Planning Code

23 October 2013

KeTTHA
KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

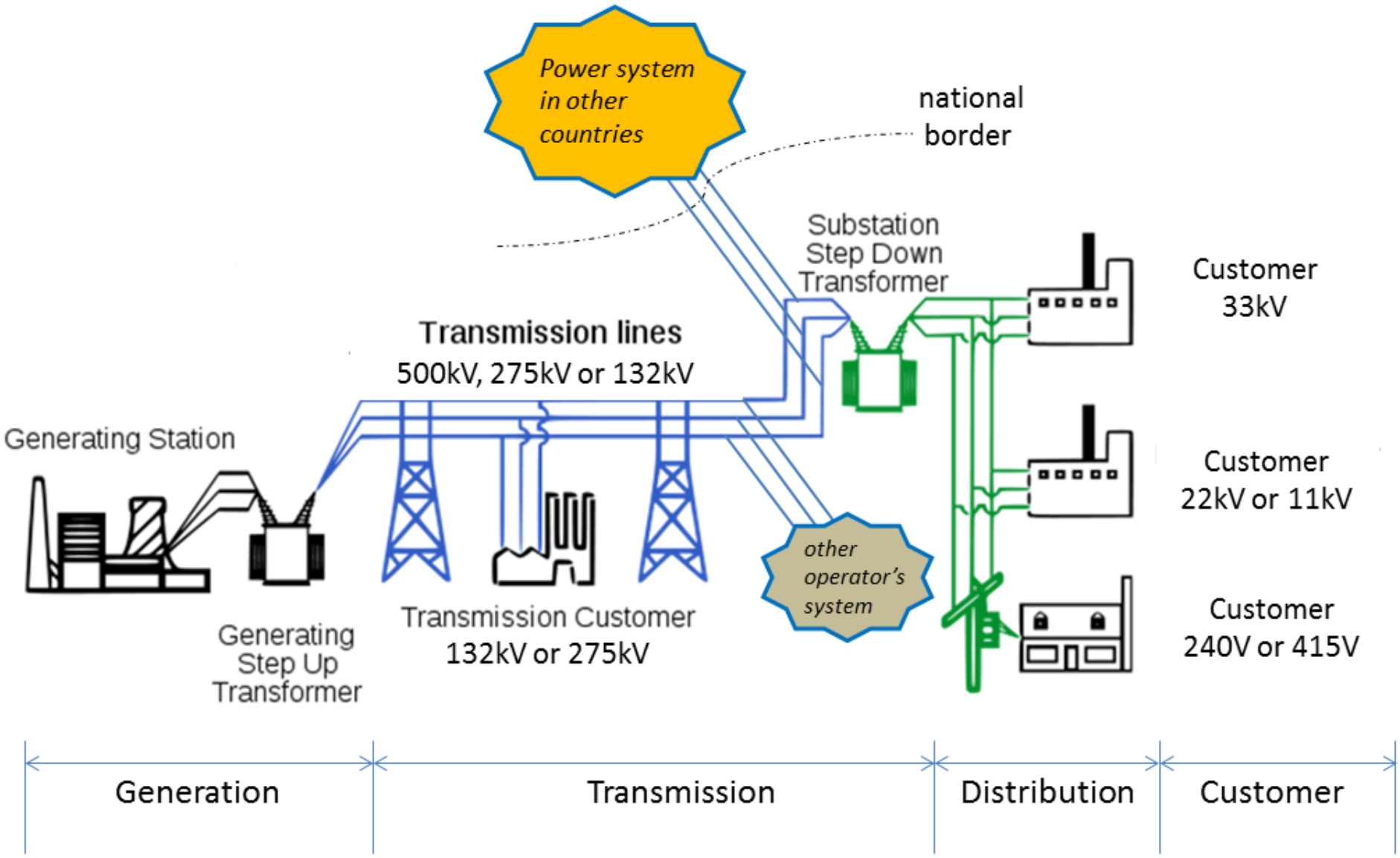
Suruhanjaya Tenaga

The Malaysian Grid Code Awareness Programme Funded by Akaun Amanah Industri Bekalan Elektrik (AAIBE)

Peninsular Malaysia National Grid

- ✓ Generators 130 (25 Stations)
- ✓ Transmission Lines 20,000 circuit.km
- ✓ Underground Cables 900 circuit.km
- ✓ Substations 400

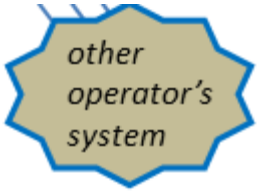
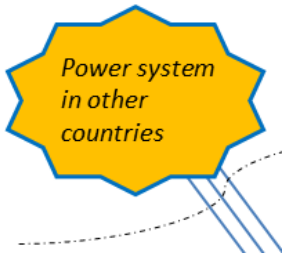
Compositions of grid system



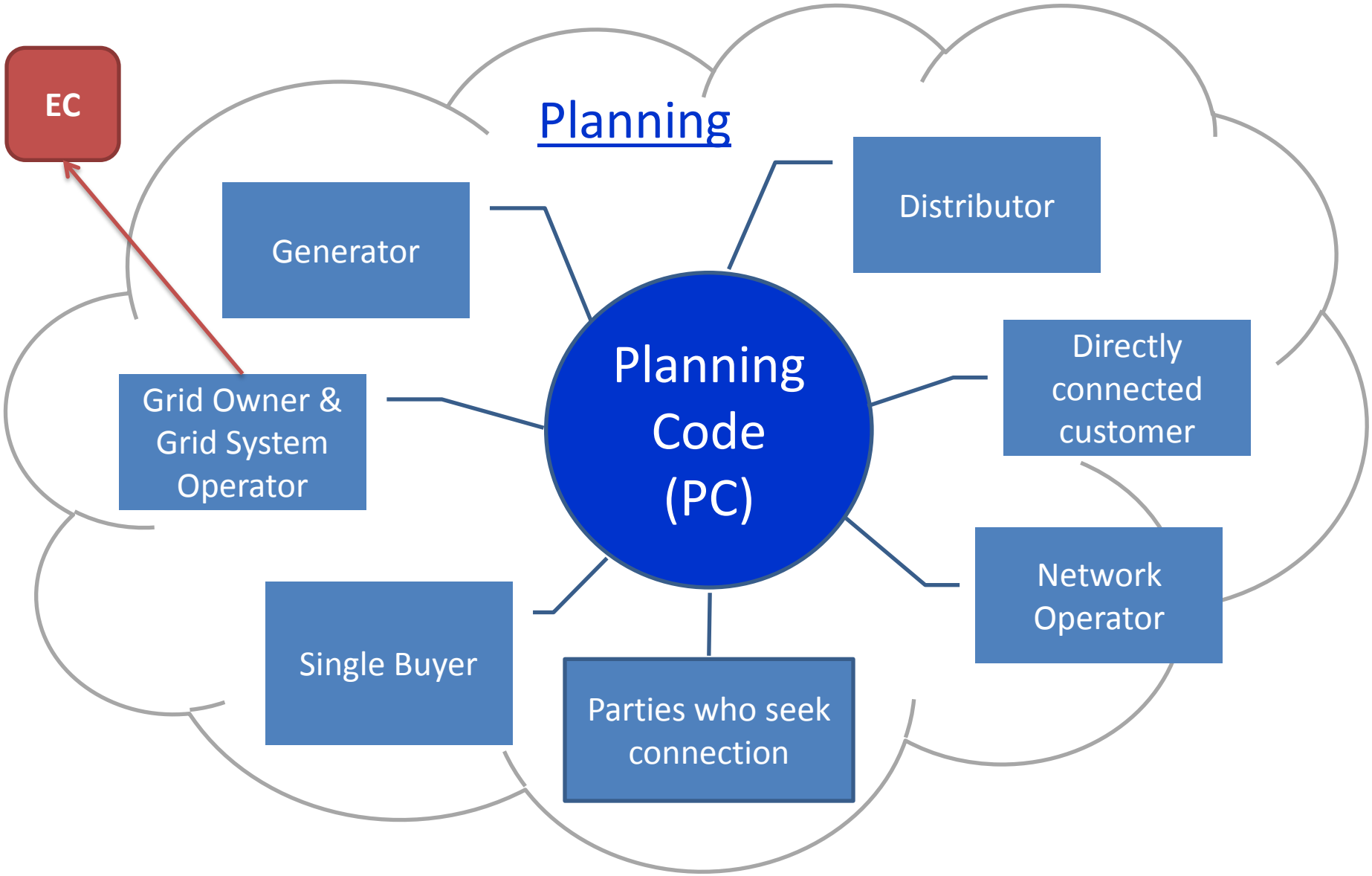
Users of the grid system

Installations	Users
 Generation	Generator
 Transmission	Grid Owner Grid System Operator Single Buyer
 Distribution	Distributor

Users of the grid system (continued)

Installations	Users
 Transmission customer	Directly Connected Customers
	Network Operators
	External Parties
X Anybody	Parties who seek connection to the grid system or User's system

PC – Scope and Applicability



“Planning” refers to:-

Planning is assessment of requirement for network reinforcement due to:

- Changes of electricity demand
- Extension or modification on User’s system
- Introduction of new connection or changes on existing connection
- Combination of the above

The Planning Code (PC) specifies the technical and design criteria and procedures to be applied by the Grid Owner in the planning. PC is Part IV of the Malaysian Grid Code

Contents of the PC

PC1 Introduction
PC2 Objectives
PC3 Scope
PC4 Development Of The Grid System And Applicable Standards
PC5 The Planning Process
- PC5.0 General
- PC5.1 Demand (Load) Forecasting
- PC5.2 Generation Adequacy Planning
- PC5.3 Transmission Adequacy Planning

PC6 Connection Planning
PC7 Data Requirements
- PC7.0 General
- PC7.1 User Data
- PC7.2 Preliminary Project Data
- PC7.3 Committed Project Data
- PC7.4 Contracted Project Data

Planning Code Appendix A

PC1: Introduction

The introduction state to preempt the following:

- PC specifies technical design criteria and procedures to be applied by the Grid Owner (GO)in the planning & development of the Grid System (GS).
  - It details information to be supplied by Users to GO and certain information to be supplied by GO to Users
- PC also specifies procedures by GO for Demand Forecasting, Generation Adequacy Planning & Transmission Adequacy Planning
- Emphasises on the required lead time of planning & development of GS and therefore requirements on timescales for exchange of information while respecting its confidentiality.

P1.1.4 & P1.1.6 : Grid Owner

In Peninsular Malaysia TNB is the Grid Owner (GO) who is the entity entrusted to carry out the transmission functions.

TNB Transmission Div can be viewed to consist three distinct functions, namely: Grid System Operator (GSO), the Transmission Asset Development and Operation & Maintenance.

Grid Owner (GO) is entrusted to plan and develop the Grid System in order to maintain adequate grid capacity

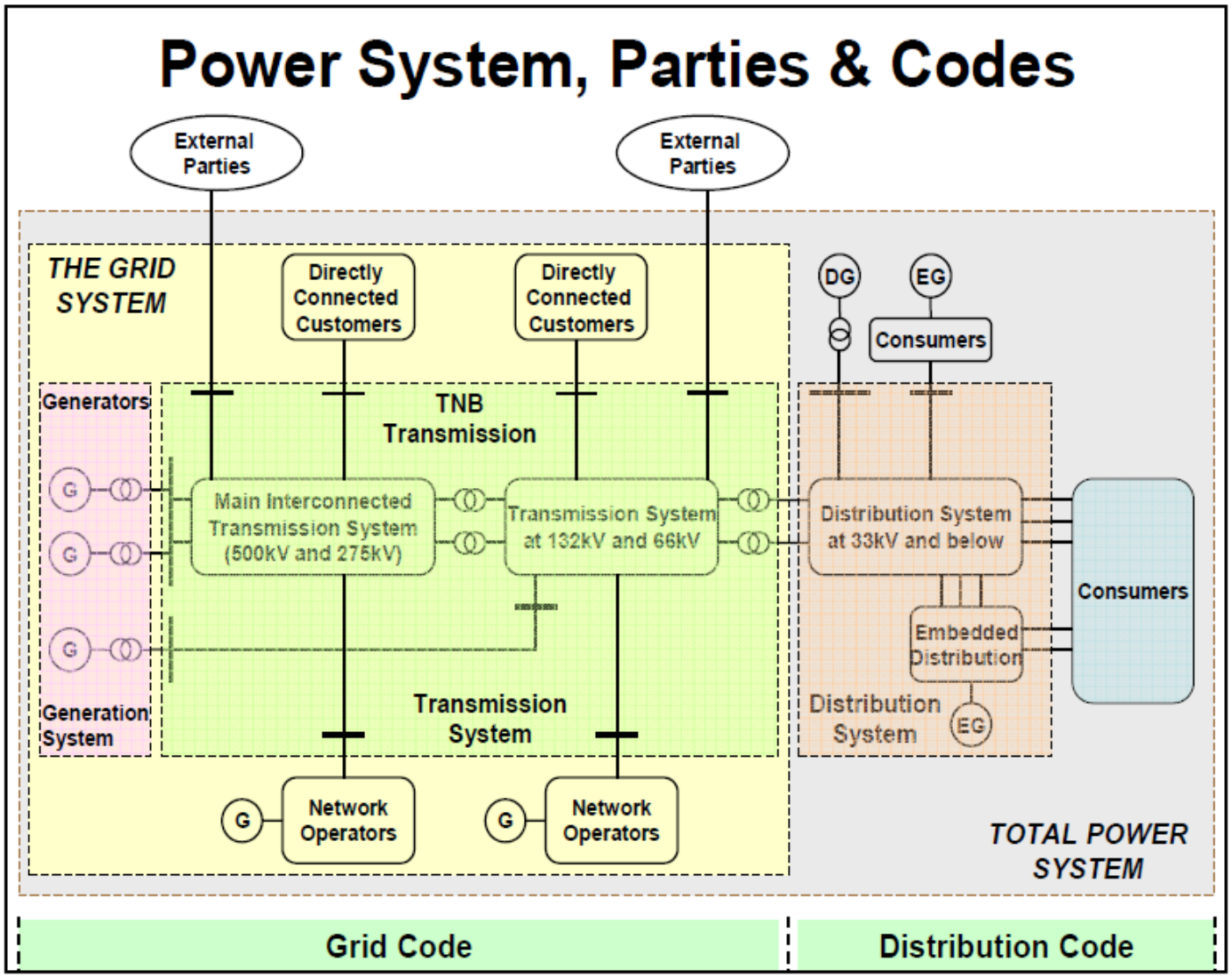
PC2: Objectives of PC

1. to promote interaction between the GO and Users w.r.t. any development that may impact the Grid System;
2. to provide for the supply of information required by the GO from Users; and to provide for the supply of certain information from the GO to Users and from Users to the GO in relation to short circuit current;
3. to specify the Licence Standards used by the GO;
4. to provide for the supply of information by the GO required by the EC for future generation adequacy and capacity requirements; and
5. to provide sufficient information to the EC on optimal points for connection to the Grid System.

PC3: Scope of PC

1. PC applies to GO, GSO, Single Buyer (SB) and the following Users:
    1. Generators
    2. Distributors
    3. Network Operators
    4. Directly Connected Customers, and
    5. Parties seeking connection to the Transmission System or on to a User System.
2. Users will be bound by the PC prior to them generating, supplying or consuming electric energy to or from the Grid;
3. It is User's responsibility to inform the GO and SB of all changes to information and supply of all required info in accordance with requirement of the PC

Parties in Grid Code



PC3: Scope of PC (continued)

4. Embedded Power Station may be required to provide information to GO
5. Users and appropriate Government Agencies to provide information required by the GO to enable the preparation of the calculation of future generation adequacy and capacity requirements
6. GO shall take into account of existing and new cross-border interconnections in planning the development of the system and in the calculation of generation adequacy and capacity requirements.

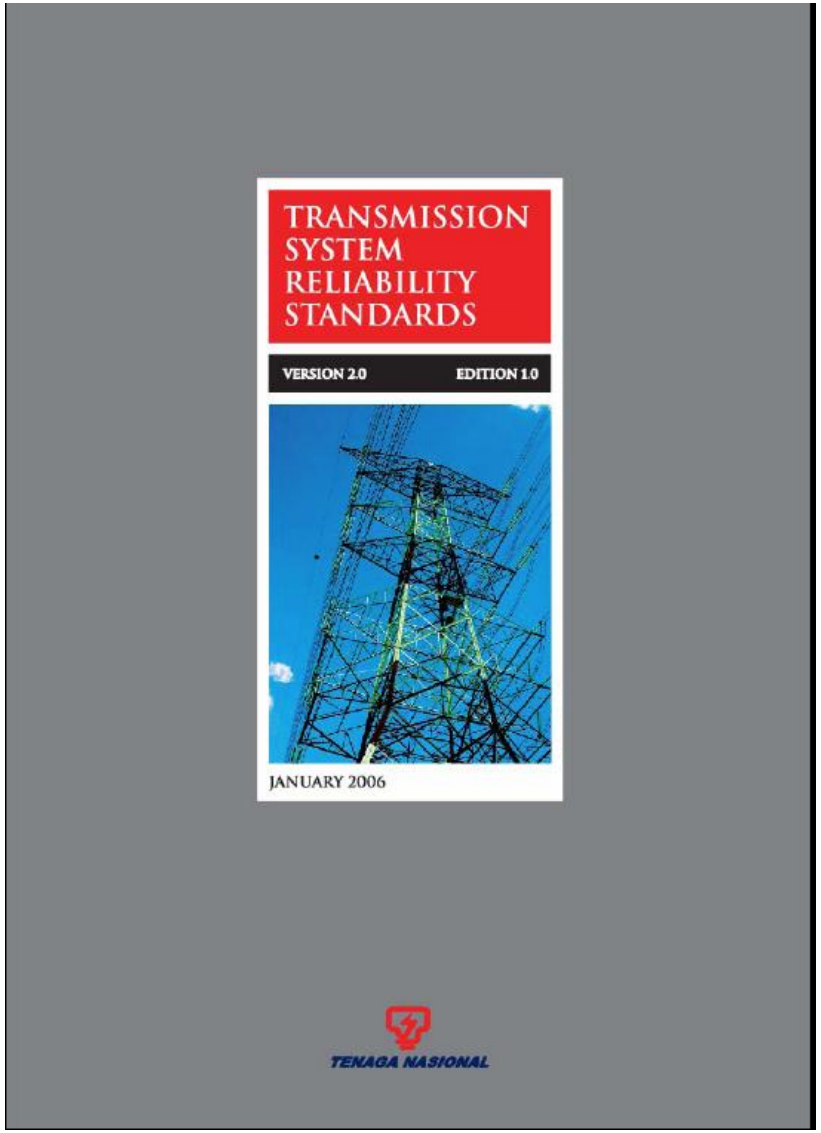
PC4: Development Of The Grid System And Applicable Standards

- Compliant with the Licence Standards relevant to planning, connection to and development of the Grid System
- Requirement to Submit System Development Statement
- Compliant with Connection Requirements

Compliant with the Licence Standards

1. The GO applies the Licence Standards for planning, connection to and development of the Grid System.
2. Potential Users may request connection, which are lower or higher connection requirements than implied by the Standards; GO may refuse the below Standards application.
3. Users are also required to comply with the Licence Standards relevant to planning, connection to and development of the Grid System, in the development of their own Power Stations, Distribution Systems and User Networks.

GO's Licence Standards – cover page



GO's Licence Standards – TOC

TRANSMISSION SYSTEM RELIABILITY STANDARDS

CHAPTER 1: INTRODUCTION

1.1 GENERAL

1.2 APPLICATIONS AND OBJECTIVES OF THE STANDARDS

1.3 SCOPE

CHAPTER 2: GENERATION RELIABILITY STANDARD

2.1 GENERATION PLANNING SECURITY CRITERIA

2.2 REQUIREMENTS ASSOCIATED WITH LOSS OF POWER INFEED

2.3 GENERATION CONNECTION CRITERIA

- 2.3.1 General Generation Connection Requirements
- 2.3.2 Planning Criteria for Generation Connections
- 2.3.3 Operational Criteria for Generation Connections

GO's Licence Standards – TOC (cont'd)

GO's Licence Standards – TOC (cont'd)

Requirement to Submit System Development Statement

1. The GO is to produce Annual System Development to cover succeeding 10 years;
2. To state opportunities available for connections and further use of the Transmission System;
3. To take into account all the developments planned;
4. To include the necessary information to enable the EC to identify and evaluate the opportunities for connections.

Content of System Development Statement

1. Grid System and background to system development;
2. Aggregated load forecast;
3. Generation Plant capacity developments including existing and Licenced plant and plant under construction;
4. Generating Plant capacity requirements for compliance with Generation Reliability Standard;
5. Existing and planned transmission developments including the requirements for equipment replacement and technology upgradation;

Content of System Development Statement (cont'd)

6. Transmission System capability including load flows and system fault levels;
7. Transmission System performance information including frequency and voltage excursions and fault statistics; and
8. Commentary indicating those parts of the Transmission System considered most suited to new connections and transport of further quantities of electricity.

Annual System Development is for the purpose to enable the EC to identify and evaluate the opportunities for connections.

PC5: The Planning Process

General

1. GO prepares 10-year system development plan;
2. Users submit required planning data by September each year;
3. Users are responsible for the accuracy of the data;
4. Users submit data for connection studies;
5. GO provides information on short-circuit level;

PC5: The Planning Process

PC5.1 : Demand Forecasting

1. Users and Distributors have the primary responsibility to forecast for consumers demand and energy;

2. GO takes into account inputs from Users and Distributors to establish Peninsular Forecast for use in:
   i. Generation Development Plan
   ii. Transmission Development Plan

3. Users and Distributors have responsibility to notify GO of any material changes to their forecast at the end of September and March each year

PC5: The Planning Process

Generation Adequacy Planning

1. The GO annually calculate the generation adequacy and capacity requirements for the next 10 years and to notify EC in the Generation Development Plan;

2. Apply Generation Reliability Criteria in the Licence Standards;

3. GO to take into account factors including:
   i. Forecast
   ii. Existing generation schedule outage, forced outage rate, maintenance programme
   iii. Committed plant, Contract with external parties by SB
   iv. Economic growth, Government fuel energy policy, etc.

4. Size of generating units and impacts on the Grid System

PC5: The Planning Process

Transmission Adequacy Planning

1. The GO to apply the Licence Standards in the planning and development of the Transmission System;

2. The GO to report the compliance of the Transmission System with the Licence Standards on an annual basis to the EC in a Transmission Development Plan;

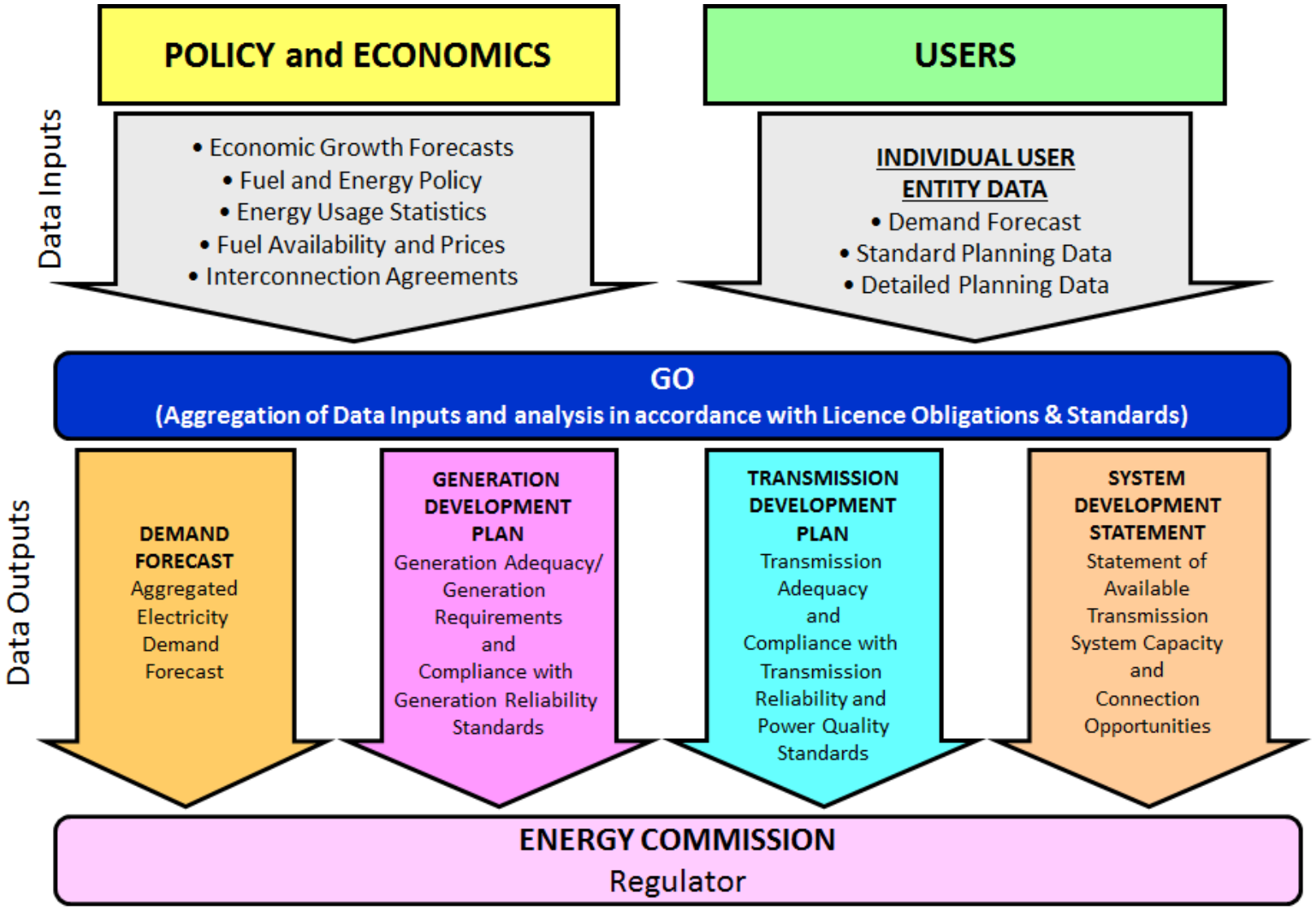
3. Each User to also report the compliance of their User Networks with the appropriate Licence Standards on an annual basis to the EC and GO;

Connection Planning

PC6: Connection Planning

1. On receipt of an application for connection to the GO will undertake the necessary studies to enable an offer of connection to be made by the Single Buyer;
2. May require extensive studies;
3. Requirements to provide:
   i. Preliminary data
   ii. Detailed information etc.

Summary of Planning Process, input & output



PC7: Data Requirements

Categories of planning data

	Standard Planning Data		Detailed Planning Data	
Preliminary Project Data • Submitted DURING application • confidential	Estimated Registered Data	Forecast Data	Estimated Registered Data	Forecast Data
Committed Project Data • Submitted once Agreement accepted • no longer confidential	Estimated Registered Data	Forecast Data	Estimated Registered Data	Forecast Data
Contracted Project Data • Submitted after commissioning • not confidential	Registered & Estimated Registered Data	Forecast Data	Registered & Estimated Registered Data	Forecast Data

Registered & Estimated Registered Data is data on User assets
Forecast Data is data on User loads or system

List of Data to be Submitted

Standard Planning Data\Registered & Estimated Registered Data (summarised)

No.	List of data to be submitted	List of Users to submit	Ref in the MGC
1.	Connection point and User system data	NO, DCC, PSC, G	PCA.2
2.	Generating unit data	NO, DCC, PSC, G	PCA.3
3.	Demand (MW) and energy (kWh) data	NO, DCC, PSC, D	PCA.4
4.	Generating unit data	NO, DCC, PSC, G	PCA.5
5.	User's system data	NO, DCC, PSC, External Interconnection	PCA.6

NO = Network Operator	DCC = Directly Connected Customer	PSC = Parties who seek new connection	G = Generator	D = Distributor	GO = Grid owner

List of Data to be Submitted

Standard Planning Data\Registered & Estimated Registered Data (itemised)

	Ref	List of Data to be submitted	List of User to submit
1.	PCA.2.2.1	Single line diagram (SLD)	NO, DCC, PSC, G
2.	PCA.2.2.4	(Related to the SLD)	NO, DCC, PSC, G
3.	PCA.2.2.5	(Related to the SLD)	NO, DCC, PSC, G
4.	PCA.2.2.6	(Related to the SLD)	NO, DCC, PSC, G
5.	PCA.2.3.1	Lumped shunt susceptance of User system	NO, DCC, PSC, G
6.	PCA.2.4.1	Reactive compensation equipment	NO, DCC, PSC, G
7.	PCA.3.2.2(a)	Registered capacity (MW)	NO, DCC, PSC, G
8.	PCA.3.2.2(c)	System constrained capacity (MW)	NO, DCC, PSC, G
9.	PCA.3.2.2(d)	Minimum stable generation (MW)	NO, DCC, PSC, G

List of Data to be Submitted

Standard Planning Data\Registered & Estimated Registered Data (itemised)

	Ref	List of Data to be submitted	List of User to submit
10.	PCA.3.2.2(e)	MW obtainable in excess of Registered capacity	NO, DCC, PSC, G
11.	PCA.3.2.2(f)	Generating unit performance chart	NO, DCC, PSC, G
12.	PCA.3.2.2(g)	CCGT units in CCGT modules	NO, DCC, PSC, G
13 .	PCA.3.2.2(j)	External Interconnection	Single Buyer
14 .	PCA.3.2.2(k)	Centrally dispatch generating units	PSC, G
15 .	PCA.3.4.1	Point of connection to Transmission System	NO, DCC, PSC, G
16 .	PCA.3.4.2	Generating unit excitation system	NO, DCC, PSC, G
17 .	PCA.4.5(a)(i)	Load transfer capability; 1st outage – alternative connection point	NO, DCC, PSC, D

List of Data to be Submitted

Standard Planning Data\Registered & Estimated Registered Data (itemised)

	Ref	List of Data to be submitted	List of User to submit
18 .	PCA.4.5(a)(iii)	Load transfer capability; 1st outage – manual or automatic	NO, DCC, PSC, D
19 .	PCA.4.5(b)(i)	Load transfer capability; 2ndoutage – alternative connection point	NO, DCC, PSC, D
20 .	PCA.4.5(b)(iii)	Load transfer capability; 2nd outage – manual or automatic	NO, DCC, PSC, D
21 .	PCA.5.3.1	Generating unit parameters	NO, DCC, PSC, G
22 .	PCA.6.2	Transient overvoltage assessment data	NO, DCC, PSC, G
23 .	PCA.6.3	HVDC and power electronic devices	NO, DCC, PSC, External Interconnection

List of Data to be Submitted

Standard Planning Data\Forecast Data (summarised)

No.	List data to be submitted	List of Users to submit	Ref in the MGC
1.	Generating unit data	NO, DCC, PSC, G	PCA.3
2.	Demand (MW) and energy (kWh) data	NO, DCC, PSC, D	PCA.4
3.	Generating unit data	NO, DCC, PSC, G	PCA.5

NO = Network Operator	DCC = Directly Connected Customer	PSC = Parties who seek new connection	G = Generator	D = Distributor	GO = Grid owner

List of Data to be Submitted

Standard Planning Data\Forecast Data (itemised)

	Ref	List of Data to be submitted	User to submit
1.	PCA.3.2.2(b)	Output (MW) on a monthly basis	NO, DCC, PSC, G
2.	PCA.3.2.2(h)	Mode (regime) of running (of generating units)	NO, DCC, PSC, G
3.	PCA.3.2.2(i)	Output (MW) profile of generating units	NO, DCC, PSC, G
4.	PCA.3.2.2(j)	MW import/export via external interconnection	Single Buyer
5.	PCA.4.2.1	MW and MWh; daily load profile	NO, DCC, PSC, D
6.	PCA.4.2.3	(Related to the MW and MWh daily load profile)	NO, DCC, PSC, D
7.	PCA.4.3.1	Forecast of maximum demand MW and power factor	NO, DCC, PSC, D
8.	PCA.4.3.2	(Related to the forecast of maximum demand MW and power factor)	NO, DCC, PSC, D

List of Data to be Submitted

Standard Planning Data\Forecast Data (itemised)

	Ref	List of Data to be submitted	List of User to submit
10.	PCA.4.3.4	(Related to the forecast of maximum demand MW and power factor)	NO, DCC, PSC, D
11.	PCA.4.3.5	(Related to the forecast of maximum demand MW and power factor)	NO, DCC, PSC, D
12.	PCA.4.5(a)(ii)	Load transfer via alternative connection point under 1st outage	NO, DCC, PSC, D
13 .	PCA.4.5(b)(ii)	Load transfer via alternative connection point under 2nd outage	NO, DCC, PSC, D
15 .	PCA.5.2.1	Power station local load	NO, DCC, PSC, G
16 .	PCA.5.2.2	Power station local load	NO, DCC, PSC, G

List of Data to be Submitted

Standard Planning Data\Registered & Estimated Registered Data (summarised)

No.	Types of data to be submitted	List of Users to submit	Ref in the MGC
1.	Generating unit connection; directly or embedded	NO, DCC, PSC, G	PCA.5.1.1, PCA.5.1.2
2.	Power station local load	NO, DCC, PSC, G	PCA.5.2
3.	Synchronous machine and associated control system data	NO, DCC, PSC, G	PCA.5.3
4.	User's protection data	NO, DCC, PSC, G	PCA.6.4
5.	Harmonic studies	NO, DCC, PSC, G	PCA.6.5
6.	Voltage assessment studies (including voltage unbalance)	NO, DCC, PSC, G	PCA.6.6
7.	Short circuit analysis	NO, DCC, PSC, G	PCA.6.7
8.	Additional data for new types of power stations and configurations	NO, DCC, PSC, G	PCA.7

Grid Owner/GSO Data

(summarised)

No.	Types of data to be submitted	Ref in the MGC
1.	Single point of connection to User system	PCA.8.1
2.	Multiple points of connection to User system	PCA.8.2
3.	Data items on system operating conditions (e.g. symmetrical 3 phase short circuit current, source impedance, pre-fault voltage, etc)	PCA.8.3
4.	Typical single line diagram for connection – Generation spur connection	Planning Data Requirement Part 3 – Appendix B
5.	Typical single line diagram for connection – Generation loop-in-loop-out connection	Planning Data Requirement Part 3 – Appendix B
6.	Typical single line diagram for connection – Generation network connection	Planning Data Requirement Part 3 – Appendix B

THANK YOU

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