Planning and Connection Codes

For Sabah and Labuan Grid Codes

16 June 2014

KeTTHA
KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

SuruhanjayaTenaga

Sabah dan Labuan Grid Code Awareness Programme Funded by Akaun Amanah Industri Bekalan Elektrik (AAIBE)

Objectives

- To give awareness about the Sabah & Labuan Grid Codes.
- To understand the Electricity Supply Industry (ESI) structure of Sabah
- To facilitate cooperation within all grid participants to realized safe, reliable and economic operation of the grid system
- To understand compliance and derogation issues

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Planning Code

- The Planning Code (PC) specifies the requirements for the supply of information by **Users connected or** seeking connection to the **Power System.**
- It also specifies the technical and design criteria and procedures to be applied by the **Single Buyer and Network Operator in the planning and development of** a **Power System.**
- the PC establishes the requirements for the **Single Buyer to notify the GSO, RSOs and Network Planners of its proposals for future generation capacity through a "*Generation Master Plan*"** and for the **TNO Network Planner to notify of its proposals for future transmission development through** the "*Transmission Master Plan.*"

Development of a Power System

Its reinforcement or extension, will arise for a number of reasons :

(a) growth in **Demand for electricity from existing Consumers and the connection of** new **Consumers;**

(b) addition of new generating **Capacity, modification of existing generatingCapacity, or the removal of generation Capacity connected to a Power System**

by a **User;**

(c) development on a **User's Network already connected to the Power System;**

(d) introduction of a new **Connection Point or the modification of an existing**

Connection Point between a User's Network and a Power System;

(e) introduction of a new **Custody Transfer Point or the modification of an existing Custody Transfer Point between a User's Network and a Power System; and**

(f) the cumulative effect of a number of such developments referred to in (a), (b) or (c) by one or more **Users including the addition or removal of significant blocks** of **Demand.**

Scope

The PC applies to the **Single Buyer, the GSO, RSOs, Network Operators including IDNOs and to Users** which in the PC means;

(a) **Power Producers;**

(b) **Interconnected Parties; and**

(c) **Large Consumers.**

The PC applies to **Rural Networks and to those areas currently without a Network.**

PC-Responsibility

- It is the responsibility of each **User to keep the appropriate Network Planner and/or Single Buyer** informed of all changes, relating to the information requirements of the Planning Code.
- The production of the *Transmission Master Plan, referred to in PC5.1 is the responsibility of the* ***TNO who*** will coordinate the inputs from the **Users.**
- The production of the *Generation Master Plan referred to in PC5.2, is the responsibility of the* ***Single*** **Buyer.** All Users with a Power Station will submit their proposals, including any modifications that impact upon Power Station performance to the Single Buyer in accordance with the Planning Code.

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PC4- System Performance Characteristics

- PC4.1- frequency limits
- PC4.2.1- Voltage limits
- PC4.2.2- Transient voltage
- PC4.2.3- Voltage fluctuation and flicker
- PC 4.3-Harmonics
- PC 4.4- Protection
- PC4.5- publish system performance data

Frequency Limits

Table 4.1-1: Frequency Excursions

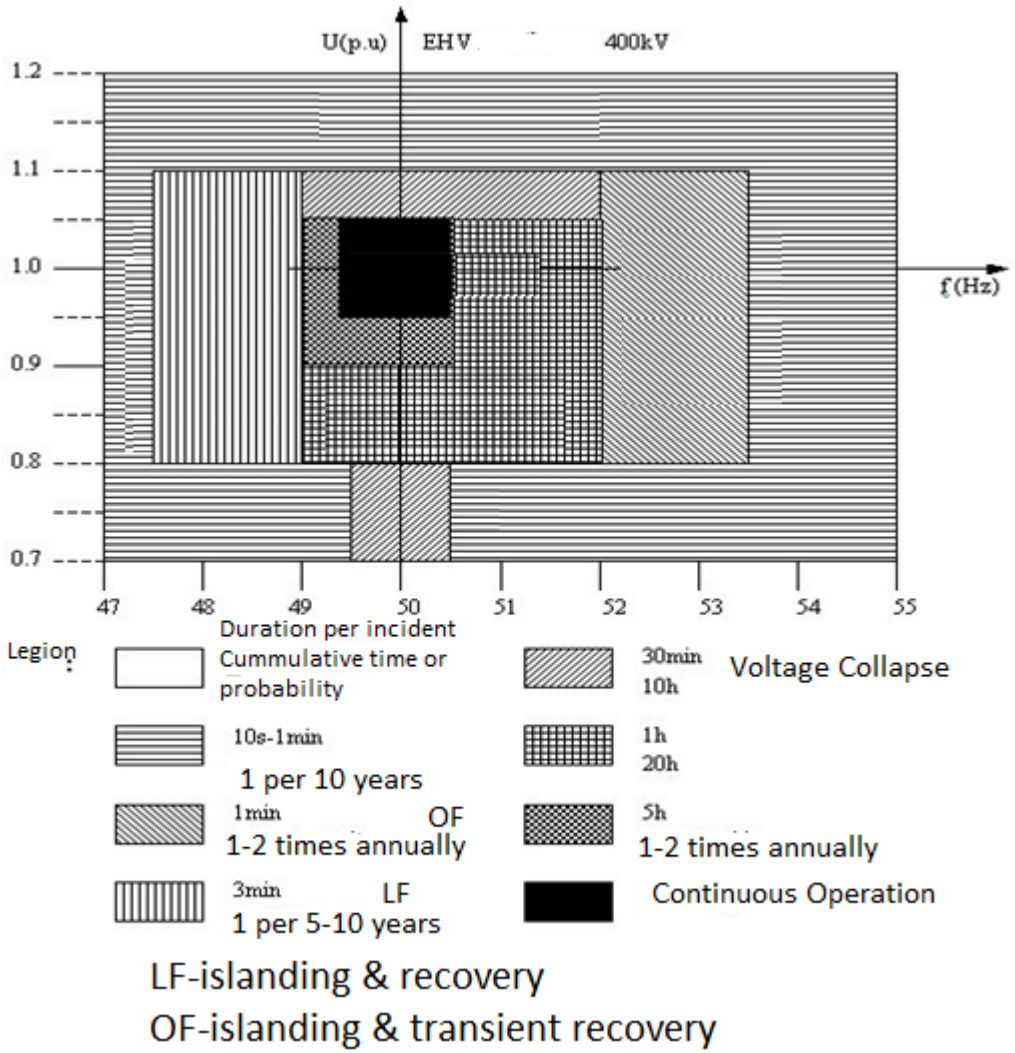
Under Normal Operating Conditions	49.5 Hz to 50.5 Hz
Under **System Stress** conditions	49.0 Hz to 51.0 Hz
Maximum operating band for frequency excursions under **System** fault conditions.	48.75 Hz to 51.25 Hz
Under extreme **System** fault conditions all sets should have disconnected by this frequency unless agreed otherwise in writing with the **Single Buyer**.	51.5 Hz or above and 47.5 Hz or below

Voltage Limits

Table 4.2-1: Voltage Excursions

Under Normal Operating Conditions	± 5% at **Transmission Network** nominal voltage of 500 kV ± 5% at **Transmission Network** nominal voltages of 275 kV, 132 kV and 66 kV ± 5% at **Network** nominal voltages of 33 kV and 11 kV + 10% and - 6% at **Network** nominal voltages of 400 V and 230 V
Under **System Stress** conditions following a **System** fault	± 10% at all **Power System** voltages, however in the case of the **Transmission Network**, this condition should not occur for more than 30 minutes.

Operation Boundary



Protection Criteria

PC4.4.1 Protection Criteria

Total fault clearance times include relay operation, circuit breaker operation, telecommunication signalling and local breaker back-up (stuck breaker back-up at same site). For the overhead line protection these times are:

(a) for the 500 kV lines, 5 cycles (100 ms);
(b) for the 275 kV lines, 6 to 7 cycles (120 to 140 ms);
(c) for the 132 kV lines, 6 to 7 cycles (120 to 140 ms); and
(d) for the 66 kV lines, 6 to 7 cycles (120 to 140 ms).

Transient Voltage

- The transient over-voltage during lightning strikes is typically experienced over a voltage range of ± 20% of nominal voltage. C**onnection Points close to a Network lightning** strike will experience voltages higher than this.

Transient Voltage Standards

Unless otherwise agreed in writing with the **Network Operator the basic insulation level** (BIL) for **User Apparatus shall be as follows:**

(a) at 275 kV voltage level, the BIL is 850 kV;

(b) at 132 kV voltage level, the BIL is 550 kV;

(c) at 66 kV voltage level, the BIL is 325 kV; and

(d) at 33 kV voltage level, the BIL is 170 kV.

PC5 ANNUAL PLANNING REQUIREMENTS(1)

PC5.1 TRANSMISSION MASTER PLAN

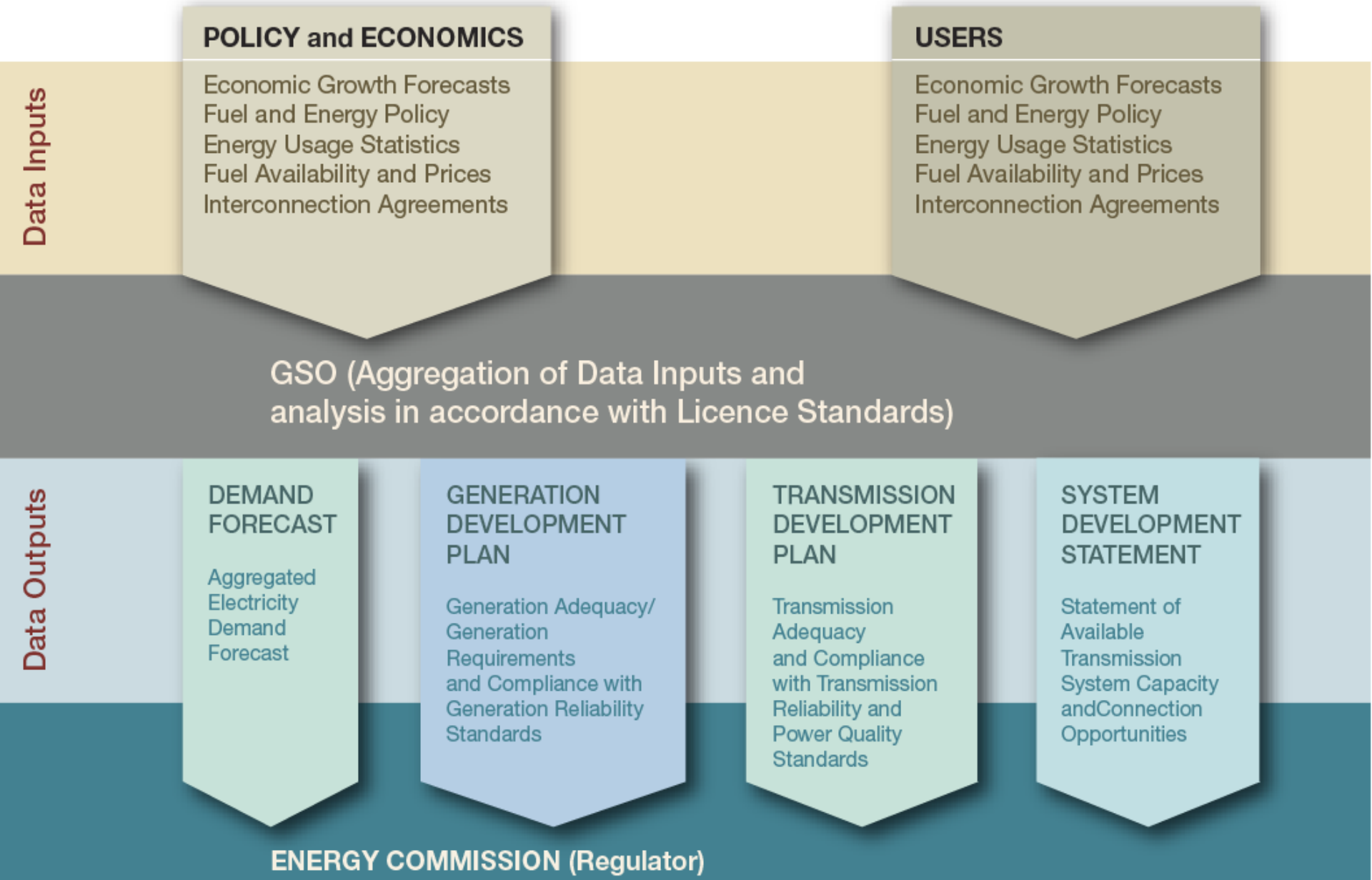
PC5.1.1 **TNO to Prepare**

i. Requirements on submission of data by users

ii. Non-routine requirements on submission of data by users

PC5.1.2 Transmission Network Planning Criteria

Inputs and Outputs of the Planning Process by the SB/GO/GSO



Transmission Master Plan

It *covers each of the five succeeding calendar years*

It shows the opportunities available for connecting to and using the **Transmission Network** indicating those parts most suited to new connections and the transport of additional quantities of electricity.

It *shall also include details of the development of the 33 kV* sub-transmission **Network along with the *Transmission Network and show where new* Connection Points or reinforcement to existing Connection Points are required between** the **Transmission Network and Distribution Network.**

This should include details of future substation sites that require land to be obtained and outline planning permission obtained, for the time when the **Network loading justifies the necessary reinforcement.**

PC5 ANNUAL PLANNING REQUIREMENTS(2)

PC5.2 GENERATION MASTER PLAN

- PC5.2.1 Single Buyer to Prepare
- PC5.2.2 Generation Capacity Planning Criteria

Single Buyer to Prepare (1)

The **Single Buyer** will prepare and publish in accordance with the requirements of this Planning Code, a **Generation Master Plan**, being primarily a generation **Capacity plan, by** the end of December annually providing in respect of the 5 succeeding calendar years the following information:

(a) projections of the seasonal maximum and minimum **Demand for** electricity in the Sabah and Labuan **Power Systems and the** corresponding **Energy requirements for each year across the study** period ;

(b) the amount and nature of generation Capacity currently available to meet that **Demand** on each Power System and any anticipated restrictions in the production of **Energy, the amount and nature of** generation that it expects will be out of service for more than one year (identifying whether such capacity will be temporarily or permanently out of service) and generation under construction;

Single Buyer to Prepare (2)

(c) the amount and nature of **Demand** that can be met across Interconnectors to power systems external to Sabah and Labuan;

(d) the amount and nature of generation **Capacity it expects will be required** to ensure that generating security standards are achieved;

(e) general details of its current plans for securing that additional **Capacity; &**

(f) plans for the reinforcement of the Rural Networks and electrification of the remaining rural areas not yet electrified, which shall combine generation and **Network planning.**

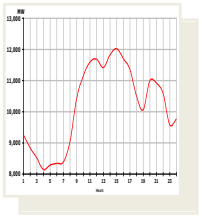
SYSTEM PLANNING PROCESS - Development Plans & Operation Plans

PROCESS

OUTPUT

Existing Network

- Substation Load
- Transmission Parameters
- Generator Data
- Capacity Addition
- Load Forecast



System Analyses

- Load flow Simulations
- Short Circuit Analysis
- Stability Analysis

Systems Information

- Transmission Line Loading
- Transformer Loading
- Bus Voltage Profile
- Fault Level
- Sys. Response to Disturbance

Breach Planning Criteria? V,I, P N-1

GRID CODE

Systems Improvement

- *New Generation*
- *Transmission Line Reinforcement*
- *New Line Addition*
- *Substation Expansion*
- *New Substation*
- *Capacitor/Reactor Allocation*
- *Network Reconfiguration*

Systems Security

- *Operational Plans*
- *Contingency Plans*
- *Special Protection Scheme*
- *Monitoring & Control software*

New Projects

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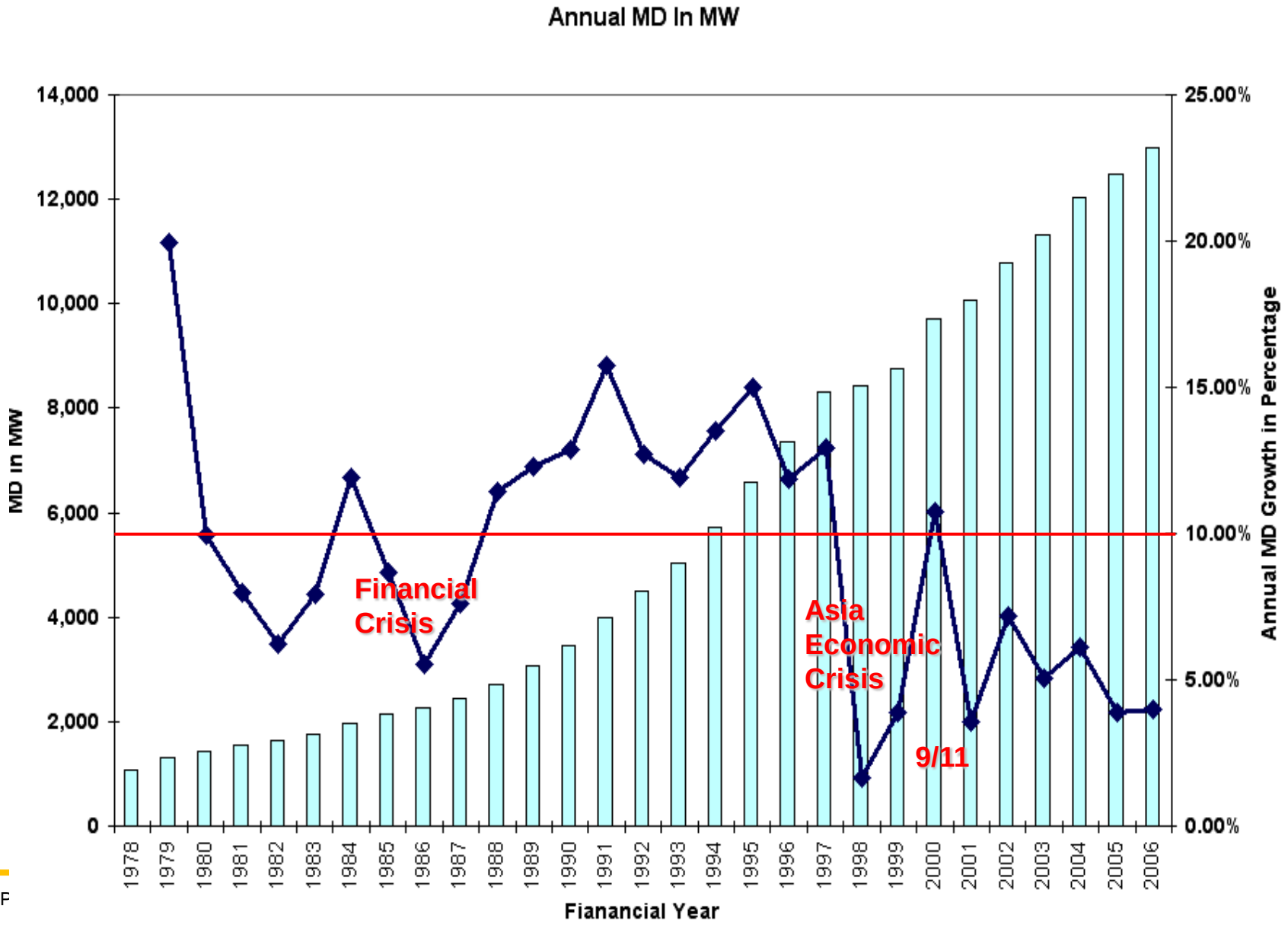
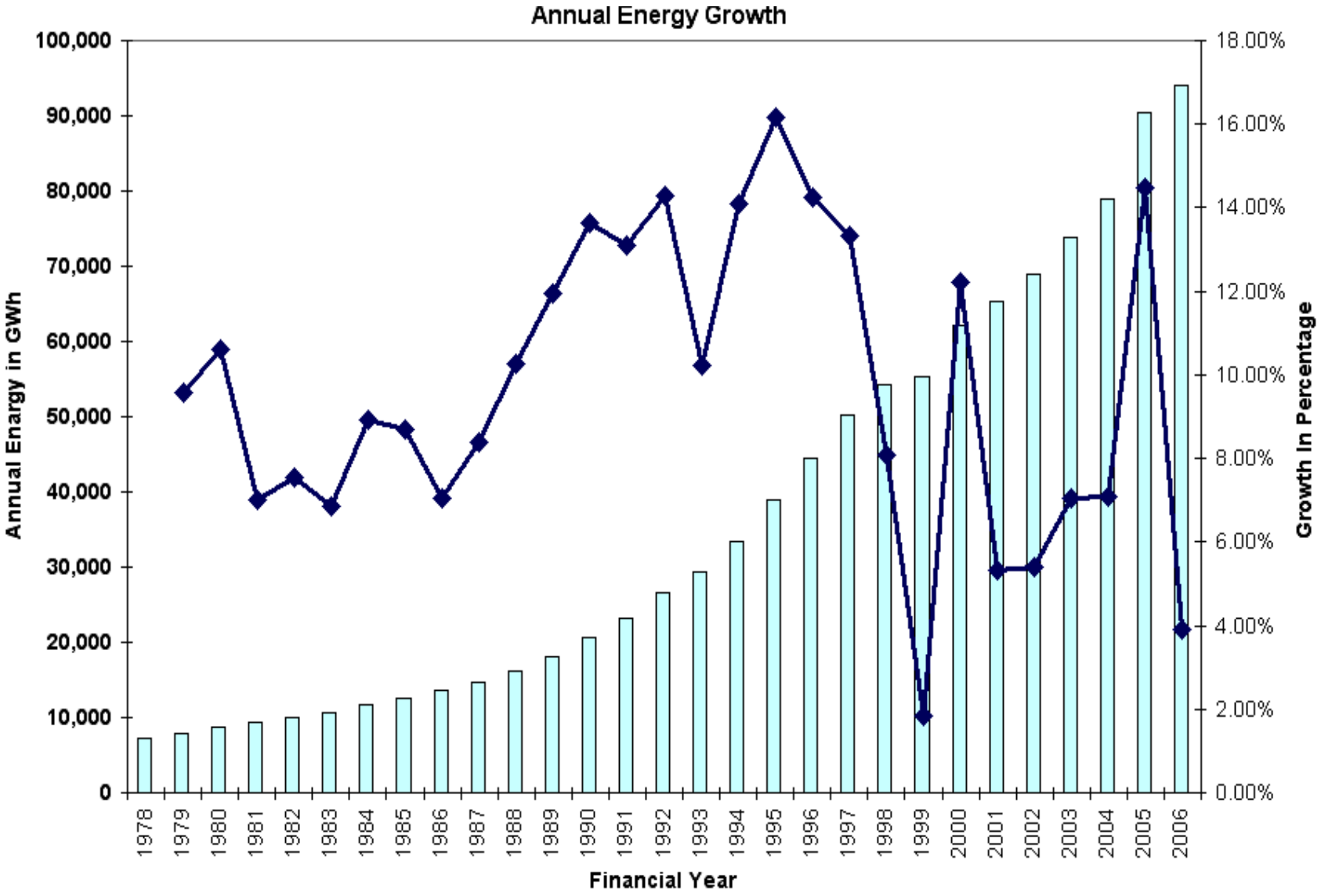
Maximum Demand Growth (FY1978 - FY2006)



Annual Energy Growth (FY1978 - FY2006)



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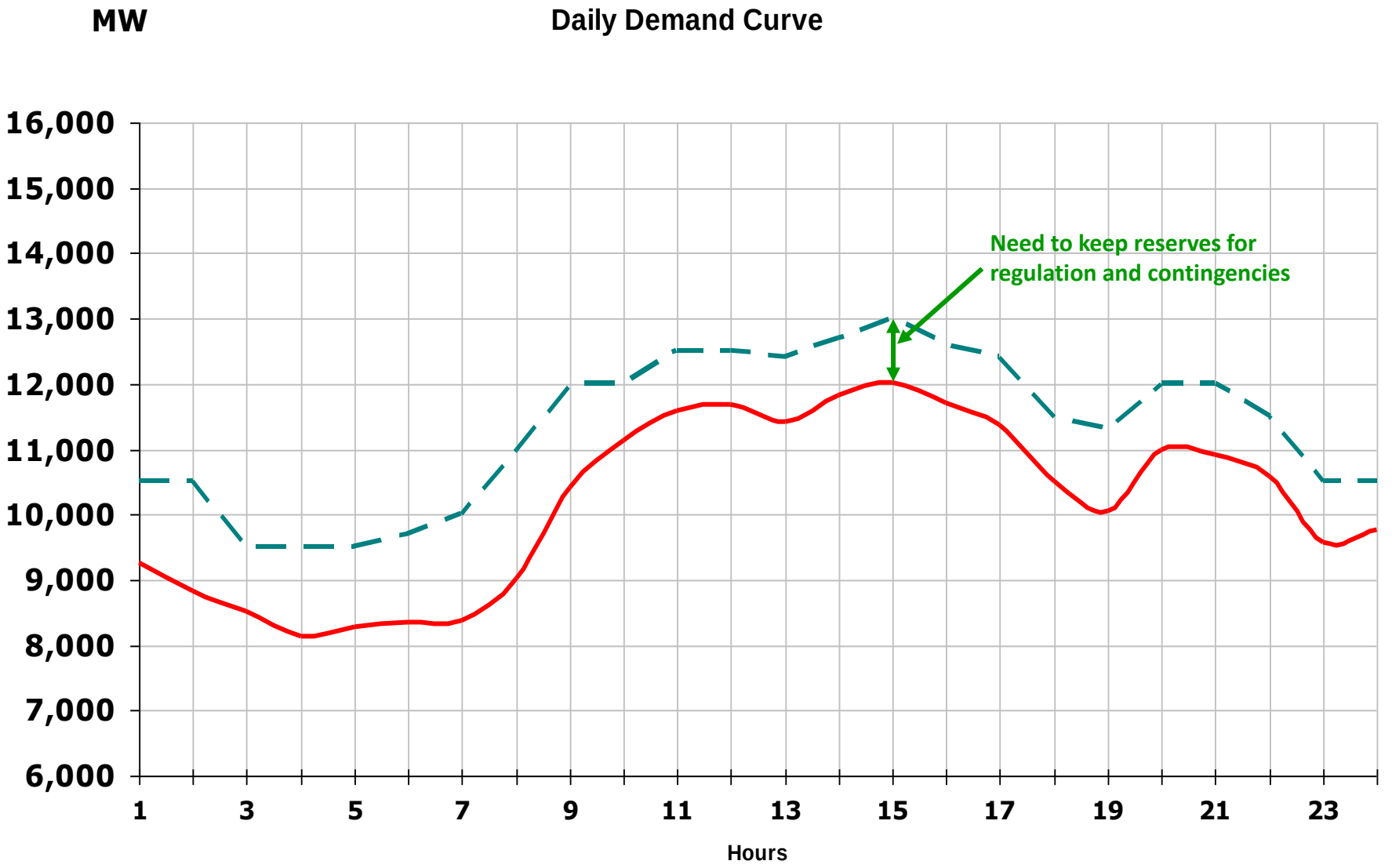
Generation Reserves



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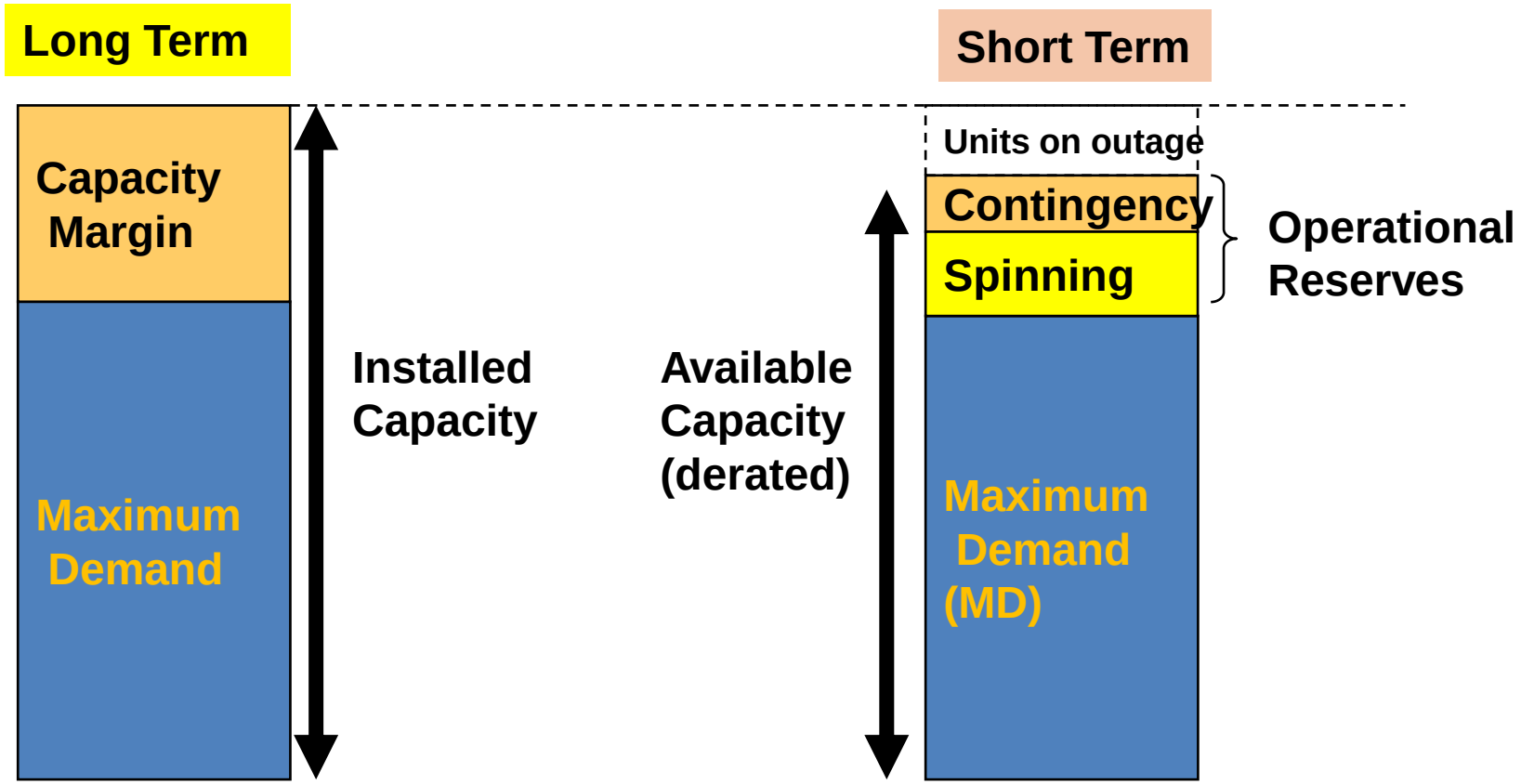
Generation Reserves Requirement



Capacity Margin =

$$\frac{\text{Installed Capacity} - \text{Max. Demand}}{\text{Max. Demand}}$$

Which consideration is for adequacy?
Which consideration is for security? And which aspect of security?
What is the difference between Installed and Available Capacity?

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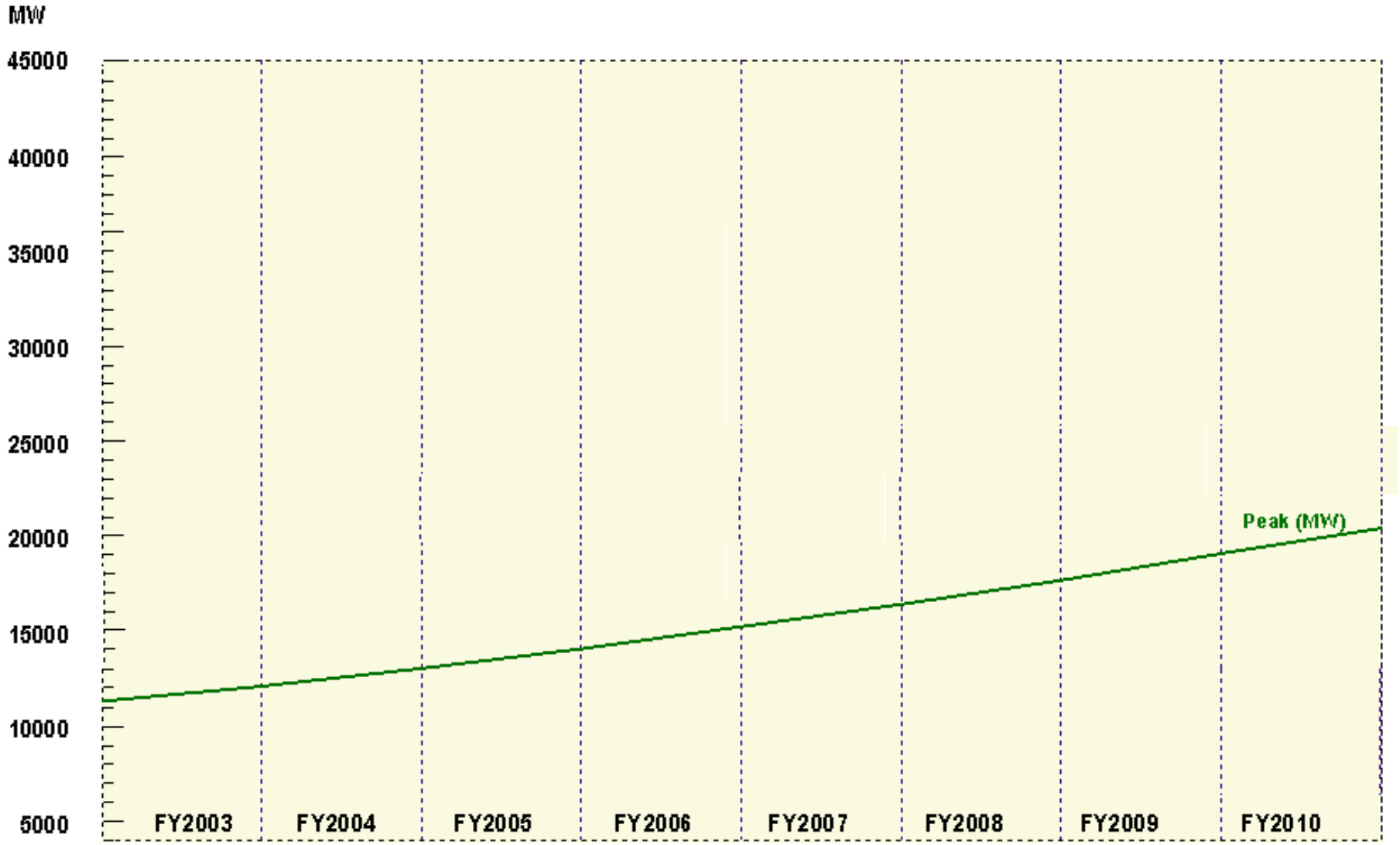
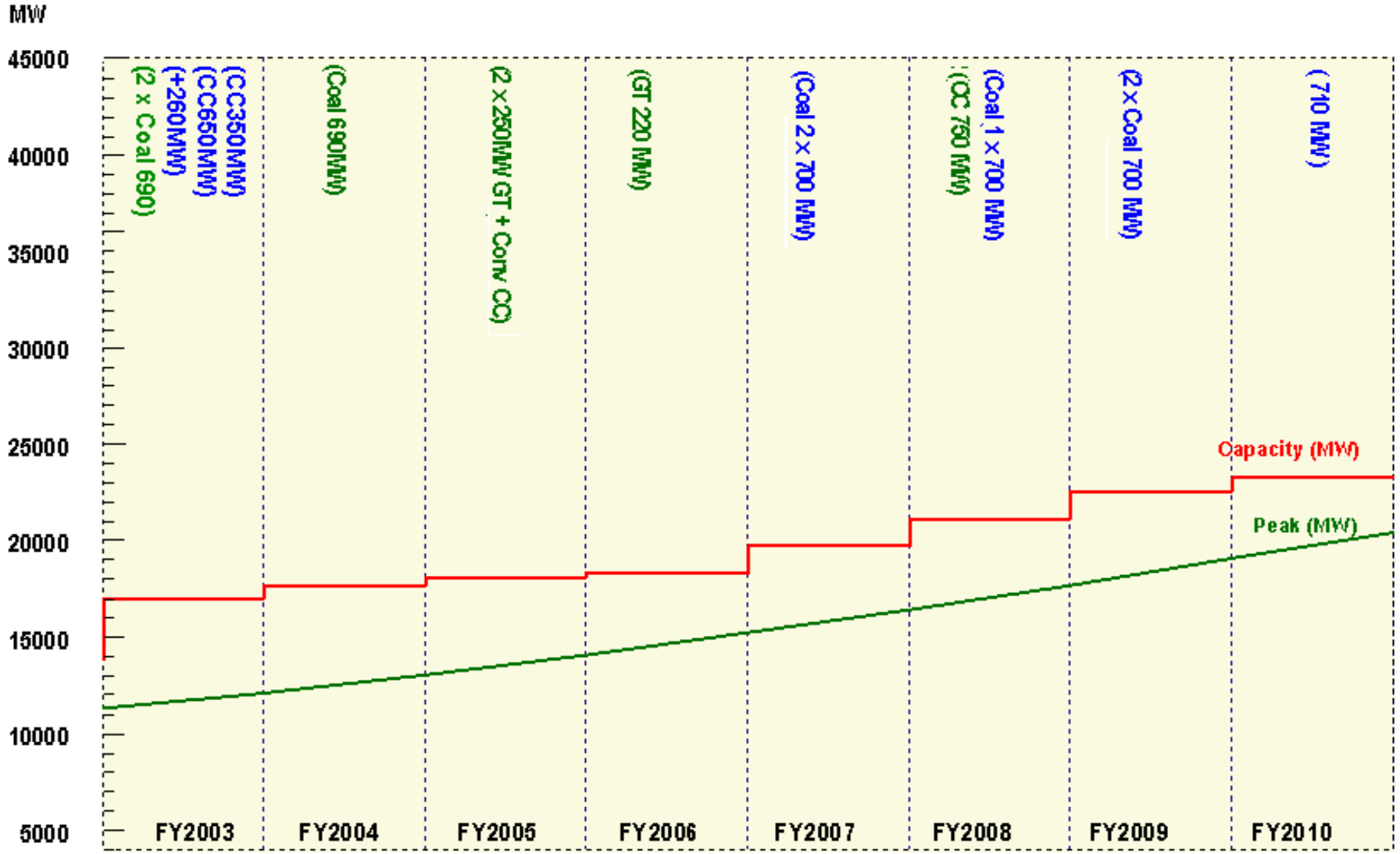
Generation Plant-up Plan (Stage 1)



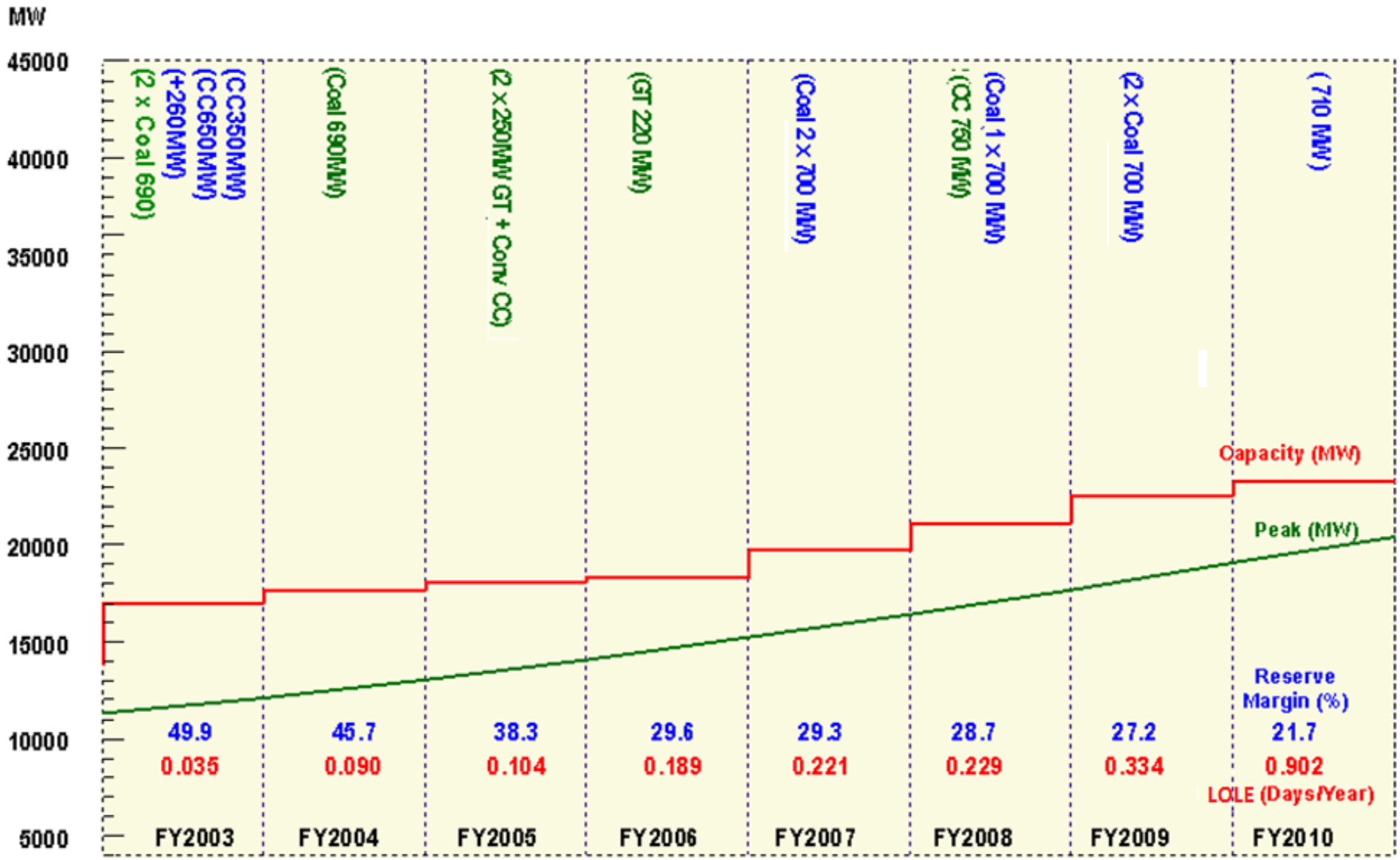
Based on February 2004 Demand Forecast

Generation Plant-up Plan (Stage 2)



Based on February 2004 Demand Forecast

Generation Plant-up Plan (Stage 3)

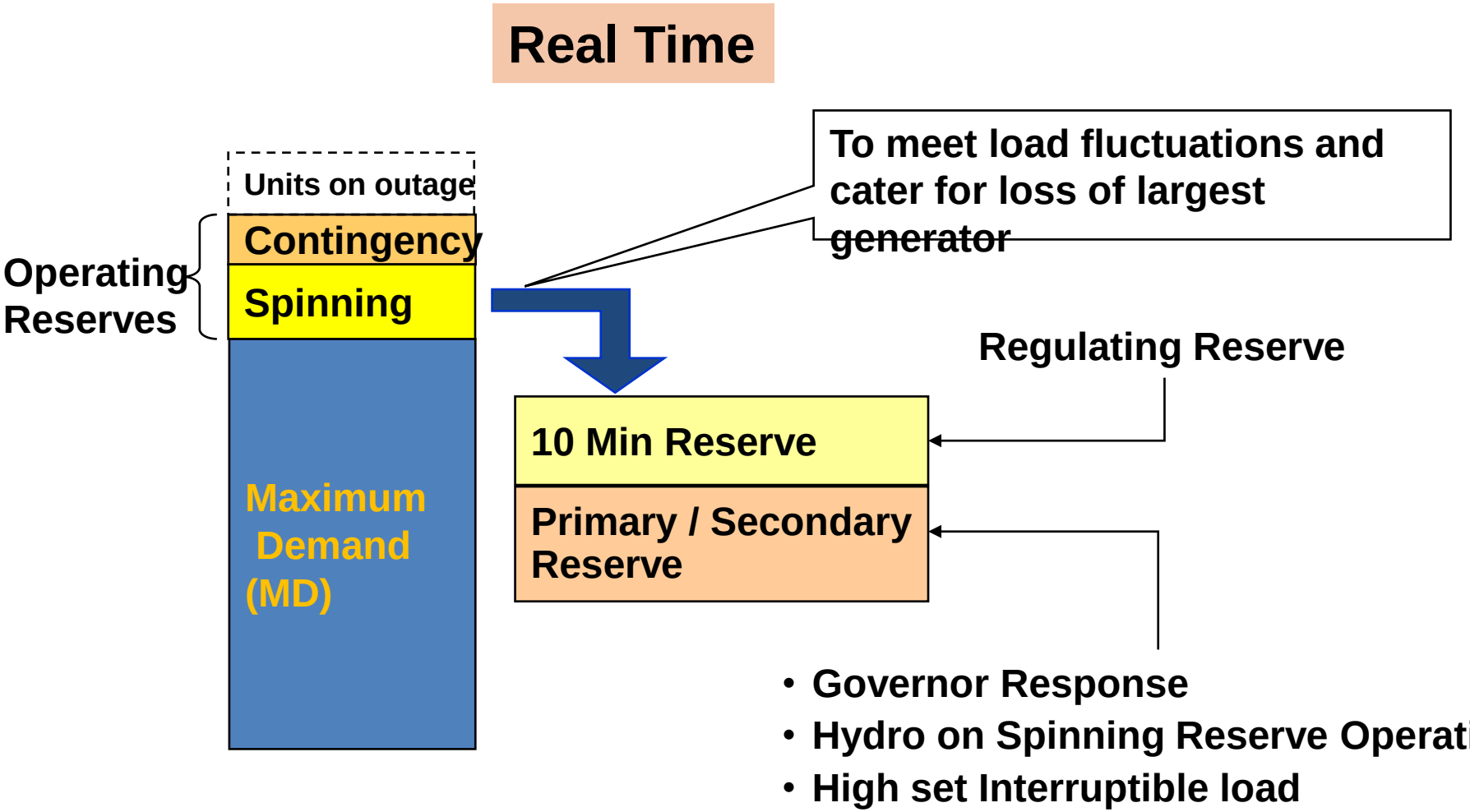


Based on February 2004 Demand Forecast

Discussion

1. *What is the Reserve Margin of a power system?*
2. *What is the Capacity Margin of a power system?*
3. *What is the current Reserve Margin of Peninsular Malaysia?*
4. *What is LOLP?*
5. *What is LOLE?*
6. *What is the LOLE for Peninsular Malaysia as defined in Malaysian Grid Code?*
7. *What are the considerations to calculate for LOLE?*
8. *LOLE addresses adequacy or security? Why?*

Generation Reserves Requirement (During Operations)



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Summary (Generation Adequacy)

The objective is to sustain a balance in generation and demand at reasonable generation price.

1. Ensure adequate generation capacity long & short term
2. To commit adequate units for short term spinning and contingency reserve
3. To ensure sufficient primary & secondary reserves to cater for loss of the largest generating unit without causing
   - Violation of performance requirements
   - Loss of demand
   - Loss of any other generating units

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What are Reliability Issues?

- **Adequacy**
  - Generation capacity & reserves
  - Transmission capacity

- **Security**
  - Operation and control within safe margin from limits
  - Contingency of tripping / loss of equipment or elements
  - System Stability
  - System Protection & Defense Schemes

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Transmission Lines in Peninsular Malaysia

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Transmission Capacity Planning

Determined by:

Transmission planning standards

Model the whole grid system network for steady state and dynamic conditions

Define all the credible contingencies and test the system by computer simulation to check grid performance against the standards

Conducted annually, especially when there is new generation plan up and demand growth

Criteria for Stability Limits:

Under normal demand condition & N-1 conditions, all system equipment are in safe operating condition: grid system is in stable operation, and meet the following performance criteria:

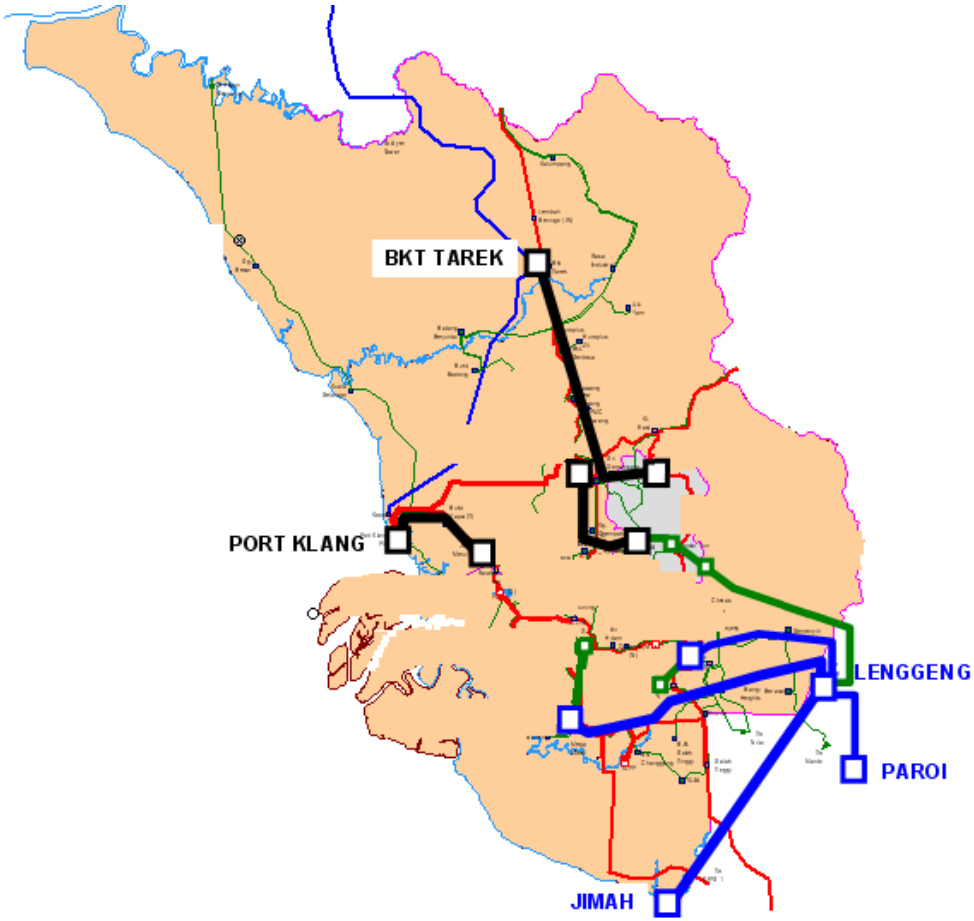
- **Thermal limits,**
- **Voltage and frequency limits,**
- **Angle stability limits**
- **Short circuit limits**

MAJOR REINFORCEMENT PROJECTS TO ENSURE SUPPLY SECURITY IN CENTRAL AREA

In 1998 transmission reinforcement project (275kV 1000MVA circuits) was carried out to cater for the new generation plantup in the north.

In 2006, transmission reinforcement (500kV) was implemented in view of Jimah Power Station plantup.

2009, additional transmission (275kV & 132kV) reinforcement was carried to cater for new load growth



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PC5.2.2. Generation Capacity Planning Criteria

The **Single Buyer shall be responsible for determining the generation capacity planning** criterion to be used for the Primary Criterion. For the main interconnected **Power System this should be based on a model utilising loss of load expectation, where the Single Buyer determines the acceptable loss of load probability value (LOLE).**

The generation capacity planning study based on the primary criterion shall then be judged against the Secondary Criterion which shall be the loss of the single largest **Generating Unit connected to the Power System or the loss of the largest Interconnector.** Whichever criterion then prevails in terms of the required new **Capacity shall be the one** used for that period.

PC5.2.2 Generation Capacity Planning Criteria (2)

When Sabah and Sarawak are interconnected, the Primary Criterion LOLE value for the interconnected **Power System is to be one day per year representing an expected energy** not served (EENS) value of 0.1%.

Where the **Single Buyer considers that this LOLE value** would create a need for too much generation **Capacity to be built in a single year, then** he may consider the LOLE value at the end of a five year period to show he has meet the Primary Criterion, provided the Secondary Criterion is always being met across the same period. Each **Rural System shall be planned to a N-1 generation capacity planning criterion.**

Any changes to this shall be published in the *Generation Master Plan.*

Planning Code 5.2.3&5.2.4

PC5.2.3 Use of Overly Large Generating Units is to be Avoided

The size of any proposed **Generating Unit should take account of the Power System** maximum and minimum **Demand at the time and the size of the largest currently** operating **Generating Units available to provide Operating Reserve, in the event that the** proposed **Generating Unit trips out.**

PC5.2.4 Power Producers to Provide Details to the Network Planner

Power Producers requiring a new Connection Point and/or CTP or modifications to an existing **Connection Point and/or CTP will also provide the data required under this PC to** the **TNO, DNO or RNO Network Planner by the end of January each year in connection**with the Generation Master Plan.

PC6 PLANNING DATA

PC6.1 DATA TO BE PROVIDED

The PC requires two types of data to be provided:

(a) Standard Planning Data; and

(b) Detailed Planning Data.

PC6.2 STATUS OF PLANNING DATA

The PC allocates planning data to one of three different status levels. These reflect a progression in degrees of confidentiality, commitment and validation. They are:

(a) Preliminary Project Data;

(b) Committed Project Data; and

(c) Contracted Project Data.

PC6.3 CONFIDENTIALITY OF PLANNING DATA

PC7 PLANNING CRITERIA

The **TNO Network Planner will apply the relevant technical and Grid Code standards** in the planning and development of the Transmission Network and these shall be taken into account by Users. Such **planning criteria** for the Transmission Network shall be published in **the *Transmission Master Plan*.**

The **Single Buyer, Network Planner and Interconnected Party will apply the relevant technical, national,** international and Grid Code standards in the planning and development of the *Generation Master Plan in* accordance with PC5.2.2 and these shall be taken into account**. Such planning criteria shall be published in the *Generation Master Plan*.**

PLANNING CODE – APPENDIX A- Data Requirement Part 1

PC A1 STANDARD PLANNING DATA

PC A1.2 DEMAND DATA

PC A1.2.2 Demand (Active and Reactive) Data Requirements

PC A1.2.3 Fluctuating Loads (>1 MVA)

PC A1.2.4 User's Abnormal Loads

PC A1.3 GENERATING UNIT AND POWER STATION DATA

PC A1.3.2 Power Station Data Requirements

PC A1.3.3 Generating Unit Data Requirements

PLANNING CODE – APPENDIX A
Data Requirement Part 2 (1)

PC A2 DETAILED PLANNING DATA

PC A2.1 CONNECTION POINT AND USER NETWORK DATA

- **PC A2.1.2 User Network Lay-out**
- **PC A2.1.3 Reactive Compensation Equipment**
- **PC A2.1.4 Short Circuit Infeed into the Transmission Network**
- **PC A2.1.5 Lumped System Susceptance**
- **PC A2.1.6 Interconnector Impedance**
- **PC A2.1.7 Demand Transfer Capability**
- **PC A2.1.8 System Data**
- **PC A2.1.9 Protection Data**
- **PC A2.1.10 Earthing Arrangements**
- **PC A2.1.11 Transient Overvoltage Assessment Data**

PLANNING CODE – APPENDIX A
Data Requirement Part 2 (2)

PC A2.2 DEMAND DATA

PC A2.2.1 General

All Users with demand shall provide the Network Planner with the Demand both current and forecast specified in this PCA2.2.

PC A2.2.2 User's System Demand (Active and Reactive Power)

PC A2.2.3 User Consumer Demand Management Data

PLANNING CODE – APPENDIX A
Data Requirement Part 2 (3)

PC A2.3 GENERATING UNIT AND POWER STATION DATA

PC A2.3.1 General

All **Power Producers with Power Stations which have a site rating Capacity of 5 MW and** above shall provide the **Network Planner with details as specified in this PCA2.3.**

PC A2.3.2 Auxiliary Demand

PC A2.3.3 Generating Unit Parameters

PC A2.3.4 Parameters for Generator Unit Transformers

PC A2.3.5 Power Station Transformer Parameters

PC A2.3.6 Excitation Control System Parameters

PC A2.3.7 Governor Parameters (for Reheat Steam Generating Unit)

PC A2.3.8 Governor Parameters (for non-Reheat Steam Generating Units and Gas Turbine Generating Units) including Generating Units within CCGT Blocks.

PC A2.3.9 Governor and Associated Prime Mover Parameters – Hydro Generating Units

PC A2.3.10 Plant Flexibility Performance

PC A2.4 ADDITIONAL DATA

End of Planning Code

It covers:

- Responsibility of User to submit data
- Planning technical Criteria and equipment standards
- Transmission Plan Production by TNO
- Generation Plan Production by SB
- Data Submission

Connection Conditions

The Connection Conditions (CC) specify the minimum technical, design and certain operational criteria which must be complied with by the **Users connected to, or seeking connection to a Power System.**

They also set out the procedures by which the **Network Operators including the Rural Network Operator** will seek to ensure compliance with these criteria as a requirement for the granting of approval for the connection of a User to a Power System.

CC2 OBJECTIVES

The objectives of the Connection Conditions are designed to ensure that:

(a) no new or modified connection will impose unacceptable effects upon a Power System or any User Network nor will it be subject itself to unacceptable effects by its connection to a Power System; and

(b) the basic rules for connection treat all **Users of an equivalent category in a non discriminatory** fashion.

CC3 The **scope** applies to GSO,RSO, TNO & all users.

Connection Conditions (2)

CC4 CONNECTION PRINCIPLES

- The design of the connection between a **Power System and User Network shall be physically determined** with respect to the point of connection by the **TNO, DNO or RNO concerned and comply with the** technical standards contained in the Planning Code (PC).
- Metering installations shall be designed to comply with the Metering Code.
- **CC4.1 EXCHANGE OF INFORMATION CONCERNING THE CONNECTION POINT**
  - CC4.1.1 There shall be an exchange of information concerning the **Connection Point in terms of** operational responsibilities and safety coordination in accordance with the Grid Code. These shall include but not be limited to the requirements of OC5, OC8 and OC11.

CC4.1.1. Site Responsibility Schedule

CC4.1.1 Site Responsibility Schedule

- A schedule shall be agreed between the **Network Operator and the User concerning** division of responsibilities at the site pertaining to, amongst other things, ownership, control, safety, operation and access. The "*Site Responsibility Schedule" and an* **Operational Diagram will be agreed by the Network Planner and User.**
- These will indicate the operational boundaries and asset ownership boundaries, between the **Network Operator, the User and any other Users at the Connection Point** (including a proposed **Connection Point).**
- **This shall include a geographic site plan and** operational schematic indicating ownership boundaries. A copy of this will be clearly displayed at each part of the site, once mutual agreement has been reached. Such agreement, not being unreasonably withheld by either party, shall be necessary before commissioning can commence on the site.

CC4.2 CONFIDENTIALITY OF CONNECTION DATA

- All **Users shall identify such data that are submitted pursuant to the CC that are required** to be maintained as confidential and submit these to the **Network Operator. Such data** that are classified as confidential by a **User may be shared with the GSO, RSO, Single Buyer or Commission and be marked as confidential.**

CC5 CONNECTION REQUIREMENTS

CC5.1 SUPPLY STANDARDS

- The **Frequency, voltage and harmonic design criteria of each Power System are designed to** comply with international requirements. The **Power Systems in Sabah and Labuan are nominally** 50 Hz **Systems.**
- The **Frequency of a Power System shall be maintained between 50.5 Hz and 49.5 Hz unless there** are exceptional circumstances.

System Frequency

- Frequency is a system wide indicator for power imbalance
- When demand is greater than generation, generators slow down and frequency decreases
- When demand is less than generation, generators pickup speed and frequency increases

Frequency Strip Recorder

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CC5.1.1 Power Factor

- Each User that is a Consumer or a Large Consumer is required to ensure that its installation has satisfactory power factor correction to ensure that, as measured at the Connection Point, the power factor of its Load meets the current power factor requirements for that Network.
- Each User with a connection at HV shall use reasonable endeavours to maintain its average Load power factor between unity and 0.90 lagging during Normal Operation. Failure to maintain the Load power factor within this range or such range as has been notified by the Network Operator, shall be deemed to be a breach of this Grid Code and a breach of the Connection Agreement unless a derogation in accordance with the General Conditions has been approved.
- Under System Stress conditions the GSO or RSO may temporarily amend the power factor operating range for Large Consumers to assist with voltage control. Under these conditions Large Consumers may be requested to operate at or very close to unity power factor. Once the condition of System Stress is ended, the User should return to operating its Power Factor under the condition of Normal Operation, as detailed above.

CC5.1.2 Harmonic Content

The maximum total level of harmonic on the existing and any future **System from all** sources under both scheduled outage and fault outage conditions must not exceed:

(a) at 500 kV, a total harmonic distortion of 1.5% with no individual harmonic greater than 1%;

(b) at 275 kV, a total harmonic distortion of 2% with no individual harmonic greater than 1.5%; and

(c) at 132 kV, a total harmonic distortion of 2% with no individual harmonic greater than 1.5%.

CC5.1.3 Technical Criteria for Plant and Apparatus

At the **Connection Point all User's Plant and Apparatus shall meet acceptable technical** design and operational criteria. Detailed information relating to a particular connection will be made available by the **Network Planner on request by the User. Such** information will include, but not be limited to, the following:

(a) load flow studies;

(b) short circuit studies;

(c) **System stability analysis;**

(d) annual/monthly load curves;

(e) line forced outage rates, for the **Network associated with the proposed Connection Point or Custody Transfer Point; and**

(f) telecommunications network associated with the proposed **Connection Point or Custody Transfer Point (CTP).**

CC5.1.4 Plant and Apparatus

- Plant and Apparatus proposed for connection to the Power System is required to meet certain **minimum technical standards**. Additionally, new Plant and Apparatus to be connected to the Power System must conform to relevant technical standards as detailed below, in the following order of preference:

  (a) relevant Malaysian national standards (MS);

  (b) relevant international and pan-Europe technical standards, such as IEC, ISO and EN;

  (c) other relevant national standards such as BSS, DIN and ASA.

- The User shall ensure that the specification of Plant and Apparatus at the Connection Point or CTP shall be such to permit operation within the applicable safety procedures agreed between the User and Network Operator.

CC5.2 TECHNICAL REQUIREMENTS FOR PARALLEL OPERATION OF CONSUMER'S GENERATING UNITS

The technical requirements for parallel operation of **Consumer's Generating Units not** subject to **Dispatch by the GSO or RSO shall be as follows:**

(a) Each **Generating Unit must be capable of continuously supplying its** output within the **System frequency range given in the Planning Code.**

(b) The output voltage limits of **Generating Units must not cause excessive** voltage excursions in excess of ± 5% of nominal. Voltage regulating equipment shall be installed by the **User to maintain the output voltage** level of its **Generating Units within limits.**

(c) The speed governor of each **Generating Unit must be capable of** operating to the standards approved by the **GSO or RSO, such approval** not to be unreasonably withheld.

(d) The isolation and earthing requirements shall be in accordance with the **Network Operator's current guideline documents or in the absence of** such documents the Tenaga Nasional Berhad guidelines.

CC5.2.2 Synchronous Generators

- **Consumers utilising synchronous generators shall be required to generate Reactive Power so that they do not impose any additional Reactive Power requirements upon the Power System.**
- **Sufficient generator Reactive Power capability shall be provided to** withstand normal voltage changes on the **Power System.**
- **The Consumer shall not be** permitted to deliver excess **Reactive Power to the Power System unless otherwise** agreed with the **GSO or RSO to control the voltage at the Connection Point and/or as** contracted through an **Ancillary Services agreement.**

Generator Capability Tests

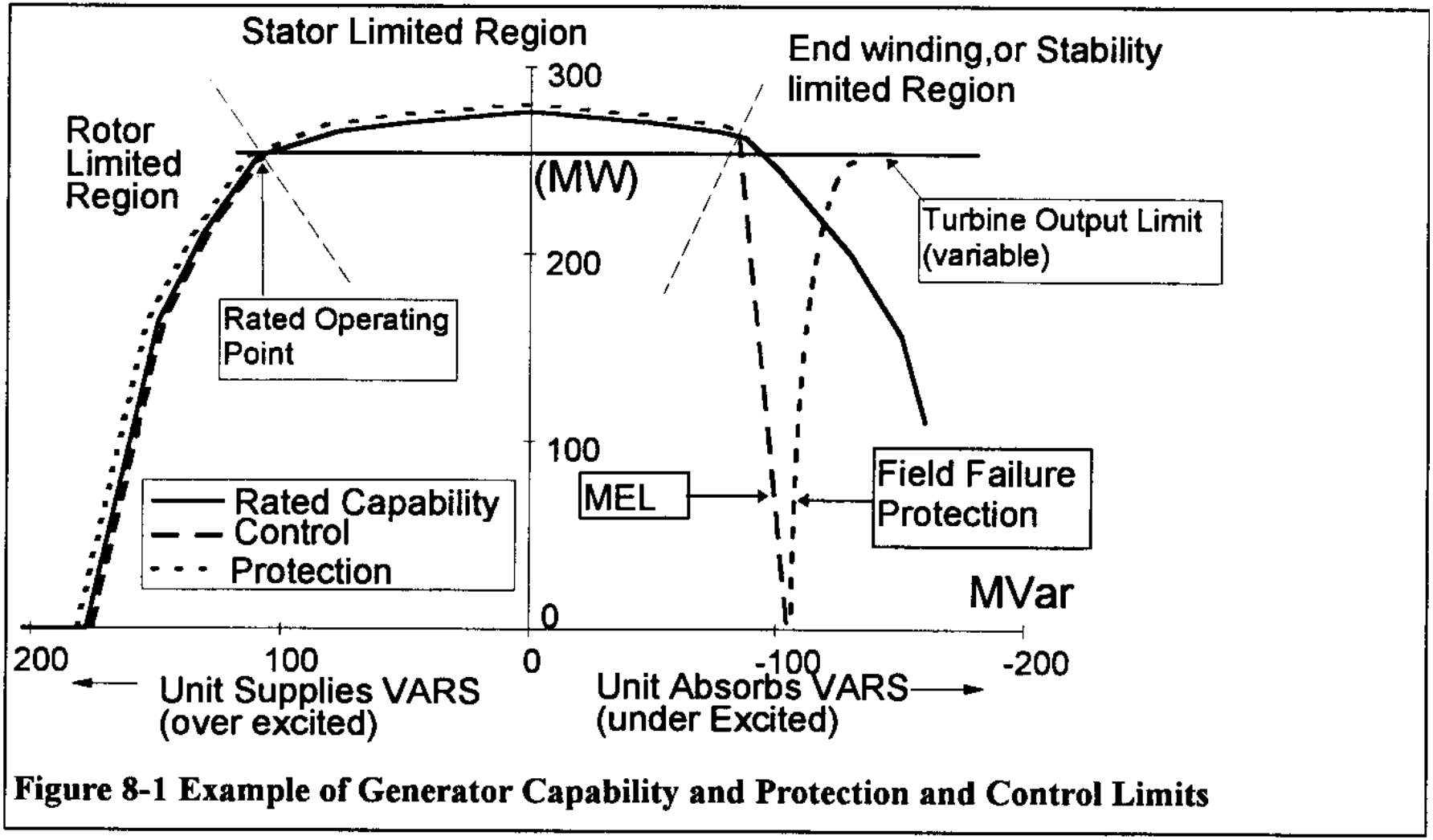

Figure 8-1 Example of Generator Capability and Protection and Control Limits

CC5.2.3 Induction Generators

- If the **Consumer utilises induction type generators, the Consumer shall provide the** necessary power factor correction such that it shall operate within the power factor limits of unity and 0.95 lagging.

- The **Network Operator, GSO or RSO shall have the right** to review the **Consumer's power factor correction plan and to require modifications or** additions as needed if in its reasonable opinion, it is required to maintain the **Power System's voltage within the limits specified in the Planning Code.**

CC5.3 TECHNICAL CRITERIA COMMUNICATION EQUIPMENT

- The technical criteria concerning voice and data communication equipment for **Power Stations is** contained in the **Network Operator's guidelines document, which is available on request.**

CC5.4 PROTECTION CRITERIA

- In order that the **GSO or RSO and the appropriate Network Operator can coordinate the** operation of the **Power System protection, it will be necessary for prospective Users to submit** their protection scheme proposals to the **Network Planner.**

- **Users should request existing protection details from the relevant Network Planner, concerning** the proposed **Connection Point. The scheme proposed by the User should take account** of any planned upgrades to the **Network protection as notified by the Network Planner.**

- Such schemes could also include **Interconnectors with external parties, which the Network Operator** will advise of fault clearance times at the **Connection Point and the method of system earthing including,** where relevant, the recommended generator neutral earthing configuration, will also be provided by the **Network Planner on request.**

- **Users will be expected to coordinate their protection times according to the clearance times** given in PC4.4.1.

CC6 PROCEDURES FOR APPLICATIONS FOR CONNECTION TO AND USE OF THE POWER SYSTEM

CC6.1 APPLICATION AND OFFER FOR CONNECTION

CC6.1.1 Application Procedure for New Connection and Use of the Power System

Any person or **User seeking to establish new or modified arrangements for connection** and or use of the **Power System must make an application on the standard application** form available from the **Network Planner of the Network concerned on request.**

CC6.1.2 Offer of Terms of Connection

The **Network Planner will, in accordance with the Grid Code and having obtained the** consent of the **Single Buyer, where such an offer involves a Power Producer, offer terms** upon which it is prepared to enter into an agreement with the applicant for the establishment of the proposed new or modified connection to and/or use of the **Power System.**

CC6.2 COMPLEX TRANSMISSION NETWORK CONNECTIONS

- The magnitude and complexity of any **Transmission Network extension or reinforcement will** vary according to the nature, location and timing of the applicants proposed Development. In the event, it may be necessary for the **Network Planner to carry out additional more extensive** system studies. In such circumstances, the **Network Planner shall, within the original time scale, provide a** preliminary offer indicating those areas that require more detailed analysis.
- **CC6.3 RIGHT TO REJECT AN APPLICATION**
- **CC6.4 CONNECTION AND USE OF SYSTEM AGREEMENT**

CC6.4 CONNECTION AND USE OF SYSTEM AGREEMENT

A **Connection Agreement and or Use of System Agreement (or the offer for a Connection Agreement and or Use of System Agreement) will include as appropriate, within its terms and** conditions:

(a) a condition requiring both parties to comply with the Grid Code;

(b) details of connection and or **Use of System Agreement charges;**

(c) details of any capital related payments arising from the necessary reinforcement or extension of the **Power System;**

(d) a "**Site Responsibility Schedule", detailing the divisions of responsibility at the Connection Point in relation to ownership, control, operation, and maintenance** of **Plant and Apparatus and to the safety of staff and members of the public; and**

(e) a condition requiring the **User to supply Detailed Planning Data (to the extent** not already supplied) within 28 calendar days of the acceptance of the offer (or such longer period as may be agreed in a particular case).

CC7 APPROVAL TO CONNECT

CC7.1 READINESS TO CONNECT

A User whose Development is under construction in accordance with the relevant Connection Agreement who wishes to establish a connection with the Transmission Network or a Rural Network or a Distribution Network, shall apply to the relevant Network Operator in writing with specified details.

CC7.2 CONFIRMATION OF APPROVAL TO CONNECT

Within [30 calendar days] of notification by a **User.**

Where approval is withheld, reasons shall be stated.

Summary of Connection Conditions

It Covers

- Connection principle
- Requirement for NTO to grant approval
- Technical standards requirement (equipment, protections, power quality)
- Site schedule
- Studies for complex design and right to reject
- Application and offer for connection agreement for connection and use of system
- Approval to connect

The End

- Summary
- Aware of Planning and its criteria
- Aware of connection criteria and conditions

THANK YOU

KeTTHA
KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

Suruhanjaya Tenaga

Sabah dan Labuan Grid Code Awareness Programme Funded by Akaun Amanah Industri Bekalan Elektrik (AAIBE)