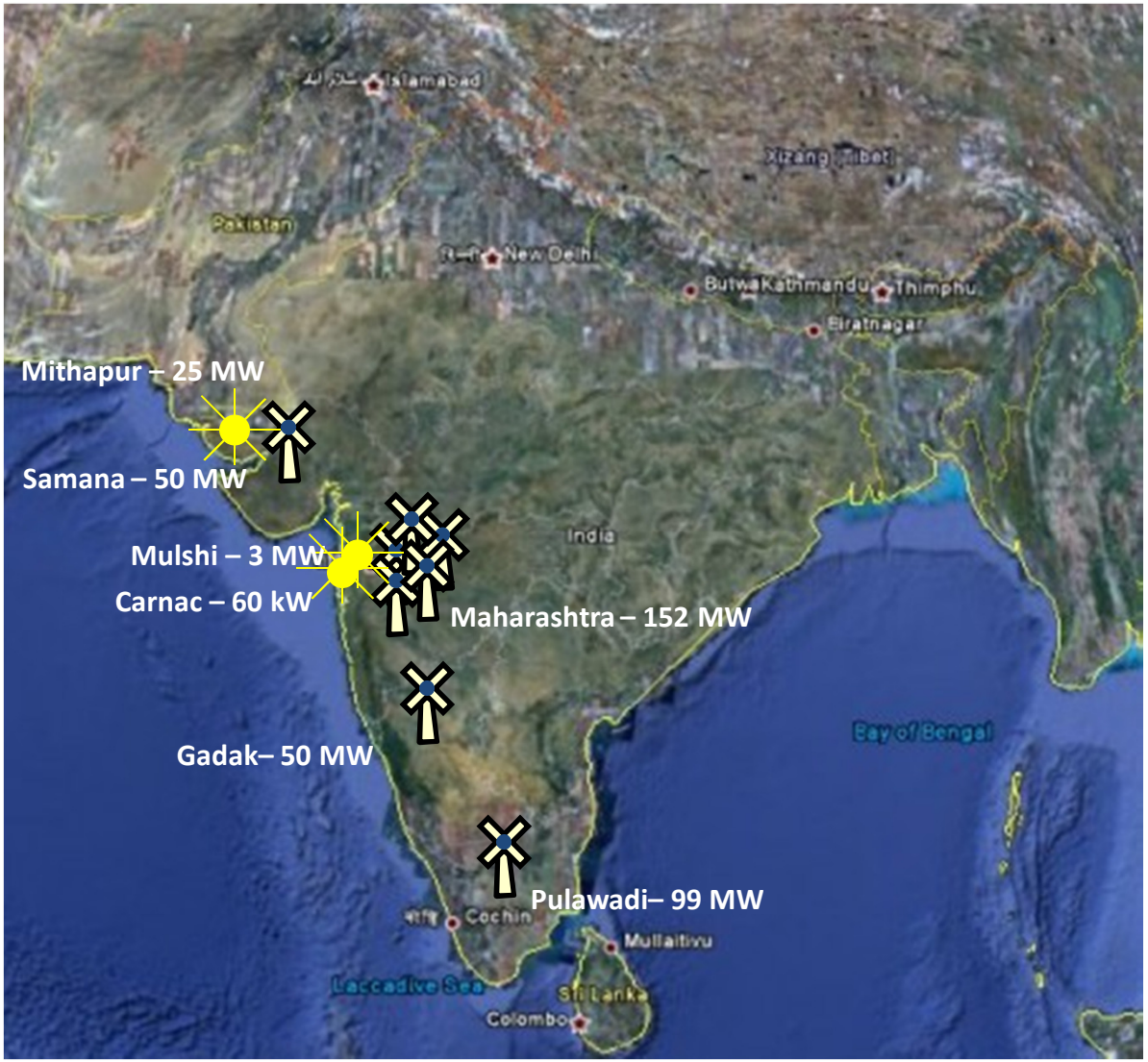
Renewable Energy Portfolio of Tata Power



Urban Rooftop PV Projects

60 kW Solar PV at Carnac

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60 kW Solar PV at Carnac - Commissioned

Purpose	- Contribute to achieving Solar RPO requirement of Tata Power- D - Pilot project to evaluate the feasibility of utilising the rooftops of Commercial and Industrial establishments

Number of panels	336 (28 arrays each containing 12 modules or panels)
Size of each panel	1587 mm x 790 mm
Area occupied	549 m^2
Generation Level	35.8 V (at P_{max})

Output Voltage	400 volts three phase, 4 wire, grid tracking
Nominal voltage adjustment	$\pm$5% via system set points
Output Frequency	50 Hz $\pm$ 0.5%
Inverter to follow grid frequency	upto $\pm$3Hz of the nominal output frequency
Continuous Rating	60kVA with all phase equally loaded
Efficiency	94%

Urban Rooftop PV Projects

60 kW Solar PV at Carnac
-where to connect

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Stand for Connectivity of the Project

Which is right place to connect ?

- Regulation 2.1 (cc) of MERC (RE Tariff) Regulations, 2010,

  "'Solar rooftop PV and other small solar power' means the Solar rooftop or other small solar Photo Voltaic power projects that uses Photo Voltaic technology for generation of electricity, which are mounted on rooftop of buildings or ground mounted installations, and satisfying any other eligibility criteria as may be specified by MNRE from time to time."

- Appropriate location – Carnac Rooftop and nearest connectivity at 415 V station auxiliary bus of Tata Power-T at Carnac Receiving Station

- Carnac Receiving Station and 415 V station auxiliary bus of Tata Power-T part of Tata Power-T assets

Issues Faced – Grant of Connectivity

- MERC (State Grid Code) Regulations, 2006 states as under,

  "13.1 Application for establishing new arrangement or modifying existing arrangement of connection to and/or use of the InSTS shall be submitted by the concerned Transmission Licensee or User to the State Transmission Utility:

  Provided that the standard format for application mentioned in the Regulation 13.1 shall be developed by State Transmission Utility and shall be made available at its Internet website within two (2) months of notification of these Regulations."

- Accordingly, Tata Power-Solar made an application to the STU for grant of connection for 60.48 kWp Rooftop Solar PV Project.

- STU replied as under,

  "…The Open Access sought by you is for load/generation less than 1 MW. As per MERC's Open Access Regulation, there are no guidelines for granting Open Access for load/generation less than 1 MW.

  Hence, you are requested to take up the matter with Hon. MERC for necessary guidelines."

Extracts of MERC Order

- CEA is in a process of initiating expert consultation to formulate and notify grid connectivity standards and regulations, which shall govern connectivity related aspects for such distributed generation sources

- The nearest distribution s/s of BEST is around 0.5 km away from the project. This prima facie shows the non-availability of any Distribution network in the proximity of the project. This has led Tata Power-T to connect the project to its own Receiving Station, which is a part of the Tata Power-T asset and on the Rooftop of which, the Project is installed

- In view of the above, the Commission recognises that this project needs to be treated as unique case and the issues raised need to be addressed, particularly in view of the fact that as per Section 86(1)(e) of Electricity Act 2003, the Commission is mandated to promote generation from renewable sources of energy by inter alia providing suitable measures for connectivity with the grid.

Urban Rooftop PV Projects

500 kW Solar PV at Tata Motors

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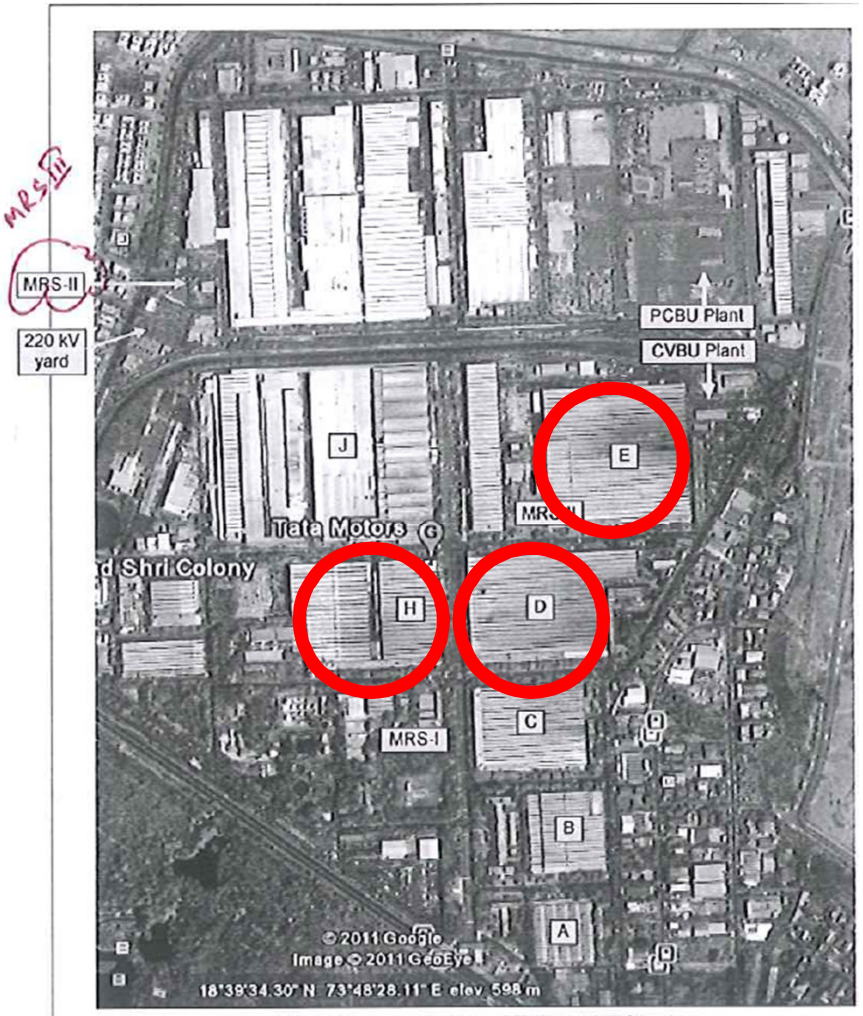
Location of the Project

Location	Capacity
Block D of Tata Motors, Pimpri	100 kWp
Block E of Tata Motors, Pimpri	300 kWp
Block H of Tata Motors, Pimpri	100 kWp

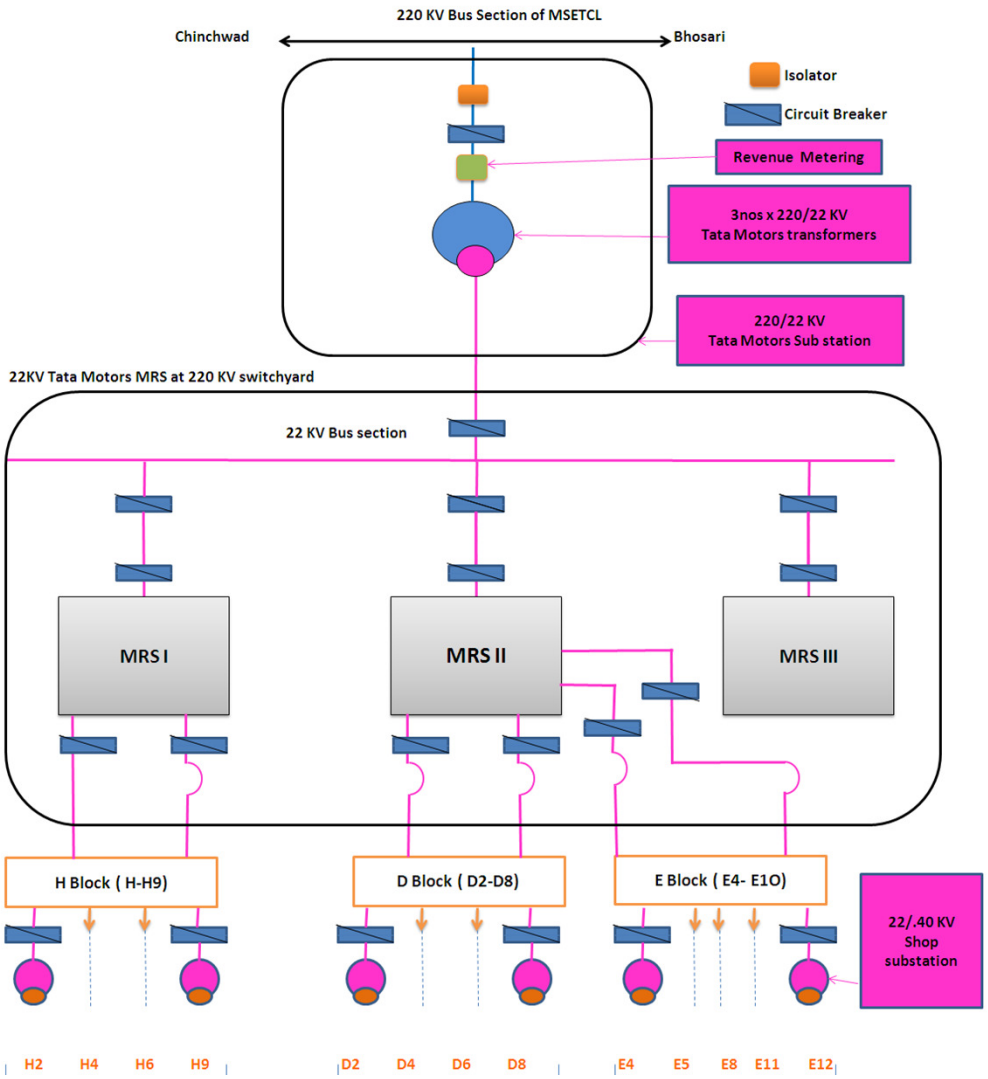
Advantages of the Project:

- Pioneer a case for use of rooftops of large industrial premises for renewable energy generation which can be replicated
- Generate electricity from renewable sources
- Meet RPO obligations of the distribution licensees



Bird's eye view of Pimpri Plant

Tata Motors - Present Electrical Set



- Tata Motors is fed by 220 kV MSETCL R/s situated in North West side of the premises
- Tata Motors have laid 220kV cable within its premise to feed its own 220kV /22 kV S/s
- S/s consists of 2 no. of 30 MVA 220/22 kV transformers and a 40 MVA 220/22 kV transformer. Installed capacity of 100 MVA
- Revenue metering arrangement at 220 kV level
- The 22kV outgoing feeders from the Tata Motor's S/s feeds the 3 Nos Main Receiving station (MRS) located at different places
- MRSs feed the different blocks. Within each block , there are 2 MVA 22kv /440 V Transformers which feed the different loads within each block.

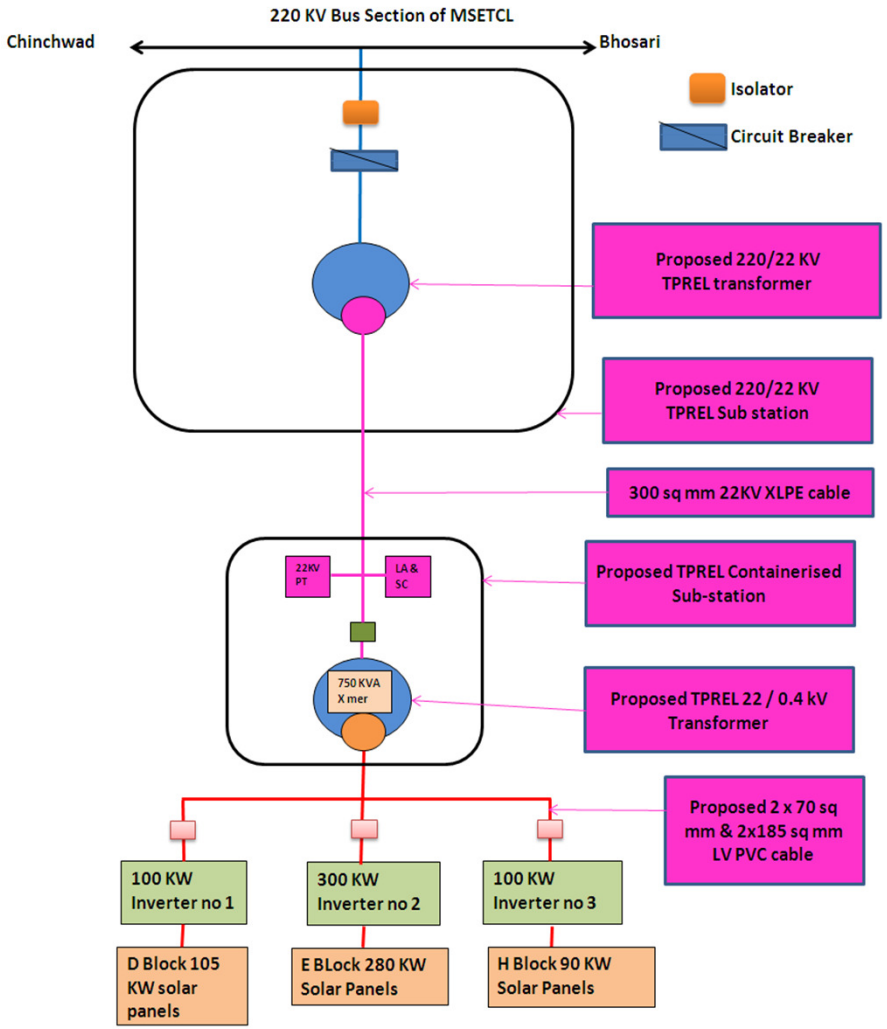
MERC RE Tariff Regulations, 2010

- Regulation 2.1 (p) of MERC (RE Tariff) Regulations, 2010 defines Inter- connection Point as follows:

"*Inter-connection Point shall mean interface point of renewable energy generating facility with the transmission system or distribution system, as the case may be:*

1. *in relation to wind energy projects and Solar Photovoltaic Projects, inter-connection point shall be the line isolator on outgoing feeder on HV side of the pooling sub-station……"*

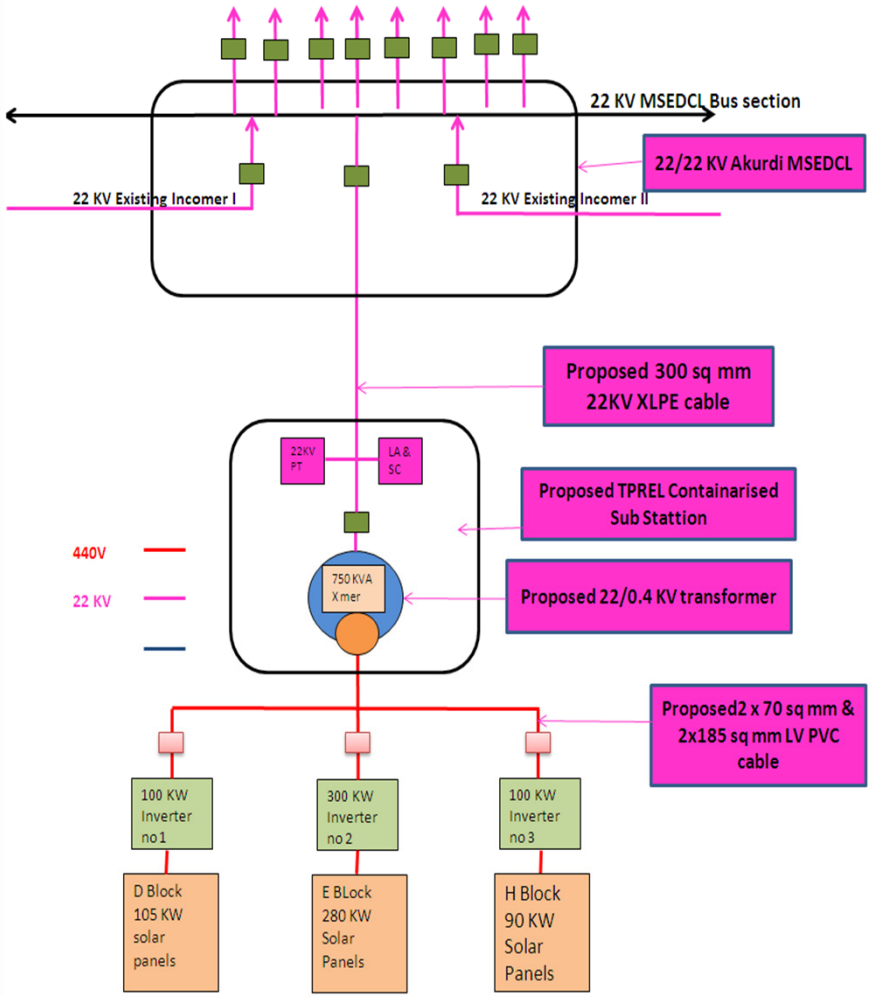
Interconnection to Transmission System



Interconnection Cost – Rs. 615 lakhs

Advantages	Inter-Connection is as per MERC (RE Tariff) Regulations, 2010
Disadvantages	High Capital Cost
	Availability of space for the installation of Containerised S/s as well as the 220kV S/s may be a constraint
	Availability of bay in MSETCL is mandatory for connection
	Heavy losses for transforming 500KW power from 270 V to 220kV
	Long lead time to establish this setup

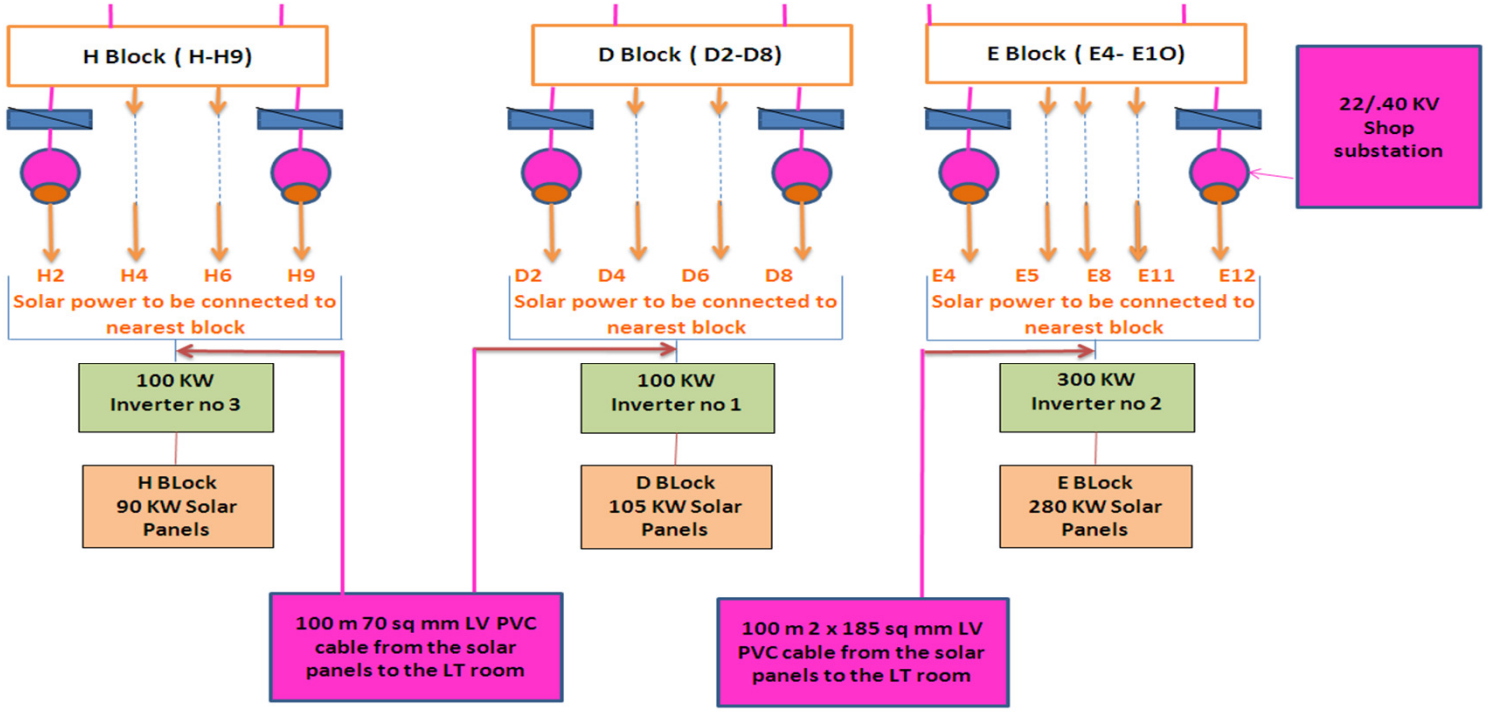
Interconnection to Distribution System



Interconnection Cost – Rs. 215 lakhs

Advantages	Inter-Connection is as per MERC (RE Tariff) Regulations, 2010
Disadvantages	High Capital Cost
	There may be right of way issues for laying a line of 3 Km. Further in our humble submission, a line length of 3 km is high for a 500 kW power plant
	Space availability for an additional bay at MSEDCL Akurdi Sub-station may be a constraint
	Long lead time to establish this setup

Interconnection to Tata Motor's System



Advantages	Capital cost only to the extent of Rs . 35 lakhs
	Losses in the system would be minimum
	Early execution
Disadvantages	Energy Accounting methodology to be decided along with MSEDCL/MSETCL as the meter for Tata Motors at 220 kV shall record net consumption

Interconnection Cost – Rs. 35 lakhs

Financial Impact of the options

Scenario Summary		Tata Motors System *(Base Case)*	Transmission Network	Distribution Network
Capital Cost	Rs. in Lakhs	845	1425	1025
Impact on Pre-Tax RoE	%	19%	5%	13%

Proposed Metering Arrangement

- MSEDCL shall record the meter reading at the revenue meter for Tata Motors, which shall be a net meter reading **(A)**

- MSEDCL shall also record meter reading for the proposed Roof top Solar PV (Generation Meter) **(B)**

- Bill of Tata Motors for power supplied by MSEDCL shall be the aggregate of meter reading at revenue meter and meter reading at Generation Meter – **(A) + (B)**

- MSEDCL shall provide credit of the entire energy recorded at the meter to TPREL and shall not apply wheeling charges & losses as the inter-connection is to the consumer's system and then to the transmission system

Preliminary Views of the stakeholders

Tata Power

•The connections though not on basis of the present practice is not incorrect.
•It involves adjustment of energy

MSEDCL

•This is not a normal connection practice. It will involve taking meter reading of Solar Plant which is inside the premises

SLDC

•The norms for connections has to be established else every solar plant would like to get connected his own way

MERC

•This seems to be an offgrid connections. We may have to wait for guidelines for connectivity develop on the same

Issues are with respect to connectivity & separate metering arrangement

Urban Rooftop PV Projects

Summary of Issues

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Summary of the Issues

Connectivity to the Grid

- Most of the rooftop in urban area are smaller in size
- Smaller rooftop would entail Solar PV projects of smaller capacity
- It would not be economically feasible to connect these projects to the 11 kV or 33 kV network using a separate step-up transformer
- Policies need to be framed to allow these projects to directly connect with the grid (like a net metering system allowed in many countries) while ensuring the adequate safety of the grid and the system

Monitoring & Metering of the smaller system

- Proper mechanism for monitoring and metering the smaller systems need to be established but should not be an hindrance in the promotion of Rooftop Solar

“Journey Continues..
We value your inputs, suggestions and critique.”

We take pride in Lighting up Lives!