

Annexure-1: Technical Note on proposed Capital Investment Plan

Methodology

An important feature of MSETCL's Business Plan is the Capital Investment plan and a brief of new technologies to be adopted during the period. While covering the above-mentioned areas it is imperative to analyse evolving sector scenario both at the central and state level.

The Five Year Business Plan is formulated taking in to account previous years load growth and upcoming load centers such as SEZs, development of urban areas & New Cities like LAVASA, Malls etc.

Load Growth is considered as per the District wise Load forecasting based on "Compounded Annual Growth Rate" (CAGR) by MSEDCL.

The following guidelines given by CEA and State Grid Code have been incorporated while conducting the simulation studies for formulation of plan:

CEA – Transmission system planning & design criteria:

Central Electricity Authority (CEA) has evolved transmission system planning & design criteria for the National Electricity Plan. The planning criteria as per CEA are

- In the national approach N-2 criteria may be adopted for large generating complex (3000 MW or above) and multi line corridors (3 D/C lines or more), on case-to-case basis. Whereas, regional planning may be continued with N-1 criteria. However, while N-1 would be applied to test withstand without necessitating load shedding or rescheduling of generation during steady state operation, N-2 would be applied to test withstand without necessitating load shedding but could be with rescheduling of generation during steady state operation.
- The steady state voltage limit on 400kV system is within 380kV to 420kV.

The Maharashtra State Grid Code:

Maharashtra Electricity Regulatory Commission (MERC) has published the Final State Grid code 2006 which lays down the rules, guidelines and standards to be followed by various agencies and participants in the intra-State transmission system to plan, develop, maintain and operate the intra-state transmission system apart of Western Regional Grid System, in the most efficient, reliable and economic manner, while facilitating a healthy competition on in the generation and supply of electricity.

Section 9 of the Grid Code prescribes the planning criterion to be followed for planning the transmission system. The planning criterions as per the regulation are reproduced below:

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Clause 9.1 The planning criterion shall be based on the security philosophy on which the ISTS (Inter State Transmission System) has been planned. The security philosophy may be as per the Transmission Planning Criteria and other guidelines as given by the authority provided that State Transmission Utility shall carry out appropriate system studies while developing the transmission system plan.

Clause 9.2 The intra state transmission system, as a general rule, shall be capable of withstanding and be secured against the following contingency outages without necessitating load shedding or rescheduling of generation during Steady State operation:

- 1) Outage of a 110kV /132 kV D/C line or,
- 2) Outage of a 220 kV D/C Line or,
- 3) Outage of a 400 kV S/C line or,
- 4) Outage of a single Interconnecting Transformer or,
- 5) Outage of a one pole of HVDC Bi-pole or,
- 6) Outage of a 765 kV S/C Line.

Provided that the above contingencies shall be considered assuming a pre-contingency system deletion (planned outage) of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same substation.

Clause 9.3 All the Generating Units may operate within their reactive capability curves and the network voltage profile shall be maintained within voltage limits specified.

Clause 9.4 The intra-State transmission system shall be capable of withstanding the loss of most severe single in feed without loss of stability

Cause 9.5 Any one of the events defined in the Regulation 9.2 above shall not cause:

- 1) Loss of supply;
- 2) Prolonged operation of the system frequency below & above specified limits;
- 3) Unacceptable high or low voltage;
- 4) System instability;
- 5) Unacceptable overloading of ISTS elements.

Clause 9.6 In all substations (66kV/110kV/132kV and above), except HVDC, suitable number and capacity of transformers shall be provided to have adequate redundancy required to

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maintain firm capacity at the substation. In HVDC substations, at least one spare converter/inverter transformer shall be kept ready to use at any time.

Explanation – for the purpose of Regulation 9.6, the term firm capacity shall mean the minimum transformation capacity available at the substation in case of outage of any one transformer.

Clause 9.7 State Transmission Utility shall carry out planning studies for Reactive Power compensation of ISTS including reactive power compensation at the in-State Generating Station's switchyard.

Section 22.24 of the Grid Code/CEA Transmission planning criteria describes the voltage profile as per

| Voltage (kV – rms) | | |
|---------------------------|----------------|----------------|
| Nominal | Maximum | Minimum |
| 765 | 800 | 728 |
| 400 | 420 | 380 |
| 220 | 245 | 198 |
| 132 | 145 | 122 |
| 66 | 73 | 60 |

System modeling & approach:

Maharashtra system has been modeled from 765 kV voltage level to 33 kV & 11 kV and integrated with Western grid network, which is modeled from 765 kV voltage level to 220 kV. Inter-regional points are modeled as equivalent generators with appropriate fault level.

Total Maharashtra demand considered for the various years is around 23826 MW during 2012-13, 24780 MW during 2013-14, 25789 MW during 2014-15 & 30729 MW during 2015-16 and the total installed generation capacities (hydro, thermal) during these are years are 21177 MW, 25783 MW (additional capacity - 4606 MW) and 28588 MW (additional capacity - 2805 MW), 29396 MW (additional capacity - 808 MW) respectively.

The load flow study not only considers the existing and upcoming generations planned by state sector but also the generating stations planned by central sector & other IPPs.

To meet the upcoming load and evacuation of power generation by M/s Adani Tiroda, power generation of MSPGCL (MAHAGENCO) at Koradi and power generation of India Bulls Amaravati, new 765 kV corridor, Tiroda-

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Koradi- Akola- Amaravati- Aurangabad is being Established by MSETCL through J. V with MEGPTCL. The work of construction of 765 KV lines is already started. 765 KV lines and 765 KV sub-stations at Tiroda, Koradi and Akola are being established by M/s MEGPTCL. 765 KV Aurangabad sub-station is being established by MSETCL. From 765 KV Aurangabad sub-station, 400 KV network is being established and power will be transmitted to Padghe (Kudus) through 400 KV Aurangabad-Babhaleshwar – Padghe D/c quad Moose line. In addition to this 400 KV substation is proposed at Tapti Tanda (Aurangabad) to meet local load of Aurangabad –Jalna Districts.

MSETCL submits that though the Business Plan has been prepared with intention to cover all aspects affecting the business of MSETCL for the second MYT control period, however looking into the possibility of revision in the Transmission plan based on load flow analysis over the 5-year period, the related Capital Investment Plan and the Financing structure, are susceptible to external driven factors which may get revised during the horizon period and thus humbly requests the Hon'ble Commission to permit such revisions as and when required.