TRANSMISSION CORPORATION OF ANDHRA PRADESH LIMITED

CODE OF TECHNICAL INTERFACE (GRID CODE) 2001

Approved by Andhra Pradesh Electricity Regulatory Commission vide Proceedings No. APERC/Dir-Engg/Grid Code/20, dated 26-05-2001

REVISION 1
June 2001

Summary of the Proceedings No.APERC/Dir-Engg/Grid-Code/20 dated 26-05-2001 wherein the Code of Technical Interface is approved

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1. APTRANSCO (the owner of Transmission System) is the Transmission and Bulk Supply Licensee and is authorised to carry out Transmission and Bulk Supply of energy utilising intra-state and inter-state transmission lines.

2. As per condition No.11 (1) of the Government's Provisional Licence and condition No.18 of T&BS Licence issued by APERC, APTRANSCO is to prepare, comply and implement the Grid Code.

3. Main contents of the Grid Code are mentioned, quoting Condition No.18 of the T&BS Licence. (The same are included in para 1.1.1, General Code of this Grid Code wherein the entire Section 18 is reproduced).

4. APTRANSCO prepared the Grid Code in association with M/s SNC– Lavalin after conducting three workshops on 29-01-1999, 10-02-1999 and 25-04-1999 participated by various stakeholders. The views of the participants were taken into account in preparing the Grid Code.

5. Versions 0, July 1999 was submitted by APTRANSCO to APERC on 29-10-1999. This contains the General Code, Planning Code, Connection Code, Operation Code and Metering Code.

6. The main purpose of the Grid Code is to achieve co-ordination among the various power utilities in operation and development.

7. The comments of the APERC were sent to APTRANSCO on 10-11-2000. APTRANSCO submitted the revised draft (Revision 0 December 2000) on 08-01-2001.

8. Discussion took place on December 2000 Version. The Code was further revised and Version 0, March 2001 was submitted to APERC on 07-04-2001 by APTRANSCO. The modifications do not affect the interests of DISCOMS, which were formed on 01-04-2000.

9. The Grid Code is a dynamic document, which is continually reviewed and revised.

10. Copies of the Grid Code shall be distributed to all concerned and the Grid Code Review Panel is to be established immediately.

(10) Copies

Andhra Pradesh Electricity Regulatory Commission
#298
6 OCT 2001
(4)
Hyderabad.

PREFACE

The principal functions of the Power Sector viz, Generation, Transmission and Distribution of Electricity were vested in Andhra Pradesh State Electricity Board until 01-02-1999 (the Transfer date). The Board itself was constituted in 1959 under Electricity (Supply) Act 1948.

From 01-02-1999 the Power Sector was restructured pursuant to AP Electricity Reform Act 1998. Two functionally distinct Corporations, viz APTRANSCO and APGENCO came into being on 01-02-1999. Initially, the functions of Transmission and Distribution of Electricity were vested in APTRANSCO. On 01-04-2000 Four Distribution Companies were established as subsidiaries of APTRANSCO. Each Distribution Company was given a territory in AP State and the function of Distribution of Electricity was transferred by APTRANSCO to the respective Distribution Companies. The Generating Stations formerly owned by the erstwhile APSEB are now owned and operated by APGENCO.

Electricity is an essential commodity on which the daily activities in the home, industry, commerce, transportation, agriculture and other important spheres of national life like public illumination depend. It flows from the Generating Stations to the Consumers via a network of power lines and equipment instantaneously and cannot be stored on a commercial scale. These aspects distinguish electricity from other merchandise. After restructuring, different organisations are involved in handling electricity as it flows from the Generating Stations to the Consumers. These entities own and operate different segments of the total system over which the electric power flows.

There are numerous combinations of organisational structures dealing with Generation, Transmission and Distribution of Electricity in various countries. However, the integrated/interconnected operation of the total power system (the grid system) and the associated technical and economic advantages are nowhere dispensed with. Further, centralised on-line control (Load Despatching) is invariably retained in the hands of a regulated monopoly, usually publicly owned, because of the technical and economic advantages of such an arrangement.

The foregoing considerations lead to the conclusion that a Code must exist, compliance with which is mandatory, for all entities operating different stages or sections of the integral system network. This is the Code of Technical Interface or the Grid Code. APTRANSCO is vested with coordinating all Power Sector Organisations and is responsible for developing and implementing the Code in addition to operating the Grid. The Draft Code was available on the Transfer Date and requires approval of APERC. The Draft was prepared taking into account the views, suggestions and comments of various individuals, organisations, consultants and experienced officers of the erstwhile APSEB obtained through direct dialogue and in the course of workshops.

The Code of Technical Interface is a dynamic document that is revised periodically as per the procedures laid down, taking into account the reasonable interests

and views as expressed by the stake–holding entities in the light of the experience gained in the actual implementation of the C.T.I.

The objective of the CTI is to provide guidance for efficient, economical and coordinated operation, maintenance and expansion of the entire power system, especially the Transmission Network and to create an environment conducive to competition in the generation and distribution of electricity.

The C.T.I consists of five Codes: The General Code, Planning Code, Connection Code, Operation Code and Metering Code. They deal with the procedures and responsibilities especially at boundaries between entities, prescribe formats and time scales for exchange of data between entities in respect of operation and development activities and lay down connection conditions to be followed by Users. By following the C.T.I., coordination in real time operation, maintenance of equipment, load relief, load restoration, standards of supply, safety, frequency and reactive power management, metering, protection and outage coordination are achieved. Coordinated development of systems of various entities is also assured.

APTRANSCO owns and operates the transmission system in AP State consisting of EHT lines and sub-stations.

The Grid is controlled on real time basis by the **State Load Dispatch Centre (SLDC)** which is part of **APTRANSCO**.

Power generated by various generating stations of **AP GENCO**, IPPs, CPPs Joint Venture Corporations (JVCs), National Generating Stations, and power obtained through Inter-State and Inter-Regional power transfers is fed into the Grid from which Distribution systems draw power at various connection points.

The general objective of all power sector undertakings is to supply electricity to consumers at the lowest possible tariffs and to maintain quality of power supply, service reliability, voltage, frequency and waveform within limits. The various entities of the power sector, i.e. Generation, Transmission and Distribution Companies are inter-dependent for planning and day-to-day operations. The Code of Technical Interface is prepared such that the interface activities and responsibilities especially at the boundaries are clearly defined and can be smoothly carried out. A competitive environment is to be created while ensuring fairness to all parties.

Functions of APTRANSCO: -

APTRANSCO as Transmission and Bulk Supply Licensee owns, operates and maintains the interconnected transmission system (the Grid) consisting of EHT lines and substations. In addition, **APTRANSCO** shall carry out the following functions:-

i) Coordinate the activities of all entities especially the operation and development of Generation, Transmission and Distribution Companies.

ii). Manage and control the Grid to ensure adequacy of supply. This entails the preparation of Generation Schedules, monitoring and controlling the output of various generating stations and receiving and dispatching power from various Generators.

iii) Deliver power that conforms to specified quality characteristics to Distribution systems at designated connection points

iv) Carry out statutory functions under all Acts, Rules, Laws and Regulations of the State Government and the Government of India, the License issued by **APERC**, and the CTI and superintend the DISCOMs in complying the Distribution Code.

v) Develop, maintain and implement the Code of Technical Interface as approved by **APERC**.

vi) Assume the powers and responsibilities of the State Tranmission Utility that succeeds the APSEB.

vii) On-Line control of the Power System of AP.

viii) Responsibilities as per various Agreements as successor entity of the erstwhile APSEB.

ix) Liaison with the State Government, Government of India, **SREB, SRLDC, CTU, PGCIL, NTPC, CEA** and implementation of the directives of **CERC** and **APERC**. Also ensures that the directives of **SREB** and **SRLDC** are iimplemented.

x) Control the Distribution Companies in AP State as a parent Company and ensure compliance of conditions of Retail Power Supply Licensee and Distribution Code.

xi) Carry out any other function on the instructions of the State Government **/APERC.**

xii) Promoting power pooling, wheeling and banking

This Preface is meant for information only and does not constitute part of the Code of Technical Interface.

Changes made in CTI while revising the Final Draft and in the preparation of Version 0, which will be submitted to APERC for approval.

1) Preface has been added.

2) Definition in General Code and Metering Code have been merged. The synthesized list now appears in 1.2.

3) The provision of Disputes Resolution Cell has been deleted.

4) The other Common Services Organizations have been reduced in number.(Since deleted altogether).

5) In General Code repetition of certain matters is avoided. 1.1 (Introduction) and 1.1.2 have been re-written.

6) Para 1.3.7 (Disputes) has been re-written.

7) The following paras have been added in the General Code:

   a) Unforeseen circumstances.
   b) Equipment owned by Third Party.
   c) System Control.
   d) Emergency Periods.

8) In Connection Code, while prescribing standard values for Grid Characteristics, three separate periods are recognized: Preliminary Stage, Transition Stage, and Final Stage. In the earlier Version these periods were considered only for "Reliability". In Version-0 the stages are applied for more parameters. In the "Preliminary Stage" no standards are specified.

9) Paras 4.9 and 4.10 have been revised so that no operational difficulties arise when the boundaries decided by the erstwhile APSEB between Generators and APTRANSCO and between APTRANSCO and Discoms are implemented.

10) Commercial Metering of Distribution Systems has been added.

Changes made in November-December 2000

11) Revision has been made taking into account the views and recommendations of PricewaterhouseCoopers and NGC Consortium.

12) Revision has been made taking into account Guidelines No. 3 of APERC.

13) Revision has been made in order to make CTI consistent with Indian Electricity Grid Code.

14) Miscellaneous other corrections have been made, considering the formation of Discoms.

Changes made in March 2001 before the approval of APERC

15) Planning for Modification Works, Sub-Section 2.18, added.

16) Revision has been made taking into account Messers SNC – Lavalin's Response to Pricewaterhouse Cooper's comments.

17) Section 4.1 (Demand Forecast) has been re-written.

ANDHRA PRADESH CODE OF TECHNICAL INTERFACE
(AP GRID CODE)

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ANDHRA PRADESH

CODE OF TECHNICAL INTERFACE

Section 1

GENERAL CODE

ANDHRA PRADESH CODE OF TECHNICAL INTERFACE

(AP GRID CODE)

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1 GENERAL CODE

1.1 General Issues

1.1.1 Scope

The Code of Technical Interface is a document that defines the boundary between APTRANSCO and Users and establishes procedures for operation and development of facilities connected to the Transmission system. It lays down both the information requirements and procedures governing the relationship between APTRANSCO and Users.

The C.T.I. shall be complied with by **APTRANSCO**, in its capacity as holder of the **Transmission and Bulk Supply Licence**, and by **Generators**, **Distribution Companies**, **Suppliers** and **Bulk Power Consumers** in the course of their activities in generation, supply, and utilization of electricity and in the capacity as holders of Retail Supply Licence.

The CTI is designed to facilitate the development, operation and maintenance of an efficient, co-ordinated and economical AP State transmission system by specifying to all parties connected to that system, including **APTRANSCO**, their technical and procedural obligations. It seeks to be non-discriminatory and to ensure that interfaces are not areas of weakness in the supply chain.

The Transmission and Bulk Supply License requires **APTRANSCO** to prepare and continually maintain in force, a Grid Code (or Code of Technical Interface)

Section 18 (Part III) of the License issued by APERC to **APTRANSCO** is reproduced below:

"Section-18 Grid Code

18.1 Except as provided in paragraph 18.4, the Licensee shall ensure that, within six months from the issue of the Licence, there is in force at all times a Grid Code, which meets the requirements of this paragraph 18. Subject to Paragraph 18.11, the Licensee shall implement and comply with the Grid Code.

18.2 The Grid Code shall include:

(a) All material technical aspects relating to, connections to, and the operation and use of the Transmission System including the operation of electric lines and electrical plant and apparatus connected to the Transmission System in so far as relevant to the operation and use of the Transmission System including, but not limited to connections specifying the technical, design and operational criteria to be complied with Transmission System or by any Generating Company who is

ANDHRA PRADESH

CODE OF TECHNICAL INTERFACE

SECTION 1

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(b) An Operating Code, specifying the conditions under which the Licensee shall operate the Transmission System and under which Generating Companies shall operate their plant and the Suppliers shall operate their Distribution System, in so far as necessary to protect the security and quality of supply and safe operation of the Transmission System under both normal and abnormal operating conditions.

(c) A Planning Code, specifying the technical and design criteria and procedures to be applied by the Licensee in the planning and development of the Transmission System;

(d) A Scheduling and Despatch Code specifying the system for the scheduling and despatch of Generating Sets.

(e) Procedures relating to the co-ordination of outages for scheduled maintenance of

Generating Sets and transmission and distribution circuits;

(f) A Metering Code, setting out requirements and procedures for metering, and

(g) A Protection Code, setting out the requirements and co-ordination of protection systems.

18.3 The Grid Code shall:

(a) be designed so as to permit the development, maintenance and operation of an efficient, coordinated and economical system for Transmission and Bulk supply in the state of Andhra Pradesh; and

(b) allow the Licensee to comply with its obligations in relation to the inter–state transmission of power.

18.4 Where no Grid Code in the form provided for in this paragraph 18 is in force at the effective date of this license it shall not be considered a breach of this paragraph 18 provided that:

(a) the Licensee shall file with the Commission a compilation of the Interim Grid Code within 60 days of the grant of this License;

(b) the Licensee shall implement and comply with the Interim Grid Code from the date of its submission to the Commission, subject to such modifications as the Commission may direct; and

(c) Within six months of the commencement of this License, the Licensee shall submit the comprehensive Grid Code described in Paragraph 18.2 and 18.3 for the approval of the Commission, which must be formulated by the Licensee after consultation with Suppliers, Generating Companies, Distribution Licensees, Central Transmission Utility, Regional Electricity Board and such other Persons as the Commission may direct.

18.5 The Interim Grid Code shall continue to remain in effect until such time as the Commission has approved the final Grid Code.

18.6 The Licensee shall, in consultatant with Distribution Licensees, Generating Companies, the Central Transmission Utility, the Regional Electricity Board and such other persons as the Commission may specify, review the Grid Code and its implementation from time to time. The Licensee shall also undertake such review as and when directed to do by the Commission. All the representations received during the interim period shall be considered by the Licensee.
Following any such review, the Licensee shall send to the Commission:

(a) a report on the outcome of such review;. and

(b) any proposed revisions to the Grid Code from time to time as the

Licensee reasonably thinks fit for the achievement of the objectives referred to in paragraph 18.2 and

(c) all written representations or objections from suppliers arising during the consultation process.

18.7 All revisions to the Grid Code shall require the prior written approval of the Commission.

18.8 The Commission may issue directions requiring the Licensee to revise, supplement or replace the Grid Code in such manner as may be specified in the directions, and the Licensee shall comply with any such directions.

18.9 The Licensee shall make available a copy of the Grid Code in force to any person requesting it at a price not exceeding the reasonable cost of duplicating it.

18.10 In preparing , implementing and complying with the Grid Code (including in respect of the scheduling of maintenance of the Transmission System), the Licensee shall not unduly discriminate against or unduly prefer:

(a) any one or any group of Persons or

(b) itself in the conduct of any business other than the Transmission Business.

18.11 The Commission may issue directions relieving the Licensee or (following consultation with the Licensee) third parties of their obligations to implement or comply with the Grid Code to the extent as may be specified in the directions."

The Code of Technical Interface is not concerned with the detailed design and operation of the Generator's Power Stations and Supplier's Distribution systems, provided that their overall compatibility with the needs of the Grid is assured. The responsibilities of the entities are defined and demarcated. Similarly, the CTI is not meant to be the internal operating instructions of **APTRANSCO**'s transmission system.

1.1.2 Interpretation

The meaning of certain terms (which are usually printed in bold letters and/or capitalized) used in the Code of Technical Interface (CTI) shall be in accordance with the definitions listed in Section 1.2, "Definitions" of the C.T.I..

1.1.3 Implementation and Operation of the C.T.I.

APTRANSCO has the duty to implement the Code of Technical Interface (CTI). All Users are required to comply with the CTI, which will be enforced by **APTRANSCO**. Users must provide **APTRANSCO** reasonable rights of access, service and facilities necessary to discharge its responsibilities in the User's premises. Users shall comply with instructions issued by

APTRANSCO which are reasonably required to implement and enforce the Code.

If any User fails to comply with any provisions of the C.T.I., the User shall inform **APTRANSCO** without delay of the reason for its non-compliance. Repeated failures to comply with the C.T.I. may lead to the disconnection of the User's plant and/or facilities. The responsibility for the consequences of disconnection including payment of damages and compensation to consumers rests with the User who consistently violates the CTI.

The Operation of the C.T.I. will be reviewed regularly by the C.T.I. Review Panel in accordance with the provisions of the relevant Section of the C.T.I..

The C.T.I. contains procedures to permit equitable management of day to day technical situation in the Electricity supply system, taking into account a wide range of operational conditions likely to be encountered under both normal and abnormal circumstances, relevant both in the present conditions and future expanded system and in the present generation shortage period, as well as surplus generation period which may come in the future.

However, the C.T.I. cannot predict and address all possible operational conditions. **APTRANSCO** is therefore empowered in such unforeseen circumstances to act decisively to discharge its obligations under its License. Users shall provide such reasonable cooperation and assistance as **APTRANSCO** may request in such circumstances. It is to be recognized that the **SLDC** is required to make quick decisions for remedying Grid crises and the instant judgments and decisions may contain oversight errors. Post-event corrections shall be made by **SLDC** itself, taking into consideration the feedback from various stakeholders and consumers. The Users and consumers have the right to approach the Regulator for redressing their grievances and unfairness. All parties must first comply with the spot instructions of **SLDC** and if injustice is experienced, the matter shall be represented to **SLDC**. If **SLDC** does not carry out the necessary changes in the subsequent operation, the aggrieved party may complain to the **APERC**.

1.1.4 Code Responsibilities

In discharging its duties under the Code of Technical Interface, **APTRANSCO** has to rely on information which Users supply regarding their requirements and intentions. **APTRANSCO** shall not be held responsible for any consequences that arise from its reasonable and prudent actions on the basis of such information.

1.1.5 Confidentiality

Under the terms of the Code of Technical Interface **APTRANSCO** will receive information from Users relating to their intentions in respect of their generation or supply businesses. **APTRANSCO** shall not, other than as required by the Code of Technical Interface, disclose such information to any other person without the prior written consent of the provider of the information.

1.1.6 Dispute Settlement Procedures

In the event of any dispute between any Users and **APTRANSCO**, or between Users, regarding interpretation of any Clause of the Code of Technical Interface, the matter will be resolved according to procedures set up in this Code (Section 1.5). The Commission will be the final arbitrator whose decision shall be final and binding. In the event of any conflict between any provision of the Code of Technical Interface and any contract or Agreement between **APTRANSCO** and a User, the provision of the Code of Technical Interface shall prevail.

1.1.7 Communications between Licensee and Users

All communications between **APTRANSCO** and Users shall be in accordance with the provision of the relevant section of the Code of Technical Interface. Unless otherwise specifically required by the Code of Technical Interface, all communications shall be in writing, except where operation time scales require oral communication, in which case these communications shall be confirmed in writing as soon as practicable.

1.1.8 Partial Invalidity

If any provision or part of a provision of the Code of Technical Interface should become or be declared unlawful for any reason, the validity of all remaining provisions or parts of provisions of the Code of Technical Interface shall not be affected.

1.1.9 Directives

Under the provisions of the Act, the State Government may issue policy directives in certain matters. The Licensee shall promptly inform the Commission and all Users of the requirement of such directives. The Users, subject to the relevant section of the Act, shall comply with the directive.

1.2 Definition of Terms

In the **Code of Technical Interface** the following words abbreviations and expressions shall bear the following meanings:

TERM	DEFINITION
Act	The A.P. State Electricity Reforms Act 1998
Active Power or MW	Product of voltage and current and cosine of the phase angle between them measured in units of Watt (W) Kilowatt (kW) = 10^3 W Mega Watt (MW) = 10^6 W Giga Watt (GW) = 10^9 W Tera Watt (TW) = 10^{12} W

Active Energy	The electrical energy produced, flowing in or supplied by an electrical circuit during a time interval, being the integral with respect to time of Active Power, measured in units of watt-hours or standard multiples thereof, that is :- 1000 Wh = 1kWh = 1 unit 1000 KWh = 1MWh 1000 MWh = 1GWh = 1MU (Million units) 1000 GWh = 1 TWh = 10^{12} Wh
A.C.	Alternating Current
Agreed Procedure	Procedure for dealing with specific situations in metering as specified in Section 5.2.3 of the Metering Code.
Alternator	The electrical machine which is driven by a prime mover and generates AC electric power. The term Generator is reserved for another meaning to avoid confusion (see def. of Generator)
Annual Hydro Plan	The plan prepared by APTRANSCO on the instructions of High Power Electricity Irrigation Coordination Committee by mid September each year relating to Water Resource Management during the period of twelve months commencing on 1st October in that year.
Apparent Power	S = P + JQ. Magnitude is calculated by the formula S = $\sqrt{(P^2 + Q^2)}$ expressed in units of Volt-amps (VA) or multiples like kVA, MVA
A.P. Code of Technical Interface	The set of principles and guidelines prepared by APTRANSCO in accordance with the terms of the Transmission License, as amended from time to time by the direction of the Commission, relating to the Planning, Design and Operation of the APTRANSCO System and all Users connected to it.
APERC	Andhra Pradesh Electricity Regulatory Commission. (referred to as the 'Commission')
Apparatus	All equipment in which electrical conductors are used, supported or of which they may form part.
Appendix	An Appendix to a Section of the Code of Technical Interface
APGENCO or APGC	Andhra Pradesh Generation Corporation Ltd., registered under the Companies Act and successor of APSEB in generation of power
APTRANSCO or APTC	Transmission Corporation of A.P Limited, Registered in 1999 under the Act of 1998 which is the successor to APSEB in Transmission of Electricity and other general functions like coordinating all Power Sector entities in AP State.
APTRANSCO Control Centre	A location used for the purpose of control & operation of the APTRANSCO system which, on the transfer date is at

		Vidyut Soudha in Hyderabad, Andhra Pradesh
	APTRANSCO Data Collector	A data collecting device owned by APTRANSCO which transmits data to the Data Collection System of APTRANSCO for the purpose of compiling information
	APTRANSCO Demand	The Demand on the APTRANSCO system less the output of Independent Generating Plant limited to provision by the Connection Agreement
	APTRANSCO Site	A Site owned by APTRANSCO, or owned by a User but occupied by APTRANSCO, in which there is a Connection point.
	APTRANSCO System	The transmission system at voltage levels of 400 kV, 220 kV, 132 kV and 66 kV. (The Distribution system shall be treated as a separate entity of the Supplier.)
	APTRANSCO System Data	Data concerning the APTRANSCO System to be supplied by APTRANSCO to Users. APTRANSCO system data consists of salient features to the existing system and future system as per the perspective plan. Such data shall contain details of EHV lines (i.e.132KV and above) and shall include the following: (a) Single line diagram of the APTRANSCO system indicating the existing lines and proposed lines (shown dotted). (b) Map of A.P showing the existing lines of the APTRANSCO system and proposed lines (dotted) preferably to scale 1Cm = 10 kM
Area of Supply		As defined in the license concerned.
	Area Load Despatch Centre	One of the four stations in AP State being established under Southern Region System Coordination and Control Project, having as main functions: - Data acquisition and transfer to SLDC and supervisory control of 132 kV and 33 kV equipment.
	Automatic Load Shedding	A Load shedding scheme implemented by APTRANSCO to prevent frequency collapse or other problems and to restore the balance between generation output and demand on the APTRANSCO system
	Automatic Voltage Regulator (AVR)	A continuously acting automatic excitation system to control the voltage of a Generating Unit measured at the Generator Terminals
Back Supply		Supply of electricity to the APTRANSCO and for its own use
BIS		Bureau of Indian Standards.
Black start		The procedure necessary for a recovery from a Total Shutdown or Partial Shutdown.
BPTA		Bulk Power Transmission Agreement

Break-down	An occurrence relating to equipment of supply system which prevents its normal functioning
Cancelled start	A response by a Generator to an instruction from APTRANSCO canceling a previous instruction to synchronize to the APTRANSCO system
Capability	The Capability of a Generating unit, expressed in MW, to generate electricity determined at the Interconnection point (after deducting consumption of auxiliaries)
Captive Power Plant (CPP)	A Power Station which is primarily operated to meet a Captive Demand
CCGT Module	A group of Generating Units comprising one or more Gas Turbine Units and one or more Steam Units wherein the waste heat from the gas turbines is passed to the water/steam system of the steam units thereby increasing the overall efficiency of CCGT Module.
CEA	The Central Electricity Authority of India.
CCGT	Combined Cycle Gas Turbine
CCGT Unit	A Generating Unit within a CCGT Module
Central Despatch	The process of scheduling and issuing Despatch Instructions in relation to CDGUs direct to a Generating plant by APTRANSCO pursuant to the Code of Technical Interface
CERC	Central Electricity Regulatory Commission established under Electricity Regulatory Commission Act 1998 and Electricity Laws (Amendment) Act 1998 (Central Acts)
Central Sector Projects	Power Projects and Transmission Projects built and operated by Central Organisations such as National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), Power Grid Corporation of India Limited (PGCIL)

Centrally Despatched Generating Unit or CDGU	A Generating Unit within a Generating Plant
Changed Status Data of a CDGU	Newly arisen factors pertaining to a CDGU and its parameters which may have a material effect on the probable output of a CDGU and which must promptly be intimated to the SLDC by the Generator concerned (Refer also "GSDP" Notice)
Civil Emergency	Any National disaster or other emergency which is declared by the State/National Government as one that is likely to disrupt Electricity supplies

Code of Technical Interface Review Panel	A standing body established by APTRANSCO to carry out the following functions. (a) Keep the Code of Technical Interface and its working under periodic review (b) Review any suggestions for amendments to the CTI at meetings of the panel held in accordance with the Panel's constitution, and (c) Give guidance in relation to the Code of Technical Interface, its implementation, performance and interpretation on the reasonable request of any User.
Commission	The A.P Electricity Regulatory Commission established pursuant to Sec.3 of the A.P. Electricity Reforms Act 1998, same as APERC.
Confirmation Statement	A daily statement prepared by a Generator and submitted to APTRANSCO in accordance with the relevant PPA.
Connected Load	Aggregate of rated capacity of all apparatus including portable apparatus in the Consumer's premises which are supplied or declared by the Consumer to be taking supply from the system. This shall be expressed in kW, kVA
Connection Agreement	An Agreement between APTRANSCO and a User setting out the terms relating to a connection to and/or use of the APTRANSCO system
Connection Conditions	Chapter of the Code of Technical Interface dealing with the condition of connection of a User's system to the APTRANSCO System.
Connection Point	A point at which a User's Plant and/or Apparatus connects to the APTRANSCO system or Inter-State Transmission system.
Connection Site	A site containing a Connection point
Consumer	Any person supplied with electrical energy by the supplier either as owner or lawful occupier and whose premises are for the time being connected to the supplier's system and includes the consumer whose power supply, notwithstanding the subsistence of agreement has been disconnected for the time being

Contingency Reserve	The margin of generating capacity over forecasted Demand required in the period from 24 hours ahead down to real time to cover against uncertainties in Generating plant availability, imports from external connections and against Demand forecast variations. It is provided by Generating plants not required to be synchronized but must be held available to synchronize within 10 to 15 minutes.
Contract Demand	Maximum kW or kVA agreed to be supplied by the Supplier and reflected in the agreement executed between the parties

Contracted Capacity	In relation to a CDGU, the maximum capability of the CDGU as specified in the relevant PPA. It is the net active power that can be injected by the CDGU into the Transmission System at the connection point, excluding the power consumed in the auxiliaries of the CDGU.
Control Person	A person identified as having responsibility for cross boundary safety under relevant Section.(Cross Boundary Safety) of the Code of Technical Interface
Control Phase	The phase that follows the Programming phase and starts with the issue of the Indicative Running Notification for the next schedule day and covers the period down to real time.
CTU	Central Transmission Utility. It is an organisation which owns and operates inter-state and inter-regional transmission system in the territory of India.
Data Acquisition System (DAS)	A device provided to record the sequence of operation in time, of the relays / equipment / system parameters at a location.
Data Collection System	A system operated by APTRANSCO to collect data from Generating Stations and Connection points of EHT consumers and Distribution Systems.
Delivery Point at Generating Stations	The point at which a generator transfers power and energy to the APTRANSCO system and with reference to which the transaction of power and energy between Generators and APTRANSCO are made. This normally corresponds to the interface boundary. Meters are usually connected at this point and if connected at some other point, the quantities of power and energy will be adjusted with respect to this point. Generally the delivery point corresponds to the relevant connection site.
Delivery Point of Bulk Supply	The point at which energy is delivered by APTRANSCO to a DISCOM and with reference to which the transaction between APTRANSCO and the DISCOM is made. This normally corresponds to the interface boundary. Meters are usually connected at this point, and if located at some other point, the quantities of energy and power will be adjusted with respect to this point. Generally the delivery point corresponds to the relevant connection site.
D.G.C	The part of the Distribution Code which is identified as the Distribution General Supply Code.
Disclosee	Person to whom confidential information has been disclosed because it is essential for that person to know the particular confidential information in order to fulfill his duties/obligations and statutory requirements.
Disputes Procedure	The procedure detailed in a PPA for resolving disputes between APTRANSCO and another party.
D.O.C	That portion of the Distribution Code which is identified as the Distribution Operating Code
D.P.C	That portion of the Distribution Code which is identified as the

		Distribution Planning and Connecting code.
	De-Loaded	The condition in which a Generating unit has reduced or is not delivering electric power to the System to which it is synchronized and the terms "De-Loading" and "De-Load" shall be construed accordingly.
	De-synchronised	The act of taking out a Generating unit from the APTRANSCO system to which it has been synchronized; like terms shall be construed accordingly.
	Demand	The Demand of active power and reactive power unless otherwise stated
	Demand Charges	Fixed charges payable by the Consumer at the rate fixed by the Supplier per KVA of Maximum Demand attained by the consumer's system or 80% of Contracted Demand whichever is higher.
Demand	**Control**	All or any of the methods of achieving a Demand reduction set out to the provisions made by APTRANSCO and procedures to be followed by APTRANSCO and Users to permit reductions in Demand
	Demand Forecast	The process which specifies procedures to be followed and data to be supplied to APTRANSCO to enable APTRANSCO to forecast Demand on the APTRANSCO system through time scales ranging from Two years in advance plus the current year through to the control phase and into real time operation.
Despatch		The issue by APTRANSCO of instructions to Generating plant pursuant to Scheduling and Despatch Section(4.3) of Operation Code and the term "Despatched" shall be construed accordingly.
	Despatch Instructions	An instruction by APTRANSCO to a Generator to operate a CDGU issued in accordance with Section 4.3 (Scheduling and Despatch) of Operation Code.
	Detailed Panning Data	Data specified in Planning Code.
	Development	A Modification relating to a User's Plant and/or Apparatus already connected to the APTRANSCO system.
	Disconnect	The act of physically separating User's (or Customer's) equipment from the APTRANSCO system.
	Distribution Code	The document produced by Distribution Company pursuant to condition of the Electricity Supply License
	Distribution Mains	Portion of main supply line owned and managed by Supplier with which the service line is or intended to be connected.
	Distribution System	The Distribution System comprising electric lines and apparatus at voltage levels of 240V, 400V, 11 kV, 33 kV which as at the Transfer Date, is owned by APTRANSCO.
	Distributor	A person appointed through an operating agreement for the operation of a part of the Distribution system
	Earthing	A way of providing a connection between conductors and earth by an Earthing Device.
	Earthing Device	A means of providing a connection between a conductor and earth being of adequate strength and capability and conforming to Indian

	Standard Code of Practice.
Earth Fault Factor	EFF at a particular location is the ratio of the highest RMS phase voltage at Power frequency in a sound phase during earth fault in other phases to the RMS phase voltage without fault.
Effective Date	The Transfer Date
Electricity Board	The erstwhile A.P. State Electricity Board
Electricity Supply Act	The Electricity Supply Act'1948 as amended up to date
Emergency Manual	Load shedding carried out at short notice or no notice for safety of personnel and equipment or when a Regulating Margin cannot otherwise be achieved.
Energy	Quantity of electrical energy measured in units equal to one Kilowatt hour (kWh) or multiples thereof such as: 1000 Wh = 1 kWh (One Unit) 1000KWh = 1 MWh 1000MWh = 1 MU (Million units) = 1 GWh
Engineer	The Executive Engineer of the Division having jurisdiction over the area of supply in which the premises to be served are located and includes any other subordinate Engineer duly authorised by him or his superior officer.
Event	An unscheduled or unplanned occurrence on a Grid including faults, incidents and breakdowns.
Event Logger (EL) or Event Recorder (ER)	A device provided to record the sequence of operations in time, of the relays/equipments at a location during an event.
Export	In respect of any party, a flow of electricity from the plant or apparatus of such party to the plant or apparatus of another party and the verb "export" and its respective tenses shall be construed accordingly.
External Interconnections	Apparatus for the transmission of Electricity to or from the APTRANSCO system into or out of a Transmission system located outside A.P.State.
Extra High Voltage or EHV	A voltage exceeding 33000 volts under normal conditions subject, however, to the percentage variation allowed by the Indian Electricity Rules, 1956 as amended up to date.
Fault Locator (FL)	A device provided at the end of a transmission line to measure / indicate the distance at which a line fault may have occurred.
Final Metering Scheme	A Tariff Metering scheme as set out in Metering Code Sub-Code 2, intended to be the permanent metering system after the FMS Date
Financial Year	Period commencing on 1st day of April and ending on 31st day of March of next year

	Five Minute Reserve	That component of the Operating Reserve which is fully available within 5 minutes from the time of a frequency drop or a Despatch Instruction pursuant to Section 4.3 (Scheduling and Despatch) of Operation Code and which is sustainable for a period 24 hours.
	Flexible Alternating Current Transmission (FACT)	Facilities that enable power flows on AC lines to be regulated, to control loop flows, line loadings etc.
FMS Date		In respect of Generation Metering, the date on which the Final Metering Scheme comes into effect for all Units and Relevant Connection Sites subject to such exceptions as may be agreed with the Commission after consultation in each separate case with the party which operates the Generating Unit or occupies the Relevant connection site which is subject to such exception.
Force Majeure		Has the meaning ascribed to that term in the relevant PPA
Forced Outage		An outage of a CDGU or item of Power Station equipment of which no notice can be given by the Generator to APTRANSCO.
Frequency		The number of alternating current cycles per second (expressed in Hertz or Hz) at which a System is running.
	Frequency Control	The control of the frequency of the APTRANSCO System. (Practically it is the control of frequency of the Southern Grid).
	Frequency Sensitive Mode	The operation of a Generating unit whereby its generation level is varied automatically to compensate for variations in the frequency of the APTRANSCO System.
	Frequency Transient	An abrupt increase or decrease of 0.5 Hz or more in the frequency of the APTRANSCO System.(and therefore in the frequency of Southern Region.)
	Frequency Variation Index (FVI)	A performance index representing the degree of frequency variation from the nominal value of 50.00 HZ over a specified period of time $$FV1 = 10 \times \frac{\sum_{i=1}^{N} (f_i - 50)^2}{N}$$ Where F i = actual frequency in Hz at i the time period

	N= number of measurements over the specified period of time
Full Load	Maximum net electrical output of a Generating Unit after Auxiliaries, measured at the Interconnection point.
Generating Plant	A Power Station subject to Central Despatch
Generator Data Collector	A data collecting device owned by a Generator available to transmit data directly to the relevant Generator and dedicated at all times to such transmission of data to such Generator.
Generating Scheduling and Despatch Parameters	Information provided by Generator to APTRANSCO pursuant to the relevant section of the PPA and Section 4.3 of the Code of Technical Interface to enable APTRANSCO to formulate the generation schedule and dispatch instructions. Such information shall comprise the capacity and availability of all generating units and any special factors that may affect the output of the CDGU
Generating Unit	Any Apparatus which produces electrical energy including a CCGT Unit.
Generation Schedule	A statement prepared by APTRANSCO detailing the generation schedule of each CDGU for a Schedule Day (00 to 24 Hrs) and issued by 1600 hrs on the previous day with the object of maintaining quality and security of supply (with adequate margin if available) taking into account inter-state transfers, the output of central generating stations, IPPs , JVCs and CPPs.
Generator	A person or agency who generates electricity and who is subject to the Code of Technical Interface either pursuant to any agreement with APTRANSCO or otherwise.
Generator Reactive Performance Chart (Capability Curve)	A diagram which shows the MW and MVAR Capability limits within which a CDGU is expected to operate under steady state conditions in the manner prescribed by the manufacturer of the alternator. The diagram shall indicate the output under different power factors.
Generator Terminals	The stator terminals of an alternator.
Good Utility Practice	Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period which could have been expected to accomplish the desired results at a reasonable cost consistent with good business practices, reliability, safety and with expedition.

Governor Droop	In relation to the operation of the Governor of a Generating Unit, the percentage drop in APTRANSCO system frequency which would cause the Generating Unit under free governor action to change its output from zero to full load.
Grid Code	Synonym of the Code of Technical Interface.

Grid Entry Point		A point at which a Generating Unit or an External Interconnection connects to the APTRANSCO system
Grid Exit point		A point at which electricity may be delivered from the APTRANSCO system to a customer or to a Distribution System.
GSDP Notice		A notification by a Generator to APTRANSCO of any change in the GSDP values of any of its CDGUs previously notified by the Generator in its last GSDP Notice (a) given by 10.00 hours on the day before the relevant Schedule Day in accordance with Section 4.3.4.1 of Operation Code in respect of revised values of which the generator is then aware of. (b) given after 10.00 hours on the day before the relevant Schedule Day in accordance with Section 4.3.4.1 of Operation Code in respect of revised values of which the generator subsequently becomes aware of.
	High Voltage or HV	Voltage exceeding 650 Volts.
	Hot Standby	In relation to a Generating Unit, a condition of readiness of the Generating Unit's boiler to enable the Generating Unit to be synchronized to the APTRANSCO System and attain an instructed output in a specified time scale.
HV Apparatus		High Voltage electrical circuits forming part of a System
Hydro Station		A Hydro-electric Power Station.
IEGC		Indian Electricity Grid Code, a document developed by the Central Transmission Utility and approved by the Central Electricity Regulatory Commission which lays down procedures for operation and development of Regional Grids and the relationship between various constituents and users of each Regional Grid and the relationship between the Regional Electricity Board/RLDC and the constituents in the Region and which primarily deals with ISTS and ISGS and incidentally with the State Systems.
Import		In respect of any party, a flow of electricity to the Plant or Apparatus of such Party from the Plant or Apparatus of another Party and the verb "import" and its respective tenses shall be construed accordingly.
	Implementing Safety Coordinator	A person nominated by APTRANSCO and/or a User to be responsible for the co-ordination of safe working procedures at a connection point when cross boundary work is carried out which necessitates the provision of safety precautions on HV Apparatus. An Implementing Safety Coordinator may be responsible for more than one connection point.
	Independent Generating Plant	A Power Station which is not subject to Central Despatch.
	Independent Power Producer (IPP)	A generating company not owned /controlled by the Central/State Government.

Indicative Running Notification (IRN)	A notification issued by APTRANSCO informing the CDGUs the period and the loading for which the CDGUs may schedule their units during the following scheduled day. The Generator may confirm or seek modification immediately.
In-Situ test	A test or calibration made on a meter, CT or PT in its normally located place, with respect to physical mounting, and where it normally functions.
Interconnection Point	In relation to a CDGU or generating station the point at which the CDGU or generating station is connected to the APTRANSCO system and at which Energy is delivered to APTRANSCO, as specified in the relevant PPA.
Interconnections	The electric lines, plant or apparatus and meters for the transfer of electricity to or from the APTRANSCO Transmission System include into or out of the transmission system of the Power Grid Corporation of India (PGCIL) or neighboring States.
Interested Party	In relation to Metering of Generator Circuits at any Relevant Connection Site of a Generating unit, the Generator which operates such Generating unit; in relation to Substation metering, APTRANSCO are the interested parties.
Inter-State Generating Station (ISGS)	A Central /MPP/ other generating station in which two or more than two States have a share and whose scheduling is to be coordinated by RLDC.
Inter-State Transmission System (ISTS)	Any system for the conveyance of energy by means of a main transmission line from the territory of one State to another State and includes: (i) The transmission system to convey energy across the territory of an intervening State as well as the system for conveyance of energy within a State, which is incidental to such inter-state transmission of energy. (ii) The system for transmission of energy within the territory of a State built, owned, operated, maintained or controlled by the Central Transmission Utility or by any person/ agency under the supervision and control of the Central Transmission Utility.

Interim Metering Scheme	In respect of Generation Metering, a Tariff Metering scheme as set out in the Metering Code, Sub-Code 1, which takes effect from the Effective Date in relation to Generating Units and Relevant Connection Sites, commissioned on or prior to such date, until the Final Metering Scheme comes into effect.
Intertripping	A method of tripping a circuit breaker on receipt of a signal initiated

		from protection at another location
	Isolating Device	A switching device which when in the open position provides an isolation distance. It shall be possible to observe the isolation distance.
	Isolation	The disconnection of any HV Apparatus from the remainder of the System in which the HV Apparatus is isolated by approved means such that electricity cannot pass through the Apparatus and the Apparatus is de-energised. The state of isolation must be capable of observation.
	Joint System Incident	An event occurring anywhere on the Total System which has or may have a serious and widespread effect on a User System or on the APTRANSCO system or may result in cross-boundary consequences.
JVC		Joint Venture Company, it is a company in which both Government and a private party hold substantial stocks.
KVA		Kilovolt Ampere
LCP		Line Clear Permit
License		A License granted under the Act for the purpose specified
Licensee		Licensee or License Holder is a person or Corporation to whom a License or Authorisation is issued by the AP State Government or, under Section 15 of AP Electricity Reform Act 1998, by the AP Electricity Regulatory Commission for carrying out transmission, bulk supply or retail supply of electrical energy in AP State, or a territory inside AP State for a given period.
	License Standards	The standards set out or referred to in the Transmission License
Load		The Active and Reactive Power, as the context requires, generated, transmitted or distributed and all like terms shall be construed accordingly.
Load Factor		Ratio of total number of units consumed during a given period to the total number of units that could have been consumed, had the contract demand/maximum demand been maintained throughout the same period. It is usually expressed as a percentage.
	Load Management Arrangements	Agreement between certain large Users and APTRANSCO for Users to reduce their Demand at certain times of the year having been given an advance notice of this requirement by APTRANSCO.
	Load Price	That element of the Generation prices for a CDGU (expressed in Rupees/hour of operation of the CDGU) which relates to the operation of the CDGU at no load but which is applicable for all loads of output of the CDGU.
	Local Safety Instructions	The combined sets of safety instructions supplied by a User to APTRANSCO and by APTRANSCO to a User which provide necessary information pertaining to safety precautions and safe working procedures such as, but not limited to, isolation and earthing, on its side of the connection point at each connection site. The timing of the issue of the safety instructions shall be as stated in the connection agreement.
	Loss of Load	The probability of not being able to meet the peak load of

	Probability (LOLP)	APTRANSCO system due to planned or forced outage of Generating units.
	Low Frequency Relay or Under Frequency Relay	An electrical measuring relay intended to operate when the frequency falls below predetermined value.
	Low Voltage or LV	A voltage below 250 volts under normal conditions subject, however to the percentage variation allowed by the I.E.Rules 1956.
M.U.		Million Units of Energy (10^6 kWh)
Margin		An appropriate Operational Planning margin, set by APTRANSCO, of generating capacity over that required to meet APTRANSCO Demand.
	Maximum Demand	In respect of any Settlement Period, four times the largest number of Kilowatt hours supplied and taken during any continuous fifteen minute period (calculated from either the commencement or the middle of an hour).
	Mega Power Project (MPP)	A generating station of an IPP having two or more States as beneficiaries.
	Merit Order	A priority order of CDGUs compiled by APTRANSCO pursuant to Schedule and Despatch Section (4.3), generally in ascending order of cost of energy and taking into account the PPAs, flood water utilisation at hydel stations, conservation of fuel and lowest cost consideration for APTRANSCO.
	Metering	Tariff Metering in respect of energy transfer from Generating Stations to the Grid and from the Grid to Distribution Systems and operational metering at Generating Stations and EHT Sub-Stations for operational purposes.
	Metering Code	That part of the Code of Technical Interface identified as the Metering Code and dealing with Interface Metering.
	Metering Committee	The Committee in the relevant form established in accordance with 5.15
	Minimum Demand Regulation	That margin of Active Power sufficient to provide a regulating margin for adequate frequency control.

	Minimum Generation	The minimum output which a Generating Unit can generate continuously. This parameter is registered with APTRANSCO as GSDP.
	Monthly Contribution Schedule	For Independent Generating Plants which cannot be despatched the Generator shall furnish a monthly schedule of contribution of power to the APTRANSCO system.
MVA		Mega Volt Ampere = 1000 kVA
	National Grid	The entire inter-connected electric power network of the country,

		which would evolve after inter connection of Regional Grids.
	Non-Tariff Consumer	A Consumer who purchases electricity under the terms of a special agreement and who is subject to Code of Technical Interface either by virtue of a License or pursuant to an agreement with APTRANSCO, or otherwise.
	Notice to Synchronize	A Despatch instruction given by APTRANSCO to a Generator requiring a CDGU to synchronize to the APTRANSCO system
Notified	**Area**	Scheduled areas within which the Distribution Company/Corporation or Supplier is licensed to distribute and sell electricity.
NTPC		National Thermal Power Corporation
	Operating Margin	Extra generation capacity comprising Contingency Reserve and Operating Reserve, that is required in a system to cover uncertainties in plant availability, variation in Demand forecast, loss of external connections, loss of Generation, weakness of APTRANSCO system and other factors so that the system is operated within the specifications and standards of the License. (APTRANSCO will issue timely instructions to Generators to hold the required reserves).
	Operating Reserve	The additional output from the Generating plant and/or the reduction in Demand which is available to respond/contribute to containing and correcting any APTRANSCO system frequency deviation to an acceptable level in the event of a loss of generation, or a loss of import from an External Interconnection, or mismatch between generating output and Demand.
	Operational Boundary	The boundary between the systems of any two entities in the total system or network. It divides the responsibilities and facilities between the Corporations and defines jurisdiction.
	Operational Metering	Meters and associated equipment including metering and protection equipment installed by or on behalf of APTRANSCO for: i) Operational and System control purposes ii) Monitoring Power stations in order to check the output of generating units or any part thereof, excluding any tariff metering and generator circuits.

Operational Planning	The process carried out by APTRANSCO which involves planning through various time scales, the matching of Generating Capacity with forecasted APTRANSCO Demand, together with a reserve of generation, to provide a suitable system margin, taking into account the output of Independent Generating Plant and External Interconnections, in order to maintain the security and integrity of the APTRANSCO system
Operational Planing Phase	In respect of Grid Operation and Generation despatching the period between the fourth week from real time to the end of year II.

	Other User's Network	A system of a co-generator having a network of its own connected to the transmission system of APTRANSCO.
Outage		In relation to a CDGU, a total or partial reduction in Availability due to failure or maintenance of the CDGU or its auxiliary system; or an interruption in supply of fuel. In relation to APTRANSCO system, the removal of any part of the APTRANSCO system due to breakdown or maintenance.
Outage Notice		A notice submitted by a Generator under the relevant clause of the Operating Code notifying APTRANSCO of an unplanned outage or a notice issued by APTRANSCO to a DISCOM, notifying the DISCOM of an unplanned outage of APTRANSCO's system/equipment which affects the supply to the DISCOM's System.
	Outage Programme	The programme of outages prepared by APTRANSCO under Operation Code.
Output		The actual output at the Interconnection point of a CDGU derived from data measured pursuant to the Metering Code.
	Overall Accuracy	The combined accuracy of meters and instrument transformers whose secondary circuits feed the meters.
	Ownership Diagram	A Diagram containing numbering and nomenclature prepared for each connection site indicating the ownership of plant and apparatus by each Corporation.
Part Load		Condition of a Generating Unit which is loaded but is not running at its declared availability.
	Partial Shutdown	The condition of a complete loss of generation in a separate part of the total system with no electricity supply available from any other part of the total system or external interconnection.(That part of the total system which cannot begin to function again without APTRANSCO direction relating to a Black Start). Planned outage is also applied to the outage of any part of APTRANSCO, system which may affect supply to any DISCOM's system of which APTRANSCO intimates the DISCOM one year ahead.
Party		Any person, company, organisation, authority, firm or association subject to the provisions of the Code of Technical Interface
Planned Outage		An Outage in relation to a CDGU or items of Power Station Equipment which has been planned and agreed with APTRANSCO in advance of the year in which it is to be taken. Planned outage also means the outage of any part of APTRANSCO's System which may affect supply to a DISCOM's System which is intimated by APTRANSCO to the DISCOM one year ahead.
Power Factor		Ratio of active power (kW) to apparent power (kVA)
	Power Grid (or PGCIL)	The Power Grid Corporation of India Limited
	Power Purchase Agreement or PPA	The Agreement entered into between a Generator and APTRANSCO pursuant to which APTRANSCO amongst other matters, agrees to purchase from the Generator the capacity of its Generating Units.

Power Station	An installation comprising one or more Generating units (even where sited separately) owned and/or controlled by the same Generator, which may reasonably be considered as being managed as one Power Station.
Power Station Equipment	Items of plant in a Power Station which are integral to the operation of a CDGU, but which are not used exclusively in the operation of such CDGU, the outage of which will, or is likely to reduce the output or availability of a CDGU.
Power System Stabilizers (PSS)	A device into which is fed data of speed, frequency and power and which controls the output of the exciter of an alternator such that power oscillations of the synchronous machines are dampened.
Primary Response	The automatic response of the Governor of a generation unit to APTRANSCO system frequency changes over a time period of 0 to 30 seconds, from the time of frequency changes and fully available by 30 seconds and sustainable for up to 3 minutes.
Programming Phase	The period between the Operational Planning Phase and the Control Phase, i.e, reckoning from real time, the period from the issue of IRN to the end of the Fourth week
Protected Customer	A Customer in relation to whom, in accordance with guidelines prepared by APTRANSCO and approved by the Commission, Load Shedding shall, so far as possible, not be exercised.
Protection	Provisions for detecting abnormal conditions on a System and initiating fault clearance and activating alarms and indications.
Prudent Utility Practice	Those practices, methods, techniques and standards as changed from time to time, that are generally accepted internationally for use in electric utility industries taking into account conditions in India and commonly used in prudent electric utility engineering and operations to design, engineer, construct, test, operate and maintain equipment lawfully, safely, efficiently and economically as applicable to power stations and substations of the size, service and type of project; and which practices, methods, standards and acts shall be adjusted, to the extent necessary in order: 1) to conform to operation and maintenance guidelines recommended by the equipment manufacturers and suppliers to the project and according to the guidelines given in the IS code of practice for such equipment. 2) to ensure compliance with the Indian Electricity Act and Rules and all other Acts and Laws 3) to take into account the site location, including without limitation, the climatic, hydrological and other environmental or general conditions thereof. 4) to conform to energy conservation and 5) to conform to General Safety Standards.
Reactive Power or MVAr	The product of voltage and current and the sine of the phase angle between them measured in units of volt-amperes reactive (Var) and

	standard multiples thereof i.e 1000 VAr. = 1kVAr 1000 KVAr = 1MVAr
Reactive Energy	the integral with respect to time of the Reactive Power measured in units of volt ampere hours reactive or standard multiples thereof, that is: 1000 VArh = 1 kVArh 1000 k VArh = 1 MVArh
Recorder	An apparatus that stores a series of instantaneous readings at different times and interval and records the data obtained through a direct internal or external connection, feeding all such data into an instrument that allows such internal data to be retrieved at a future point in time.
Regional Grid	The entire synchronously connected electric power network of the Region, comprising ISTS, ISGS and intra-State systems (India is divided into various Regions each Region comprising a few contiguous states)
Regional Load Despatch Centre	The centre so designated for a specified region where the operation of the power system in that Region and the integration of the power system with other Regions and areas inside or outside India are coordinated.
Registered Capacity	The normal maximum Capability of a Generating Unit (expressed in MW)
Registrant	the party referred to as such in the Metering Code who is responsible for a particular Metering.
Regulating Margin	The margin of generating capacity over Demand which is required in order to maintain Frequency Control.
Relevant Connection Site	A site which includes a point of connection of a Power Station or a DISCOM's distribution system or a customer to the APTRANSCO Transmission system. Generally corresponds to Delivery Point or Metering Point

Requesting Safety Coordinator	The Safety Coordinator who has responsibility for the HV apparatus on which work is to be done
Rotational Load Shedding or Rota Load Shedding	Planned Disconnection of Customers on rotational basis during periods when there is a significant shortfall of generation required to meet the total demand.
Safety Coordinator	The person responsible for safe work practices in cross boundary work. This includes the Implementing Safety Coordinators and the Requesting Safety Coordinator
Safety Management	The procedure adopted by APTRANSCO, a Distribution Company

		or a User to ensure the safe operation of its system and the safety of personnel required to work on that system.
	Safety Precautions	Methods and procedures adopted to ensure safety and avoid danger when working in hazardous environment. In relation to working on HV apparatus, this entails but is not limited to Isolation and/or Earthing.
	Safety Procedures	The procedures specified within a safety management system.
SCADA		See "Supervisory Control and Data Acquisition"
Scheduling		The process of compiling a Generating schedule as set out by the SLDC, and the term "scheduled" and like terms shall be construed accordingly.
	Secondary Response	The automatic governor response to Frequency transients which is fully available within 30 seconds from the time the Frequency transient occurs and maintained for at least 30 minutes
	Settlement Period	In relation to metering, any period of 15 minutes commencing on the hour or half hour or quarter hour
	Settlement Values	Values of Active Energy and Reactive Energy delivered and the maximum demand occurring over a settlement period, as recorded by metering required by and operating in accordance with the Metering Code, or as estimated or submitted in accordance with the Metering Code. Settlement values are identified by the time at the end of the relevant settlement period
	Shut Down	The condition of a Generating Unit where it is at rest or on barring gear.
	Significant Incident	An event with a significant effect on either the APTRANSCO system or a User's system and usually entails one or more of the following operational effects: • Tripping of plant and/ or apparatus manually or automatically • Voltage outside statutory limits • System frequency outside statutory limits • System instability • System overload Whether an event has a significant effect on a system is determined by the entity (APTRANSCO or User) that owns that system.
	Site Responsibility Schedule	For connection to the APTRANSCO system for which a connection agreement is required, a schedule prepared by APTRANSCO pursuant to the relevant connection agreement which shall state for each item of plant and apparatus at the connection site:- 1) Ownership of the Plant/Apparatus 2) Responsibility for control of the Plant/Apparatus 3) Responsibility for operation of the Plant/Apparatus 4) Responsibility for maintenance of the Plant/Apparatus and 5) Responsibility for all matters relating to the safety of any person at

		the connection site.
	Site Common Diagram	Drawings prepared for each connection point, which incorporates layout drawings, electrical layout drawing, common protection/ control drawings and common service drawings.
SLDC		State Load Despatch Centre situated at Hyderabad. The SLDC is responsible for system control and load despatch on real time basis round the clock for the State of Andhra Pradesh.
	Southern Region System Coordination and Control Project	A unified computerised facility for carrying out advanced system operational functions for the power system in the Southern Region (including SCADA and EMS functions) and comprising SRLDC (Bangalore), SLDC of all constituent States and ALDCS in each State as main stations.
	Spinning Reserve	Unloaded generating capacity, which is synchronized to the system and is ready to provide increased generation at short notice pursuant to Despatch Instruction or instantaneously and automatically in response to Frequency drop.
	Spinning Reserve Capability	The ability of a CDGU to provide Spinning Reserve as specified in the relevant PPA
	Spinning Reserve Capability Schedule	A schedule supplied to APTRANSCO in accordance with the Planning Code, listing all CDGU's of a Generator and setting out the reserve required at each MW output of each CDGU
	SREB	The Southern Regional Electricity Board
	SRLDC	The Southern Regional Load Despatch Centre
	Standing Instructions	An instruction for the Despatch of a CDGU notified to a Generator in advance by APTRANSCO, whereby when the specified circumstances arise (which will be capable of being known by the Generator), the Generator will take the specified action as though a valid Despatch Instruction had been issued by APTRANSCO.
	Standard Metering	The Metering System that as a whole and all its component parts conform to the relevant Indian Standards and the Metering Code.

Start date (outage)	The date on which a planned outage is to begin
Start time (outage)	The time at which a planned outage is to begin
Start-up	The action of bringing a Generating unit from shut down to the speed required by the Generating unit to enable it to be synchronized to the APTRANSCO system.
Start-up Price	That element of the Generation Prices for a CDGU which relates to the start-up of the CDGU.
State	The State of Andhra Pradesh
State Government	Government of Andhra Pradesh State.
Static Var.	An electrical facility designed for the purpose of generating or

	Compensator (SVC)	absorbing reactive power.
	Statutory Requirements for Frequency Control	In accordance with the stipulation under Rule.55 of the Indian Electricity Rules 1956 the Frequency of supply of alternating current shall not vary by more than 3 percent from the declared frequency which is 50Hz.
STU		State Transmission Utility. An Organisation which owns and operates the Transmission System of the State.
Substation		An assembly of equipment including any necessary housing for the conversion, transformation, switching or control of electrical power.
Subsystem		Part of a System which by itself constitutes a system such as a type of equipment in a generating plant
	Supervisory Control and Data Acquisition or SCADA	A real time control and monitoring system in which the control and data collection functions are carried out from a central station through a communications system. System data is monitored and fed back to the central terminal continually, based on which control instructions are issued to all parts the system. The communication system can be telephone lines, radio, microwave or any other means of communication.
Supplier		A person authorised to supply electricity to a consumer under a License issued by the Commission pursuant to the Act. A Distribution Division under APTRANSCO drawing power from a Grid substation shall be treated as Supplier until the Distribution is privatised or corporatised
	Synchronized	The condition where an incoming Generating unit or system is connected to another system so that the frequencies and phase relationships of that Generating Unit or System, as the case may be and the system to which it is connected are identical and the terms “Synchronize” and “Synchronization” shall be construed accordingly.

	Synchronous compensation	The operation of rotating synchronous Apparatus for the specific purpose of either the generation or absorption of Reactive Power.
System Test		A Test carried out by a User or APTRANSCO which involves simulating conditions or the controlled application of irregular, unusual or extreme conditions on the User’s system or the APTRANSCO system which may affect the Total System.
Tariff Customer		A person who requires a supply of electricity and is supplied by a supplier on general terms and conditions which are applicable to all customers belonging to that particular category.
Tariff Metering		The entire system of measurement of active and reactive energy or relating to a Relevant Connection Site, comprising meters, associated current and voltage transformers, metering protection equipment including alarms, electrical circuitry, their associated data collectors

		(including Generator data collectors) and wiring and other devices or any part thereof. Based on these measurements, the energy supplying entity raises bills payable by the energy receiving entity.
Test Panel		A panel made up of representatives of APTRANSCO, Generators and DISCOMs as detailed in the Operating Code, which is responsible for various matters including consideration of proposed system tests and preparation of a Test Programme.
Test Programme		A programme prepared by APTRANSCO for conducting tests on the system which will include. (a) Procedures to be adopted for carrying out the system test including the switching sequence and proposed timings of the sequence. (b) The manner in which the system test is to be maintained. (c) List of members of staff who will be involved in carrying out the system test including those who will be responsible for safety at the connection site/Power station and (d) Other matters that APTRANSCO considers appropriate including matters suggested by Users and identified by APTRANSCO.
Test Proposer		The entity or authority who first proposes the system test.
Testing		Testing carried out by APTRANSCO pursuant to System Tests of CDGUs and User's Equipment and the term "Test" shall be construed accordingly.
Tolerance		The allowable deviation from despatch instructions such that at the end of the Monitoring Period, if the Generator has achieved each Despatch instruction for the period within the relevant tolerance limits as per provisions in the PPA, the CDGU will be deemed to have complied with each Despatch instruction.
Total Shutdown		The condition of complete loss of generation in the total system with no electricity supply from any External Interconnection. The total system will not begin to function again without APTRANSCO's directions relating to Black Start.
Total System		Together, the APTRANSCO system and all other User systems in A.P State.
Transfer Date		The date notified by the Government of A.P under Section 23(b) of the Act
	Transmission System	The system consisting of EHV lines owned and/or operated by APTRANSCO for the purposes of the transmission of electricity from a Power Station to a Substation or to another Power Station or between Substations or to or from any External Interconnection including any plant and Apparatus and meters owned or used by APTRANSCO in connection with the transmission of electricity.
	Under Frequency Relay or Low Frequency relay	An electric measuring relay intended to operate when its characteristic quantity (frequency) decreases below the relay setting by decrease in frequency.
	Unit Load	A device which regulates the generation level when the Generating Unit

	Controller	is operating in a Frequency Sensitive Mode to ensure (so far as possible) that it does not exceed or fall short of previously set limits.
User		Person or entity that uses the APTRANSCO system. More specific definitions are identified in each Section of the Code of Technical Interface. Examples: A Generator whose generating unit is connected to the APTRANSCO's system and a DISCOM whose distribution system is connected to, and receives power from, the APTRANSCO's system.
User System		Any System owned or operated by a User including Generating Units, Distribution Systems and Customer equipment together with plant and/or Apparatus connecting them to the APTRANSCO system
Utility		Any person or entity engaged in the generation, transmission, sale, distribution or supply, as the case may be of energy.
Var		A single unit of Reactive Power (Volt-ampere reactive)
	Virtual Metering Point	An effective point of measurement, that may or may not be physically locatable, where active energy or reactive energy deemed to have been transferred through the point is derived from an algorithmic manipulation of the active energy and reactive energy data of one or more metering points. The phrases "Virtual measurement point", "real metering point" and "real measurement point" are to be construed accordingly.
Warning	**Notice**	A notice issued by APTRANSCO to a Generator informing the Generator that it has failed to comply with Despatch instructions

- All the expressions used herein but not specifically defined shall have the same meaning as defined in the I.E Act, 1910, Electricity Supply Act,1948 and the rules framed there under and if the said Act, Rules and Codes are silent, the expressions shall have the same meaning assigned to them in the General Clause Act, 1877 or in the absence thereof, the meaning as commonly understood in the Electricity Supply Industry and current Electrical Engineering practices.

1.3 Management of the Code of Technical Interface (CTI)

1.3.1 Introduction

Under the terms of the A. P. Transmission and Bulk Supply License, The Licensee (**APTRANSCO**) is required to implement and comply with the CTI and periodically review the same and its implementation.
For the above purpose a **CTI Review Panel** comprising representatives of all Users of the Transmission System shall be established.

Except under conditions described in the next paragraph, no revision or modification of the CTI may be made without being discussed at the **CTI Review Panel** meeting and approved by the Andhra Pradesh Electricity Regulatory Commission (**APERC**).

In an unusual situation where normal day to day operation is not possible without revision of some clauses of CTI., a provisional revision may be implemented before approval of **APERC** is received, but only after discussion at a special Review Panel Meeting convened on emergency basis. The **APERC** should promptly be intimated about the provisional revision by recorded means of communication.

The **APERC** may issue directions requiring **APTRANSCO** to revise the CTI in such a manner as may be specified in those directions, and **APTRANSCO** shall promptly comply with any such directions.

The document defines the procedure to be followed by **APTRANSCO** in maintaining the CTI and also in pursuing any change.

1.3.2 Objective

The objective of this procedure is to define the method of managing the CTI., submitting and pursuing of any proposed change to the CTI and the responsibility of all Users to effect that change.

1.3.3 Responsibilities

APTRANSCO will be responsible for managing and servicing the CTI., for discharging its obligations under the License. **APTRANSCO** shall establish and service the requirements of the CTI Review Panel in accordance with provisions of the relevant sections of the Code.

1.3.4 C.T.I. Review Panel

APTRANSCO will inform all Users of the names and addresses of the Panel Chairman and Member Secretary at least seven days before the first Panel meeting and shall inform Users in writing of any subsequent changes.

Each User shall inform the Panel Member Secretary of the names and designations of their Panel Representatives not less than 3 days before the first Panel meeting and shall inform the Panel Member Secretary in writing of any subsequent change.

The Panel shall be chaired by **APTRANSCO** and shall consist of the following members:

- Chairman to be nominated by **APTRANSCO**
- Member Secretary to be nominated by **APTRANSCO**
- One Member from **APGENCO** to represent all Hydel Stations
- One Member from **APGENCO** to represent all Thermal Stations
- One Member from **N.T.P.C**.

- One Member from **PGCIL**.
- One Member from **SRLDC** (Southern Regional Load Dispatch Centre)
- One Member to represent all Joint Venture Companies
- One Member from each Distribution Companies
- One Member to represent all private IPPs
- One Member to represent all Captive Power Plants
- One Member to represent all EHT Consumers
- The Chairman of the Metering Committee is an Ex–Officio Member of the Panel.

The Chairman of the Protection Committee is an Ex-Officio Member of the Panel and shall attend the Panel meeting whenever protection matters are discussed.

The Panel shall invite the Chairman of each of the Standing Committees concerned with particular items of the Agenda. The Chairman of a Standing Committee may delegate a representative to take part in the discussion.

The Panel may invite representatives from Consultants, CEA, Central Electricity Regulatory Commission or, at their discretion, any other Organization such as Railways, Telecom Department, Indian Standards Organization, Financing Institutions or academic / technical institutions, to attend the Panel Meeting as observers or non-voting Members, depending on the Agenda.

The rules to be followed by the Panel in conducting its business shall be formulated by the Panel itself and shall be approved by the **APERC**. The Panel will meet at least once in three months.

The functions of the Panel are as follows:

1. To keep CTI and its workings under continuous scrutiny and review.
1. To analyze any major Grid disturbances soon after the occurrence, and evolve any consequent revision to the CTI.
2. To consider all requests for amendment to the CTI which are proposed by the Users.
3. To publish recommendations for changes to the CTI together with the reasons for the changes and any objections, if applicable.
4. To issue guidance on the interpretations and implementation of the CTI
5. To examine problems raised by Users.
6. To prepare operating instructions

APTRANSCO may hold sub-meetings with a User to discuss individual requirements and with a group of Users to prepare proposals for the Panel meeting. The Panel may set up sub-committees for detailed study of related problems.

1.3.5 CTI Review and Revisions

The Member Secretary shall present all proposed revisions of the CTI to the Panel for its consideration.

APTRANSCO shall send the following reports to the Commission at the conclusion of each review meeting of the Panel.

1. A report on the outcome of such review.
2. Any proposed revisions to the CTI as **APTRANSCO** reasonably thinks necessary for achievement of the objectives referred to in the relevant paragraph of the Transmission & Bulk Supply License.
3. All written representations or objections from Users raised during the review.

All revisions to the CTI shall require approval of the Commission. **APTRANSCO** shall publish revisions to the CTI., once approved by the **APERC**.

APTRANSCO shall present proposals to the **APERC** to allow relaxation, where Users have difficulties in meeting the CTI.

Every change from the previous Version shall be clearly marked in the margin. In addition, a revision sheet shall be placed at the front of the Revised Version noting the number of every changed sub-section, together with a brief statement of change.

APTRANSCO shall keep an up-to-date list of the recipients and locations of all serviced copies of the CTI.

1.4 Communications Between Entities

The Communications existing on the date of issue of approved CTI are the minimum requirements of communications and shall be maintained by the respective corporations in good working condition. The additional communication facilities as prescribed in the following paragraphs shall be established within a period of five years from the date of issue of approved version of the CTI.

1.4.1 Head Office Communications

The following communications are to be established between **APTRANSCO**'s Registered office and Business Head Quarters and each Generating station.

PSTN Telephone (Listed)
PSTN Telephone (Unlisted)
FAX on DoT Telephone
FAX on Wide band Telecom network

APTRANSCO Head Quarters shall have wide band Optical Fiber/Digital Microwave network communication with all Generating Stations of 50 MW installed capacity and higher, 400

kVSSs, 220 kVSSs and Inter System Power Exchange Stations connected to PLCC at nodal points. All EHT sub-stations shall also have DoT telephones as backup communication.

1.4.2 Communication Between SLDC and Sub-LDC

The following communications are to be established between SLDC and Sub-LDC offices:

4-Synchronous Data channels for computer to computer linkage.

4-Voice channels on administrative network.

4-Voice channels on Express network.

All the above channels shall be connected on Wide Band network communication system i.e., either Optical Fiber or Digital Microwave.

1.4.3 Communication Between SLDC & Generating Stations.

The following communications are to be established between SLDC and Generating Stations:

Express channel to Generating Stations either directly or through EPAX of Sub-LDC connected on Wide Band Network/PLCC.

One administrative channel to a Generating station through EPAX of Sub-LDC.

DoT Telephone in all Generating stations and Sub-stations.

SLDC shall have Hot Line connection with all generating stations of 200 MW capacity and higher on the Wide Band/Digital network.

1.4.4 Communication Between Remote Terminal Unit Location And Sub-LDC

The following communications are to be established between Remote Terminal Unit locations and Sub-LDC offices:

Data	Asynchronous Data channel to Sub-LDC connecting the RTU at each EHT SS to the computer at the respective Sub-LDC.
Voice on Admin Dialing Network	Admin. Voice channel to Sub-LDC generally routed through EPAX at intermediate Substations (not more than two or three PLCC lines)
Voice on Express Dialing Network	One Express voice channel single PLCC hop between RTU location and Sub-LDC with back to

	back connections at intermediate stations terminated on EPAXs at either end. Alternate routes to Sub-LDC via., neighboring PLCC nodes for redundancy wherever possible
PSTN Telephone	All RTU locations and Sub-LDCs shall have PSTN telephones as backup for Voice

1.4.5 Communication Between Corporate offices of DISCOMs / District Head Quarters

The following communications are to be established between Corporate offices of DISCOMs and District Headquarters, either on PLCC or WIDE-BAND communications:

Administrative Channel to Sub-LDC
Express Channel to sub-LDC
Express channel to SLDC
Administrative Channel to SLDC

APTRANSCO Headquarters shall have INTERNET connection. Major EHT consumers having a demand of 30 MW or more or having captive power plant that can be connected to the Grid, shall have suitable radio communication to the connected **APTRANSCO** substation and DoT/PSTN phone for voice communication as back-up.

Mini Generating Stations of capacity less than 30 MW shall have VHF wireless communication with the connected **APTRANSCO** substations.

1.4.6 Communication Between EHT Substations

Wide band Network connected between EHT substations shall also cater to Data and Voice Communication with PLCC as backup. EHT substations not on Wide-Band network shall have PLCC, PSTN Telephones for Voice / FAX requirements.

1.4.7 Communication between EHT Substations and 33 kV SS

Point–to–Multipoint Radio Communication systems shall be provided from each EHT Substation (Master Station) to all 33 kVSSs (Outstations). Master stations shall be interfaced to the Broad Band Telecom Network at the nearest node. PSTN Telephones shall also be connected at all 33 kV Substations as backup.

1.4.8 Communication For Emergency & Disaster Management (Voice, Data and MIS) Inter / Intra Entities

VSAT based Satellite Communication shall be provided at all Generating Stations, 220 kV Substations, Intersystem Power Exchange Points and nodal 132 kV Substations among and within the entities for Voice, Data throughout and MIS requirements as backup and for emergency and disaster management.

1.4.9 ***Written Confirmation***

all oral or telephonic communications between different entities must be confirmed in writing within a reasonable period.

1.4.10 Communication between SLDC and SRLDC. As required by SRLDC.

1.5 Disputes

1.5.1 ***Disputes regarding interpretation of C.T.I:***

The provisional Agreement between the Corporations having different interpretations is to be followed till a ruling is issued by the CTI Review Panel. If one or both parties are not satisfied with the ruling of the Panel the matter shall be referred to APERC whose decision is final.

1.5.2 ***Dispute pertaining to issues not covered by CTI:***

The issue shall be discussed by the executives of the corporations who shall arrive at an Agreement. If an Agreement cannot be reached the executives shall formulate a provisional working arrangement and then refer the issues to the CTI Review Panel even if the issue is not covered by the C.T.I. The ruling issued by the CTI Review Panel shall supercede the provisional agreement and shall be implemented, by all parties. If any party is not satisfied by the ruling of the CTI Review Panel the matter shall be referred to the APERC. The decision of APERC shall be final and binding.

1.5.3 ***Continuity of Functioning of Corporations:***

Immediately after a dispute arises the entities shall discuss and arrive at an agreement. If an agreement cannot be reached the corporations shall, after deliberations, formualte a provisional working arrangement which shall be implemented till a valid ruling is issued by an appropriate authority / arbitrator. The objective of this procedure is that no dispute should stall the daily operations of any Corporation.

1.6 Unforeseen Circumstances:

In situations not addressed by any clause of the Code of Technical Interface, **APTRANSCO** shall convene an emergency meeting with all affected entities to formulate a solution and the actions to be taken in the circumstance by the various entities. If no agreement can be reached, **APTRANSCO** shall provisionally determine the action to be taken after giving consideration to the views expressed by other corporations. **APTRANSCO** shall, as soon as possible, refer the matter to the CTI Review Panel whose decision shall prevail over the provisional determination of **APTRANSCO**. If any entity appeals to **APERC** over the decision of the Panel, the decision of

APERC shall supersede the decision of the Panel. The normal operations of any Corporation should never be disrupted by any situation or dispute. The majority decision of the meeting of entities or the considered determination of **APTRANSCO** shall be implemented unless and until the CTI Review Panel issues a different ruling; and the ruling of the Panel shall be in force unless and until a different decision is issued by **APERC** (if the issue is referred to **APERC**). The decision of **APERC** is ultimate and shall be implemented by all corporations.

1.7 Equipment owned by Third party:

References in the CTI to Plant/Apparatus/Equipment shall include the Plant/ Apparatus/equipment owned by a third party but used by a User/**APTRANSCO** under any agreement with the third party.

1.8 System Control:

Where a User's system is, by aggreement, under the control of **APTRANSCO**, then for the purposes of coordination, communication and operational schedules, **APTRANSCO** may treat that User's system, as part of **APTRANSCO**'s system, but, as between **APTRANSCO** and Users, it shall remain to be treated as the User's system.

1.9 Emergency Periods:

In periods of emergency like fuel shortage, war, national calamities and abnormal law and order situations the State Government or Government of India may issue certain directions, restrictions, controls and orders, and if these orders contradict any provisions of the CTI those provisions, paragraphs or clauses of the CTI shall be treated as temporarily suspended so as to facilitate implementation of the Government's orders as long as the emergency lasts.

1.10 Precedence of Indian Electricity Grid Code:

This CTI is prepared such that it is consistent with the IEGC. However if any clause of the AP CTI (AP Grid Code) contradicts the provision of the IEGC during a real situation, the IEGC takes precedence. It is open to APTRANSCO to obtain from CERC exemption from any provision of IEGC in favour of a clause of AP CTI where the issue pertains solely to the internal system of A.P (considering the present, future, direct and indirect impacts) and does not impact the Southern Regional Grid or the system any of the other constituents of the Southern Regional Grid.

1.11 Availability Based Tariff and other Commercial Aspects:

In para 1.8 of the Indian Electricity Grid Code the rate to be charged for reactive energy exchange is stipulated. Complementary Commercial Mechanisms are also provided in the IEGC.

These tariff rates and procedures apply to APTRANSCO only for the drawals from ISGS. For the drawals/injections from/ to other States the tariff as agreed mutually will apply. Similarly for the active and reactive energy transfers between Users and APTRANSCO within A. P. State the tariffs approved by APERC will apply.

1.12 Information in the first Version of APCTI

Some paras are included for information to facilitate smooth implementation of the APCTI in the post-unbundling scenario. They may be deleted in subsequent revisions. Under para 4.6.2 tables 4.1, 4.2 and 4.3 can be deleted in subsequent revisions because maintenance of updated Regional lines and ISGS entitlements is the internal matter of APTRANSCO.

ANDHRA PRADESH
CODE OF TECHNICAL INTERFACE
SECTION 2.
PLANNING CODE

Table of Contents

1. **Introduction**

The Planning Code (**PC**) specifies the criteria and procedures to be applied by **APTRANSCO** in the planning and development of the **APTRANSCO** system.

Users of the **APTRANSCO** system shall take into account the Planning Code when planning and developing their own systems. **Users** are defined for the purpose of the Planning Code in para 2.3.

2.1.1 Extension of Transmission System

A requirement for reinforcement or extension of the APTRANSCO system may arise for a number of reasons including, but not limited to:

i. a development on a **User's** system already connected to the **APTRANSCO** system as a **User** Development;

ii. the introduction of a new Connection Point between a **User's** system and the **APTRANSCO** system;

iii. the need to increase system capacity, remove operating constraints and maintain standards of security to accommodate an anticipated increase in **APTRANSCO** Demand;

iv. transient or steady-state stability considerations;

v. the cumulative effects of any combination of paragraphs i) to iv) above.

2. **Types of Extension of Transmission System**

Accordingly, the reinforcement or extension of the APTRANSCO system may involve work:

i. at a Connection Point between a **User** system and the **APTRANSCO** system;

ii. on transmission lines or other facilities which join a Connection Point to the remainder of the **APTRANSCO** system;

iii. at or between points on the **APTRANSCO** system remote from Connection Points.

2. **Need for Advance Planning Transmission System**

The APTRANSCO system must be planned with sufficient lead time to allow any necessary statutory consents or way leaves to be obtained and detailed engineering design/construction work to be completed. This Planning Code therefore imposes time scales for the exchange of information between APTRANSCO and Users, subject to all parties having regard, where appropriate, to the confidentiality of such information.

2. **Objective**

1. **Purpose of Standards and Procedures**

The standards and procedures within this PC are intended to enable APTRANSCO in consultation with Users, to provide an efficient, coordinated, secure and economical Transmission System throughout its authorized area in order to satisfy requirements imposed by future levels and dispositions of Demand and Generation.

2.2.2 How the Objectives are achieved by PC

In pursuance of the above objective, the PC:

i. defines the procedure for the exchange of information between **APTRANSCO** and a **User** in respect of any proposed **User** development on the **User's** system which may have an impact on the performance of the **APTRANSCO** system;

ii. details the information which **APTRANSCO** shall make available to **Users** in order to facilitate the identification and evaluation of opportunities for use of or connection to the **APTRANSCO** system;

iii. details the information required by **APTRANSCO** from **Users** in order for **APTRANSCO** to plan the development of its Transmission system to facilitate proposed **User** developments;

iv. specifies the planning and design standards which will be applied by **APTRANSCO** in the planning and development of the **APTRANSCO** system.

3. ***Statement of Opportunity:***

APTRANSCO shall publish annually a "Statement of Opportunity" which shall contain a summary of the prospective plan (Refer PC 2.5) and essential information required by existing and prospective Users whose systems are already connected and who are interested in applying for a connection. The format of the Opportunity Statement shall be included in future versions of the Grid Code. Till then APTRANSCO shall develop its own Format with due regard to the purpose of the Statement of Opportunity. To enable the Statement of Opportunity to be prepared, Users are required to submit to APTRANSCO the Standard Planning Data, Five Year System Plan Data and Preliminary System Planning Data as listed in Appendix-A and additional data specifically required by APTRANSCO. This data shall be submitted by 31st March of each year to cover each year of the ten succeeding years in the Plan. In the case of data being unchanged from one submission date to the next, a written statement to this effect will suffice. APTRANSCO shall make use of two-year ahead demand estimate prepared under 4.1.1 (short-term plan for operational purposes) also in preparing the Opportunity Statement.

2.3 Scope

2.3.1 Application of PC

The PC applies to APTRANSCO and to Users, and includes:

i. (a) Generators which are directly connected to APTRANSCO Transmission

system.

a. Generators having small generating units and embedded generators.

b. ISGS.

i. Suppliers (DISCOMS)

ii. Large Customers.

2.

3. ***Application to Prospective Users***

Persons whose prospective activities would place them in any of the above **User** categories become bound by the **PC** prior to their generating, supplying or consuming power, as the case may be. All references to the various categories of **User** should, therefore be taken as reference to them in that prospective role, as well as to **Users** actually connected.

2.4 Planning Criteria

APTRANSCO and other **Users** using the **APTRANSCO** system shall follow the planning criteria in general for planning and development of the systems as detailed in Appendix-B

2.5 Planning and Development of the System

2.5.1 Prospective Plan

a) **APTRANSCO** shall develop a plan (the "Prospective Plan") which will form the basis of all further detailed planning in the power sector of A.P. All aspects of generation, transmission and distribution planning shall be done on the basis of this data.

b) (i) The prospective plan will cover a period of 15 years. The forecasted values of demand, peaking power, capacity, annual energy, losses and other important power system parameters and Transmission and Generation scenarios and shortages and surpluses must be clearly depicted at the end of each five year period so that the Prospective Plan for Ten Year Period as well as Fifteen Year Period are available at any time in a single document. General guidance may be obtained from the long term National Prospective Plan prepared by CEA wherein State-wise and Region-wise data are included. Effort shall be made to prepare the State Plan within the framework of the CEA's National Plan as far as possible.

i. Reconciliation of Divergences between the estimates of APTRANSCO and CEA: -

Where there is substantial difference between the load forecast values and

therefore between generation requirement values for a future year, first it may be tried to reduce the gap by further realistic and systematic studies by APTRANSCO after obtaining data from CEA. If the difference cannot be reduced the final values shall be chosen as follows.

The AP State component values as per CEA's National Plan are adopted if they are limited by such obvious constraints as available fuel and fuel reserves or if CEA's estimates as verified by APTRANSCO are found to be based on validated data and sound methodology as accepted by APTRANSCO. Otherwise the values forecasted by APTRANSCO found realistic by a repeat study are adopted because APTRANSCO is answerable for the consequences of deviation between forecasted values and actual values, e.g., APTRANSCO will have to pay for excess scheduled generation not fully drawn from generators due to non-materialisation of high forecasted load and on the other hand, face consequences of shortage of generation when the total State generation cannot meet the actual load that is higher than the forecasted value in which case APTRANSCO will be forced to draw extra power not originally scheduled (if available) and pay at higher rates or alternatively resort to load shedding.

c) **APTRANSCO** shall conduct a sample Load Survey covering the following categories of Customers:

i. Domestic

ii. Commercial

iii. Public Water Works, Sewage Pumping etc.

iv. Irrigation Pumping and Agriculture

v. Street Lighting

vi. Industrial

vii. Railway Traction

viii. Bulk Supply to Non-industrial consumers

ix. Public Institutions

The **DISCOM**s shall conduct detailed and exhaustive Load Survey covering all nine categories of customers mentioned above and furnish this data along with their plans to APTRANSCO. Similarly all the large power consumers shall submit their expansion plans and future power requirements to **DISCOM**s as well as **APTRANSCO**. **APTRANSCO** shall process all data and prepare a comprehensive plan.

The results of the sample survey by APTRANSCO are used to validate the data furnished by DISCOMs. For actual planning the data supplied by DISCOMs is used.

d) For the purpose of planning **APTRANSCO** shall estimate the percentage losses occurring in various sections of the **APTRANSCO** system with the help of the following means:

i. On the basis of estimated peak load losses (expressed in units of power) of the **APTRANSCO** system determined by Load flow studies conducted with the help of computer programs.

ii. By carrying out pilot studies in typical lines, after installing meters, to determine Energy sent out and Energy received at the end of a line.

e) **APTRANSCO** shall work out, on the basis of obtained data of projected Loads and losses of the system, the net Energy requirement at generation end, peak Load, installed capacity, peak availability, surplus and deficit both in Demand and Energy.

f) **APTRANSCO** shall work out additional generating capacity required after taking into account the existing capacity, assistance from captive power plants, projects under construction, proposed projects under JVCs and IPPs in the state sector and share of the state out of Central sector power projects both within and outside the A.P.

g) For the integrated planning and development of the **APTRANSCO** system each User, individually and jointly, shall participate in the process for its functional requirements.

h) In developing the Prospective Plan Guidelines no. 3 dated 28-02-2000 issued by APERC shall be complied with.

6. **Basis of Planning**

2.6.1 Generation Planning

a) The basis of generation planning shall be the prospective plan as formulated by **APTRANSCO** and shall be modified from time to time to suit the circumstances in the best interests of the **APTRANSCO** system as a whole.

b) The Generator with Independent Generating Plant shall prepare a 5 year plan for its development schemes and forward the same in the manner specified in this PC for **APTRANSCO**.

In the case of a Generator with CDGUs, its plant will be contracted to **APTRANSCO** under a PPA. To the extent that a modification to plant is required, the matter shall be addressed in the context of the PPA.

c) Any development envisaged by a Generator with Independent Generating Plant must ultimately result in an increase of its efficiency and capacity and may involve the following works:

i. Addition of new units

ii. Renovation and modernization of existing units.

d) Establishment of a new Generating Station sanctioned in accordance with the Electricity Supply Act, shall be subject to:

i. Approval of **APERC** (and therefore compliance with APERC's Guidelines No. 3 from the proposal stage).

i. Acceptance of bid against international competitive bidding

ii. Sanction of State Government/Government of India.

iii. Power Purchase Agreement between APTRANSCO and the Generator.

2.6.2 APTRANSCO System Planning

a) The basis of planning the development of the **APTRANSCO** system shall be the Prospective Plan and shall be modified from time to time by **APTRANSCO** to suit the circumstances in the best interests of the **APTRANSCO** system as a whole.

b) **APTRANSCO** will formulate the prospective plan of the **APTRANSCO** system on the basis of the following:

i. Load flow studies

ii. Short Circuit studies

iii. Stability studies

iv. Loss of Load Probability studies (LOLP)

While conducting the above studies, **APTRANSCO** will take into account the transmission lines belonging to Power grid and generating units belonging to ISGS, Independent Generating Plants, JVCs and CPPs.

c) The **APTRANSCO** shall prepare a 5 year plan for its own development schemes and forward the same to the Central Electricity Authority for their observations and recommendations before implementation, as provided in the Act.

d) APTRANSCO shall comply with Guidelines No. 3 issued by APERC

2.6.3 Distribution Planning

a) The basis of planning shall be the prospective plan as formulated by **APTRANSCO**; (for a **DISCOM** as prepared under the Distribution Code). It shall be modified from time to time to suit the circumstance in the best interest of the **APTRANSCO** system as a whole and shall be submitted to **APERC** for approval. After a period determined jointly by APTRANSCO and DISCOMs , DISCOMs shall independently formulate the prospective plans and submit to APTRANSCO. APTRANSCO shall validate and modify the plans, if necessary, after studying the methodology and comparing them with the historic data. Then APTRANSCO shall consolidate the prospective plan for the entire state and use this for formulating the prospective Transmission Plan.

b) After grant of a License for distribution and sale of electricity in a Licensed Zone, the Supplier (Licensee) shall conduct a verification of the existing loads, loading of the substations, feeders and distribution mains. He shall then formulate system improvement schemes and new schemes to be included in the planning and development of the Distribution system, to cater to the existing loads in the most economical and efficient manner and to account for the load growth envisaged in the plan period. The supplier shall comply this Planning Code and the Distribution Code.

c) The Suppliers shall prepare a 5 year plan for their development schemes in the manner specified in this Planning Code and the Distribution Code and forward the same to **APTRANSCO** and to **APERC**. The Development Plans approved by **APERC** are to be implemented and **APTRANSCO**'s transmission system planning shall be made compatible with the requirement of these schemes.

7. **Planning Procedure**

    1. **Coordinating Entity**

        APTRANSCO will coordinate the planning of the Users connected to the APTRANSCO system who shall provide planning data in the manner prescribed herein.

    2. **Information to be furnished to APTRANSCO**

The Generator or Supplier connected or seeking connection to the APTRANSCO system shall be required to furnish information and data to APTRANSCO as specified in the PC. Generators planning to install CC GT Plant shall furnish the output for various combinations of Gas and Steam Turbines.

    3. **Information to be furnished by APTRANSCO**

APTRANSCO will furnish information and data to the Generator or Supplier connected or seeking connection to the APTRANSCO system on request, as specified in the PC.

2.8 Planning Data to be supplied by APTRANSCO

2.8.1 General

Information and data shall be supplied by **APTRANSCO** to the **Users** upon request, relating to a part or parts of the **APTRANSCO** system as specified in the request, to enable them to assess opportunities for connecting to and using the **APTRANSCO** system. Such information and data are subject to reservation mentioned in Sections 2.8.4 and 2.8.5, and shall include but not be limited to the data specified in Sections 2.8.2 to 2.8.5.

2. **APTRANSCO System Data**

   a) **APTRANSCO** system data consists of salient features of the existing system and future system as contained in the Perspective Plan. Such data shall include the following:

   i) Single line diagram of the **APTRANSCO** system indicating the existing lines and proposed lines (shown dotted)

   ii) Map of A.P. showing the existing lines of the **APTRANSCO** system and proposed lines (shown dotted) scale: 1cm = 10 km.

   b) Distribution Data

   Data shall be confined to Grid Substations indicating 33kV outlets. **APTRANSCO** will furnish a single line diagram of the Grid Substation nearest to the area in which the Supplier operates.

   c) APTRANSCO shall publish the list of preferred points of connection to APTRANSCO.

   d) APTRANSCO shall also furnish to Users the data specifically required by them. APTRANSCO shall obtain prior consent from a User for supplying the data of that User to another User.

3. **Data to be furnished by APTRANSCO on Demand**

   APTRANSCO will furnish any other information as may be reasonably required to enable a User to identify and evaluate the opportunities available when connecting to and making use of the part or parts of APTRANSCO system specified in the request. If so required, APTRANSCO will also offer its views as to the suitability of the parts of the APTRANSCO system specified in the request for new connection and withdrawal of further quantities of electricity.

4.

5. **Charges for Data**

APTRANSCO shall be entitled to charge the User requesting any APTRANSCO system data any reasonable costs in providing the data and shall notify the User of such costs within a reasonable time (not exceeding fifteen days), after receipt of specific request. Subject to the User agreeing to pay the cost as notified within the specified time the APTRANSCO system data shall be furnished within one to two months following the User's request depending upon the nature and complexity of the data required.

5. **APTRANSCO's Right to withhold Information**

APTRANSCO shall be entitled to withhold any APTRANSCO system data if in the reasonable opinion of APTRANSCO disclosure of such information would seriously and prejudicially affect the commercial interests of APTRANSCO. However APTRANSCO shall not withhold the minimum data where it is clear, that the User cannot carry out his business without such data.

6. **Confidentiality of Data**

All data supplied by APTRANSCO to any User or vice versa shall be treated as confidential and should not be divulged to a third party. The data shall be used only for the purpose for which it is furnished.

2.9 Planning Data Requirements of Users

2.9.1 Disposition of Data to be supplied by Users to APTRANSCO

Each User shall furnish data to APTRANSCO regarding its system:

a. to update the data base for carrying out system studies and system planning for **APTRANSCO** ;

b. to formulate the overall annual plan for **APTRANSCO** system within the 5 year plan;

c. to formulate the overall 5 year plan for the **APTRANSCO** system;

d. to review the progress of new projects and developments earlier approved within the 5 year plan and

e. to confirm compliance with the requirements under its License and under the CTI.

2.9.1.1 (a) Generators directly connected to APTRANSCO Transmission System,

DISCOMs and large consumers shall furnish data as per the Annexures of the Code.

a. Generators having small units and embedded generators shall furnish data in the formats prescribed by APTRANSCO for each entity.

b. In respect of ISGS the data shall be obtained by APTRANSCO direct from ISGS or from SREB and SRLDC in the formats mutually agreed.

2. **Categories of Planning Data**

To meet the requirements mentioned above the planning data from Users shall be categorized as follows:

a.

b. Standard Planning Data

b. Detailed Planning Data;

c. Annual System Planning Data;

d. 5 year System Plan Data;

e. Works in Progress Data;

f. Completion Data

g. Preliminary Project Planning Data

h. Committed Project Planning Data

Every User shall furnish this data in relation to each Fiscal Year to **APTRANSCO** by 31st March of each year.

2. **Additional specific Data and Confidentiality**

In addition to the above, APTRANSCO may, following receipt of the Planning Data, seek clarification and/or additional information from User in respect of the data provided.

Until such time as a Connection Agreement is entered into between **APTRANSCO** and the **User**, the data shall be treated as confidential by **APTRANSCO** and shall not be disclosed to third parties.

2.9.4 Preliminary Project Planning Data

The following Project Planning Data shall be provided:

a) Data submitted at the time of application for connection to or use of the **APTRANSCO** System shall be termed as Preliminary Project Planning Data.

b) Preliminary Project Planning Data shall normally contain only Standard Planning Data unless Detailed Planning Data is specifically requested by **APTRANSCO** to permit detailed system studies.

2.9.5 Committed Project Planning Data

After the offer for a Connection Agreement has been accepted by the **User** the data submitted earlier and data subsequently received by **APTRANSCO** under the **PC** shall be termed as Committed Project Planning Data. This data shall form the background against which planning of the **APTRANSCO** system shall be undertaken. Accordingly, Committed Planning Data will not be treated as confidential to the extent that:

a. **APTRANSCO** may include this data in their System Data in accordance with Section 2.8.2 of this **PC**.

b. **APTRANSCO** may disclose this data to other **Users** while considering application from them for connection to and/or use of the **APTRANSCO** system, as may be considered proper and relevant for the purpose.

Committed Project Planning Data shall normally contain both Standard Planning Data and Detailed Planning Data.

2.9.6 Registered Project Planning Data

Before physical connection of a User to the **APTRANSCO** system it is necessary that any estimated data contained within the Committed Project Planning Data be replaced, where practicable, by validated actual values and by updated forecasts for future data items such as Demand. Such data at this stage shall be termed as Registered Project Planning Data. **APTRANSCO** shall treat this data as confidential, save that:

a. **APTRANSCO** may disclose such data as **APTRANSCO** System Data.

b. **APTRANSCO** may use this data while considering application from other **Users** for connection to or use of the **APTRANSCO** system. This may involve disclosures of the data to a third party.

9. **Standard Planning Data**

2.10.1 Generators

a. The data required shall be as listed in paragraph A.1, Part-I Appendix-A.

b. The data shall be submitted along with the application for new connections, for additions of a new Generating Unit, for any modification of Plant or equipment which may materially affect the performance of the **APTRANSCO** system.

c. The data shall be submitted by **Users** connected to the **APTRANSCO** system in accordance with paragraph 2.9.2

2.10.2 Transmission

a. The data required shall be as listed in paragraph A.2, Part-I Appendix-A.

b. The compilation of the data is the internal matter of **APTRANSCO** and as such **APTRANSCO** shall make arrangements for getting the required data from different Divisions of **APTRANSCO** to update its Standard Planning Data in the format prescribed.

c. The data shall be updated in accordance with Section 2.9.2

2.10.3 Distribution

a. The data submitted shall be as listed in paragraph Part-I A-3 of Appendix-A.

b. The data shall be submitted along with application for new connections, for addition of new lines and substations for any modification of lines and equipment which may materially affect the performance of the **APTRANSCO** system.

c. The data shall be submitted by Users connected to the system in accordance with Section 2.9.2.

d. In the case of CCGT modules the outputs for various possible combinations of Gas Turbines and Steam Turbines are to be furnished. Other data of CCGT modules shall be furnished by the Generators as specifically required by APTRANSCO.

4.

5. ***Formats***

In all cases data must be submitted in the format prescribed in the Appendix and supported with a note covering the items not included in the Appendix.

2.11 Detailed Planning Data

1. **Formats**

The data required shall be as listed in paragraph Part-2 Appendix-A.

2. **Data of Existing Users**

Generators and Suppliers already connected to the APTRANSCO system shall provide the data at the end of each financial year ending on 31st March, no later than April 15 on a routine annual basis.

3. **Data of Prospective Users**

The data shall be submitted by all Generators and Suppliers seeking connection to the APTRANSCO system.

2.12 Annual System Plan Data

2.12.1 Format

The data required shall be as listed in paragraph Part 3-A, Appendix-A, Annual System Plan Data.

2. **Time Scale**

All Users connected to the APTRANSCO system at the end of each Fiscal Year ending on 31st March, on a routine shall submit the data by April 15 on annual basis.

2.13 Five Year System Plan Data

1. **Proforma**

   The data required shall be as listed in paragraph Part III-B.

2. **Time Scale**

All Users connected to APTRANSCO system at the end of each Fiscal year ending on 31st March, shall submit the data by April 15 on a routine annual basis.

2.14 Works in Progress Data

1. **Proforma**

   The data required shall be as listed in paragraph C, Part-3 of Appendix-A.

2. **Time Scale**

The data shall be submitted on a routine annual basis by all Users connected to the APTRANSCO system at the end of each Financial year ending on 31st March, by April 15.

15.
16. **Completion Data**

2.15.1 Format

The data required shall be as listed in paragraph D, Part-3 of Appendix-A.

2. **Time Scale**

All Users connected to the APTRANSCO system at the end of each Financial year ending on 31st March, shall submit the data by April 15, on a routine annual basis.

15. **Additional Data**

If, for carrying out planning or for discharging other functions of a utility, additional data other than what is prescribed in this PC and its Annexures is required by the utility from another utility, such data may be exchanged by mutual consent at any time between the utilities subject to the general conditions and reservations mentioned in this PC.

16. **Waiving of Data**

Supply of certain items of data prescribed in this PC may be waived at any time by means of a written statement by the recipient utility on request by the supplying utility.

18. **Planning for Upgradation and Modification of Existing Equipment and Systems:**

2.18.1 Introduction

This Sub Section deals with Planning for enhancement of performance of existing systems and equipment. The process may involve modification and / or total replacement of control equipment by executing a series of low cost works but not the main equipment. Minor modifications and repairs to main equipment only come under the scope of this Sub-Section. All utilities are expected to identify areas wherein modification works by investing small amounts would yield considerable qualitative and/ or quantitative benefits and to evolve plans for improving performance of their systems. APTransco shall initiate and coordinate the programmes of Users in evolving plans for renovation, modification, rehabilitation, upgradation, modernization, automation and computerisation. Works requiring large investment such as those involving new lines and sub-stations are outside the scope of this Sub-Section.

2.18.2 Objectives

The goals of such plans involving small investment are improving performance of equipment, quality of power supply, Grid stability and security and economy, reduction of energy losses and enhancement of safety standards and life of equipment.

2.18.3 Transmission System

APTransco shall evolve schemes to enhance the performance of its transmission system. The areas in which such improvements are planned are determined by APTransco from time to time. However examples are given below: -

i. Wherever existing relays are not fast enough the relays shall be replaced by

fast acting relays.

ii. The circuit breakers with long opening time are to be replaced by breakers with short opening time.

iii. Carrier inter-trip for EHT feeders is to be provided.

The security and stability of the grid are enhanced by actions (i), (ii) and (iii) without large investment.

Users may require APTransco to modify its protection and control system and carry out minor modifications to the transmission system to prevent adverse impact on their systems. On studied consideration of the User's proposals APTransco may accept to implement them.

4. ***Distribution Systems***

Discoms shall prepare plans for modification of their protection and switchgear and for installation of under frequency relays and obtain concurrence of APTransco. APTransco may advise suitable modifications and improvements to the distribution system like special maintenance and replacement of a few weak parts in order to reduce frequent fault trippings and their impact on the transmission system. (The schemes of DISCOMs to enhance sub-station capacities, for new lines, for reconductoring and re-configuration of lines for loss reduction and voltage improvement and to cater to load growth are not dealt in this Sub-Section).

Also when the parts of APTransco system at particular points are overloaded due to low power factor of power drawn by Suppliers the problem can be immediately mitigated by the action of DISCOMS by urgently installing shunt capacitors. APTRANSCO may require DISCOMS to install capacitors at specific locations urgently by invoking this Sub-Section of Planning Code. Failure to install capacitors by DISCOMS entails compulsory load relief. The foregoing is one instance wherein APTRANSCO requires modification / improvement of Distribution system to mitigate the strain on parts of Transmission System.

5. ***Generating Stations***

APTransco may advise particular Generators to install Power System Stabilizers for their alternators if they are found essential for enhancing grid performance after detailed studies. APTransco may also advise generators to replace / modify AVR and turbine governors. The Generators shall carry out any modifications recommended by APTransco if technically feasible. Under this provision APTransco shall not demand replacement of the main capital equipment. The cost of modification is borne by the Generators though carried out at the instance of APTransco for enhancing grid stability and security. The specifications of the existing equipment (e.g. Excitor, Governor and AVR) shall be furnished by the Generators to APTransco on request for study and examining the suitability vis-à-vis grid performance and for advising

modifications / replacements.

6. ***Time Scales***

Two-year plans (April to March year is followed) are prepared by APTransco and all Users for Renovation and Modification works in their systems and are finalized in January every year. The programme for the first year is updated. The two-year R&M plans of the Users shall be submitted to APTransco before 31st January. The plan of APTransco is submitted to APERC before 31st January. The R&M plan of APTransco or extracts from the plan are supplied by APTransco to any User on request. APERC may direct APTransco to revise its two-year R&M plan. APTransco shall either approve or indicate revisions of User's plans before 31st March.

2.18.7 #9; Implementation

The implementation of modification works may be re-scheduled or postponed by mutual consent. A utility may request for postponement for technical reasons or due to funding difficulties. If no agreement is reached between the utility proposing modification works and another utility, which is required to execute modification works, the matter is resolved by the procedure prescribed by Section 1.5 of General Code.

ANDHRA PRADESH
CODE OF TECHNICAL INTERFACE

Section 3

CONNECTION CODE

Table of Contents

CONNECTION CODE

3.1 Procedure For Application For Connection

3.1.1 Users

Any **User** seeking to establish new or modified arrangements for **Connection** to and/or use of the **Transmission System** shall follow the procedures laid out in this Code.

3.1.2 Licensee

The **Licensee** (**APTRANSCO)** shall follow the procedures and time limits specified in this Code in processing the application, making or modifying an offer and rejecting an offer.

3.1.3 Optimal Connection Locations

APTRANSCO shall publish annually before 31st March, a list of points which are technically optimal connection locations where generators and suppliers can connect their systems to APTRANSCO system.

3.1.4 Data from APTRANSCO

Any prospective user or existing user wishing capacity enhancement may after studying the Long Term Plan and the Statement of Opportunity published by APTRANSCO may request APTRANSCO for more information. APTRANSCO shall furnish the data equired within 15 days of requisition. APTRANSCO may refuse to furnish the data if it considers the data is confidential and is not required for the business of the prospective user. APTRANSCO may charge reasonable cost for supplying the data.

3.1.5 Application for Connection

Any User seeking use of the Transmission system may submit an Application for connection to APTRANSCO in Format developed by APTRANSCO.

3.1.6 Acceptance or Rejection

APTRANSCO shall either accept or reject the application within 30 days from the date of Application. If rejected, APTRANSCO shall communicate the reasons. If APTRANSCO requires additional data from the Applicant the last date for acceptance or rejection may be extended by another month from the date of submission of the additional information. The additional data shall be furnished to APTRANSCO within 15 days from the date requisitioned. If the additional information is not received by APTRANSCO within 15 days, it can either reject the Application or extend the date.

3.1.7 Connection Agreement

If the Application is accepted then APTRANSCO and the user shall proceed to finalise a Connection

Agreement as per para 3.2.3.

3.1.8 Data Exchange

The data exchange between APTRANSCO and users shall be in accordance with the provisions of the Planning code.

3.1.9 Non-Acceptable Offers

In the event of the offer becoming invalid or not being accepted by any **User** within the validity period, no further action shall be taken by the **APTRANSCO** on the **Connection** applications.

3.2 Connection Conditions

3.2.1 Introduction

Connection Conditions specify the technical, design and operational criteria which must be complied with by any **User** connected to the **Transmission System**.

3.2.2 Objectives

The objective of this Section is to ensure the following:

(i) All **Users** or prospective **Users** are treated equitably.
(ii) Any new **Connection** shall not impose any adverse effects on existing **Users**, nor shall a new **Connection** suffer adversely due to existing **Users**.
(iii) By specifying minimum design and operational criteria, to assist **Users** in their requirement to comply with **License** obligations and hence ensure that a system of acceptable quality is maintained.
(iv) The ownership and responsibility for all items of equipment is clearly specified in a schedule (Site Responsibility Schedule) for every site where a **Connection** is made.

3.2.3 Connection Agreements

A Connection Agreement shall be drawn up specifying the general conditions for connection and any specific conditions, both technical and financial, applicable to that connection.

If the design parameters based on which the original offer was made, have changed, **APTRANSCO** shall make a revised offer to the User including revised terms and extended time limit for submission of data. This revised offer shall form the basis of any Connection Agreement.

3.2.4 Connection Site Matters

3.2.4.1 Site Responsibility Schedule

For every **Connection** to the **Transmission System** for which a **Connection Agreement** is required, a schedule of equipment shall be prepared by **APTRANSCO** with information supplied by the respective **Users**. This shall include:

- Schedule of HV Apparatus
- Schedule of Plant, LV/MV Apparatus, services and supplies
- Schedule of telecommunications and measurements Apparatus
- The safety rules which apply to each Plant/Apparatus

A Site responsibility Schedule, shall state the following for each item of equipment installed at the **Connection** Site:

(i) The ownership of equipment.

(ii) The responsibility for control of equipment.
(iii) The responsibility for maintenance of equipment.
(iv) The responsibility for operation of equipment.
(v) The manager of the site.
(vi) The responsibility for all matters relating to safety of persons at site.
(vii) The responsibility for all matters relating to safety of equipment at site.

All H.V. Apparatus on any connection site shall be shown on one diagram which shall include details of the following.

1. Bus bars
2. Circuit Breakers
3. Isolators
4. Bypass facilities
5. Earthing switches
6. Maintenance of Earths
7. Overhead line entries
8. Overhead line tappings
9. Cable and Cable Sealing ends
10. Generating Unit
11. Generating Unit Transformers
12. Generation unit auxiliary transformers including lower voltage circuit breakers
13. Station Service Transformers including lower voltage circuit breakers
14. Capacitors including synchronous compensators
15. Series and shunt reactors.
16. Grid Transformers (Inter Connecting transformers)
17. Tertiary windings
18. Earthing and Auxiliary Transformers
19. 3ϕ Voltage transformers
20. 1ϕ Voltage transformers with phase identity
21. Surge Arresters
22. Neutral earthing arrangements on HV plant
23. Current transformers

The **User** owning the **Connection** site shall provide reasonable access and other required facilities to another **User** whose equipment is installed at the **Connection** site for installation, operation and maintenance, etc.

Each Connection point shall be precisely shown.

An illustrative Site Responsibility Schedule is provided in the Appendix to this Section.

3.2.4.2 Site Common Drawings

Site Common Drawings shall be prepared by the owner Company (APTRANSCO or Users) using the information furnished by the other Company (User or APTRANSCO) containing the following information:

(i) Connection Site Equipment layout
(ii) Electrical Layout

(iii) Common Protection and Controls

(iv) Common Services.

SCDs are updated by the request and initiation of either company but the responsibility of updating at every change lies with the site owner.

3.2.4.3 Maintenance at Connection Site

The User's equipment at the APTRANSCO's site shall be maintained promptly and properly by the User and vice versa so that the equipment and personnel of the site owner are not jeopardised by the neglect of the other Company.

3.2.4.4 Site Operational Procedures

APTRANSCO and User must make available staff to take necessary safety procautions and carryout operational duties at the Site. The written operating and safely instructions must be available at the site.

3.2.5 System Performance

(a) All equipment connected to the **Transmission System** shall be of such design and construction as to satisfy the requirements of the relevant Indian Standard Specification. Where no BIS exists, the appropriate **IEC** Standard or equivalent International Standard will apply.

(b) Installation of all electrical equipment shall comply with **IE Rules**

(c) For every new **Connection** sought, the **APTRANSCO** shall specify the **Connection Point** and the voltage to be used, along with the metering and protection requirements as specified in the Metering and Protection **Sections**.

(d) The **Transmission System** frequency shall be in accordance with the Grid Characteristics Section. The **User** shall however be subject to the grid discipline prescribed by **SLDC/ SRLDC** as per guidelines mutually agreed with **SREB/ SRLDC**.

(e) Voltage variation on the **Transmission System** shall be in accordance with the Grid Characteristics Section.

(f) Insulation co-ordination of the **Users'** equipment shall conform to applicable Indian Standards/Codes. Rupturing capacity of switchgear shall not be less than that specified by **APTRANSCO.**

(g) Protection and Metering schemes shall be as detailed in the Protection Section of the **Code**.

For existing **Power Stations**, the equipment for data transmission and communications shall be owned and maintained by the **APTRANSCO**, unless alternative arrangements are mutually agreed.

For new **Power Stations** the equipment for data transmission and communications shall be owned and maintained by the respective **Generator**.

(h) The new Generating units to be connected to the Grid shall be capable of increasing the output by 5% instantaneously upto 105% MCR for a minimum of 5 minutes.

(i) The new Generating units shall have AVR and turbine speed governor with overall droop of 3 to 6%.

3.2.6 Connection Point

3.2.6.1 Generator

Voltage may be 400/220/132 kV or as agreed with the **APTRANSCO**.

Unless specifically agreed with the **APTRANSCO:**

- The **Connection Point** shall be the **first takeoff tower from the Power Station switchyard** which is the boundary between **GENCO** and **APTRANSCO**

  The **Tariff Metering Point** shall be **between the synchronising breaker and the EHT bus on the HV side of the Generator Transformer**, or each feeder, i.e.,between the feeder breaker and the line isolator of the feeder.

  All equipment, including metering, protection and communication up to the GENCO-TRANSCO boundary shall be maintained by the **Generator**, and all equipment beyond the Boundary (towards the line) shall be maintained by **APTRANSCO.**

3.2.6.2 Distribution Company

Voltage may be 33/11 kV or as agreed with the **APTRANSCO**. All 33 kV lines and below shall be under the jurisdiction of the **DISCOMs.** All lines and network above 33 kV shall be under the jurisdiction of **APTRANSCO.**

- The **Connection Point** shall be **the first take off pole of the 33 or 11 kV feeder** which is the boundary between APTRANCO and DISCOMs. Alternatively the outgoing terminals of the Line Isolator of the 33 kV or 11 kV Feeder.
- The **Tariff Metering Point** shall be **between the LV Breaker of the Power Transformer and the LV bus isolator.**

All equipment, including metering, protection and communication on the transformer side of the Boundary shall be maintained by **APTRANSCO**, and all equipment beyond the Boundary shall be maintained by **DISCOMs.**

All HT services including EHT services such as 132 kV and 220 kV shall be with **DISCOMs** as per geographical jurisdiction**.**

3.2.6.3 CPPs & Bulk Power Consumers

Voltage may be 220/132/33 kV or as agreed with the **APTRANSCO**.
Sub-stations are owned by **CPP**s and **Bulk Power Consumers.** The **Connection Point** shall be the feeder gantry in their premises.

3.2.7 Data Requirements

Users shall provide the **APTRANSCO** with data for purposes of this **Section** as specified in the Annexures to Planning Code and as requisitioned by APTRANSCO.

3.3 Under Frequency Relays

The DISCOMs shall install low frequency relays at various locations to shed load when frequency falls. APTRANSCO and DISCOMs shall enter into Agreements regarding the amount of load in MW to be shed at different values of low frequency. The location at which loads are to be disconnected shall be decided by the DISCOM. The specifications of the low frequency relays are given in Appendix B. The LT AC power supply to the Low Frequency Relays shall be derived from the primary supply i.e, Station

Auxiliary Transformer but not from the external public distribution system.

3.4 Grid Characteristics

3.4.1 Introduction

This section specifies the electrical parameters of performance of the GRID which affect the performance of connected Users and other transmission systems interconnected with the AP Transmission Grid.

3.4.2 Objective

(i) To ensure that the GRID performance meets a minimum standard which is essential for the Users' system and equipment to function properly.

(ii) To enable Users to design their systems and equipment to suit the electrical environment that they operate in.

(iii) To enhance the quality standards of the AP Electrical System towards standards stipulated in or established under the authority of National and State Acts and Rules in the short term and gradually moving towards international standards in the long term.

3.4.3 Implementation

The GRID performance standards established herein shall be implemented in a manner so as to ensure that no entities are forced to achieve goals beyond the capability and limitations of the current system in the immediate future while continuing to strive for the higher standards by improving their system in the long term.

To this end, the CTI shall be implemented in three Stages:

Preliminary Stage:

The time period immediately following approval of the first version of the CTI by APERC. Existing conditions to prevail. However all entities shall endeavour to minimise the duration of the Preliminary Stage.

Transition Stage:

An agreed time period during which improvements are made to the system with the injection of investment capital.

Final Stage:

An agreed time period when substantial improvements have been carried out and the system is considered to be in satisfactory condition with the needed capital investment.

Standards for different Stages will be different.

The length of the Preliminary Stage and Transition Stage shall be determined by the Regulator who will inform all parties concerned of impending change to the next stage at least six months in advance.

3.4.4 Voltage Criteria

The voltage criteria detailed below are the target values to be achieved under the leadership of **APTRANSCO**, in coordination with SRLDC and with the cooperation of the Power Sector Utilities in Andhra Pradesh State**.**

3.4.4.1 Voltage Variations (CEA Standards)

System Voltage	Maximum (RMS)	Minimum (RMS)
400 kV	420 kV	360 kV
220 kV	245 kV	200 kV
132 kV	145 kV	120 kV

3.4.4.2 Voltage Unbalance

The phase voltages of a 3-phase supply should be of equal magnitude and 120^{o} apart in phase angle. Deviations will result in decreased efficiency, negative torque, vibrations and overheating. Severe unbalance could lead to malfunctioning of some equipment. Voltage unbalance is defined as:

$$\text{Voltage Unbalance} = \frac{\text{Deviation between highest and lowest phases}}{\text{Average voltage of three phases}}$$

Limits for voltage unbalance are:

220kV and above: 2%

Below 220 kV: 3%

Balancing loads on individual phases will help greatly in avoiding unbalanced voltages

3.4.5 Frequency

Frequency of the transmission system should be maintained within an acceptable range to ensure proper operation of the system. Insofar as possible, APTRANSCO shall fulfil its parrtial responsibility to enable SRLDC to keep the frequency within acceptable ranges and avoid the periods where the frequency values given under "Extreme Conditions" prevail.

TABLE

Frequency Limits

SREB Standards : "targets" to be achieved:	
Upper limit:	50.5 Hz
Lower limit	49.5 Hz
Statutory Limits : acceptable	
Upper limit:	51.5 Hz
Lower limit:	48.5 Hz
Extreme Conditions:	
Upper limit:	52.5 Hz
Lower limit	47.5 Hz

3.4.5.1 All new generating units shall be capable of operation in 47.5 to 51.0 Hz frequency range for short duration without damage or reduction of life.

3.4.6 Reliability Criteria

System reliability of the GRID includes three aspects:

- system adequacy
- system security.
- service reliability

3.4.6.1 Generation Adequacy

Adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of their customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.

Adequacy of the generating system is usually measured in terms of loss of load probability (LOLP) which is the probability of system capacity not being able to meet system load. LOLP can also be expressed as loss of load expectation (LOLE) in days per year. This measure does not consider the amount or duration of the capacity shortfall.

System Adequacy Limits:

Preliminary Stage:	20%
Transition Stage:	8%
Final Stage:	1% (87.6 hr/year)

3.4.6.2 Security

Security is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.
The bulk electric system shall be designed for a security level of n-1, i.e.to withstand a single contingency with little negative effect. This means the most severe fault or the tripping of a critical generator, transformer or line should not result in

a) instability of the system
b) overloading lines and/or transformers for more than 15 minutes
c) voltage drop of more than 10 % when the system import is increased by 20%
d) load shedding

System Security Limits:

Security level of "n-1" (single contingency) **PLUS**
spinning reserve margin of:

Preliminary Stage:	no mandatory requirement
Transition Stage:	0.5 % of system peak load
Final Stage:	1 % of system peak load

3.4.6.3 Service Reliability

The points where electric power is supplied from the transmission system to the **Users** (distribution companies, another transmission system, EHT customers) are called delivery points or grid supply points. Outages at these points directly affect the **Users** of the GRID. The reliability level at the delivery points is therefore an indication of the quality of service provided by **APTRANSCO** to its Users.

Service reliability of the GRID is indicated by :

System Average Interruption Frequency Index **(SAIFI)**
System Average Interruption duration Index **(SAIDI)**

which are calculated as follows:

For each forced outage involving one or more delivery points and lasting more than 1 minute, the following parameters are recorded:

- Duration of outage in minutes: **T_i (min)**
- Sum of interrupted loads at all affected delivery points**:** **ΣP_i (kVA)**

$SAIFI = \Sigma Pi / P_{total}$

$SAIDI = \Sigma(Pi \times Ti)/P_{total} \div 60$

Where P_{total} = total sum of installed load at all delivery points

Note: Scheduled outages which are communicated to the consumers beforehand and load shedding due to capacity shortage are not counted in the computation of these indices

Allowable Limits

	SAIFI	**SAIDI**
Preliminary Stage	no limit	no limit
Transition Stage	24/yr	10 hours/year
Final Stage	18/yr	8 hours / year

3.4.7 Harmonic Distortion

3.4.7.1 General Description

Many types of equipment and phenomena can produce voltages and currents at frequencies that are multiples of the power frequency. These high frequency components are called harmonics and their ratio to the fundamental frequency is the harmonic order. Harmonics have many negative effects on the system and connected loads, so they have to be limited to a manageable level.

Control of harmonics on the **APTRANSCO** system is based on voltage harmonic distortion. Users produce harmonics by drawing from and injecting into the system harmonic currents which propagate through the system creating harmonic voltage drops, thus affecting others, so control of User harmonics is based on harmonic distortion current.

Harmonics are grouped into three categories: odd triplens (multiples of three), other odd harmonics, and even harmonics, with different severity levels and effects on equipment for each category. Odd harmonics are much more common than even harmonics.

3.4.7.2 Indicator of Quality for System Harmonics

Harmonic contents of the supply voltage is indicated by the following indices:

$$V_{THD} = \sqrt{\sum_{i=1}^{40} \frac{Vi^2}{V_1^2}} \times 100\%$$

$$V_{IHD} = \frac{Vi}{V_1} x100\%$$

Where Vi : ith harmonic of voltage

V_1 : fundamental frequency (50 Hz) voltage

V_{THD}: voltage total harmonic distortion

V_{IHD} : voltage distortion of ith harmonic

3.4.7.3 Maximum Limits of Voltage Harmonic Distortion in HT and EHT Systems.

Table

Harmonic Order	Distortion %	
	HT	EHT
(odd, non-triplen)		
5	6.0	2.0
7	5.0	2.0
11	3.5	1.5
13	3.0	1.5
17	2.0	1.0
19	1.5	1.0
23	1.5	1.0
25	1.5	0.7
>25	0.2+1.3x25/n	0 .1+0.6x25/n
(odd, triplen)		
3	5.0	2.0
9	1.5	1.0
15	0.3	0.3
21	0.3	0.2
>21	0.2	0.2
(even)		
2	2.0	2.0
4	1.0	2.0
6	0.5	0.5
8	0.5	0.4
10	0.5	0.4
12	0.2	0.2
>12	0.2	0.2
Total Harmonic Distortion	8%	3%

3.4.7.4 Control and Measurement

(a) Control

APTRANSCO shall monitor the voltage harmonic levels at the supply points to the Users (**DISCOM**s, **AP Genco**, major users) and other strategic locations on the transmission system.

APTRANSCO will compile a list of all metering points and take measurements at 5 sites per month. The list has to be submitted to APERC for approval.

(b) Measurement

The measurements should conform to IEC Std 1000-4-7 or IEEE Std 519. The measurements should be taken at 10 minute intervals and should last for 1 week per site.

3.4.7.5 Enforcement of Limits

The harmonic voltage limits will be implemented in stages as follows

Preliminary Stage

Limits not in effect

Transition Stage

APTRANSCO will monitor voltage harmonic distortions at all delivery points, but no sanctions will apply for exceeding the limits

Final Stage

The limits in Section 3.4.7.3 will apply

Limits of Supply Voltage Harmonics in LT System will be included in future Versions.

3.4.8 Voltage Flicker

3.4.8.1 General Description

If the voltage fluctuates, the luminous intensity of the lamps and TV's will fluctuate correspondingly. If the fluctuation is of a magnitude and frequency perceptible to the eye, it becomes flicker. Flicker could range from annoying to complete interference of normal activity.

Flicker is not usually produced by the power system but by customer loads such as arc furnaces, compressors, starting of large motors, etc. Since voltage fluctuation of the system affects other users on the same system, the transmission company needs to control the flicker on its lines and station busses. At the same time, flicker-generating loads connected to the system have to be controlled.

3.4.8.2 Indicator of Quality for System Flicker

Flicker is measured by means of two indices, P_{st} and P_{lt}, as defined in IEC Std 1000-3-7. For the purpose of regulation, P_{st}, the short term flicker severity index, is selected as the indicator of quality.

3.4.8.3 Limits

$P_{st} = 1$, which is equivalent to the threshold of perception, is the allowable level of flicker on the transmission system.

3.4.8.4 Control and Measurement

Substations which supply heavy industrial loads such as furnaces, steel mills, etc. are targets for flicker monitoring. Other substations and connection points will be selected for monitoring on a random basis. At least one site is monitored each month.

The list of monitoring points is submitted to APERC for approval at least 2 months before the monitoring. The flicker measurement will be conducted at 10 minute intervals according to procedures outlined in IEC Std 61000-4-15. Each site is measured for 1 week

3.4.8.5 Enforcement of Limits

Flicker limits and control and measurement procedure will be in effect only in the Final Stage

3.5 Connected Plant Restrictions

3.5.1 General Principle

Users connected to the Grid can produce power disturbances which propagate to the power system. If these disturbances are severe, the power system and other Users on the system will be adversely affected. To ensure system integrity and fairness to all Users restrictions and controls have to be placed on Users of the system.

3.5.2 Safety

The term "Safety" refers to safety standards adopted in manufacture, erection stages in choice of location and in installation, operation and maintenance procedures. The term applies both to safety to equipment and safety to persons including safety of general public (in addition to safety of utility staff).

The equipment of the Users, including machines, devices, overhead lines, underground cables, transformers, etc., must conform to Safety Standards (ISS, general engineering safety standards and the safety Codes to be issued by **APTRANSCO**). The Standards of the Safety Codes to be issued by **APTRANSCO** shall not be lower than, or inferior to, the APSEB Safety Manual.

3.5.3 Insulation

The Users' system must be designed with the proper basic insulation level (BIL). Insulation of all components in service must have adequate dielectric strength for the system operating voltages at all times.

3.5.4. Clearances

All overhead lines, equipment and facilities of the User's system connected to the GRID must comply with clearance limits published in the Indian Electricity Rules. For situations not covered in the Indian Electricity Rules, the IEEE C2-1997 "National Electrical Safety Code" will apply.

3.5.5 Earthing

All components of the Users' systems must be properly earthed as per standards. All individual earth electrodes, earthing pits, and the interconnection arrangements shall be as per standards and shall be properly maintained.

The bodies/cases/trucks/enclosures of all items of equipment shall be properly earthed, with the actual earthing arrangements depending on the machine ratings. Metallic supports of overhead lines and cable

sheaths and shields shall also be earthed as appropriate.

3.5.6 Safety Training

Personnel of all entities shall be adequately trained in the correct operating techniques and safety precautions, keeping in mind cross-boundary connections.

3.5.7 Motor Starting

The Motor Starting Current of motors in the Users' systems shall be less than 6 times the full-load current unless special exemption is granted. The appropriate methods of motor starting shall be adopted. Two or more motors shall not be started simultaneously or within 5 minutes if the resulting voltage dip at the substation bus exceeds 5 %.

Where necessary, **APTRANSCO** shall have the right to advise the consumer or User to change over to "auto-transformer" motor starting if the existing starting method causes unacceptable system distortions.

3.5.8 Access to **APTRANSCO**

APTRANSCO and its authorized personnel shall have the right to inspect the plant of any USER or Consumer, to ensure conformity to standards and restrictions.

3.5.9 Unintended and Unscheduled back-energization

The Users shall take adequate precautions to ensure that no part of the grid is energized by the Users' system from another source of supply unless it is requisitioned in writing by the utility as an exceptional arrangement. The switch-gear and controls of the Users' systems shall be so designed as to prevent back-energisation and the personnel shall be made aware of the need for this precaution.

3.5.10 Harmonics (Harmonic Current Generated by Consumers)

3.5.10.1 Indicators

The level of harmonics generated by Users or customers is indicated by the percentage of harmonic distortion measured at the point of connection. The following indices are the total current harmonic distortion and the individual current harmonic distortion respectively.

$$I_{THD} = \sqrt{\frac{\sum I_i^2}{I_1^2}} x100\%$$

$$I_{IHD} = \frac{Ii}{I_1} x100\%$$

where:

I_{THD} = Total harmonic distortion of current

I_{IHD} = Individual distortion of current of harmonic order i

I_i = Current component of harmonic order "i"; I_1 = Current component of fundamental frequency 50 (HZ)

3.5.10.2 Limits

Limits of Harmonic Current Distortion (%)

Harmonic Order (n)	P > 10 kW or V< 33 kV	P>50 kW or V>33 kV
Odd, Non triplen		
5	12	6
7	8.5	5.1
11	4.3	2.2
13	3	2.2
17	2.7	1.8
19	1.9	1.7
23	1.6	1.1
25	1.6	1.1
>25	0.8+0.8*25/n	0.4
Triplen		
3	16.6	7.5
9	2.2	2.2
15	0.6	0.8
21	0.4	0.4
> 21	0.3	0.4
Even		
2	10.0	10
4	2.5	3.8
6	1.0	1.5
8	0.8	0.5
10	0.8	0.5
12	0.4	0.5
>12	0.3	0.5
Total	20.0 %	12 %

3.5.10.3 Control and Measurement

Measurements may be taken at any time by **APTRANSCO** at the customer's connection point. Measurements have to be taken in accordance with methodologies of IEC 61000-4-7 or IEEE STD 519-1992 and have to be for at least 24 hours long at 10 minute measurement intervals.

3.5.10.4 Enforcement of Limits

The customer load harmonic limits will be implemented in stages as follows:

Preliminary Stage

Limits not in effect

Transition Stage

APTRANSCO will monitor current harmonic distortions at all delivery points, but no sanctions will apply for exceeding the limits

Final Stage

The limits in Section 3.4.10.2 will apply

Limits of Current Harmonics in LT System will be included in future versions of CTI.

3.5.11 Voltage Flicker Generated by Users

3.5.11.1 General Description

Some customer loads draw intermittent current (e.g. arc furnace) or create a steep increase in current (e.g. motor start). If this happens frequently and if the magnitude of current is significant, the resulting voltage fluctuation will be sufficient to cause flicker. As an obligation to other customers, the flicker produced by customers has to be restricted.

3.5.11.2 Indicator

Flicker generated by customers is indicated by the index Pst as defined in IEC Standard 61000-3-7 and measured with a flicker meter that meets the specification of IEC Std 868 or IEC Std 61000-4-15

3.5.11.3 Limits

Tolerance for customer-generated flicker varies with the relative strength (short circuit ratio) of the load and voltage level. Limits are given in the following table.

Limits of flicker produced by Users

Short Circuit Ratio S_L/S_{CC}	**Voltage**	**Pst**
$S_L/S_{CC} \leq 0.04$	HT	0.37
	EHT	0.58
$S_L/S_{CC} > 0.04$	HT	0.8
	EHT	1.0

3.5.11.4 Control and Measurement

Flicker is measured at the point of connection using an approved flicker meter and in accordance with IEC Std. Measurement must be taken for at least 24 hours at 10 minute measurement intervals. Flicker readings with the load off must be taken for at least 5 hours as a reference.

3.5.11.5 Enforcement of Limits

Flicker limits and control and measurement procedure will be in effect only in the Final Stage

3.5.12 Power Factor

3.5.12.1 General description

It is desirable that loads on the system have power factors at or close to unity as that represents the most efficient use of the system capability and the least loss of energy. It also eliminates many transient stability problems. Any load with a power factor lower than 90% is imposing an unfair burden on the transmission system and other Users. Power Companies therefore place restrictions on the power factors of customer loads.

3.5.12.2 Limit

The minimum power factor allowed is 90%.

3.5.12.2 Control and Measurement

Power factor measurements are made continuously in conjunction with the voltage measurements. Loads with inherent low power factors should automatically include capacitors to correct the problem.

3.5.12.3 Penalty

A user with power factor worse than 90% may be refused connection to the transmission grid until the problem is rectified. Alternatively, a penalty may be assessed.

3.5.12.4 Enforcement of Limits

The limit for power factor shall be effective immediately.

3.5.12.5 Reactive Power Requirements: In general the Distribution Companies shall not depend on APTRANSCO and APTRANSCO shall not depend on ISTS for reactive support. DISCOMS shall provide reactive compensation for their systems and APTRANSCO shall provide reactive compensation for the intra state Transmission system. The DISCOMs shall ensure that consumers having inductive load install capacitors. The DISCOMs shall also install capacitors at various locations of the Distribution System so that at the interface with APTRANSCO the power factor is not less than 90%.

3.6 Operational Numbering and Nomenclature Standards

3.6.1 Introduction

Numbering and nomenclature of plant and apparatus at connection sites specifies responsibilities and procedures for determining and notifying APTRANSCO and Users of the other's plant and apparatus at connection sites. Nomenclature shall include the selections of sub station names.

The numbering and nomenclature of plant and apparatus shall be included in the ownership diagram prepared for each connection site.

3.6.2 Objective

The objective of having numbering and nomenclature standards for plant and apparatus at connection sites is to reduce errors in identification of plant and apparatus by ensuring that every item of plant and / or apparatus has a unique identifying number and nomenclature agreed to and notified between APTRANSCO and Users; thus improving efficiency of operation and safety.

3.6.3 Procedure for numbering and nomenclature of plant and apparatus at connection sites.

3.6.3.1 Plant and apparatus of new connection sites

When APTRANSCO or a User intends to install an apparatus at a new connection site, the proposed numbering and nomenclature shall be notified as part of the production of the ownership diagram or operation diagram in accordance with the provisions of the connection conditions. The principles to apply will be those set out in this Section.

3.6.3.2 Existing connection sites

a) When APTRANSCO or a User intends to install plant and / or apparatus at an existing

connection site the proposed numbering and / or nomenclature to be adopted shall be notified to the other.

b) The notification shall be in writing and will consist of a revised ownership diagram incorporating the proposed plant and numbering and nomenclature.

c) The notification shall be made at least six months prior to the proposed installation or such shorter period as APTRANSCO or the User may agree.

d) The Recipient of the notification shall respond in writing within one month confirming receipt and whether the proposed numbering and/or nomenclature is acceptable. If unacceptable the response shall state what would be acceptable.

e) In the event that agreement cannot be reached between APTRANSCO and the User, APTRANSCO acting reasonably shall have the right to determine the numbering and nomenclature to be applied.

3.6.3.3 Changes to Existing plant and apparatus.

Where APTRANSCO or a user needs to change the existing numbering or nomenclature of any of its plant and / or apparatus at a connection site, the provisions of 3.5.3.2 shall apply with amendments necessary to reflect that only a change is being made.

Clear Labelling: APTRANSCO and each user shall be responsible for the provision, execution and maintenance of clear and unambiguous signs/labels showing the numbering and nomenclature of its plant or apparatus of connection sites

3.7 Protection Requirements & Co Ordination

3.7.1 General Principles

No item of electrical equipment shall be allowed to remain connected to the Transmission System unless it is covered by appropriate protection aimed at reliability, selectivity, speed, discrimination and sensitivity. Guidelines mentioned in protection manuals of CBI & P shall be kept in view.

Protection standards are treated as interface issues because of the possible severe cross-boundary repercussions of faults that occur in the system of any entity. Minimum protection requirements are prescribed in the Section because inadequate protection or mal-operation of protection system of one entity may result in far reaching consequences, disturbances and even damages in the systems of other entities.

All Users shall co-operate to ensure correct and appropriate settings of protection to achieve effective, discriminatory removal of faulted equipment within the target clearance times specified in this Section.

The protection systems to be installed (or kept in service) at various Generating Stations and sub-stations shall not be inferior to the systems existing before the effective date under the erstwhile Andhra Pradesh State Electricity Board. The Corporations shall update the protection system as technology advances worldwide. The protection standards existing in AP State just before restructuring are given in 3.6.3.1 to 3.6.3.4. the features and functions of the various relays should have minimum protective capability obtaining before re-structuring.

Protection settings shall not be altered without consulting and informing all affected Users. No protection should be by-passed or disconnected without the agreement of the affected User. When protection is bypassed and/or disconnected by agreement, then the cause must be rectified and the protection

restored to normal condition as quickly as possible. If agreement has not been reached the electrical equipment shall be removed from service forthwith. Even when protection is temporarily bypassed by agreement, a standby protection or back-up protection system shall be operational during the period.

The **APTRANSCO** shall be responsible for arranging periodical meetings among all Users to discuss coordination of protection. **APTRANSCO** shall investigate any maloperation, non-operation or delayed operation of protection or other unsatisfactory protection performances. Users shall take prompt action to correct any protection malfunction or issue as discussed and agreed to in these periodical meetings. **APTRANSCO** shall determine the relay settings of all Transmission lines and communicate to Generating stations and **DISCOM**s. **APTRANSCO** shall determine relay settings at all EHT Sub-Stations upto the LV side of the Power Transformers. Relay settings at Generating Stations shall be determined by the generating station authority. The settings of some relays including relays of EHT Feeders emanating from generating station switchyard which require coordination with **APTRANSCO** shall be determined in consultation with **APTRANSCO**. The data required by **APTRANSCO** in respect of equipment in Generating Station for calculating fault level shall be promptly furnished by the Generating Station in the format prescribed by **APTRANSCO**. **DISCOM**s shall finalise the settings of all the protections for the 33 kV and 11 kV feeders emanating from **APTRANSCO**'s Sub-Stations for satisfactory function in consultation with **APTRANSCO.** The final authority for protection coordination and determination of relay settings is SREB. Therefore the protection schedules provided and relay settings must be approved by SREB.

3.7.2 Fault Clearance Times

The maximum fault clearance times for faults based on stability consideration on any User's system directly connected to the Transmission System, or any faults on the Transmission System itself, are as follows.

Target Clearance Times

Voltage *Class*	**Total Relay Operation Time + Breaker Opening Time**
400 Kv	100 msec
220 kV	160 msec
132 kV	160 msec

The above times shall apply after carrier inter trip and auto reclosure features are commissioned in the APTRANSCO System.

Slower fault clearance times for faults on a Users system may be agreed to if, in the opinion of **APTRANSCO**, the system conditions will allow. **APTRANSCO** shall specify the required opening times of circuit breakers at various locations owned by **Generators** and **DISCOM**s.

3.7.3 Protection Requirements

3.7.3.1 Generator Requirements

All Generating Units and associated electrical equipment of the Generating Units connected to the Transmission System shall be protected by adequate protection so that the Transmission System does not suffer due to any disturbance originating from any Generating Unit. The protection schemes shall be in accordance with the CBIP guide lines which are indicated below:

The following are the minimum protection requirements of Alternators and Generator Transformers at Generating Stations: -

(i) Generator Differential
(ii) Overall Differential
(iii) Minimum Impedance (alternatively over current/under voltage)
(iv) Negative Sequence
(v) Stator Overload
(vi) 95% Stator Earth Fault
(vii) 100% Stator Earth Fault
(viii) Loss of Excitation
(ix) Pole Slip
(x) Low Forward Power/Reverse Power (double protection for large alternators).
(xi) Minimum Frequency
(xii) Over Voltage or Over Current (protection against inter-turn faults)
(xiii) Over-fluxing (voltage/Hz)
(xiv) Over Voltage
(xv) Protection against accidential Energisation of Dead Machine
(xvi) PT Fuse Failure
(xvii) Rotor Earth Fault

Generator Transformers

(i) Overall Differential
(ii) Over Current
(iii) Earth Fault
(iv) Restricted Earth Fault
(v) HV winding-cum-overhang differential
(vi) Buchholtz Protection
(vii) Local Breaker backup protection

Unit Auxiliary Transformer

(i) Transformer Differential
(ii) Over Current
(iii) Residual Over Current
(iv) Restricted Earth Fault
(v) Buchholtz Relay

(Note: Exemption may be given to small generating units for some of the protections.)

In this sub-section only those protections which have direct impact on the Grid are prescribed. Other protections of the Alternator and Transformers and the various protections for the Turbine, Boiler and Auxiliary Machines are considered the internal issues of the Generators and hence not dealt here.

3.7.3.2 Transmission Requirements

General: Every EHT line taking off from a Power Station or a Sub-Station shall have distance protection and back up protection as mentioned below. The **APTRANSCO** shall notify Users of any changes in its policy on protection from time to time. All 400 kV lines and 220 kV lines

owned by **APTRANSCO** shall have two fast operating distance protection schemes preferably with two different operating principles the voltage of one relay being fed from Bus P.T. and the voltage of the other relay from line CVT, the currents of the two relays being fed from different CT cores. There shall be facility to change over voltage supply to relays from Bus P.T to C.V.T. and vice versa. Additional back up protection may be provided by **APTRANSCO** at its discretion.

400 kV Lines: Three zone static fast acting distance protection with permissive inter trip for accelerating tripping at remote end in case of zone-2 fault as Main 1 protection. Main 2 protection shall be similar fast acting protection using direction comparison or phase comparison carrier relaying scheme. Main 1 and Main 2 are preferably to have different operating principles.

In addition to the above single pole tripping and single shot single pole auto reclosing after an adjustable dead time shall be provided.

Main 1 and Main 2 shall have DC supplies from different batteries.

220 kV lines*:* Main 1 shall be Three zone static distance protection . Main-2 protection shall be a distance protection scheme preferably having a different operating principle.

Necessary indications, alarms and controls shall be provided for P.T. supply failure and for ensuring change over from Bus No.1 PT to Bus No.2 PT and vice versa when Bus Transfer is made.

Presently carrier inter trip has not been installed by **APTRANSCO.** This feature shall be provided in due course for accelerating tripping at the remote end in case of faults covered by Zone 2 from one end.

132 kV Lines: Three zone static or electromagnetic distance protection as main protection. Carrier inter-trip feature shall be provided as soon as possible. The back up shall be directional IDMT over current relays and one directional IDMT earth fault relay.

For short transmission lines alternative protection schemes may be adopted.

The tripping and relay indications in respect of Feeders supplied from the switchyard of a generating station shall be promptly informed by the operator at the Generating Station to the operating engineer of **APTRANSCO** and to **SLDC**.

The following shall be taken as approved protection norms for Transmission and Distribution lines.

NORMS OF PROTECTION FOLLOWED DURING ERSTWHILE APSEB REGIME. FOR TRANSMISSION & DISTRIBUTION LINES: -

S.No	Voltage	Protection Scheme
1.	220 K V Line	Main I : Non switched distance scheme (Fed from Bus PTs) Main II: Switched distance scheme (Fed from line CVTs) With a changeover facility from bus PT to line CVT and vice-versa.
2	132 K V Line	**Main Protection:-** Switched distance scheme (fed from bus PT) **Backup Protection:-** 3 Nos directional IDMT O/C Relays and 1 No directional IDMT E/L relay.

3	33 K V Lines	Non-directional IDMT 3 O/C and 1 E/L relays.
4	11 K V Lines	Non-directional IDMT 2 O/C and 1 E/L relay.

Notes:

(i) On some of the old 220 kV lines one distance scheme with backup directional IDMT 3 O/L & 1 E/L relays were provided.
(ii) On some of the 132 kV grid lines, only distance scheme is available.
(iii) Very few 66 kV lines are in service (which are also being phased out) with distance OC/EL relays.

3.7.3.2.1 Earthing: The transmission system design and the selection of vector group of EHT Transformers shall be such that the Earth Fault Factor is below 1.4

3.7.3.3 Distribution Line Requirements

All 33 kV and 11 kV lines shall be provided with a minimum of over current and earth fault protection with or without directional features as given below.

Plain Radial Feeders:

Three Non-directional time-lag overcurrent relays one non-directional IDMT Earth Fault Relay with suitable settings to obtain discrimination between adjacent relay stations.

Parallel Feeders/Ring Feeders:

Directional time-lag overcurrent and earth fault relays.

Long Feeders/Transformer Feeders:

For long feeders or transformer feeders, the relays should incorporate a high set instantaneous element within five years from the effective date..

The relay settings of the Distribution systems shall be determined by the DISCOMS in agreement with **APTRANSCO**.

3.7.3.4 Transformer Requirements

Generating Station / Transmission System: All windings of autotransformers and power transformers of EHT class shall be protected by differential relays. Overfluxing relays shall be provided for HV and LV of EHT transformers. In addition there shall be back up time lag over current and earth fault protection. For parallel operation such back up protection shall have a directional feature. For protection against heavy short circuits, the over current relays should incorporate a high set instantaneous element. In addition to electrical protection, gas operated relays, winding temperature protection and oil temperature protection shall be provided.

Distribution System: Up to (but Excluding)15 MVA, Non-directional IDMT overcurrent relays (3 nos) and earth fault relay (1 No) both on HV and LV side Instantaneous REF shall be provided within 5 years from the effective date.

For smaller transformers of 66 kV/33kV/11kV class on the Distribution System, differential protection shall be provided for 15 MVA and above along with back up time lag over current and earth fault protection (with directional feature for parallel operations).

All Power Transformers, 1.6 MVA and above, shall be provided with Buchholtz relay, winding

temp and Oil temp. protection in addition to the above mentioned relays. For 1.6 MVA and 3.0 MVA Transformers circuit breakers do not exist on HV side hence the protections serve to isolate load and initiate alarms.

The following shall be approved norms of protection for transformers of different voltage classes and capacity ratings:-

NORMS OF PROTECTION FOR EHV CLASS POWER TRANSFORMERS

(existing in erstwhile APSEB Regime.)

Voltage ratio & capacity	**H V Side**	**L V Side**	**Common relays**
i) 132/33/11 K V upto 8 M V A	3 O/L relays + 1 E/L relay	2 O/L relays + 1 E/L relay	Bucholz, OLTC Buchlolz, OT,WT
ii) 132/33/11 K V above 8 MVA and below 31.5 MVA.	3 O/L relays + 1 dir. E/L relay	3 O/L relays + 1 E/L relay	Differential, , Bucholz, OLTC Bucholz, OT, WT.
iii) 132/33 K V 31.5. MVA and above	3 O/L relays + 1 dir. E/L relay	3 O/L relays + 1 E/L relay	Differential, Overflux, Bucholz, OLTC Bucholz, PRV, OT, WT.
iv) 220/33/ KV 31.5 MVA & 50 MVA 220/132 KV 100 MVA	3 O/L relays + 1 dir. E/L relay	3 O/L relays + 1 dir.E/L relay	Differential, Overflux, Bucholz, OLTC Bucholz ,PRV, OT, WT
v) 400/220 KV 315 MVA	3 directional O/L relays (with dir. Highset) + 1 directional E/L relay. Restricted E/F relay	3 directional O/L relays (with dir. highset) + 1 directional E/L relay. Restricted E/F relay	Differential, Overflux, Bucholz, OLTC Bucholz PRV, OT WT and overload (alarm) relay.

3.7.3.5 Substation Bus Bar Protection

Adequate bus zone protection for substation bus bars in all 400 kV and 220 kV class substations shall be provided.

LBB: At all 400 kV & 220 kV substations Local Breaker Back up protection shall be provided.

3.7.3.6 Fire Protection

Fire protection systems and regulations shall be in accordance with relevant Indian Standard Specification and provisions in IE Rules & Tariff Advisory Committee (TAC). Where appropriate Indian rules do not exist or are not applicable, NFPA Fire Protection Manual or IEC standards (or better standards) shall apply

3.7.3.7 Data Requirements

a) Full description including settings for all relays and protection systems installed on the

Generating Unit, Generating Unit Transformer, Auxiliary Transformer and electrical motors of major equipment listed.

b) Full description including settings for all relays installed on all outgoing feeders from power station switchyards, tie circuit breakers, incoming circuit breakers.

c) Full description of inter-tripping of circuit breakers at the point or points of connection with the **APTRANSCO** system.

d) Most probable fault clearance times for electrical faults on the User's system.

e) Relay protection installed for all transformers and feeders along with their settings and level of co-ordination with other Users.

f) See Section 2 (Planning Code) Appendix C for a summary of the protection data requirements.

g) Data required for determination of short-circuit current at each point of connection and rupturing capacities of breakers shall be exchanged between utilities.

h) Data as prescribed in the Annexures to Planning Code in various contexts.

3.8 Earthing

Where a point in EHT system of APTRANSCO is earthed the Earth Fault Factor shall be below 1.4

(Like most stipulations in the Connection Code the clauses in the following paras must be taken into account by the Generators while placing orders of equipment on Manufacturers)

3.9 Design Parameters of New Generating Units.

(i) **New Units:** For new plant para 3.2.5 (a), this para (3.9) and other paras of this Code apply. For plant existing as on the Transfer date the actual specifications hold for the life period of the equipment. However if certain parts can be replaced at reasonable investment then those parts shall be replaced under a Renovation, Rehabilitation and Modernization Programme to ensure better performance to conform to the requirements of CTI and IEGC. For example the Generators shall replace the Turbine Speed Governors and AVR systems of the alternators, and instal Power System Stabilisers if technically possible in order to meet the operating standards of the CTI and IEGC.

In addition APTRANSCO may require Generators to comply with other specifications in a bilateral agreement before the Connection Application is accepted in order to ensure the required performance of the transmission system and the total system.

(ii) The Generating Units shall be capable of supplying rated active power output between 0.85 power factor lagging and 0.95 power factor leading.

(iii) The Short Circuit Ratio of Generating Units shall be not less than 0.5.

(iv) A Generating Unit shall be capable of supplying rated active power output within the system frequency range 49.5 to 50.5 Hz.

(v) **Decrease of output with decrease of frequency:** Any decrease of output in the frequency range 49.5 to 47 Hz should not be more than pro rata with frequency. The Generating Units must be capable of operation in 47.5 to 52 Hz range for a short duration without any deleterious effects and without reduction of life.

(vi) **Effect of Voltage Fluctuations:** The MW output of a Generating Unit should not be affected by voltage changes in the permissible range. The Reactive Power Output under steady state conditions should be fully available as per capability curves within a voltage range of ± 5% of nominal value.

(vii) **Governors:** All new Generating units must have automatic Governors with a droop of 3 to 6% and automatic voltage regulators. Power System Stabilizers shall be installed under a bilateral agreement with APTRANSCO. All new units shall have provision for incorporating power system stabilizers, if not provided at the time of initial commissioning.

(viii) **Overloads:** All new Generating units must be capable of instantaneously increasing the output (by auto governing action) by 5% for a minimum of 5 minutes (upto 105% MCR) when the system frequency falls.

(ix) The HV winding of the Generator Transformer must be star connected with the star point suitable for earthing. The earthing of HV star point and the configuration of LV winding shall be such as to enable APTRANSCO to achieve the requirement that the Earth Fault Factor in Transmission System shall be 1.4 or less as stipulated in 3.7.3.2.1.

(x) CCGT Modules meant for Central Despatch must have Fast-Start capability so that SLDC may use them for Operating Reserve.

(xi) Thermal Units must be capable of continuous stable operation at any load between 60% MCR and 100% MCR without oil support and between 45% and 60% MCR with oil support.

(xii) Hydel Units must be capable of continuous stable operation at any load between 40% MCR and 100% MCR.

3.10 Operational Metering:

Whenever APTRANSCO implements EMS and SCADA Projects, the user shall provide measurement outputs of Voltage, Current, Frequency and Active and Reactive Power, plant status indications and alarms to APTRANSCO SCADA outstation interface equipment.

General Format of Site Responsibility Schedule

-

Name of Power Station/Sub-station: . . . .

Site Owner: . . . .

Tel. Number: . . . .

Fax Number: . . . .

Item of Plant/Apparatus 1	Plant Owner 2	Safety Responsibility 3	Control Responsibility 4	Operation Responsibility 5	Maintenance Responsibility 6	Remarks 7
.... kV Switchyard						
All equipment including busbars						
Feeders						

Generating Units						

Note: Three items shall be added to this schedule: -

(i) Safety Rules pertaining to safety of each piece of equipment.
(ii) Safety Rules pertaining to system operation
(iii) Safety Rules for safety of operating personnel.

APPENDIX B

Specifications of Under Frequency Relays

(i)	Frequency Settings	:	46 to 49.0 Hz
	in steps of		0.05 Hz
(ii)	Measurement Period	:	Within minimum selectable settings
	Settings	:	range of 4 to 8 cycles.
(iii)	Operating Time	:	100 to 250 ms
(iv)	Operating Voltage	:	50 to 100% of nominal voltage with provision for selection.
(v)	Stages	:	Two stages.

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4 OPERATION CODE

4.1 Demand Forecast

4.1.1 Introduction

This Section specifies procedures to be followed and data to be exchanged between entities for forecasting demand of the distribution systems by DISCOMs and for forecasting total AP Grid Demand by APTRANSCO through time scales ranging from two years in advance plus the current year through to Control Phase and into real time operation. Long term demand estimation is necessary to ensure generation margin and short-term estimation helps frequency control. Demand Forecast estimates active and reactive power at different points of time in future period and also daily energy requirements for future days.

The maximum active and reactive power at day peak and night peak times and variation in a 24-hour day cycle (load curves) are predetermined by means of sound forecast methodology.

4.1.2 Objective

(i) To set out the requirement for consumers and to convey to APTRANSCO in advance the active power, reactive power and daily energy drawals from the transmission system into the distribution system at various connection points.

(ii) To set out the requirements for Users to provide demand and generation data to APTRANSCO to enable it to maintain a sufficient margin during Operational Planning Phase and Programming Phase and to know how much generating plant to schedule and to dispatch, to meet demand on the transmission system and to meet the License Standards. DISCOMs and APTRANSCO will take into account the factors specified when conducting Demand Forecast.

4.1.3 Data Exchange

(In general Appendix D of OC is to be followed)

A. From Large Consumers to DISCOMs:

By the end of October each year the HT and EHT consumers, Captive Power Plants and

Cogeneration Units shall provide to the respective DISCOMs in writing details of their Demand (in MW, MVAr, MWh) for two years ahead (April to March year) and for the period November to March of the current year. They must clearly indicate the periods of shut down of their plant for overhaul/maintenance or for other reasons, the reduced demand during such periods and the reduced demand during periods of reduced production for any reason foreseen. The EHT consumers and Captive Power Plants and Cogeneration Units shall submit copies of their Demand forecasts to SLDC also

B. From DISCOMs TO APTRANSCO:

(i) Each DISCOM shall by the end of November each year provide to APTRANSCO in writing the entire demand forecasts for the period covering December to March of the current year and following two years (April to March year is followed), active power, reactive power, daily energy requirements, peak demands, times of day peak and night peak and daily variation during holidays, the months when maximum agriculture load is expected and the months during which agricultural load will be minimum.

The Methodology adopted in demand estimation may be appended to the data.

(ii) The DISCOMs shall also provide to APTRANSCO estimates of load that may be shed in discrete blocks with details of arrangements of such load shedding.

(iii) Monthly energy, maximum demand and minimum demand by 15th of the preceding month.

C. From APTRANSCO to other Utilities:

(i) The demand forecasts submitted by DISCOMS to APTRANSCO are modified and rendered more realistic utilising the facility available under the Southern Region System Coordination and Control Project (SRSC&C) and taking into account holidays and weather forecasts received from meteorological Department. The improved versions of the daily demand forecasts for one week ahead and weekly forecasts for one month ahead for various DISCOM territories are transmitted to DISCOMs for use in the operation of distribution systems

(ii) To enable Users to be acquainted with the trends in demand growth during the following two years APTRANSCO shall communicate the validated demand estimates to all existing and prospective generators. APTRANSCO may opt to publish a summary of Demand Forecast in any media.

(iii) Further APTRANSCO shall furnish the information required by any User. APTRANSCO may refuse to furnish any item of data requisitioned by any User if it feels that the particular data is not required by the User for conducting its (the User's) business.

(iv) APTRANSCO shall furnish to SRLDC the predicted power flows in parts of ISTS relevant to AP System and drawals from ISGS corresponding to the forecasted State demand on daily /weekly/monthly basis for the current year in time scales as mutually agreed between APTRANSCO and SRLDC.

(v) APTRANSCO shall also furnish data to SRLDC for manually feeding the Southern Region System Coordination and Control Project as and when required by SRLDC.

D. From Generator to APTRANSCO:

(a) The output in MW and MVAr of each Power Station will be monitored. In case of failure of data transmission channel of APTRANSCO at the State Load Despatch Centre an alternative communications facility will be used.

(b) Loading profiles estimated for each Generating unit for two years ahead shall be furnished in writing by each Generator to APTRANSCO by the end of November each year. Such estimates shall include output in MW for each month in the period.

If the Loading profile of non-centrally dispatched generation materially changes or is expected to change during the Control Phase the Generator must notify SLDC each day, by 10.00 hours, an estimate in writing giving details of the revised estimate of the loading profile for the relevant generating plant for the next schedule day

4.1.4 Procedures

4.1.4.1 Demand Forecast Procedures to be followed by DISCOMS:

DISCOMs shall adopt a sound methodology for carrying out Demand forecast. The load growth as foreseen in the first two/three years as per the long term forecast carried out under the provisions of the Planning Code is considered.

Daily variation of the loads of different categories of consumers (domestic, industrial, agricultural) and Demand Side Management implemented are taken into account.

The load variation of different categories of consumers is determined from historical data and synthesized to obtain the total demand at each Connection Point at different times of the day. Seasonal variations and variations on holidays are taken into account. DISCOMs shall obtain data from EHT consumers, Captive Power Plants, Cogeneration Units, Railways (for traction load), and various other industries. General growth trends in housing, industry and agriculture are obtained from the respective Government departments. The expected agriculture load at different times in different seasons is estimated.

4.1.4.2 Demand Forecast Procedures to be followed by APTRANSCO

(a) Operational Planning and Programming Phase:

APTRANSCO utilises the facility it acquires under SRSC&C Project in estimating the simultaneous maximum Demand of AP State by synthesizing the demand estimates of all DISCOM territories furnished by the DISCOMs.

APTRANSCO shall take into account the following factors in estimating the Grid demand: -

(i) Local factors such as trade holidays, school holidays, seasonal variations of loads and weather forecasts received from meteorological department.

(ii) Anticipated loading profiles submitted by generators and other information furnished by Users.

(iii) Customer demand management.

(iv) Anticipated transfers across external connections.

(b) Control Phase

The factors mentioned in Section 4.3 (Schedule and Despatch) shall be taken into account by APTRANSCO /SLDC for conducting Demand Forecast in the Control Phase.

4.1.5 Responsibilities

(a) DISCOMs are responsible for weekly and monthly estimation of demands for the current year and monthly estimates for the year I and Year II ahead for the total service territory of the respective DISCOM as well as for each connection point.

(b) APTRANSCO is responsible for estimation of total AP State demand and power flows in various parts of the transmission system, power flows at ISTS connection points and drawals from ISGS on weekly basis for the current year and monthly basis for Year I and Year II ahead.

(c) Validation of Demand Forecasts prepared by DISCOMS is done by APTRANSCO. APTRANSCO shall independently prepare Demand forecasts using historic data and applying reasonable growth rates. The growth rates are derived from historic growth rates. If the differences between DISCOMs estimates and APTRANSCO projections are small, or if the differences are large but the DISCOMS justify the differences by stating the details of real loads awaiting imminent release of supply (eg. imminent commissioning of new industries or charging of lines supplying new colonies) to the satisfaction of APTRANSCO, the estimates prepared by the DISCOMS are accepted as realistic. Otherwise APTRANSCO shall request DISCOMs to revise the forecasts. If the differences persist, APTRANSCO shall adopt the weighted average of the estimates of DISCOMS and the projection of APTRANSCO. The degree of weightage given to each of the two estimates is decided by APTRANSCO, which is responsible for the consequences of divergence between forecasted demand and actual demand. The decision of APTRANSCO is final.

(d) DISCOMs shall maintain database of the demand at each connection point and for the total demand of the respective DISCOM territory on an hourly basis.

(e) APTRANSCO shall maintain database of the State demand on an hourly basis.

4.2 Outage Planning and Coordination

4.2.1 Introduction

This Section sets out procedures for coordinated outage Planning of Generating Units, Transmission Lines, Inter-connecting Transformers and Power Transformers whose LV sides feed 33 kV and 11 kV networks and Distribution Systems for the current year, and two years ahead. April to March is the outage Plan Year.

4.2.2 Hormonisation of Outage Plan

First outage programme of all generating units is evolved so that at any time the total injection into the Grid is adequate to meet the total demand or the deficit is minimum. Priority is given to decide the outage of Generating units because the generating equipment comprises many rotating machines and high temperature systems including furnaces which essentially require shutdown for maintenance, repairs and overhaul for giving good life time performance and enhance availability. Defaulting the maintenance schedules of generating plant may reduce life of the equipment or may reduce the output below MCR. Sometimes postponement of outage may defeat the purpose of postponement by the resulting breakdowns and forced outages. Therefore the generation outage plan is first prepared and basing on this, the outages of transmission elements (including inter-connecting transformers) are decided to correspond the outages of the respective generating units, ensuring that evacuation of the generation from units in service is not affected and the integrity and security of the Grid are maintained. Similarly the

outages of distribution systems and transformers feeding 33 kV and 11 kV networks are planned coordinating, the transmission outages. Optimal utilization of hydel power is made possible by a good generation plan.

4.2.3 Initial Data

All Generators shall furnish the tentative outage plans of their generating units for the current year, year 1 ahead and year 2 ahead to APTRANSCO by 30th November. The generators shall indicate urgency for shutdown of particular units, which may be damaged if not shutdown for repair/ maintenance within a given time. SRLDC shall furnish the data pertaining to ISGS.

4.2.4 Methodology

The methodology to be adopted by **APTRANSCO** in formulating generation and outage planning is as follows:

For arriving at generation capability, consideration is given to the past performance of the thermal units for the previous three years. From this the available generation for the future period is estimated.

Regarding Hydel Stations, the average water inflow into the reservoirs for the last ten years is considered for estimating the average generation. The annual Hydro Generation plan formulated by the High Power Irrigation Power Co-ordination Committee is the main basis for irrigation related hydel generation planning.

Both peak power delivering capability and energy output are considered.

Demand Forecast carried out as per Section 4.1 are utilized in preparing Outage Plans.

4.2.5 Objective

The objective of this procedure is to define operational methods used to assist **SLDC** to produce a coordinated generation outage program considering all the available resources and taking into account the constraints in the transmission system as well as constraints caused by release of water for irrigation or any other purposes.

To minimize surplus or deficits, if any, in the system requirement of power and energy and help operate the system at the desired frequency.

4.2.6 Interfaces and Responsibilities

APTRANSCO shall coordinate all utilities and shall coordinate generation planning.

4.2.6.1 Load Generation Balance

APTRANSCO shall prepare the proposal for the combined Load Generation Balances for the current Year, Year I and Year II, ahead based on the Generation Plan submitted by **APGENCO, IPPs, JVCs**, **CPPs** and the AP State Entitlements from ISGS.

The proposed Load - Generation Balance shall indicate Power and Energy availability, Generating Units availability, outage periods and demand forecast for the planning period.

In the quarterly review by the APTRANSCO and in further examination of monthly programmes by **APTRANSCO** the proposed Load - Generation Balance Plan prepared by **SLDC** shall be studied and then the Load Generation Balance Plan shall be issued for implementation.

APTRANSCO shall periodically review and prepare proposal for readjusting the Generation Plan to optimise the utilisation of the available resources in co-ordination with the outages of the transmission system.

4.2.7 Generation Outage Planning Process

4.2.7.1 Year I and Year II ahead

a) **APTRANSCO** shall utilise data received from **AP GENCO, IPP**s, **ISGS, JVCs, CPPs** and all other generation stations in the preparation of Generation outage planning for Year I and Year II ahead.

b) APTRANSCO, shall determine the total power and energy availability for each constituent for each month for a period of 2 years with the help of the data submitted by **APGENCO, IPP**s**, ISGS** and other generating stations.

c) **APTRANSCO**, shall compile tables depicting month-wise availability vs. requirement of power and energy, along with the associated conditions for all support levels of Thermal Units and release of water for Hydro-stations.

d) The deficit / surplus rows of the table will indicate periods during which scope exists for raising, reducing generation.

e) If there are both surplus and deficits over the planned period, the **SLDC** shall provide proposals to suitably co-ordinate and stagger generation outage periods to eliminate or reduce the deficits.

f) If there are only deficits all through the planned period, the **SLDC** shall endeavor to even out high and low deficits by similar shifting of outage periods. Also **APTRANSCO** shall endeavor to reduce the average deficit by arranging to import power from outside the state and increase drawal from ISGS beyond Andhra Pradesh entitlements.

g) **APTRANSCO** after having satisfied itself that maximum improvements have been derived, shall prepare a draft generation plan and circulate it among all the constituents, requesting for suggestions.

h) The **APTRANSCO** shall scrutinise and approve after consulting **SRLDC,** the Generation Outage Plan for current year and Year I.

i) The Generation Outage Programme after coordinating with ISGS shall form the basis for outage planning cycles.

j) Generation outage programme shall be harmonised with the Transmission outage planning in 4.2.8 to 4.2.11.

k) No outage shall be planned for hydel units during the months when overflow of reservoirs and flooding are normally expected.

4.2.7.2 Current Year

a) The Generation Outage Programme aproved by the Regulatory Commission shall form the basis of generation outage planning for the current year.

b) The outage Planning shall be reviewed by **APTRANSCO,** taking into account the system conditions viz. transmission plans, unscheduled outages of transmission lines

and generating units, demand changes, availability of generation in the system.

4.2.7.3 Amendments to Planned Outages

In the case of a planned outage which APTRANSCO would like to move

(a) beyond the period or

(b) within the period or with less than 7 days notice. APTRANSCO may upon giving a Generator written notice, request that the start date or time of outage be advanced or deferred. If the Generator agrees or APTRANSCO and the Generator agree to some other period/ date the Generator will take the outage in accordance with that agreement.

A Generator may by notice submitted to APTRANSCO in writing at any time during year 'O', request that a CDGU be substituted by another comparable CDGU at the Generator's Power Station having substantially the same contracted capacity or GSDPs (Generation Scheduling and Dispatch Parameters). APTRANSCO shall not unreasonably withhold its consent to such substitution. If APTRANSCO does consent, the final outage programme shall be amended accordingly.

4.2.8 Transmission and Distribution Outage Planning

The outage of transmission elements is primarily coordinated with outages of Generating Units and secondarily with Distribution System outages.

APTRANSCO may convene coordination meetings with Generators.

The outage programmes of the Distribution Systems for the current year, year 1 and year 2 shall be informed by all DISCOMs to APTRANSCO by 30th November.

4.2.8.1 SLDC shall prepare a tentative Transmission Outage Plan including Inter connection Transformers (ICTs), coordinating with the Generation Outage Plan and with the Distribution Outage Plan. APTRANSCO shall modify the Distribution Outage Programme following the order of priority, i.e., outage of transmission elements must be coordinated with generation outage plan and outages distribution systems must be adjusted to coordinate with transmission outage. Only minimum changes shall be made to the outage plans prepared by DISCOMs. APTRANSCO shall communicate the tentative transmission plan to SRLDC, DISCOMs and Generators by December 15. The Transmission outage planning shall be done for the following:

1. 400 kV Transmission lines and 400 kV/220 kV Auto Transformers.
2. 220 kV Transmission lines and 220 kV/132 kV Auto Transformers.
3. Identified critical 132 kV grid lines of State System which will affect Transmission System and Grid Operation.
4. Outage planning for 132 kV Radial lines feeding Distribution Systems and 132 kV consumers shall be carried out separately in Consultation with Distribution Companies.

The Distribution Outage Plans revised by SLDC shall also be communicated to DISCOMs

by December 15. Coordination meetings shall be convened by APTRANSCO to discuss and produce coordinated Transmission Outage Plan and to revise Distribution Outage Plan at the Headquarters of SRLDC and SLDC. APTRANSCO's representative shall attend the coordination meetings convened by SRLDC.

4.2.8.2 The ISTS Outage Plan shall be communicated by SRLDC to SLDC by 15th December.

4.2.8.3 SLDC shall revise the State Tranmission Outage Plan to coordinate it with ISTS Outage Plan after taking into account the decisions and recommendations of the Operation Coordination Committee of SREB and produce the Draft Transmission Outage Plan. The Draft Plan is communicated to SRLDC and all users by 31st December.

4.2.8.4 Outage of Power Transformers whose LV Voltage is 33 kV and 11 kV.

Although the Transformers are owned by APTRANSCO the operation is to be coordinated with the DISCOMs. The Outage Plan of these transformers shall be harmonized with the outages of DISCOM Systems and with the Transmission Outage Programme. DISCOMs shall communicate the Outage Plan of the Transformers to APTRANSCO before 31st December.

No interruption or minimum interruption to consumers and Distribution Systems shall be aimed at in formulating coordinated outage plan of Transmission elements, Transformers and Distribution lines. Parallel Transformers and alternative line feeding shall be utilized to the extent possible.

4.2.8.5 Verification with Transformer Outage Plan.

APTRANSCO shall ensure the Transformer Outage Plan is consistent with Transmission Outage Plan.

4.2.8.6 APTRANSCO shall ensure there is no evacuation problem in respect of Generating units in service due to Transmission constraints while evolving Transmission Outage Plan.

4.2.9 Final Verified Overall Outage Plan

APTRANSCO shall issue the final Outage Plan comprising outage of Generating Units, Transmission and Distribution System by 31st January and communicate the Plan to SRLDC, all Generators and DISCOMs. The final overall outage plan as agreed by all entities is released by 1st March each year.

4.2.10 Postponement of Outages

The SLDC is authorized to defer any planned shut down where the following events will affect the satisfactory operation of the system.

1. Major grid disturbance and total or partial black-out.
2. Systems Isolation
3. Any other incident on the system that may cause an impact on the system by the proposed outage.

SLDC shall intimate the revised programme as soon as possible to the user concerned.

4.2.11 Release of Circuits and Generating Units Included in Outage Plan

Notwithstanding provisions in any approved outage plan, no cross boundary circuits or unit of a Generator shall be removed from service without specific release from SLDC. This restriction shall not be applicable to an individual generating unit of a CPP.

Once an outage has commenced, if any delay in restoration is anticipated, the SLDC or the User concerned shall inform the other party promptly together with a revised estimate of the restoration time.

4.3 Schedule and Dispatch

4.3.1 Introduction

This Section specifies the procedure to be adopted for the scheduling and dispatch of **Generating Units** to meet demand and allocation requirements and maintain voltage and frequency within an acceptable range, and defines the contributions by Users to help achieve this goal.

4.3.2 Objective

The objective of this Section is to detail the actions and responsibilities of **SLDC** in preparing and issuing a daily generation schedule and the responsibilities of **Users** to supply the necessary data and to comply with this schedule. It also specifies the responsibilities of **SLDC** and Users in voltage and frequency management.

4.3.3 Generation Scheduling

APTRANSCO may issue Indicative Running Notification (IRN) informing CDGUs of the generation schedule to be maintained and percentage load it is scheduled during the following Scheduled Day.

APTRANSCO shall use Demand Forecast as the basis for preparing IRN. Outage Plan is also taken into account.

In the absence of IRN all **Generators** shall provide the hourly MW/MVAr availability (00.00 - 24.00 hours) of all **Generating Units**, to **SLDC** on the day ahead basis by 10.00 hours. **CPPs** shall provide the hourly import/export figures on the day ahead basis by 10.00 hours.

In working out the MW/MVAr availability, Hydro Power Stations shall take into account their respective reservoir levels and any other restrictions and shall report the same to **SLDC.**

SLDC shall obtain from **SRLDC**, the hourly MW entitlements from ISGS, by 11.00 hours on a day ahead basis. **SLDC** shall produce a day ahead hourly generation schedule after consolidation of the data provided by the **Generators** and **SRLDC.** It will take into account the hourly demand estimates and latest planned schedule agreed with **SRLDC.** In preparation of the schedule, **SLDC** shall take into account of the relative commercial costs to **APTRANSCO** of the operation of Generation units. Full generation at all Hydel stations will also be included during flooding when reservoirs are full.

SLDC shall intimate the generation schedule/import schedule for the following day to all **Generators / CPP**s (including any **Generating Unit** not required to run) by 16.00 hours.

Generators shall promptly report to **SLDC**, changes of **Generating Unit** availability or capability, or any unexpected situation which could affect its operation. All **CPP**s shall similarly report regarding their export to **APTRANSCO**.

SLDC shall advise **Users** as soon as possible of any necessary rescheduling.

SLDC shall prepare the day ahead generation schedule based on the following:

i) **Transmission System** constraints.

ii) Hourly load requirements as estimated by **SLDC.**
iii) The need to provide operating margins and reserves required to be maintained.
iv) The availability of generation from **Generators**, Central Sector Generators and **CPP**s together with any constraints in each case.
v) Overall economy to **APTRANSCO** and Customers.

SLDC shall instruct **Generators** to hold capacity reserves (spinning and/or standby) to the agreed **SREB** guidelines or as determined for local conditions. **SLDC** may also require the **Generators/CPPs** to generate MVAr within their respective capability limits to hold station bus bar voltages at specified levels. If it is not possible to create reserve, SLDC shall request DISCOMs to arrange rotational load shedding and create margin.

4.3.4 Generation Dispatch

All **Generators** shall regulate generation and **CPP**s shall regulate their export according to the daily generation schedule.

All **Generating Units**, above 30 MW, other than those in a **CPP**, will be subject to central dispatch instructions. **CPP**s will be subject to these instructions as applicable to their respective exports to **APTRANSCO**.

SLDC will dispatch by instruction all generation and imports from **CPP**s according to the hourly day ahead generation schedule, unless rescheduling is required due to unforeseen circumstances.

In the absence of any dispatch instructions by **SLDC**, **Generators** and **CPP**s shall generate/export according to the day ahead generation schedule.

Dispatch instructions shall be in standard format. These instructions will recognise declared availability and other parameters which have been made available by the **Generator** to **SLDC.** These instructions shall include time, **Power Station**, **Generating Units** (total export in the case of **CPP**), name of operators sending and receiving the same.

Dispatch instructions may include:

i) To switch a **Generator** into or out of service.
ii) Details of reserve to be carried on a unit.
iii) To increase or decrease MVAr generation to assist with voltage profile.
iv) To begin pre-planned **Black Start** procedures.
v) To hold spinning reserve.
vi) To hold **Generating Units** on standby.

4.3.4.1 Changes in parameters

In respect of changes in GSDP values the CDGU concerned shall send a GSDP Notice to SLDC by 1000 hrs on the day before the Schedule Day in respect of revised values of which the generator is then aware of or after 1000 hrs on the day before the Schedule Day in respect of revised values of which the generator subsequently learns.

4.3.5 Communication with Generators

Dispatch instructions shall be issued by E-Mail/telephone, confirmed by exchange of names of operators sending and receiving the same and logging the same at each end. All such oral instructions shall be complied with forthwith and written confirmation shall be issued promptly by Fax, teleprinter or

otherwise.

4.3.6 Action Required by Generators

All **Generators** shall provide hourly generation (MW and MVAr) to SLDC on real time basis.

All **Generators** and **CPP**s shall comply promptly with a dispatch instruction issued by **SLDC** unless this action would compromise the safety of plant or personnel.

The **Generator** and **CPP**s shall promptly inform **SLDC** in the event of any unforeseen difficulties in carrying out an instruction.

All **Generating Units** shall have Automatic Voltage Regulator (AVR) in service.

All **Generators** shall promptly transmit OUTAGE NOTICE to APTRANSCO/SLDC intimating all unplanned outages of any generating units/ auxiliaries which reduce the generation contribution to the grid.

All **Generating Units** shall have the governor available and in service and must be capable of automatic increase or decrease in output within the normal declared frequency range and within their respective capability limit.

Generators shall immediately inform **SLDC** by telephone of any loss or change (temporary or otherwise) to the operational capability of any **Generating Unit** which is synchronised to the system or which is being used to maintain system reserve. **Generators** shall inform **SLDC** any removal of AVR and/or governor from service with reasons.

CPPs shall similarly inform any change in status affecting their ability in complying with dispatch instructions.

On receiving Notice to synchronise by SLDC, generators shall sysnchronise the particular unit to the grid within the time prescribed. Inability to do so shall be intimated to SLDC without loss of time.

Generators shall not de-synchronise **Generating Units**, other than in respect of **CPP**s, without instruction from **SLDC** except on the grounds of safety to plant or personnel which shall be promptly reported to **SLDC.**

Generators and **CPP**s shall report any abnormal voltage and frequency related operation of **Generating Units**/feeders promptly to **SLDC.**

Generators shall not synchronise **Generating Units**, other than in respect of **CPP**s, without instruction from **SLDC.** In emergency situations, the **Generator** may synchronise Units with the grid without prior intimation in the interest of the operation of the grid following standing instructions developed for such purpose under "contingency planning".

Should a **Generator** fail to comply with any of the above provisions, it shall inform **SLDC** promptly of this failure.

SLDC may instruct generators to keep any CDGU as hot standby. The generator shall comply with such instructions. A clause shall be included into the PPA for the charges payable by APTRANSCO to the generator for keeping a CDGU as hot standby.

4.3.7 Enhancement Of Schedule And Dispatch Procedure

Schedule and dispatch procedures shall be suitably enhanced to cater to tariff agreements as soon as any such agreement is reached with **Generators**, **CPP**s, and **IPP**s.

4.3.8 Frequency Management

SLDC shall monitor the frequency of the transmission system and take action to ensure that they are within acceptable limits in coordination with SRLDC. Corrective action shall be initiated when frequency deviates by 1% from the nominal value. Whenever the frequency tends to fall below 50.0 Hz SLDC shall increase the drawals from Generating Stations including ISGS, according to a pre-arranged pattern based on economic and merit order despatch. Inter-state drawals also may be increased/ commenced as per agreements in force.

SLDC shall monitor actual drawal against scheduled drawal and regulate internal generation/demand to maintain this schedule. The scheduled drawal shall be intimated by **SLDC** beforehand to all Users (**DISCOM**s and EHT Customers). The scheduled drawal shall be estimated from previous maximum drawal (power as well as daily energy drawal). The **DISCOM**s can exceed the scheduled drawal by 5% without prior approval on any single day provided the frequency is above 49.5 Hz but must obtain prior approval from **SLDC** to continue the excess drawal from the second day onwards. The drawal can be increased without limit with prior approval of **SLDC**. Normally **SLDC** is expected to approve increase in load if the generation margin is deemed sufficient.

Generators and **CPP**s shall follow the despatch instructions issued by **SLDC**.

SLDC shall issue standing instructions to all DISCOMs and EHT consumers to reduce load by a given percentage at different low frequencies. APTRANSCO may request **SRLDC** to institute similar procedure in other Southern States.

Distribution Companies shall cooperate with **SLDC** in managing load**,** especially for maintaining the frequency during contingencies such as unexpected generation outage, by reducing the drawal from the transmission system on instruction from **SLDC**.

Whenever the frequency is below 49.5 Hz the drawals shall be restricted to drawal schedules. When the frequency falls below 49.0 Hz requisite load shedding shall be arranged by SLDC through the DISCOMs.

Frequency indicating meters shall be installed at ALDC control rooms, EHT Sub Stations, 33 kV Sub Stations feeding more than 10 MW and in the premises of EHT consumers, captive power plants and cogeneration units. Standing instructions may be given by SLDC regarding action to be taken when frequency falls below 50 HZ.

4.3.8.1 High Frequency Related Emergencies

When the frequency is tending to increase above the statutory upper limit, **SLDC** shall request the Generators to reduce generation and request SRLDC to take necessary action at Regional level. While reducing generation, merit order despatch procedure shall be followed by SLDC. In order to implement the merit order despatch, the relevant cost data shall be furnished by all CDGUs on one-month ahead basis.

The instructions to reduce generation will be issued by **SLDC** by Telephone communication. Failure of a Generator to follow the **SLDC** instructions in this context will constitute a violation of the CTI and will entail penalties.

During periods of high frequency operation, the **SLDC** telephone instructions to Generators shall supercede other provisions of the CTI, and all Acts, Rules and Regulations of State and Central Governments. Adequate authority shall be delegated to the duty Engineers of SLDC

to enable them to take spot decisions for on-line operation of the Grid.

On demand by a generator the SLDC shall confirm its verbal instruction by written instruction after the operation is completed. SLDC is responsible for complying all Codes, Acts, etc and must justify its instructions in the light of Codes, Acts, etc or must be ready to justify any deviation in dealing with an unforseen emergency threatening the security of the Grid.

4.3.9 Voltage Management

SLDC shall carry out load flow studies from time to time to predict where voltage problems may be encountered and to identify appropriate measures such as changing transformer tap settings or switching in compensation equipment to ensure that voltages remain within the defined limits. On the basis of these studies **SLDC** may instruct **Generators** and **CPP**s to maintain specified voltage levels at interconnecting points and determine voltage levels at the interconnection points with **Distribution Companies**.

SLDC shall continuously monitor 400/220/132 kV voltage levels at strategic sub-stations and communicate the values to SRLDC as basis of on-line operation.

Generators shall make available to **SLDC** the up-to-date capability curves for all **Generating Units**, as detailed in the Connection Code, indicating any restrictions, to allow accurate system studies and effective operation of the **Transmission System**. **CPP**s shall similarly furnish the net reactive capability that will be available for export to / import from **Transmission System**. **Generators** and **CPP**s shall inform **SLDC** of their reactive reserve capability promptly on request. **SLDC** may instruct **Generating Units** and **CPP**s to regulate MVAr generation within their declared parameters and request SRLDC, Bangalore to initiate corresponding action in other Southern States.

Distribution Companies shall participate in voltage management by regulating their drawal and by installing compensaton equipment as may be required.

If acceptable voltage levels still cannot be maintained by these measures, **APTRANSCO** shall take steps to augment the transmission system to meet the required voltage criteria.

4.3.10 Data Requirements

Users shall provide **SLDC** with data for this Section as specified in Appendix 4D-2 to 4D-5.

4.4 Contingency Planning

4.4.1 Introduction

This **Section** describes the actions to be followed by all **Users** in the event **Load Shedding** is required and the recovery process to be followed by all **Users** in the event of total or partial blackouts occurring in the Transmission System or Regional System.

4.4.2 Objective

The objective of this **Section** is to define the responsibilities of all **Users** to prevent a **Transmission System** or **Regional System** blackout, and in the event of such an occurrence, to achieve the fastest recovery, taking into account essential loads, **Generator** capabilities and system constraints.

Black start restoration requires a coordinated approach by all participants to ensure a safe and timely return of electric service to the distribution companies. Each participant is required to have procedures in place to facilitate a timely return of electric supply to the entire grid. Some large coal generating plants require start-up power within one hour of a blackout or they will take a minimum of five hours to start up

again. It is imperative that these procedures are coordinated and that the associated control center staff are prepared.

Blackouts disrupt essential services throughout the state. Areas and municipalities will have disaster plans in place to deal with such disruptions and the State Government will be requested by APTRANSCO to set up a Disaster Management Cell with a control room having a twentyfour hours telephone service to assist with these disaster plans. Whenever a large area of the state is in a blackout condition, the **APTRANSCO** would notify the Disaster Services with information pertaining to the extent of the outage, expected duration and a phone number to be used for follow-up. Diesel Generators shall be installed at all hydel stations except those hydel stations like Pochampadu which dry up during summer, of capacities sufficient to allow start-up of one generating unit without need for external power.

4.4.3 Load Shedding Schedule

Under falling frequency conditions, **SLDC** shall take appropriate action to issue instructions, in co-ordination with **SRLDC**, to arrest the falling frequency and restore it to be within normal range. Such instructions may include instructions to **Users** to reduce load demand by appropriate manual and /or automatic load sheddings.

Users shall provide to **SLDC** estimates of load that may be shed, when required, in discrete blocks with the details of the arrangements of such load sheddings.

4.4.4 Restoration

SLDC shall maintain a record of **Power Station Black Start** capability and associated **Power Station Black Start** plans.

APTRANSCO is responsible for maintaining uptodate restoration procedures following total or partial blackout. These procedures shall document the process to be followed by their associated control centre staff to ensure a safe, reliable, coordinated and expedient restoration of the electric supply to the transmission grid.

APTRANSCO shall recognize the need to integrate and coordinate with the restoration activities of other transmission grids. It is especially important that these procedures recognize the need to restore the grid in an organized and efficient manner regardless of ownership of generating plants and obligations to any particular load center.

APTRANSCO shall be responsible for gaining the endorsement of their black start procedures from the other transmission grids.

APTRANSCO shall be responsible for keeping their control centre staff adequately prepared and trained to restore the transmission grid in accordance with procedures defined above.

Users shall agree to **Black Start** procedures of **APTRANSCO** and promptly inform **SLDC** when unable to follow these procedures.

SLDC shall be responsible for directing the overall **Transmission System** restoration process by coordination with all **Users** and **SRLDC.**

DISCOMs shall be responsible for sectionalising the **Distribution System** into discrete, unconnected blocks of demand. They shall advise **SLDC** of the amount of MW likely to be picked up by the synchronising **Generating Unit**.

Generators shall be responsible for commencing their planned **Black Start** procedure on the

instruction of **SLDC** and steadily increasing their generation according to the demand which **SLDC** is able to make available. Hydel Stations shall maintain the Diesel Generating units in good condition so that the hydel generating units can be started without external power as provided in 4.5.2.

Current copies of black start procedures will be circulated to the appropriate agencies not later than November 15th of each calendar year. Approval by all agencies shall be acquired no later than December 31st of the same calendar year.

4.4.5 Black Start Procedures

The situation prevailing prior to the occurrence of the contingency, e.g. availability of specific Generators, transmission circuits and load demands, will largely determine the restorations process to be adopted in the event of a total blackout. **SRLDC** and **SLDC** shall coordinate to determine the extent of the problem. **SLDC** shall advise all **Users** of the situation and follow the strategy as outlined below for restoration.

Each **User** shall have designated persons authorised for operation and control available for communication and acceptance of all operational communications throughout the contingency. Communication channels shall be restricted to operational communications only till normalcy is restored.

4.4.5.1 Total Regional Blackout

First it is to be ascertained whether AP System is blacked out or the entire Southern Region is blacked out. If the entire Southern Region is blacked out SLDC shall play its partial role. If only AP System is blacked out SLDC shall direct restoration and obtain assistance from other States and SRLDC.

SLDC shall instruct all relevant **Generators** having **Power Stations** with **Black Start** capability to commence their pre-planned **Black Start** procedure. **SLDC** may require **CPP**s to extend start-up power supply to **Generators** as may be feasible.

SLDC shall prepare the **Transmission System** for restoration by creating discrete power islands with no interconnection. Close co-ordination with concerned **Distribution Companies** shall be maintained during the restoration process to arrange for discrete demand blocks becoming available to stabilise **Generating Units**, as these become available in individual islands. **Generators** to whom start up power supply is made available shall sequence their start up to match their auxiliary power demand with the supply available.

Generators shall inform **SLDC** as **Generating Units** become available to take load, in order that the **APTRANSCO** may assess the MW demand which the **Generating Unit** is likely to pick up on circuit breaker closure.

SLDC shall co-ordinate with **Generators** and **Distribution Companies** to:

i) Form discrete power islands with one **Generating Unit** feeding some local demand.

ii) Extend islands by adding more **Generating Units** and more demand in a coordinated manner maintaining load generation balance.

iii) Synchronise islands to form a larger, more stable island.

SLDC shall, taking into account sites where system synchronisers are available, gradually extend the synchronisation until all demand is restored.

SLDC shall utilise any **Regional** or interstate assistance available, if appropriate, at any time to assist in the above process. The procedure developed by SRLDC shall be followed. Also the Indian Electricity Grid Code is to be followed.

4.4.5.2 Total Transmission System Blackout

SLDC shall carry out the strategy for total **Regional** blackout.

SLDC shall carry out simultaneous action to utilise radial feeders from the **Southern Region** and neighbouring States.

4.4.5.3 Partial Transmission System Blackout

SLDC shall ensure with **Users** that the security of the healthy part of the **Transmission System** is maintained.

SLDC shall gradually extend the healthy system to provide start – up power to appropriate **Generating Units.**

SLDC shall, in close co-ordination with the **Distribution Companies** and **Generators**, gradually restore demand to match generation as it becomes available.

All **users** shall take care to ensure load generation balance is maintained at all times under **SLDC's** direction.

4.4.5.4 Blackout involving ISTS Elements:

Where ISTS elements or important elements of AP State system having significant operational impact on ISTS are involved in the black out the recovery procedures provided in the relevant Section of IEGC are to be complied with.

4.4.6 Special Considerations

During the restoration process following **Transmission System** or **Regional System** back out conditions, normal standards of voltage and frequency shall not apply.

A list of essential loads and priority of restoration is given in the Appendix **C.**

Distribution companies with essential loads shall separately identify non-essential components of such loads, which may be kept off during system contingencies. **Distribution Companies** shall draw up an appropriate schedule with corresponding load blocks in each case. The non-essential loads can only be re-energised when system normalcy is restored, and as advised by **SLDC.**

All **Users** shall pay special attention in carrying out the procedures so that a secondary collapse, due to undue haste or inappropriate loading, is avoided.

Despite the urgency of the situation, careful, prompt and complete logging of all operations and operational messages shall be ensured by all **Users** to facilitate subsequent investigation into the incident and the efficiency of the restoration process. Such investigation shall be conducted promptly after the incident.

4.5. Operational Coordination with PGCIL, CTU,SRLDC and SREB

4.5.1 Interface With Southern Regional Electricity Board

a) **The Chief Executive (Chairman and Managing Director)** of **APTRANSCO** shall represent A.P. State power sector in toto in all affairs pertaining to SREB, ISGS, Power Grid Corporation and SRLDC. Similarly one Chief Engineer, or one Superintending Engineer, of **APTRANSCO** shall attend the Bimonthly/Quarterly meetings of SREB and shall represent all other Power Sector entities of A.P. State. In the monthly and quarterly meetings past situations are reviewed and future programmes are chalked out, including any operational modification, Transmission augmentation and commercial issues of inter regional and intra regional energy transactions. **APTRANSCO** represents the interests in general of A.P. State at the SREB.

b) **APTRANSCO** shall coordinate the day to day operational issues of the A.P Power System and furnish the data required by SRLDC/SREB and participate in smooth integrated operation of Southern Region.

c) **APTRANSCO** shall depute its experts to the quarterly Protection Committee Meetings (which analyse fault trippings and decides on improvements which may be necessary) and also to Operation Committee meetings of SREB.

d) **APTRANSCO** will co-ordinate with SREB transmission line outage planning, generation planning and scheduling of generation unit outage planning, demand estimation, system operational improvement transmission augmentation and similar operational and planning programmes of AP Electricity Sector.

e) **SLDC** shall, in emergency situations, co-ordinate with **SRLDC** with regard to power exchange and service restoration.

f) All utilities including all Generators and DISCOMs shall comply with the instructions of SLDC and SRLDC to carry out the integrated operation of the Southern Regional Grid of which AP State is a part. To this end the utilities shall follow the CTI (AP Grid Code), the Indian Electricity Grid Code, "Operating Procedures of Southern Region" issued by SRLDC and the Operating Procedures and Manuals formulated by PGCIL and APTRANSCO . All utilities shall comply with the instructions issued by APSLDC and SRLDC in the course of their real time operation and control of the system. If any entity has a grievance or objection to the spot instructions of SLDC or SRLDC, the entity must first comply and then the lack of fairness must be brought to the notice of SLDC/ SRLDC for redressal in subsequent period, failing which the entity may lodge a complaint with APERC /CERC. If any entity cannot immediately implement an instruction of SLDC/ SRLDC due to reasons beyond its control or due to the equipment limitation then the entity must immediately intimate the same (inability to comply) to SLDC/SRLDC and seek a revised instructions which can be implemented under the circumstances.

4.5.2 Coordination with SREB and SRLDC

APTRANSCO shall coordinate with SREB and SRLDC in maintaining the voltage, frequency and security in the Southern Regional Grid. The Transmission lines of PGCIL, Inter – State lines, critical lines of AP System and the entitlements of ISGS are listed in statements 4 –1, 4 –2 and 4 – 3. The updated lists are to be kept with SLDC . Also a list of important elements vital for the operation of Southern Regional Grid as recognised by SRLDC in addition to those listed in statements 4 –1 and 4 – 2, is prepared and kept with SLDC for enabling compliance with sub section 6.2 (c) and (d) of Indian

Electricity Grid Code wherein it is stipulated that no important element of the Regional Grid shall be deliberately opened without prior clearance of SRLDC.

Table 4-1

I. Central Sector Interconnecting Transmission Network in A.P

1.	400kV Cuddapah – Bangalore	AP — Karnataka
2.	400kV Nagarjuna Sagar – Raichur	AP — Karnataka
3.	400kV Gooty – Bangalore	AP — Karnataka
4.	400kV Cuddapah – Sriperambadur	AP — Tamil Nadu
5.	400kV Ramagundam – Chandrapur Double Circuit	AP — Maharashtra
6.	400kV Gazuwaka—Jeypore	AP— Orissa
7.	400kV Ramagundam—Hyderabad Double Circuit	AP
8.	400kV Hyderabad—Nagarjunasagar Single Circuit	AP
9.	400kV Ramagundam—N'sagar Double Circuit	AP
10.	400kV Ramagundam—Khammam Single Circuit	AP
11.	400kV Khammam—Nunna Single Circuit	AP
12.	400kV Nunna—Vishakapatnam Single Circuit	AP
13.	400kV N'Sagar—Cuddapah Double Circuit	AP

II. Interstate Lines Connecting A.P State with Neighbouring States

1.	220kV Gachibowli,Hyd – Sadem,	AP—Karnataka
2.	220kV Gooty—Bellary	AP— Karnataka
3.	220kV Chittor—Tiruvalam	AP— Tamil Nadu
4.	220kV Sulurpet—Gummidipundi	AP— Tamil Nadu
5.	132kV Guntakal—Hampi	AP— Karnataka
6.	66kV Bellary—Adoni	AP— Karnataka
7.	220kV Upper Sileru—Balimela	AP— Orissa
8.	HVDC Lower Sileru—Barsur	AP— Madhya Pradesh

Table 4-2

Critical 220 kV Lines Owned By AP State

(1) Kothagudem – Shapurnagar

(2) Lower Sileru – KTPS Double Circuit

(3) KTPS – Miryalaguda Single Circuit

(4) Visakhapatnam – Bommur – Nidadavolu – Bhimadolu – Vijayawada – Double Circuit

(5) VTS – Tallapalli – Double Circuit

(6) Srisailam – Somayajulapalli – Gooty Double Circuit

(7) Srisailam – Mydukur-Cuddapah-Chinakampally.

(8) Srisailam – Chandrayanagutta Double Circuit

(9) VTS--Tadikonda Double Circuit

(10) Tadikonda--Ongole Single Circuit

(11) Ongole--Podili Double Circuit

(12) VTS—Podili Double Circuit

(13) Podili—Srisailam Double Circuit

(14) Tallapalli—Srisailam Double Circuit

(15) Nagarjunasagar—Tallapalli Double Circuit

(16) Nagarjunasagar—Tallapalli Single Circuit

(17) VTS—Malkaram Double Circuit (Via Narketpalli and Chilakallu)

(18) KTS V—Khammam Double Circuit

(19) Khammam— Wadde Kothapalli

Table 4-3

National Power Stations With AP Entitlements

	TOTAL CAPACITY (MW)	AP SHARE (MW)
1.Ramagundam Super Thermal Station (NTPC)	2100	580
2. Madras Atomic Power Project (MAPP)	340	28
3. National Lignite Corporation (NLC)		
Mine cut II , Stage I	580	97
Mine Cut II, Stage II	790	180
TOTALS	3810	885
Approximate AP Share of unallocated Capacity		115
Total Approximate AP Entitlement from National Power Stations		1000

4.6 Protection Committee

Protection committee shall be formed with following composition:-

Chairman	Deputee from **APTRANSCO**
Secretary	Deputee from **APTRANSCO**
Member	**APGENCO** (Thermal) Protection in Charge
Member	Protection Engineer of any IPP, Deputed by all IPPs to represent all IPPs, CPPs and JVCs
Member	Protection of **APGENCO** (Hydro)
Member	**SREB**
Four Members	One from each of the four DISCOMs

(The Chairman and Secretary who are from **APTRANSCO** and the Representative of **SREB** shall represent the interests of **SRLDC**, **PGCIL** and **ISGS** also).

The Committee shall hold a meeting at least once quarterly and also after every major incident in the AP Grid. All trippings and incidents shall be discussed at the Meetings and any remedial measures including modification to protection schemes, change of relay setting etc. shall be resolved at these meetings.

Revisions to the parts of the CTI dealing with protection issues shall be proposed and initiated by the Protection Committee. When such revisions are contemplated, the protection committee shall send its representative to CTI review meetings for placing the issues and committee's recommendations before the Panel.

The Protection Committee may invite experts from relay manufacturers, consultants and representatives of other power sector organizations for participation in the meetings without voting rights.

The Chairman of the Protection Committee is ex-officio member of the CTI Review Panel and he or his representative shall attend all CTI Review Panel Meetings whenever protection matters are discussed.

4.7 Cross Boundary Responsibility

4.7.1 Introduction

This Section sets down the requirements for maintaining safe working practices associated with cross boundary operations. It lays down the procedures to be followed when work is required to be carried out on electrical equipment that is connected to another User's system.

4.7.2 Objective

The objective of this Section is to achieve agreement and consistency on the principles of safety as prescribed in Indian Electricity Rules when working across a control boundary between **APTRANSCO** and another User.

4.7.3 Safety Coordinator

APTRANSCO and all Users shall nominate suitably authorised persons to be responsible for the co-ordination of safety across APTRANSCO/User interfaces and boundaries. These persons shall be referred to as **Safety Coordinators**.

4.7.4 Procedures

4.7.4.1 General

(i) **APTRANSCO** shall issue a list of Safety Coordinators (names, designations and telephone numbers) to all Users who have a direct control boundary with **APTRANSCO**. The jurisdiction of each Safety Coordinator shall be clearly indicated in the list. This list shall be updated promptly whenever there is change of name, designation or telephone number.

(ii) All Users with a direct control boundary with the **APTRANSCO** shall issue a similar list of their Safety Coordinators to the **APTRANSCO**, which shall be updated promptly whenever there is a change to the Safety Coordinators list.

(iii) Whenever work across a control boundary is to be carried out, the Safety Coordinator of the party wishing to carry out work shall directly contact the other relevant Safety Coordinator. Code words will be agreed at the time of work to ensure correct identification of both parties.

(iv) Contact between the Safety Coordinators shall normally be by direct telephone. Should the work extend over more than one shift the Safety Coordinator shall ensure that the relief Safety Coordinator is fully briefed on the nature of the work and the code words in operation.

(v) The Safety Coordinators shall co-operate to establish and maintain the precautions necessary for the required work to be carried out in a safe manner. Both the established isolation and the established earth shall be locked in position, where such facilities exist, and shall be clearly identified preferably with easily visible signs.

(vi) Work shall not commence until the Safety Coordinator of the party wishing to carry out the work is satisfied that all the safety precautions have been established. This Safety Coordinator shall issue agreed safety documentation to the working party to allow work to commence.

(vii) When work is completed and safety precautions are no longer required, the Safety Coordinator who has been responsible for the work being carried out shall make direct contact with the other Safety Coordinator to request removal of those safety precautions.

(viii) The equipment shall only be considered as suitable for return to service when all safety precautions are confirmed as removed, by direct communication using code word contact between the two Safety Coordinators, and return of agreed safety documentation from the working party has taken place.

i) **APTRANSCO** shall develop an agreed written procedure for cross boundary safety and continually update it.

ii) Users shall also develop written procedure for crossboundary safety at each connection point.

iii) Any dispute concerning Cross Boundary Safety shall be resolved at an appropriate higher level of authority.

4.7.4.2 Special Considerations

(i) For cross boundary circuits, all Users shall comply with the agreed safety rules which

must be in accordance with IE Rules.

(ii) All equipment on cross boundary circuits which may be used for the purpose of safety coordination and establishment of isolation and earthing, shall be permanently and clearly marked with an identification number or name, that number or name being unique in that sub-station. This equipment shall be regularly inspected and maintained in accordance with manufacturer's specification. Each Safety Coordinator shall maintain a legibly written safety log, in chronological order, of all operations and messages relating to safety coordination sent and received by himself. All safety logs shall be retained for a period of not less than 10 years.

4.7.5 Site Responsibility Schedule:

The Safety Coordinator and working party at a connection site shall refer to the Site Responsibility Schedule for that site and follow the safety rules pertaining to that site. These safety rules shall be recorded on the Site Responsibility Schedule.

4.8 Operational Liaison

4.8.1 Introduction

Operational Liaison details the requirement for exchange of information relating to operations and/or events on the total system including the Southern Regional System which may have an operational effect on:

a) The **APTRANSCO** System in the case of an Operation and/or Event occurring on a User system.

b) A User System in the case of an Operation and/ or Event occurring in the **APTRANSCO** System.

The procedure for issue of warnings in the event of a risk of serious and widespread disturbances on the whole or part of the **APTRANSCO** system are set out in the following sections.

4.8.2 Objective

The objective of this section is to specify the information to be exchanged between Users in order to identify the potential impact of an operation and/or event and to assess the possible risk arising therefrom, so that appropriate action is taken by the relevant party to maintain the integrity of the **APTRANSCO** system. Also in the case of an Operation in the system of one User the execution of associated, corresponding and coordinating operations by other Users and/or **APTRANSCO** in the correct sequence and with the required promptness are to be ensured through a Operational Liaison (O.L) process to safeguard the integrity and healthy operating condition of the **APTRANSCO** System as well as the systems of the Users concerned.

4.8.3 Definitions

Operation: means scheduled or planned actions relating to the operation of a system.

Event means an unscheduled or unplanned occurrence on a system including faults, incidents and breakdowns.

Operational Effect shall mean any effect on the operation of the relevant system which may cause the

system of **APTRANSCO** or the other Users to operate differently from the way in which they would have operated in the absence of that effect.

4.8.4 Notification of Operations

a) **APTRANSCO**: In the case of an operation or an unplanned event in the **APTRANSCO** system which may have an operational effect on a User system, **APTRANSCO** will notify the User whose system may, in the opinion of **APTRANSCO**, be affected.

b) **User**: In the case of an operation or an unplanned event on a User system which may have an operational effect on the **APTRANSCO** system, the Users will notify **APTRANSCO** who will in turn notify other Users on whose systems the operations may have an operational effect in the opinion of **APTRANSCO**.

c) The following are examples of scheduled or planned actions for which notification in advance will be required under 4.8.4 if they may have an operational effect.

- Planned operation of any circuit breaker or isolator or any sequence or combination of the two other than at the instruction of **APTRANSCO**.
- Voltage Control

d) All operations on elements of 132 kV or higher voltage or on lines and equipment having impact on the Regional Grid, must be notified by SLDC to SRLDC.

These examples are by way of illustration and do not in any way limit the general requirement to notify in advance.

4.8.5 Nature of notification of operations

a) A notification under 4.8.4 must contain sufficient details to describe the operation to enable the recipient to consider and assess the implications and risks existing and will include the name of the individual reporting the operation on behalf of **APTRANSCO** or the User. The notification needs to state the cause, but the recipient may ask questions to clarify the notification and the notifying party shall provide the necessary information using its reasonable efforts.

b) A notification shall indicate that operation on the Total System or any part of the Total System is likely, the general nature of the Operation and if associated power supplies are likely to be affected the estimated time of the interruption and return to service. The notification need not state the cause of the operation.

c) **Timing:-** A notification under 4.8.4 must be given as far in advance as practicable as will reasonably allow the recipient to assess the implication and risks arising.

d) **Recording:-** The notification shall be given orally or in writing. The oral notification is to be confirmed in writing if required either by the sender or the recipient but response actions shall be taken by the parties based on the oral notification.

4.8.6 Requirement to notify events

a) **APTRANSCO**:- An event or a planned operation on the **APTRANSCO** System which has an operational effect on a User system will be notified by **APTRANSCO** to the Users whose systems have been affected.

b) User:- An event or a planned operation on a User system which has an operational effect on the

APTRANSCO System shall be notified by the User to the **APTRANSCO** who will in turn notify the other Users on whose systems the event may have an operational effect.

c) An event or a planned operation of APTRANSCO system which has an operational effect on the Regional Grid shall be notified by APTRANSCO to SRLDC.

d) The following are examples of situations where notification will be required if they have an operational effect.

(i) Where plant and/ or appratus being operated in excess of its capability or may present a hazard to personnel
(ii) Activation of any alarm or indication of any abnormal operating conditions.
(iii) Adverse weather conditions being experienced or forecast. Breakdowns of, or faults in or temporary changes in, the capability of plant and/or apparatus.
(iv) Breakdown of, or faults on, control, communication or metering equipment.
(v) Increased risks of protection operations.
(vi) Breakdown or fault in the **APTRANSCO** System.
(vii) Opening and closing of Isolators and Circuit Breakers.

These examples are illustrative only and in no way limit the general requirement to notify.

4.8.7 Significant Incidents

A significant incident is an event with a significant effect on either the **APTRANSCO** system or a **User**'s system and usually entails one or more of the following operational effects:

- Tripping of plant and/ or apparatus manually or automatically.
- Voltage outside statutory limits.
- System frequency outside statutory limits.
- System instability
- System overloads.

Where a User notifies an event which **APTRANSCO** considers to have had a significant effect on the **APTRANSCO** system, **APTRANSCO** may require the User to report the event in writing within one Business Day. APTRANSCO will then advise the User accordingly.

Where **APTRANSCO** notifies a User of an event which the User considers to have had a significant effect on its system, the User may require **APTRANSCO** to report the event in writing in which case it will be within one Business Day. The User will then notify **APTRANSCO** accordingly.

4.8.8 Warnings

a) A warning will be issued by **APTRANSCO,** confirmed in writing to Users who may be affected when **APTRANSCO** knows there is a risk of wide spread and serious disturbances to the whole or part of the Total System.

b) Where sufficient time is available, the warning will contain such information as **APTRANSCO** considers reasonable to explain the nature and extent of the anticipated disturbance to the User, provided that such information is available to **APTRANSCO**.

c) Each User on receipt of the warning shall take steps to warn its operational staff and maintain its plant and apparatus in the condition in which it is best able to withstand the anticipated disturbance for the duration of the warning.

d) Scheduling and Dispatch may be affected during the period covered by a warning.

4.8.9 Incident Reporting

4.8.9.1 Introduction

This **Section** describes the requirements for reporting, in writing, incidents which were initially reported orally by/to other **Users**.

Incidents occuring in a User's system shall be promptly reported to SLDC/ APTRANSCO and to other affected Users. Incidents occuring in the transmission system shall be promptly reported by APTRANSCO to the affected Users. All incidents occuring in elements of 132 kV or higher voltage shall be reported by SLDC/ APTRANSCO to SRLDC/ SREB.

4.8.9.2 Objective

The objective of this **Section** is to define the incidents to be reported, the reporting route to be followed and the information to be supplied to ensure a consistent aproach to the reporting of incidents and accidents on the **Transmission System**.

4.8.9.3 Reportable Incidents

Typical examples of reportable incidents that could affect the **Transmission System** are the following:

(i) Exceptionally high/low system voltage or frequency.
(ii) Serious equipment problem, e.g. major circuit, transformer or bus-bar.
(iii) Loss of major **Generating Unit**.
(iv) System islanding, split, **Transmission System** breakaway or **Black Start.**
(v) Major fire incidents.
(vi) Major failure of protection.
(vii) Equipment and transmission line overload.
(viii) Excessive Drawal deviations.
(ix) Violation of security standards.
(x) Grid Indiscipline.
(xi) Non–Compliance of instructions of RLDC and SLDC.
(xii) Tripping of any important element of State Grid or Southern Regional Grid.
(xiii) Loss of stability.
(xiv) Minor equipment alarms. (minor means not having cross-boundary impact)

The last two reportable incidents are typical examples of those which are of lesser consequence but which can still affect the **Transmission System.** They may require corrective action but may not warrant a management report until a later, more reasonable time.

4.8.9.4 Reporting Procedure

a) General

i. All reportable incidents occurring in lines and equipment of 11 kV and above [at grid sub-stations] shall promptly be reported orally by the **User** whose equipment has experienced the incident to any other significantly affected **Users** and to

APTRANSCO.

ii. Within 1 (one) hour of being informed by the Reporting **User**, **APTRANSCO** may ask for a written report on any incident.

iii. If the reporting incident cannot be classed as minor then the reporting **User** shall submit an initial written report within two hours of the request for a written report by **APTRANSCO**. This shall be further followed up by the submission of a comprehensive report within 48 hours of the submission of the initial written report. (if the incident does not have any impact on the system of any other User or APTRANSCO's system the incident shall be treated as minor.

iv. In other cases the reporting **User** shall submit a report within 5 (five) working days to **APTRANSCO**.

b) **SLDC** may call for a report from any other Users affected by a reportable incident, or **APTRANSCO** in case the same is not reported by such **User** whose equipment might have been the source of the incident.

c) The above shall not relieve any **User** from the obligation to report events in accordance with the **IE Rules.**

d) The format of such a report will be as agreed at the **CTI Review Panel,** but will typically contain the following information:

(i) Location of incident and antecedent conditions
(ii) Date and time of incident.
(iii) Plant or equipment involved,
(iv) Supplies interrupted and duration if applicable.
(v) Amount of generation lost if applicable.
(vi) Brief description of incident.
(vii) Estimate of time to return to service.
(viii) Name of originator.
(ix) Safety interlocks/instruction violated.
(x) Damage to plant/equipment.
(xi) Details of Relay Operation / Indications.
(xii) Sequence of Trippings.

4.8.9.5 Reporting Form

The standard reporting form other than for accidents, shall be as approved by the **CTI Review Panel**, and is included as an Appendix to this Section.

4.8.9.6 Major Failure

Following a major failure, **APTRANSCO** and **Users** shall co-operate to inquire and establish the cause of such failure and produce appropriate recommendations. **APTRANSCO** shall report the major failure to the **Commission** within 15 days for information and shall submit a full report to the **Commission** within two months of the incident.

4.8.9.7 Investigation of User's premises by APTRANSCO :- APTRANSCO is entitled to inspect any User's equipment and the procedure is governed by Appendix B to this OC.

4.8.10 Accident Reporting

Reporting of accidents shall be in accordance with the **IE Rules, 1956**, Rule 44-A. In both fatal and non-fatal accidents, the report shall be sent to the Electrical Inspector in the prescribed form.

4.9 Integrity of Transmission System and Continuity of power Flow

The EHT bus bars are owned and operated by the generating stations in accordance with the present demarcation of inter-corporate boundaries. However, from the standpoint of Grid network power flow, they (the EHT bus bars) form essential parts of the Grid circuits. The flexibility of power flow and continuity of the Grid System are achieved physically by means of the bus bars at the generating stations, therefore **APTRANSCO** shall have operational control of them. Any operational or developmental work on the bus bars or the terminal equipment of EHT feeders shall be carried out by the generating station on request from, or with the approval of, **APTRANSCO**. **Generators** are bound to promptly carry out any requisition of **APTRANSCO** pertaining to the bus bars, terminal equipment of feeders or providing new outlets. Personnel of **APTRANSCO** shall have timely access to the switchyard for inspection of bus-bars and the terminal equipment of all EHT Feeders. **Generators** shall be responsible for maintaining the EHT bus bars and the terminal equipment of the EHT Feeders in good condition. The cost of the operational and developmental works carried out by Generators for the requirements of the **APTRANSCO** system shall generally be reimbursed by **APTRANSCO** to the **Generators** and any apportionment shall be subject to the approval of the **APERC**.

4.10 Coordination between APTRANSCO and DISCOMs at EHT Sub-station

According to the present demarcation of boundaries, the jurisdiction of the **DISCOM**s starts from the outgoing terminals of the line isolator of 33 kV or 11 kV feeders, and the equipment in EHT Substation, including the isolator itself, is owned and operated by **APTRANSCO.** From the consideration of continuity of power flow, the 33 kV bus bars form part of the integral network of the **DISCOM**, especially when a 33 kV ring feeder is formed by the **DISCOM**. So although **APTRANSCO** owns the substation equipment, it shall promptly comply with requests of the **DISCOM** concerned in operations pertaining to the 33 kV bus and terminal equipment of feeders, or providing new outlets from the 33 kV bus, or issuing line clear permits to the **DISCOM**. Cross-boundary safety rules shall be complied with by both entities. Representatives of the **DISCOM** shall have timely access to EHT substations for purposes like ensuring safety precautions, personal guarding of the line isolator during line clear permits, studying the system in EHT substations and taking check readings of the tariff and operational meters etc. **APTRANSCO** shall maintain in good condition all 33 kV and 11 kV breakers, Power Transformers, 33 kV and 11 kV bus-bars which affect the system of the **DISCOM** concerned and shall promptly carry out all O&M works to ensure reliable and stable operation of the distribution system. Apportionment of costs between **APTRANSCO** and the **DISCOM** concerned for operational and development work shall be subject to the approval of the Regulatory Commission. **APTRANSCO** and the **DISCOM** concerned shall jointly prepare written procedures and protocols for smooth coordinated operation and maintenance for each EHT substation. This provision applies in addition to the provisions made in the Planning Code, Operation Code and Metering Code.

4.11 Operational Aspects pertaining to Inter-State and Inter-regional systems:

In all operational matters pertaining to Inter-State and Inter-regional Transmission Lines and National Generating Stations the Indian Electricity Grid Code prepared by PGCIL and approved by CERC is to be followed by SLDC and APTRANSCO. All such operations are carried out in coordination with SRLDC and PGCIL (CTU).

4.12 Data Exchange between Entities:

Data as provided in Planning Code and Connection Code is expected to be available with APTRANSCO and Users. If at any time data already exchanged falls short of the data prescribed in Planning Code and Connection Code as found in Operational processes any entity is entitled to requisition and acquire the data from APTRANSCO and vice versa. If additional data over and above what is provided in Planning Code and Connection Code is found to be necessary for operational purposes the required data shall be supplied by Users to APTRANSCO and vice versa. For example, any entity may undertake to update studies of fault levels at various points of system in operation and for this purpose the other entities shall provide data for determination of short-circuit currents based on the actual parameters of lines and equipment in operation. The data furnished by one utility to another in order to comply the Grid Code (APCTI) should be used only for the purpose for which the data is supplied i.e., to discharge the functions and responsibilities by each utility. The data should be kept confidential.

Section 4 Appendix A **INCIDENT REPORTING**

FIRST REPORT _____ Date_____ Time _____

1. Date and time of incident:

2. Location of incident:

3. Type of incident:

4. System parameters before the incident (Voltage, Frequency, Flows, Generation, etc.)

5. System parameters after the incident:

6. Network configuration before the incident :

7. Relay indications observed and performance of protection:

8. Damage to equipment:

9. Supplies interrupted and duration, if applicable:

10. Amount of Generation lost, if applicable:

11. Estimate of time to return to service:

12. Cause of incident:

13. Any other relevant information [and remedial action taken]:

14. Recommendations for future improvement/repeat incident:

15. Name of the Organisation :

Place

Time

Date	Signature and Designation of the Officer Reporting the Incident

Section 4 Appendix B **Incident Investigation**

APTRANSCO may upon giving reasonable notice (which shall not be less than two days) send representatives to a **Power Station** or a **User site** in order to **Investigate** any equipment or operational procedure at such **Power Station** or **User's Site,** including without limitations:

(i) the compliance by **Generators** with **Dispatch Instructions** issued by SLDC in respect of CDGUs; and

(ii) the compliance by **Generators** and other Users with design and operating requirements in relation to their **Generating Units** and **User's Equipment**.

(a). The Investigation can only take place in furtherance of **System** operational matters and may not take place immediately. In addition, after a period of **Monitoring** a **Test** may be required. **APTRANSCO** will give written notice, indicating reasons to the **Generator** why it wishes to carry out Investigation.

(b). The User must allow **APTRANSCO** representatives access to all relevant parts of its **Power Station** or **User Site**, in order to conduct Investigation.

(c) The procedure for the Investigation will be as determined by **APTRANSCO** acting reasonably and as notified to the Generator or User. The Generator/User will comply with all reasonable instructions of **APTRANSCO** in carrying out the Investigation.

(d) The purpose of an Investigation is to enable **APTRANSCO** to obtain information concerning equipment and operational procedures. Consequently the carrying out of an Investigation by **APTRANSCO** shall have no direct consequence under either the CTI or the relevant **PPA**.

Section 4 Appendix C **Essential Loads And Priority Of Restoration**

Priority	Type of Load	Name of Sub-station
1. Mining		
2. Railways		
3. Ports & Important Industrial Loads		
4. Important Cities		
5. Hospitals, Water Works, TV and Radio Stations		
6. Process Industries		
7. Defence Establishments		

Section 4 Appendix D **Operational Planning Data**

4D.1 Outage Planning Data

4D.1.1 Demand Estimates

	Item	To be Submitted By
i.	Estimated aggregate annual sales of energy in million units and peak and lean demand in MW & MVAr at each **Connection** point for the period from April of next year to March of following year.	30th November of the preceding year.
ii.	Estimated aggregate monthly sales of energy in million units and peak and lean demand in MW & MVAr at each **Connection** point for the next month.	15th of current month
iii.	Hourly demand estimates for the day ahead.	10.00 Hours every day

4D.1.2 Estimates of Load Shedding

	Item	To be Submitted By
i.	Details of discrete load blocks that may be shed to comply	Soon after connection is made.

with instructions issued by **SLDC** when required, from each **Connection** point.

4D.1.3 Year ahead Outage Programme

(For the period April to March)

4D.1.3.1 Generators' Outage Programme

Item	**To be Submitted By**
i. Identification of **Generating Unit**.	30th November each year
ii. MW which will not be available as a result of **Outage**.	30th November each year
iii. Preferred start* of outage date and start* of outage time, or range of start dates and start times and period of **Outage**.	30th November each year
iv. If outages are required to meet statutory requirements, then the latest date by which **Outage** must be taken.	30th November each year

* Start of Outage

4D.1.3.2 Year ahead SRLDC's Outage Programme

(affecting **Transmission System**)

Item	**To be Submitted By**
MW which will not be available as a result of **Outage** from Imports through external **Connections**.	31st December each year
ii. Start date and start time and period of **Outage**.	31st December each year

4D1.3.3 Year ahead CPP's Outage Programme

Item	**To be Submitted By**
i. MW which will not be available as a result of **Outage**.	30th November each year
Start date and start time and period of **Outage**.	30th November each year

4D.1.3.4 Year ahead Distribution Company's Outage Programme

Item	**To be Submitted By**
i. Loads in MW not available from any **Connection** point.	30th November each year
ii. Identification of **Connection** point.	30th November each year
iii. Period of suspension of drawal with start date and start time.	30th November each year

4D.1.3.5 The [1][APTRANSCO's] overall Outage Programme

Item	**To be Submitted By**
i. Report on proposed **Outage** programme to **SRLDC.**	31st January each year
ii. Release of finally agreed **Outage** plan.	1st March each year

4D.2 Generation Scheduling Data

Item	To be Submitted By
i. Day ahead hourly MW & MVAr availability (00.00 - 24.00 Hours) of all Generating Units.	10.00 Hours every day.
ii. Day ahead hourly MW import/export from **CPP's**.	10.00 Hours every day.
iii. Status of **Generating Unit** excitation AVR in service (Yes/No).	10.00 Hours every day.
iv. Status of **Generating Unit** speed control system Governor in service (Yes/No).	10.00 Hours every day.
v. Spinning reserve capability (MW)	10.00 Hours every day.
vi. Backing down capability with/without oil support (MW)	10.00 Hours every day.
Hydro reservoir levels and restrictions	10.00 Hours every day.
Generating Units hourly summation outputs (MW)	10.00 Hours every day.
Day ahead hourly MW entitlements from **Central Sector Generating Stations from SRLDC.**	11.00 Hours every day.
Day ahead hourly MW entitlements of Hydel Stations fromAPGENCO	11.00 hours every day.

4D.3 Capability Data

Item	To be Submitted By
i. **Generators** shall submit to the **APTRANSCO** up-to-date capability curves for all **Generating Units**.	On receipt of request by the **APTRANSCO**
ii. **CPPs** shall submit to the **APTRANSCO** net return capability that shall be available for export/import to/from **Transmission System**.	On receipt of request by the **APTRANSCO**

4D.4 Response to Frequency Change

i. Primary response in MW at different levels of loads ranging from minimum generation to registered capacity for frequency changes resulting in fully opening of governor valve(Droop Setting).

ii. Secondary response in MW to frequency changes.

4D.5 Monitoring of Generation

Item	To be Submitted By
i. **Generators** shall provide hourly generation summation to **SLDC.**	To be submitted on real time basis
ii. **CPPs** shall provide hourly export/ import MW to **SLDC.**	To be submitted on by real time basis
iii. Logged readings of Generator—**Generators** to **SLDC.**	As required

iv. Detailed report of **Generating Unit** trippings on monthly basis.	In the first week of the succeeding month

4D.6 Essential and Non-Essential Load Data

Item	**To be Submitted By**
i. Schedule of essential and non-essential loads on each discrete load block for purposes of load shedding.	As soon as possible after **Connection**

ANDHRA PRADESH

CODE OF TECHNICAL INTERFACE

Section 5

METERING CODE

Table of Contents

5. METERING CODE

5.1 Introduction and Scope

This Metering Code sets out or refers to the requirements of Metering at Generating stations and Sub-stations for:

a) Tariff Metering for Active and Reactive Energy at delivery points at Generating stations and at delivery points at **APTRANSCO**'s Substations.

b) Operational Metering for Active and Reactive Power and monitoring of Power Stations and Grid Substations and deals with metering at delivery points which are generally the same as relevant connection sites.

Where the requirement for Metering are too extensive for inclusion in the main code, they are set out in the Subcodes and Agreed Procedures. The Sub-codes and Agreed procedures cover the following matters:

5.1.1 Generating Metering Sub-codes

Sub Code No	Subject
1	Generation Tariff Metering -Interim Scheme
2	Generation Tariff Metering Final Scheme
3	Generation Operational Metering

2. ***Distribution Metering Sub-codes***

Sub Code No	Subject
4	Distribution Tariff Metering Scheme
5	Distribution Operational Metering Scheme

3. ***Agreed Procedures***

No	Title	Reference
1	Maintenance, testing, inspection and sealing of Tariff Metering (Generation) and Generator Circuits	5.7.7
2.	Meter Advance reconciliation (Generation)	5.9
3.	Settlement Value Estimation (Generation)	5.12 & 13
4.	Communication Protocols	5.3.4
5.	Maintenance, testing, inspection and sealing of Tariff Metering (Distribution)	5.7.7
6.	Meter Advance reconciliation (Distribution)	5.9
7.	Settlement Value Estimation (Distribution)	5.12 & 13
8.	Notification for new Registrant	5.18.1

Note:- Agreed Procedure nos. 2 to 8 and Sub-Code 5, i.e., Distribution Operational Metering Scheme will be added into future editions of CTI.

4. ***Word/Number Definitions***

A word expressed in the Metering Code in masculine gender includes the feminine gender also and vice versa. Similarly a singular number includes the plural and a plural applies to a singular also.

5.2 General

5.2.1 Energy and Power Metering

Active and Reactive Energy and Power exported or imported by parties shall be metered and generating units/grid substations shall be monitored as required by this Metering Code. Each Generating unit which is subject to central dispatch (whether alone or jointly with other generating units) shall have separate Tariff Metering. Each power transformer of a grid substation supplying power to Distribution Companies shall have separate tariff meters on the L.V. side.

2. ***Tariff Metering***

Tariff metering shall be designed and installed so as to measure imports from the **APTRANSCO**'s Transmission system and net output from each generating unit. Data from tariff metering required under this Metering Code shall be collected from Generator data collectors, or any other data collector mutually agreed by **APTRANSCO,** and respective generators. Data required by Distribution Companies shall be collected from **APTRANSCO**'s Load Dispatch Centre. As far as possible the tariff metering shall be connected at the delivery point i.e., for energy exported from the generating unit to the grid at the HV side of the unit transformer (step up transformer) and for energy imported from the grid for station consumption on the HV side of the station auxiliary transformer. At both the delivery points one main meter which shall be an electronic trivector meter and a check meter which shall also be an electronic trivector meter are to be connected. The main meter and check meter shall preferably be of two different makes. Permission has been given by APERC to APTRANSCO to connect tariff meters for Feeders. But Generators shall have a programme to instal tariff meters on the HV side of the Generator Transfomer.

The existing metering at locations of energy transfer between Generators and **APTRANSCO** shall continue as they exist until the FMS is approved by the Regulator and metering is changed as per the FMS within the time prescribed by the Regulator.

Similarly on the LV side of the Power Transformers at EHT Sub-Stations two electronic trivector meters shall be installed (one main and the other check meter for measuring energy delivered by APTRANSCO to DISCOMs.

3. ***Ownership***

All Generation Metering shall be owned by respective Generators and the Generators

are responsible for ensuring that all such metering complies with the Metering Code.

1. All tariff metering at EHT Sub-stations shall be the responsibility of **APTRANSCO**.

2. All metering to interconnection points shall be governed by the provisions of the relevant interconnection agreement. The Party responsible for metering shall be known in this Metering Code as the Registrant in respect of such Metering.

3. The energy consumed by auxiliary machines at generating stations shall be measured accurately by the Generator concerned. The power tapped from the output of the generating unit before the step-up transformer and consumed by the auxiliary equipment etc. in generating stations is an internal issue of the Generator and not an interface matter. However, the energy so consumed shall be measured by Generator by providing accurate energy meters on the primary side of the unit auxiliary transformer and monthly readings shall be furnished to **APTRANSCO** and **APERC** for statistical and other miscellaneous purposes. The data from this metering shall be furnished to the Metering Committee when required. However, if plant Load Factor is calculated based on gross generation and if some clauses pertaining to Tariff are related to PLF then the auxiliary Consumption shall be metered in the same way as Tariff Metering and the metering of consumption in auxiliaries shall be treated as an interface issue.

4. The part of energy consumed by auxiliary equipment inside the Generating Station and drawn from the Grid shall be measured by tariff metering. Generators shall pay for this energy which is drawn through the Station Auxiliary transformer from the Grid. The metering shall be connected on the HV side of the Station Auxiliary transformer and is subject to the Metering Code in all details.

The internal consumption of the substations of **APTRANSCO** (Substation auxiliaries such as lighting, fans and cooling equipment) shall be measured by **APTRANSCO** by connecting a metering system of suitable accuracy. The data shall be furnished to the **APERC**, Government (on requisition), Metering Committee (on requisition) and Statistical authorities and to other organisations.

4. ***Responsibilities***

Each Party, shall by the applicable date, become bound by this Metering Code in respect of that Metering or those Generator circuits for which it is responsible and each party shall ensure such Metering or Generator circuits are properly installed and that they comply with the requirements of this Metering Code.

Details of such Metering or Generator Circuits shall be provided by the relevant Registrant to the Interested Party on request for the purposes of maintaining the Register pursuant to 5.7.6.1. provided always that all reasonable costs of upgrading

any Generator Circuits/Substation Circuits to ensure compatibility with the requirements of the Interim Metering Scheme or the Final Metering scheme or any other changes will be the responsibility of the Generators/**APTRANSCO** respectively. Any other change to the Data collection system required by **APTRANSCO** shall be met by **APTRANSCO.** Maintenance and replacement of Generator circuits/Substation circuits in the ordinary course shall be carried out by the relevant Interested Party.

5. ***Installation of Tariff Metering***

   Under the Final Metering Scheme all current and voltage transformers associated with Tariff Metering must be installed at the expense of the Registrant as close as reasonably practicable to each Delivery Point taking into account physical location and cost. Under the Interim Metering scheme, Tariff metering shall remain where sited at the Effective Date.

6. ***Compliance with FMS***

   After the FMS Date all Tariff Metering shall comply with the Final Metering Scheme. Tariff Metering installed after the Effective Date shall also comply with the Final Metering Scheme except for replacement Tariff Metering installed after the effective date and prior to the FMS date at generating units, Grid Substations or Relevant connection sites which were commissioned on or before the Effective Date. In such case Metering shall comply with Interim Metering Scheme or the Final Metering Scheme as the relevant Registrant may reasonably decide.

7. ***Location of Operational Metering***

   Operational Metering shall be sited where reasonably required by **APTRANSCO** after consultation with the Interested Party so as to measure the parameters at the points reasonably determined by **APTRANSCO**. Installation of Operational Metering shall be undertaken by the Interested Party, as soon as is reasonably practicable following the request of **APTRANSCO** and under the supervision of **APTRANSCO** with the Interested Party bearing all such reasonable costs in respect thereof.

8. ***Registrant's Responsibility***

   A Registrant shall continue to be responsible for Metering in accordance with this Metering Code, until another party becomes Registrant in respect of such Metering or until electricity ceases to be imported or exported at the relevant connection site as a result of permanent disconnection.

9. ***Generator/Substation Circuits***

Subject to 5.2.4 above Generator Circuits/Sub-station Circuits are the responsibility of the Interested Party which operates the Power Station /Substation where such circuits are

installed. Such Interested Party shall be required to maintain the same in accordance with this Metering Code.

5.2.10 Revision of the Metering Code

Any part of the Metering Code can be revised by the CTI Review Panel. When the CTI Review Panel takes decisions to revise the Metering Code the Chairman of the Metering Committee or a Member of the Metering Committee authorised by the Chairman, shall be present.

5.3 Data Collection

5.3.1 Rights of Data Acquisition

APTRANSCO/Distribution Co. shall have the right to collect, import/export data relating to Active Power, Reactive Power, Active Energy and Reactive Energy imported and exported and Operational Metering data permitted to be collected by remote interrogation or manual on site interrogation in accordance with the terms of this Metering Code.

2. ***Meter Registers***

   Each interested party shall read each meter register in respect of which it is the interested party, daily at or around midnight, and pass such readings to **APTRANSCO**/Distribution Co. as soon as possible thereafter.

3. ***Remote Monitoring***

   For the purposes of remote interrogation **APTRANSCO** may use its own data communications network or failing this shall enter into, manage and monitor contracts to provide for the maintenance of all data links by which data is passed from Generator Data Collector or operational metering. Similarly, a Distribution Company may use its own data communication network to collect data from substation/Load Dispatch station of **APTRANSCO**. In the event of any fault or failure of such communication lines or any error or omission in such data **APTRANSCO** shall, if possible, retrieve such data by manual on-site interrogation in accordance with Agreed Procedure No.5 or No.6 as the case may be, failing which it shall estimate the same in accordance with the relevant Agreed Procedure.

4. ***Communication Protocols***

Each party shall use communications protocols in relation to Metering specified in Agreed Procedure No.4.

5.4 Description of Metering

a) Metering shall comply with the requirements set out in the relevant Sub-code.

b) All Tariff Metering shall be compatible with the Data Collection System.

c) All Generator Circuits/Substation circuits shall be compatible with the relevant Metering.

5.5 Accuracy

Metering shall be accurate within the prescribed limits set out in the relevant Subcodes. With respect to Tariff Metering these prescribed limits shall be applied after adjustments have been made in accordance with the relevant Subcode to compensate for any errors due to measuring transformers and connections thereto and/or due to Generator/Substation Circuits.

5.6 Calibration

Each Registrant shall ensure that all Metering for which it is responsible and each Interested Party shall ensure that all Generator Circuits/Substation Circuits for which it is responsible shall, at the Effective date and thereafter, be calibrated or compensated in accordance with this Metering Code in order to meet the accuracy requirements in the Subcodes. The Registrant in the case of Metering or **APTRANSCO** in the case of Generator circuits and the Distribution Co. in the case of Substation circuits shall be granted access to such Metering or Generator/Substation circuits by the relevant Party upon reasonable notice and at reasonable times, in order to make or inspect any adjustments thereto and to attend any tests or inspection thereof required pursuant to this Metering Code.

5.7 Proper Order, Testing, Sealing and Readings

5.7.1 Proper Order

5.7.1.1 Each Registrant shall at its own expense keep in good working order, repair and condition all Metering in respect of which it is the Registrant to ensure the correct registration, recording and transmission of the requisite data relating to, or in respect of, the quantity of Active and Reactive Energy and Active and Reactive Power measured by the relevant Metering and of the performance of the relevant Power Station/Sub-Station.

5.7.1.2 Each Generator shall, at its own cost and expense, keep in good working order, repair and condition all Generator circuits for which it is responsible.

3. **APTRANSCO** shall at its own expense, keep in good working order, repair and condition all substation circuits for which it is responsible.

2. ***Testing***

5.7.2.1 Any new or replacement meters shall be tested by the Registrant as soon as reasonably practicable after installation.

2. Any new or replacement meters shall be calibrated at

APTRANSCO's/Generator's meter testing department prior to installation of the same.

3. No less frequently than is specified in the relevant Subcode each Registrant shall carry out a periodic calibration of all Metering in respect of which it is Registrant.

4. The Registrant shall give **APTRANSCO** or (in the case of metering of which **APTRANSCO** is the Registrant) the Distribution Co. at least one month's prior written notice of a routine test and 5 days prior written notice in the case of every site test of new, replacement or modified metering stating the date, time, work required and estimated duration of every such test except where such test is carried out as a result of an emergency or equipment failure in respect of metering which is already in service.

5. **APTRANSCO**/Distribution Co. as the case may be shall have the right to attend any such test should it so require. Any such test shall comply with the relevant Sub-code. A copy of all test reports shall be given to the Interested Party.

6. The costs and expenses of such testing shall be borne by the Registrant.

7. If all or any part of a Generator/Substation circuit is replaced, the relevant Generator/Substation circuit shall be recalibrated as soon as possible. If required Generator/Distribution Co. and **APTRANSCO** shall agree to any change that may be necessary to the existing compensation for that circuit.

2. ***Ad-hoc Testing***

5.7.3.1 If any party has reason to believe that Metering or Generator Circuits/Substation Circuits are not performing properly or within the prescribed limits of accuracy referred to in the relevant Subcode, then such party (where it is not **APTRANSCO**) shall promptly notify **APTRANSCO** accordingly.

2. Subject to 5.7.3.3 **APTRANSCO** shall notify the relevant Registrant or Interested Party promptly and require him to test the accuracy of the relevant Metering or Generator/Substation Circuits as soon as practicable but in any event within 24 hours of receiving notification of such requirement, whereupon the relevant Registrant or Interested Party, as the case may be, shall inspect such Metering or Generator Circuits/Substation Circuits and carry out such tests as **APTRANSCO** shall reasonably deem necessary to determine the accuracy of the same.

3. Where **APTRANSCO** has reason to believe it would not be appropriate for the relevant Registrant or Interested Party to test the accuracy of Metering or Generator/Substation Circuits then **APTRANSCO** shall, without being required to give prior notice to the relevant Registrant or Interested Party, as

the case may be, inspect such Metering or Generator Circuits/ Substation Circuits and make such tests as **APTRANSCO** shall reasonably deem necessary to determine the accuracy of the same.

4. Subject to 5.7.3.5 below:

    1. the Registrants' costs associated with any such inspections and tests of Metering referred to in 5.7.3 shall be borne by such Registrant and

    2. the Interested Party's costs associated with any such inspections and test of Generator Circuits /Substation circuits referred to in 5.7.3 shall be borne by such Interested Party.

5. Where any Metering or Generator /Substation Circuits pass all inspections and tests required pursuant to 5.7.3.2 or 5.7.3.3, the costs of or associated with such inspections and tests referred to in 5.7.3.4 shall be borne by the Party which has notified **APTRANSCO** pursuant to 5.7.3.1, or otherwise by **APTRANSCO** which shall reimburse the relevant Registrant or Interested Party such costs and expenses on demand.

6. Calibration certificates for test equipment shall be made available for the relevant Registrant or Interested Party.

5.7.4 Testing General

5.7.4.1 Subject to 5.7.3.3 above, any testing of any Metering or Generator/Substation Circuits shall, prima facie, be carried out by the Registrant in the case of Metering, or by the Interested Party in the case of Generator Circuits/Substation Circuits, on the relevant Metering or Generator/Sub-Station Circuits mounted in their operational position.

Both the Interested Party and the Registrant or (where **APTRANSCO** is not the Registrant) **APTRANSCO** shall have the right to attend all such testing. All testing will be carried out in accordance with the relevant Subcode. Any breaking of seals and Sealing on Tariff metering will be carried out in accordance with Agreed Procedures No. 1 or 2 as the case may be. The test performance of any metering or generator circuits / substation circuits shall be compared with calibrated test equipment by one of the following methods:

5.7.4.1.1 injecting into the measuring circuits (i.e. excluding the primary current and voltage transformers) and comparing the readings or records over such period as may reasonably be required by **APTRANSCO** or where an Interested Party has requisitioned the test, by that Interested Party to ensure a reliable comparison or

5.7.4.1.2 where practicable, operating the calibrated test equipment from the same primary current and voltage transformers as the meter under operating conditions. The readings or recordings of the meter and the calibrated test equipment shall be compared over the required period by **APTRANSCO** or, where the test is carried out at the behest of the Interested Party by the Interested Party, to ensure a reliable comparison or

5.7.4.1.3 in any other circumstance, such other method as may be reasonably specified by **APTRANSCO** or Interested Party.

5.7.5 Test Failures

1. Any meter which fails any test whilst in its operational position shall be removed by the Registrant forthwith and tested by **APTRANSCO** under laboratory conditions at **APTRANSCO**'s meter testing department in the presence of the Registrant or the Interested Party. **APTRANSCO** shall give the Registrant or Interested Party, as the case may be, prior notice of such test.

2. Where meters are removed in accordance with 5.7.5.1 on circuits that are required to remain in service the meter shall be replaced by the Registrant forthwith with a previously recalibrated meter suitably prepared and compensated for the circuit or, where the Metering includes both main and check meters, and the meter (main or check) which is to remain on site is within its calibration period, such other metering may be removed provided it is returned to site or replaced within 14 days. In such circumstances where the remaining meter is the check meter it shall, for all estimation or retrieval purposes, be regarded as the main meter until replacement or return to site of the main meter.

6. ***Records***

5.7.6.1 Each Registrant or Interested Party shall at its own cost and expense maintain a register in relation to Metering for which it is responsible.

Each register shall detail any relevant loss adjustment factors and specification details e.g. serial number and accuracy class and all relevant matters as may be required by the relevant Subcode relating to the calibration of such Metering including the dates, location and results of any tests, readings, adjustments or inspections carried out. Any temporary or permanent replacement of meters and the dates on which any seal was applied or broken, the reason for any seal being broken and the persons carrying out and attending any such tests, readings, inspections or sealings shall also be recorded in the register. Such records shall also include any other details as may be reasonably required by **APTRANSCO** or any other Registrant. Any such records shall be

complete and accurate and be retained for a minimum period of 12 months following the removal of the relevant Metering or Generator Circuits/Substation Circuits. Any data which forms part of such metering records shall be made available to the Interested Party and/or **APTRANSCO,** as applicable. Copies of the results of all manual readings, adjustments, tests and inspections shall be provided to the Registrant, Interested Party or **APTRANSCO** as appropriate, but without limitation and in accordance with the Agreed Procedures.

5.7.6.2 Each Registrant shall pass such records or copies of the above to the successor Registrant in relation to any Metering.

5.7.6.3 Each Registrant or in the case of Generator Circuits/Substation Circuits, each Interested Party shall, at its own cost and expense, ensure that **APTRANSCO**/Distribution Co. is provided with copies of all records referred to in 5.7.6.1 and that these are updated forthwith whenever there is any change in the information contained in such records.

5.7.6.4 Each Party shall upon reasonable notice and at reasonable times have access to the records maintained by the Registrant or Interest Party pursuant to 5.7.6.1 and used for the purposes of a PPA which the Party has entered into and may take copies thereof.

5.7.6.5 Each Party shall upon reasonable notice and at reasonable times have access to the operational Metering data that is relevant to the Generating unit / Substation operated by such party.

7. ***Sealing***

5.7.7.1 Following the Effective Date, all Tariff Metering as is capable of being made secure shall be sealed by **APTRANSCO**. The seal shall be replaced following any test or inspection in accordance with Agreed procedures No.1 or No.2 as the case may be, except, where sealing is impractical in the reasonable opinion of such Registrant and/or **APTRANSCO** or Interested Party as is appropriate having regard to the physical and electrical configuration at each relevant connection site.

2. Each Generator and **APTRANSCO** shall, following the Effective Date, make arrangements for all Generator Circuits/Substation Circuits as are capable of being made secure, to be sealed by it or on its behalf in accordance with Agreed Procedure No.1 except where in the reasonable opinion of the relevant Generator and **APTRANSCO,** having regard to the physical and electrical configuration at each relevant connection site, it is impractical.

3. No seal applied pursuant to this Metering Code shall be broken or removed except in the presence of, or with the prior consent of the Party affixing the seal, or on whose behalf the seal has been affixed unless it is necessary to do so in circumstances where (i) both main and check meters are malfunctioning,

or there occurs a fire or other similar hazard and such removal is essential and such consent cannot be obtained (provided that the Party which has affixed the seal and which has not given such consent shall be informed immediately thereafter), or (ii) such action is required for the purposes of 5.11. Where verbal consent is given it must be confirmed in writing immediately after taking the necessary action.

The seals of the Tariff meters shall be broken in the presence of representatives of both parties (e.g. Generator and **APTRANSCO**) i.e., the supplier of energy who raises the bill and the receiver who pays the bill.

4. No party shall incur any liability under this Metering Code in the event it cannot perform any of the duties hereby prescribed due to any such consent required by 5.7.7.3 being withheld, save that it shall promptly inform **APTRANSCO** and the relevant Registrant or Interested Party accordingly.

5. Each Party shall ensure, so far as it is able, that physical access to Metering and Generator Circuits/Substation Circuits is, where practicable, restricted to personnel who are required to have such access for the proper performance of their duties and have received permission for such access. Record of any such access shall be maintained by the Party on whose land the Metering or Generator Circuits/Substation Circuits are positioned, with copies provided to the Registrant and **APTRANSCO** pursuant to 5.7.6.3.

   In addition, all Metering and Generator Circuits/Substations Circuits, where practicable, must be made secure, if necessary by providing padlocks.

   The lists of persons authorized to inspect and to note meter readings shall be kept at Generating Stations and EHT Sub-Stations. The lists shall be updated periodically and whenever changes occur and the revised lists shall be kept at the Station.

6. Each Party shall control the issue of its own seals and sealing pliers and shall keep an accurate register of all such pliers and the authorised persons to whom they are issued.

7.

8. The points of sealing shall be

a. CT secondary boxes

b. PT secondary boxes

c. Meter Box

d. Meter Test Block

e. Meter Terminal Cover

f. Meter Cover

g. Panel doors where CT and PT secondary circuits are terminated and/or provisions for shorting/breaks/fuses/links etc., are available.

h. PT selector relay where automatic change over of potential supply to meter from one PT to another is provided.

i. CT primary links and top covers of CTs where ratio changes are by primary change over.

6. ***Inspection and Readings***

5.7.8.1 **APTRANSCO** shall ensure that all meters which are subject to the terms of this Metering Code are inspected and read by it, or on its behalf, by on-site interrogation not less than once in every three months, and shall give the Registrant or the Interested Party at least five day's prior notice thereof, or such shorter period as the relevant parties may agree. A failure to notify in accordance with 5.7.8.1 shall invalidate the results of any such inspection or reading. Each reading shall be taken at or as close as is practicable to the end of a Settlement period. **APTRANSCO** shall keep written reports of all such inspections and readings and provide copies to the Registrant or the Interested Party for the purposes of 5.7.6.1. Any resulting discrepancies will be dealt with as provided in 5.9, the relevant Agreed Procedure and the relevant PPA.

5.7.8.2 The Registrant or Interested Party, as the case may be, shall have the right to attend any such inspection and readings, although their failure to attend shall not prevent such inspection or reading taking place nor invalidate its results. The representative of any Interested Party or Registrant shall acknowledge the results of any such inspection or reading in the manner required by the Agreed Procedure.

5.8 Access

5.8.1. Rights of Access

Each Party hereby agrees to grant to any other party, its employees, agents and contractors and persons duly authorised by them full right to enter and remain upon any part of such Party's property to the extent necessary for the purposes of this Metering Code subject to the other provisions of 5.8. Each Party granting access must further ensure that any consents or other forms of approval obtained remain valid at the time of such access including, if appropriate, rights of access across third party land.

5.8.2 Access with Equipment

The right of access provided for in 5.8.1 includes the right to bring in such vehicles, plant, machinery, test kits, loading kits, sub-standard meters and maintenance or other materials as shall be necessary for the purposes of this Metering Code.

5.8.3 Authorization for Access

Each Party shall ensure that any particular authorisation or clearance for any person which is required to be given to ensure access is available on the arrival of such person at the relevant site.

5.8.4 Limiting Disruptions and Disturbances

Subject to the right of **APTRANSCO** to inspect without notice pursuant to 5.7.3.3 each Party shall ensure that all reasonable arrangements and provisions are made and/or revised from time to time, as and when necessary or desirable, to facilitate any right of access granted pursuant to 5.8.1 with the minimum of disruption, disturbance and inconvenience. Such arrangements and provisions may to a reasonable extent limit or restrict the right of access and/or provide for any party to make directions or regulations from time to time in relation to a specified matter. Matters to be covered by such arrangements and/or provisions include:

1. the identification of Access relevant to Metering Circuits

2. the particulars of access routes applicable to the land in question having particular regard to the weight and size limits on these routes any limitation on time of exercise of the right of access

3. any requirements as to prior notification and as to authorisation or security clearance of individuals exercising such right of access and procedures for obtaining the same.

4. the means of communication of any relevant directions or regulations made by the Party granting access and

5. the identification of, and arrangements applicable to, personnel exercising the right of access granted by 5.8.1 and

6. Safety Procedures

   Each person/employee granted access shall observe and comply with any such safety arrangements and all provisions (or directions or regulations issued pursuant thereto) that are made from time to time.

5.8.5 Responsibilities of Access

Each party granted access shall ensure that all reasonable steps are taken in the exercise of any right of access to:

1. avoid or minimise damage in relation to the property over which they have access, and

2.

3. cause as little disturbance and inconvenience as possible to any party or other occupier of such property, and shall make good any damage caused to any such property in the course of exercising such rights, as soon as may be practicable. Subject to this, all such rights of access shall be exercisable free of any charge or payment of any kind.

5.8.6 Locations of Operational Metering

In the case of Operational Metering **APTRANSCO** shall agree with the Interested Party (such agreement not to be unreasonably withheld) whenever such Operational Metering is sited in an area which includes both Operational Metering and other equipment which is of importance in relation to a Generating unit and if it is so, the Interested Party shall maintain, or with the approval of **APTRANSCO,** shall arrange the maintenance of such Operational Metering on behalf of, and under the supervision of **APTRANSCO**, with **APTRANSCO** bearing all such costs and expenses as are reasonable in respect thereof.

5.8.7 Non-Liability if Metering Access is Denied

For avoidance of doubt, no party shall incur any liability under this Metering Code in the event it cannot perform any of its duties hereunder due to access to Metering being denied to it, save that such party shall promptly inform **APTRANSCO,** the relevant Registrant and the Interested Party accordingly.

5.9 Metering Discrepancies

The parties acknowledge that, in transmitting metered data, impulses representing electrical quantities may be lost between the relevant meter and the **APTRANSCO** Data Collector or the Data Collection System, giving rise to inaccuracies in Settlement values, notwithstanding that the Metering is complying with the standards required by this Metering Code. In such Circumstances any differences between electricity flows recorded on meters and the total of the Settlement values recorded in the Data Collection System will be noted at the time that the meter is inspected and read pursuant to 5.7.8 or 5.3.2. Reports of such meter readings will be provided to the Interested Party and any resulting discrepancies will be dealt with as provided in the relevant Agreed Procedure and PPA. In any other circumstances where metering is not complying with the standards required by this Metering Code such difference will be dealt with in accordance with 5.12.

No financial adjustment shall be made to any payment to be made in respect of a day under

a PPA as a result of identifying any metering discrepancy in respect of such day unless a dispute is raised in respect of such discrepancy prior to the expiry of the seventh Business Day following receipt by the Interested Party of the confirmation statement in respect of such day, or the Meter Reconciliation statement which identifies such discrepancy.

As far as possible settlement values shall be derived from the direct readings of the meters read by personnel and conveyed by phone or by post.

5.10 Defective Equipment

If at any time any metering is destroyed or damaged, or otherwise ceases to function, or is found to be outside the prescribed limits of accuracy referred to in 5.5, the Registrant or, the Interested Party shall, subject to compliance with its obligations under 5.7.7, promptly adjust, renew or, repair the same or replace any defective component or, procure the same so as to ensure that the relevant Metering is restored to service and operating within the prescribed limits of accuracy within one month from the date of noticing the defect. Metering includes the secondary circuits of instrument transformers.

5.11 Sanctions for non-compliance

In the event that a Registrant or Interested Party cannot or does not comply with its obligations to repair, adjust or, replace or, renew any defective component pursuant to 5.10, **APTRANSCO** or the Interested Party shall have the right to carry out such repair, adjustment, replacement or renewal and to recover its costs, expenses and interest thereon from such Registrant or Interested Party forthwith on demand.

5.12 Meter Failure

5.12.1 Assumed Meter Readings in the event of Faulty Metering

If at any time Metering ceases to function or is found to be outside the prescribed limits of accuracy referred to in 5.5 (as the case may be) for whatever reason then except in the circumstances in 5.12.4,

2. ***Non-Functioning of Metering***

In the case of Metering ceasing to function, during the period from the date of such cessation or,

5.12.3 Other cases of Inaccuracy

In any other case, during the period from the time when such inaccuracy first occurred or, if such time is unknown, from the midnight preceding the day during which the disputed reading occurred, until the date of adjustment or replacement, repair or renewal of such Metering under 5.10 and 5.11, the metering readings shall be deemed to be those calculated pursuant to Agreed Procedures No.1,2,3,4,5,6 and 7 as the case may be and in the case of disputes, the relevant PPA.

5.12.4 Voltage Transformer Fusing

If any time a voltage transformer fuse on a circuit supplying a meter has failed with the result that the Metering is outside the prescribed limits of accuracy referred to in 5.5, the meter readings from the time the failure is deemed to have occurred until the voltage transformer circuit is again restored to the meter, shall be deemed to be those calculated pursuant to Agreed Procedures Nos.1,2,3,4,5,6 and 7 as the case may be, and in the case of disputes, the relevant PPA.

5.13 Collection, Retrieval, Validation and Estimation of Data

Where a party identifies that, as determined by the relevant Agreed Procedure, data required from a Metering is incomplete, inaccurate or has not been transmitted or received, that Party will notify **APTRANSCO,** the Interested Party or the Registrant as appropriate, in accordance with the relevant Agreed Procedure taking into account the following priorities in the following order:

1. The need to obtain accurate data
2. The need to apply verification procedures
3. The need to produce edited or substitute data where it is incorrect or unavailable.
4. The need to rectify the metering, PTs and CTs at the earliest possible time.
5. The need to estimate by realistic methods the energy exchanged during the period while the metering, and/or PTs and/or CTs were defective.

5.14 Disputes

5.14.1 General

Any dispute relating to metering which would affect any payment to be made or reduced in respect of a Generating Unit/Delivery point to the Distribution under a PPA shall be dealt with in accordance with the relevant Disputes procedure.

5.14.2 Referrals to the Metering Committee

Any dispute in relation to the following matters shall be referred to the Metering Committee whose decision shall be final and binding and shall be communicated to all parties concerned.

5.14.2.1 Siting of metering

5.14.2.2 Technical specifications for Metering and associated installations like measuring transformers or the Data Collection System

5.14.2.3 Sealing of Tariff Metering

5.14.2.4 Compliance of Metering or Measuring transformers with technical specifications of the Metering Code.

5.14.2.5 Compensation values

5.14.2.6 Any other issue pertaining to interface metering which a party may raise.

5.14.3 Procedure for Other Disputes

Any other dispute under this Metering Code shall be dealt with in accordance the disputes procedure in the relevant connection Agreement or Section 1.5 of the General Code according to the subject and context.

5.14.4 Testing of Metering

Any testing of metering or measuring transformers required to settle a dispute shall be carried out in accordance with 5.7.4 and 5.7.5.

5.14.5 Payment of Costs

The Metering Committee shall have the power to order payment of costs and expenses in respect of any dispute referred to it in such manner as it considers appropriate. The Metering Committee shall have the power to demand any information it may properly and reasonably require to settle a dispute from any Party and such Party shall provide the relevant information on request.

5.15 Metering Committee

5.15.1 Composition of the Metering Committee

A Metering Committee shall be appointed for the purposes of this Metering Code. The composition of the metering committee shall vary depending upon whether it is considering generation matters or supply matters. It will comprise:

5.15.1.1 when it considers generation matters, one representative from **APTRANSCO** (such person having one vote for each vote cast by a Generator at the meeting), one representative from each major Generator (> 100 MW) one representative to represent all CPPs, one representative to represent mini hydel and non-conventional, and one representative from the Commissioner's Office, and

5.15.1.2 when it considers supply matters, one representative from **APTRANSCO**, one representative from each Distribution Company, and one representative from APERC. The representative from APTRANSCO shall have one vote for each vote cast by a DISCOM at the meeting.

5.15.2 Appointments to the Committee

Members of the Metering Committee shall be appointed from time to time by the relevant Party or Parties concerned. In default of appointment by the relevant Parties, the Commissioner shall have the right to appoint representatives from the Parties who have failed to appoint their own representatives. Members of the Metering Committee shall be required to enter into confidentiality undertakings in favour of all parties in a form specified by the Review Panel of Code of Technical Interface.

3. ***Committee Voting Procedures***

Decisions of the Metering Committee shall be made by the voting of committee members attending any meeting. Save as provided in 5.15.1.1, and 5.15.1.2, each committee member shall have one vote. The Chairman, where necessary, shall have a casting vote. Two committee members with atleast one member from APTRANSCO and one member from each DISCOM involved in the issues to be discussed shall be a quorum for any meeting of the Metering Committee when supply matters are considered. Two committee members with one member from APTRANSCO and one member from the Generating Company involved in the issue shall be the quorum of the committee meeting when Generation matters are considered. No less than 5 Business Days notice of a meeting of the Metering Committee shall be given to all committee members entitled to attend such meeting, unless otherwise agreed by all such committee members.

5.15.4 Committee Chairman

The Chairman of the Metering Committee shall be an ex-officio member of the CTI Review committee. He has one vote on matters pertaining to Metering. The Chairman shall be appointed by the Metering committee and in the absence of agreement, the representative from the Commissioner's office shall be the Chairman.

5.15.5 Rules and Procedures

The Metering committee shall operate in accordance with such other rules and procedures as are laid down by it.

5.15.6 Committee Secretary

One representative from **APTRANSCO** shall be the Member-Secretary and act as Secretary of the Metering Committee for the purpose, inter alia of giving and receiving of notices. The addresses and telephone numbers of all Committee Members shall be furnished to the Secretary. The address and telephone number of the Secretary shall be informed to all Committee Members, the Chairman of the Committee, the Corporate Offices of all entities and APERC.

5.15.7 Attendance at the Committee by Non-Members

A technical person from the manufacturers of Meters may attend any meeting without voting right on invitation by Generators/**APTRANSCO**/Distcoms/ Commissioner.

5.15.8 Communicating Revisions to the Metering Code

If, during any committee meeting, it is decided to revise any part of the Metering Code the decision shall be communicated in writing to the Code of Technical Interface Review Panel for effecting the revision. The Chairman of the Metering Committee shall attend the CTI Review Meeting whenever metering issues figure in the agenda. If the Chairman cannot attend the CTI Review Meeting he may authorise any Member of the Metering Committee to represent him in the CTI Review Meeting. Metering Code is part of CTI (Grid Code) and for any revision of Metering Code the same procedure for revision of Grid Code has to be followed. Proposals for revision of the Metering Code may also be sent direct to the Review Panel by any utility. The Panel shall in turn inform the proposals to the Metering Committee.

5.16 Information

5.16.1 Provision of Information to APTRANSCO

All Parties shall give to **APTRANSCO** all such information in their possession regarding Metering which **APTRANSCO** shall reasonably require for the proper functioning of the Data Collection System including information regarding the dates and time periods for installation of new metering and the dates and periods when metering will be out of service.

5.16.2 Dispute Resolution

At the request of any Party which is a party to the dispute referred to in 5.14.2 any relevant data associated with the Metering in question shall be submitted by **APTRANSCO** to the Metering Committee for the purposes of resolving such dispute.

5.16.3 Electronic Data

5.16.3.1 In the event of any malfunction, breakdown or other such occurrence or, difficulty affecting the Data Collection System which, in the reasonable opinion of **APTRANSCO** affects or, is likely to affect, any Party other than **APTRANSCO** to a material extent, **APTRANSCO** shall, as soon as reasonably practicable thereafter, provide each Party so affected (or likely to be affected), with a report describing in reasonable detail such occurrence or difficulty and its likely duration.

5.16.3.2 Any Party that chooses to receive electronic data from Metering shall install such Computer equipment as may be necessary for such purpose and which shall be compatible with such Metering and shall comply with any relevant requirement of the Agreed Procedures. Each Party shall be responsible for its own computer equipment and communication lines.

5.16.3.3 Each Interested Party shall have the right to receive electronic

data from any Metering in respect of which it is the Interested Party via the Generator Data Collector. **APTRANSCO** shall not, without good cause, interrupt or otherwise disturb such electronic data. The Interested Party shall be responsible for the maintenance of any communication lines to or from the Generator Data Collector.

5.17 Ownership of Metering Data

The Registrant of any Metering shall own the data acquired therefrom. Any Party shall at all times have the right of access to the data and to use the same as may be permitted pursuant to this Metering code, free of charge. If the data is confidential, the party may only release such data to others to the extent required pursuant to this Metering Code or as permitted by the Connection Agreement.

5.18 Notice of Installation of New Meters

5.18.1 Timely Installation

Where notice is served on **APTRANSCO** in the form set out in the relevant Agreed Procedure No.8 by a proposed Registrant of an existing Relevant Connection site, which is the point of supply of a Distribution Company, the proposed Registrant shall confirm that metering required for the purposes of this Metering Code will be installed and kept operational at the Relevant connection site. Where the necessary metering will not be installed and operational by a required date, the Registrant and **APTRANSCO** shall follow the provisions set out in 5.18.2. Such Metering shall be tested in accordance with the provisions of 5.7.2

5.18.2 Settlement of Disputes

Where 5.18.2 has effect pursuant to the provisions of 5.18.1 above:

5.18.2.1 the Registrant and **APTRANSCO** shall agree demand Settlement values for each demand Settlement period, for each day from the expiry of the notice until the relevant Metering is installed and operational.

5.18.2.2 if agreement cannot be reached in accordance with 5.18.2.1 within 14 days, the matters may be referred to arbitration in accordance with the relevant Connection Agreement and payments will be made on the basis of values as reasonably determined by **APTRANSCO** pending a decision of the arbitrator. Payments shall be adjusted as appropriate at the time of such decision to take into account the Settlement values so determined since the date of such notice;

5.18.2.3 **APTRANSCO** shall take such values determined in accordance with 5.18.2.1 or 5.18.2.2, into account for the purpose of the Data collection system and the Registrant shall be bound to accept

such values, subject to adjustment in accordance with 5.18.2.2, for the purpose of electricity consumption until the relevant metering is installed and operational;

5.18.2.4 As soon as practicable after the Registrant has installed the required Metering, the Registrant shall notify **APTRANSCO**. As soon as reasonably practicable thereafter, **APTRANSCO** shall commence using the data collected from the meter for the purposes of the Data collection system and shall inform the Registrant of the date on which it commenced doing so.

5.19 Notices

5.19.1 Changes in Registrants

Any notice of a new Registrant or of a change in Registrant or any other communication required under this Metering Code to be given to **APTRANSCO** shall, if required, be sent by facsimile to number [ ] at [ ] attention [ ] (with hard copy to follow by first class post) or such other facsimile number and address as may from time to time be nominated in writing by **APTRANSCO.** Where it is required to be given to any other Party it shall be sent by a facsimile to such number, at such address and to such person as such Party shall nominate in writing to **APTRANSCO** (with hard copy to follow by first class post). In the absence of nomination such communication, as is required, shall be sent to the registered office of the other Party.

5.19.2 Validity of Facsimile Notice

Any notice or other communication sent by facsimile pursuant to 5.19.1 shall be deemed to have been received when dispatched.

5.19.3 Requirement for 28 Day Notification

A new Registrant must be notified to **APTRANSCO** at least 28 days prior to either:-

5.19.3.1 The date of the intended commencement of obligations of the Registrant or

5.19.3.2 The date of simultaneous termination of obligations by the existing Registrant and the assumption of those obligations by the new Registrant, (as the case may be) in connection with the relevant Metering.