Transmission Planning Code

Version 1.0

25th April 2011

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1. INTRODUCTION

1.1. OBJECTIVE

Transmission system planning shall be aimed at the system being capable of delivering power from the generating plants to the load centres.

The Transmission system and Distribution system shall be so designed and operated as to render reliable and secure service to the consumers served by the system at the declared voltage and frequency of supply and to cause minimum losses as defined in the License Standards or approved planning standards.

2. TRANSMISSION PLANNING

2.1. TRANSMISSION SYSTEM

The transmission system is connected with the generating stations wherever these are located. Lines at HV (i.e. above 33kV) are drawn between the following network locations:

(i) From a generating station to another generating station
(ii) From a generating station to a grid substation
(iii) From a grid substation to another grid substation
(iv) From a grid substation to customers supplied at HV
(v) From captive power plants to grid substations.

The Transmission Licensee who will own, operate and maintain the transmission system shall in general follow the transmission planning criteria as outlined herein. The entire transmission network inclusive of loads and generating plants connected is considered as an integral system and is designed to give the required performance.

2.2. PLAN BOUNDARIES

The Plan shall cover the boundaries of the Bulk Supply and Operations Business of the Transmission Licensee, namely:

Off-take from Generating Plant at the high voltage terminals, and delivery to Distribution Licensees and other Transmission Customers.

2.3. THE PLANNING PERIOD, FREQUENCY OF UPDATES AND DATE OF SUBMISSION

The planning period shall be twenty (10) years, commencing from the first year after the year the plan is published. The Transmission Licensee may conduct studies covering more than ten years.

The Transmission Licensee shall update the transmission plan at least once in two years. The plan shall be documented in the form of a report titled “Long-term Transmission Development Plan *start year – ending year*” (hereinafter referred to as the “the Plan”). The contents of the Plan are provided in section 3.

An updated “Long-term Transmission Development Plan” shall be submitted for the Commission’s approval once in two years. In a year a tariff filing is due, the Commission may specify a different timing.

The Plan shall be submitted for review and approval by the Commission not later than 31st day of May, of the year in which an update to the Plan is due. However, the first such submission of the Plan will be due on 30th June 2011. The Commission shall review the Plan for compliance with the guidelines provided herein, request for clarifications and amendments, and approve the Plan. The Transmission Licensee shall publish the Plan on the Licensee’s web site immediately after the Plan is approved by the Commission.

2.4. SYSTEM MODELLING

System modelling shall be conducted for each year of the plan period to assess the required and probable year of commissioning of particular lines, based on the network, obtaining for the year in question, with the generation and load bus bars properly located.

2.4.1. SYSTEM STUDIES

The system shall be evolved based on detailed power system studies which shall include

(i) Load flow studies
(ii) Contingency studies
(iii) Short circuit studies
(iv) Transient Stability studies

2.4.2. COMPUTER PROGRAMS

Studies shall be carried out by suitable computer aided programs, as the discretion of the Transmission Licensee. Efforts shall be made by the Licensee to maintain up to date, industry standard models for the simulation of the transmission system.

2.4.3. SYSTEM DATA

The Transmission Licensee shall use updated system data in carrying out system planning studies.

2.4.4. GRID SUBSTATION-WISE LOAD FORECAST

The grid substation-wise load forecast (at 33 kV and 11 kV, in case of 132/11kV GSs) shall be prepared for each year within the planning period. The forecast shall provide the maximum demand on the GS and well as the demand coincident with the maximum demand of the Transmission Licensee's network. These forecasts shall be based on data obtained from the Distribution Licensees and the Transmission Licensee's System Control Centre.

2.4.5. LOAD AND GENERATION DISPATCHES

Load
Studies shall be carried out for day peak, night peak loading for each year.

Generation
Maximum of two generation dispatch scenarios (i.e. maximum hydro generation and maximum thermal generation) will be provided.

2.4.6. PLANNING CRITERIA

(a) The System shall be planned to maintain voltage and thermal loading criteria for the loss of one element i.e. one generator, one transformer or one transmission circuit. Prior to the contingency, all elements are considered to be in service.
(b) Optimum reactive compensation in the transmission system shall be determined by studies carried out to identify location and measure of shunt compensation at grid substations for improvement of voltage profiles under peak load conditions.
(c) Voltage profile shall be planned to be within the following limits under normal operating conditions

33 kV: $\pm$ 2% at the grid substation bus bar
132 kV: $\pm$10%
220 kV: $\pm$5%

(d) Security criteria

After outage of any one element (i.e. any one circuit of a transmission line or a transformer), the system should be able meet the distribution demand while maintaining the bus bar voltage levels as given below and loading of all the remaining elements should not exceed their emergency ratings specified.

33 kV: $\pm$2 % at the Grid Substation live bus bar.
132 kV : $\pm$10%
220 kV : +5 to –10%

(e) Thermal Load limits

Loading of all lines and substation equipment must be maintained within safe limits under all conditions.

Normal Conditions

The Transmission Licensee shall develop thermal load limits for all equipment used in the supply of load, sufficient to avoid the following:

(i) excessive sag of transmission conductors, leading to unacceptable clearance of line conductors to ground
(ii) overheating of transmission line conductors, leading to excessive damage to overhead wires due to annealing, or insulation damage on underground cables
(iii) overheating of power transformers and other substation equipment, leading to equipment damage

Emergency Conditions

The Transmission Licensee shall develop emergency thermal load limits for all equipment used in the supply of load, sufficient to avoid the following:

(i) excessive sag of transmission conductors, leading to unacceptable clearance of line conductors to ground over a defined period of overloading after the contingency
(ii) overheating of transmission line conductors, leading to accumulated damage during the overload period which significantly shortens the life of the conductors
(iii) overheating of power transformers and other substation equipment, leading to accumulated damage during the overload period which shortens the life of the equipment

(f) Short circuit criteria

It is planned to limit the maximum three phase circuit currents at the 33kV and 11kV bus bars of any grid substation, in order to protect the elements in the downstream distribution network.

Allowable maximum 3 phase short circuit levels

Bus bar voltage	Distribution System	Maximum 3-phase fault level (kA)
132 kV and above	Overhead	40.0
	UG cable	40.0
33 kV	Overhead	13.1
	UG cable	16.0
11 kV	UG cable	20.0

(g) Stability Criteria

For all relevant equipment in service, the system should remain stable in case of:

(i) A three-phase fault at any one overhead line terminal, cleared by the primary protection with successful and unsuccessful auto re-closing.(132 kV and above)
(ii) Loss of any one generation unit
(iii) Load rejection by loss of any transformer.

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(h) Load security

In addition to the planning criteria stated above, the future transmission developments plans shall be developed conforming to the load security criteria given below.

Load security criteria

Class of supply	Range of group demand	Minimum demand to be met after	
		1st Circuit Outage	***Supply Implication***
A	up to 6 MW	In repair time Group demand	No Requirement
B	over 6 MW to 12 MW	a. Within time to switch in standby transformer Group demand minus 6MW b. In over head line repair time Group demand	Requirement for standby transformer and associated switch gear, etc., but a single circuit over head line is acceptable.
C	over 12 MW to 24 MW	c. Within time to switch in standby transformer Group demand minus 12MW d. Within three hours Group demand	Requirement for standby or (firm) transformer capacity and for duplicate over head line or cable supply route
D	over 24 MW to 60 MW	e. Within 15 Minutes for group demand from 36 MW to 60MW **:** 2/3 of Group demand f. Within three hours Group demand	No requirements. Alternative supply as per Class C

Class of Supply	Range of Group Demand	Minimum Demand to be met after	
		First Circuit Outage	*Second Circuit Outage*
E	over 60 MW to 300 MW	g. Within 60 Seconds Group demand minus 20MW (Automatically disconnected) h. Within 3 hours Group demand	i. Within 3 hours For group demand from 100MW to 150MW**:** Group demand-100MW For group demand from 150MW to 300MW**: ½** group demand j. Within time to restore arranged outage Group demand
F	over 300 MW	k. Immediately Group demand	l. Immediately ½ group demand m. Within time to restore arranged outage Group demand

Note: A circuit is the part of an electricity supply system between two or more circuit breakers switches and/or fuses inclusive. Bus bars are not considered as circuits.

3. THE PLANNING REPORT

The Transmission Licensee shall submit to the Commission, a report titled "Long-term Transmission Development Plan xxxx to xxxx", which would consist of the following sections:

(1) Development of the demand forecast, disaggregated to each Distribution Licensee and Transmission Customer delivery points and/or grid substations

(2) Performance of the existing transmission system including a review of at least the past five years

(3) Analysis of performance under the forecast demand, and proposals to resolve bottlenecks

(4) A comprehensive list of proposed large and small capital expenditure to be incurred in each year, and the specific impacts expected by each investment.

- Small capital expenditure shall be defined as expenditure either on a line or a substation not exceeding LKR 500 million

(5) Unit costs transmission system components

(6) Costs of the proposed investments, and the annual investment requirements, with clear indications of

- investment requirements in each year
- taxes and other expenses expected.

(7) Analysis of the status of ancillary services, especially reactive power balance, and the plan to address the related issues.

(8) The recommended development plan

Capital expenditure should be prepared in the format provided by the Commission and annexed herewith.