Grid Code Awareness Program
Operating Code No.4 (OC4): Demand Control

By :

MR NOOR AZLAN HAMZAH – SYSTEM OPERATIONS DEPT
TNB TRANSMISSION

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

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Background

- System Operations Dept is also known the Grid System Operator (GSO).
- GSO operates as a ring fence entity.
- GSO operates and control the Transmission Grid System in Peninsular Malaysia including the interconnections to Singapore and Thailand.

OC4.1 Introduction

- (OC4.1.1) Operating Code No.4 is concern with the procedures to be followed by GSO and users to facilitate Demand Control in the event that insufficient generating capacity is available to meet forecast or real-time demand, leading to possibility of frequency excursions.

OC4.1 Introduction

- OC4.1.2 Demand Control shall include but not limited to the followings
  - Automatic demand shedding (UFLS and UVLS)
  - Manual demand shedding (EMDS and RDS) via instruction or direct switching
  - Reduction of load through voltage reduction
- OC4.1.3 GSO can also use Demand Control to prevent system overloads or voltage collapse

OC4.2. Purpose or Objectives of Demand Control

- OC4.2.1 the objectives of this OC4 are to:
  - To achieve reduction in demand in the grid system
    - *To manage system security*
    - *During low operating reserve*
    - *To prevent system overloads or voltage collapse*
  - Enable the GSO to instruct Demand Control in a manner that does not unduly discriminate against, or unduly prefer anyone
  - Ensure that the GSO is notified of any Demand Control utilized by users other than following an instruction from the GSO

OC4.3 Scope

- OC4.3.1 This OC4 applies to the GSO, and the following users:
  - Generators with CDGUs;
  - Network Operators;
  - Grid Owner;
  - Distributors;
  - Directly connected customers; and
  - Single buyer

OC4.4 Procedures for Notification of Demand Control

- OC4.4.3 Appropriate warnings shall be issued by the GSO when there is likely to be a requirement to shed demand. These warnings will be categorized in accordance with the perceived levels of risk.
- OC4.4.4 **Yellow warning**, Probable risk of Demand Reduction. One **week** before anticipated event in writing.
- OC4.4.5 **Orange warning**, High risk of Demand Reduction. **24 hrs** before the event in writing.
- OC4.4.6 **Red warning**, Extremely high risk of Demand Reduction. **30 mins** before event by telephone instructions, fax or in writing.
- OC4.4.7 GSO may issue warnings to cover a local situation where the risk of serious overloading is foreseen in a particular section of the system. Such warnings will be issued as Yellow, Orange or Red warnings but specific to locality.
- OC4.4.8 The purpose of warnings is to obtain the necessary demand relief required with the least possible inconvenience to consumers and, to that end, to ensure that response to requests for disconnection is both prompt and effective. Demand Reduction will, however, be required **without warning** if unusual and unforeseeable circumstance create severe operation problems.

OC4.4 Notification Procedures

Demand Reduction

Let's say **Demand Reduction** is on 23rd of March....

Yellow Warning

(Probable Risk of Demand Reduction)

issued **1 week before** the anticipated event by GSO.

Orange Warning

(High Risk of Demand Reduction)

issued **1 day before** the anticipated event by GSO.

Red Warning

(Extremely High Risk of Demand Reduction)

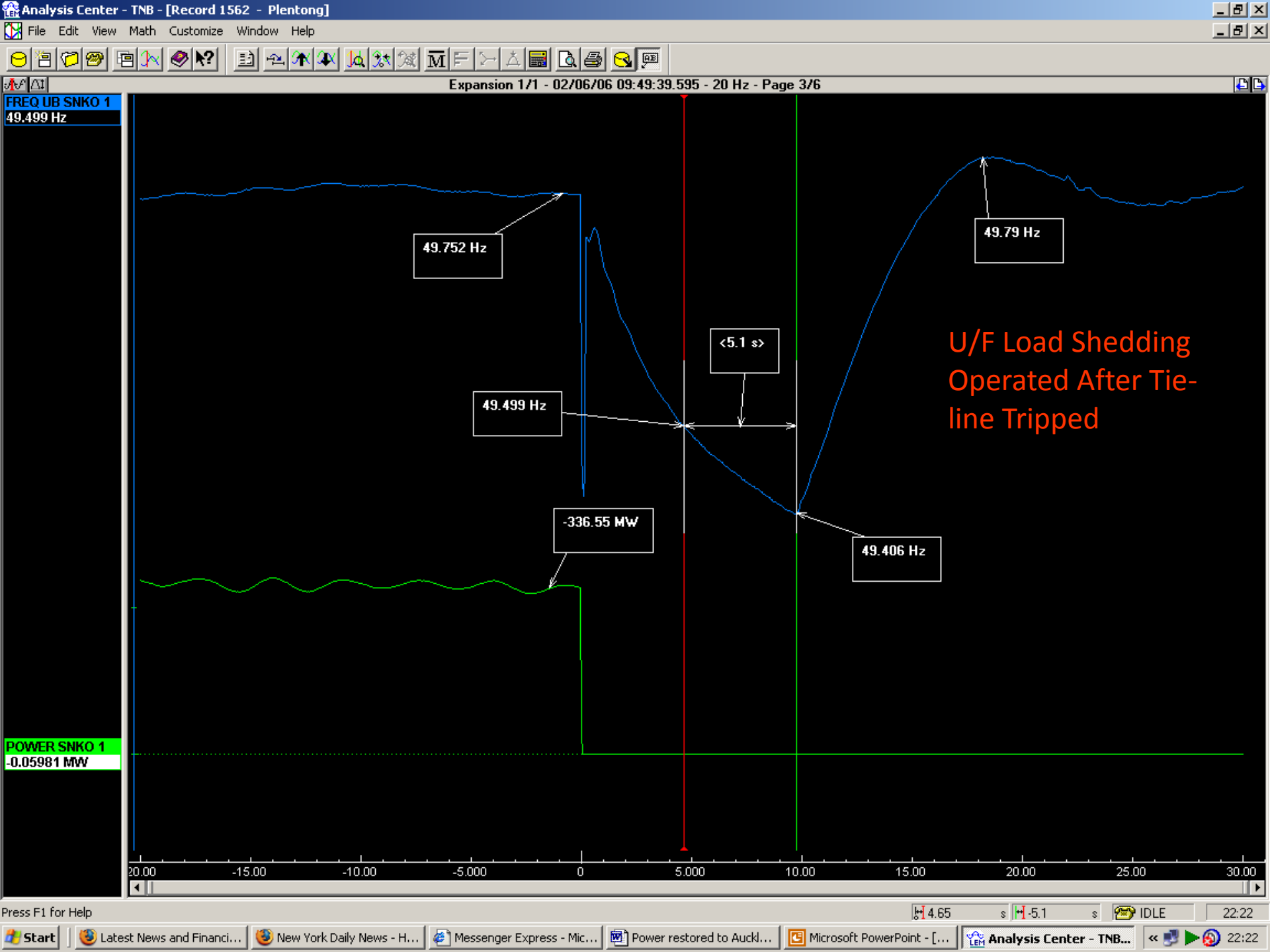
issued **30 minutes before** the anticipated event by GSO.

OC4.5 Procedure for Implementation of Demand Control

- OC4.5.1 During Demand Control, scheduling and dispatch in accordance with the principles in the SDCs may cease until GSO decides that normal operation can be resumed.
- OC4.5.2 Demand Control will be achieved by **telephone instructions** in the case of instructed Demand Control, to each relevant user and by **direct switching** by the GSO in the case of manual Demand Control.
- OC4.5.3 Whether a Yellow, Orange or Red warning has been issued or not User shall abide by the instructions of the GSO without delay
- OC4.5.5 Restoration of demand – under instruction of GSO. Restoration must be achieved without delay, within **two (2) minutes** of the instruction being given by the GSO.

OC 4.6 Automatic Demand Shedding: UFLS

- OC4.6.1 The GSO has to ensure sufficient quantum of automatic under frequency load shedding which is likely to be **around 60%** of the Grid System total peak Demand or otherwise as determined in accordance with the requirements of the Grid System.
- OC4.6.3 GSO monitors the availability of the quantum of load shedding using data from system disturbances and review the overall quantum at least **once every 3 years**. Users shall make available all the data.
- OC4.6.5 Once UF demand shedding has taken place, the user on whose system it has occurred, will not reconnect until the GSO instructs that user to do so. Once frequency has recovered, each user will abide by the instructions of GSO with regard to reconnection.
- OC4.6.6 Reconnection must be achieved as soon as possible – within **two (2) minutes** of the instruction being given by GSO.


Analysis Center - TNB - [Record 1562 - Plentong]
File Edit View Math Customize Window Help
Expansion 1/1 - 02/06/06 09:49:39.595 - 20 Hz - Page 3/6
FREQ UB SNKO 1
49.499 Hz
POWER SNKO 1
-0.05981 MW
49.752 Hz
49.79 Hz
<5.1 s>
49.499 Hz
-336.55 MW
49.406 Hz
U/F Load Shedding Operated After Tie-line Tripped
20.00
-15.00
-10.00
-5.000
0
5.000
10.00
15.00
20.00
25.00
30.00
Press F1 for Help
4.65 s
-5.1 s
IDLE
22:22
Start
Latest News and Financi...
New York Daily News - H...
Messenger Express - Mic...
Power restored to Auckl...
Microsoft PowerPoint - [...
Analysis Center - TNB...
22:22

OC4.7 Automatic Demand Shedding: UVLS

- OC4.7.1 The GSO has to ensure sufficient quanta of automatic under voltage load shedding which is likely to be around **15%** of the Grid System total peak Demand or otherwise as determined by requirements of the Grid System
- OC4.7.3 GSO monitors the availability of the quantum of load shedding using data from system disturbances and review the overall quanta at least **once every 3 years**. Users shall make available all the data.
- OC4.6.5 Once UV demand shedding has taken place, the user on whose system it has occurred, will not reconnect until the GSO instructs that user to do so. Once voltage has recovered, each user will abide by the instructions of GSO with regard to reconnection
- OC4.6.6 Reconnection must be achieved as soon as possible – within **two (2) minutes** of the instruction being given by GSO.

Voltage Reduction

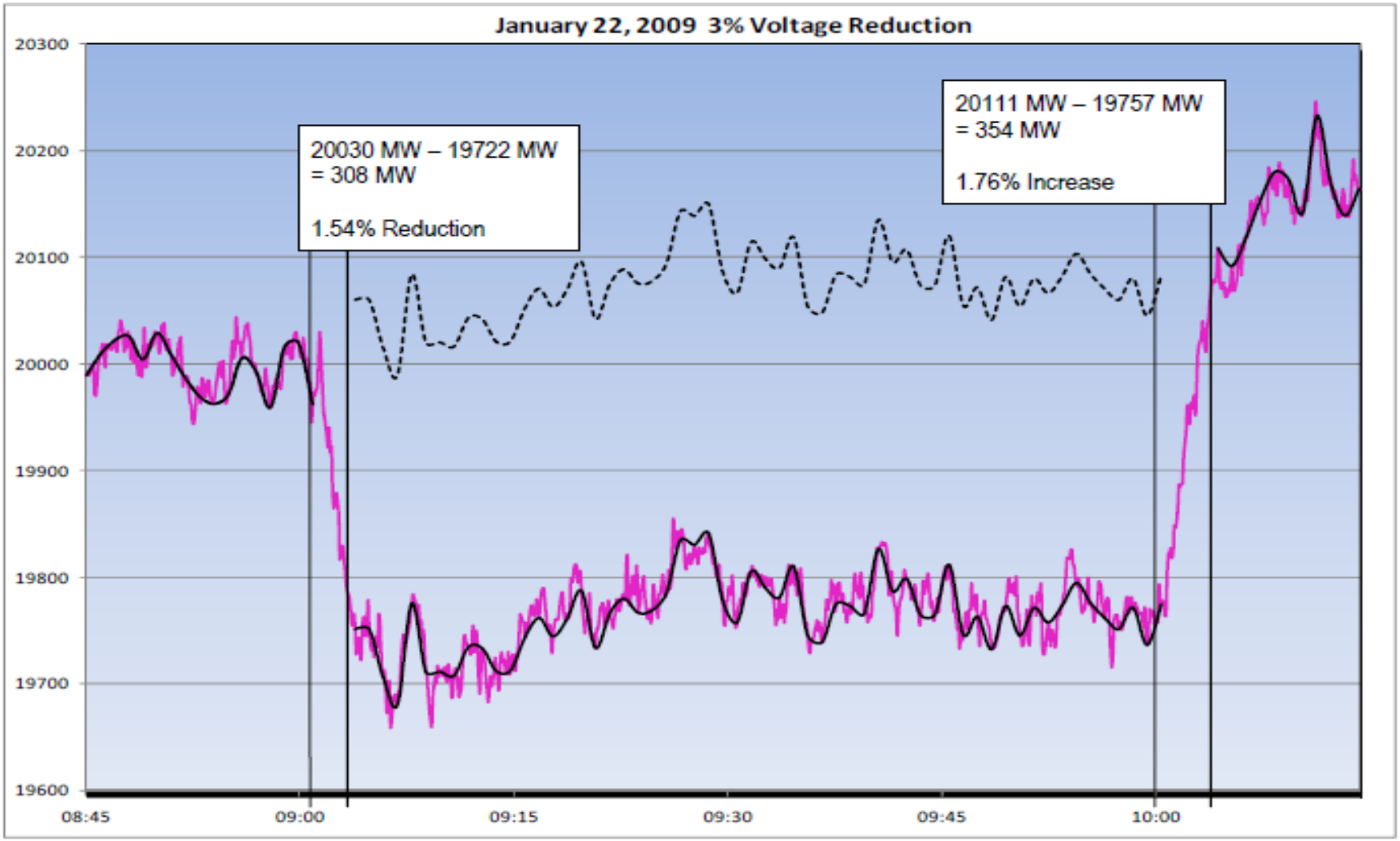


Figure 1: IESO Primary Demand Graph for 3% Voltage Reduction Test

OC4.8 Emergency Manual Demand Shedding

- OC4.8.1 Each User will make arrangements that will enable it, following **an instruction** form the GSO, to disconnect loads under emergency conditions irrespective of Frequency **within twenty (30) minutes.**
- OC4.8.2 Each user shall provide the GSO in writing by the **end of September** in each year, in respect of the next following year, as set out in a tabular format in the Appendix 1, its total peak demand and the percentage value of the total peak demand that can be disconnected.
- OC4.8.3 Each user shall abide with regard to disconnection without delay, and the disconnection must be achieved as soon as possible after the instruction being given by GSO, and in any case, within the timescale given above.
- OC4.8.4 The GSO will notify a user who has been instructed under this OC4.8, of what has happened on the transmission system to necessitate the instruction.
- OC4.8.5 Once a disconnection has been applied by a user at the instruction of the GSO, that user shall not reconnect until the GSO instructs it to do so.
- OC4.8.6 Reconnection – under instruction of GSO. Reconnection must be achieved as soon as possible – within **two (2) minutes** of the instruction being given by GSO.
- OC4.8.7 The GSO may itself disconnect manually and reconnect directly connected customers as part of a demand control requirements under emergency conditions.

OC 4.9 Rotational Demand Shedding

- OC4.9.1 As well as reducing demand, with the objective of preventing any overloading of apparatus and/or when there is insufficient generation to meet forecast demand, or in the event of fuel shortages and/or water shortages at hydro-CDGUs, the GSO may utilise this OC4.9 to initiate demand disconnections.
- OC4.9.2 The GSO in coordination with users will prepare rota disconnection plans for levels of demand disconnection in accordance with plans drawn up by the GSO. These plans will be reviewed at **least once in three (3) years** or as and when necessary.

Rota Load Shedding Plan 2013

ROTA LOAD SHEDDING CONTINGENCY PLAN MANUAL

TNB DISTRIBUTION

REVISED EDITION
APRIL 2013

PREPARED BY:

KENDALIAN SISTEM PEMBAHAGIAN

Region	MW
MRCC	672.09
NRCC	626.86
SRCC	611.16
ERCC	639.92
Total	2550

OC 4.10 Scheduling and Dispatch

- OC4.10.1 During demand control, scheduling and dispatch in accordance with normal operation may cease and will not be re-implemented until the GSO decides, in each case in accordance with the provisions of the SDCs. The GSO will inform users of the schedule.

Conclusions

- Demand control mechanism as provided by the Malaysian Grid Code is necessary as a means to manage system security.
- GSO is mandated to ensure system reliability and therefore will take all necessary steps to ensure the integrity of the network including Demand Control.

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Demand Side Management

Interruptible Rates

- Customers participating in this scheme can be interrupted for a specified number of times a year and a specific kW or MW, at TNB's call
- Customers can be given a DMIS Tariff which is lower than normal and this tariff is valid for them 24/7 throughout the year
- Customers can still enjoy this tariff even if they do not get called to curtail their load

Direct Load Control (DLR)

- Similar to interruptible tariff, but typically targets residential appliances – discount on ac cycling
- Special device installed that allows the utility to remotely connect or disconnect electricity to affected devices
- During peak loading conditions, the utility can remotely disconnect enough appliance to prevent system overload.

Demand Response

Time of use rates	• Some time periods are more costly than others for the utility to provide service.
Real time Rates	• Reductions in energy demand in response to a price signal from the electricity market.
Dynamic Pricing	• Utility can inform customers that critical peak pricing will be in effect the next day. Customers have a financial incentive to reduce consumption.
Critical Peak Rebates	• Customers with the capability to reduce their electricity demand during peak periods can earn a payment for their reduction.