

# Review of the Power System

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4<sup>th</sup> October 2007

# Introduction

- Manager Power System Control
- Reporting to Director, Operations
- Responsible for short term operations, including National Control Centre, up to 1 week ahead

# Presentation Structure

- Discuss plant portfolio
- Challenges for system operation
  - Frequency Excursions
  - Night Valley

# Summary System Statistics

Generating Plant (excl. wind)	6200 MW
Generating Stations	21
Energy 2006	28 TWh
Load variation from	1814 to 5035 MW

*Max/Min ratio of 2.8*

N-S imports up to 300 MW

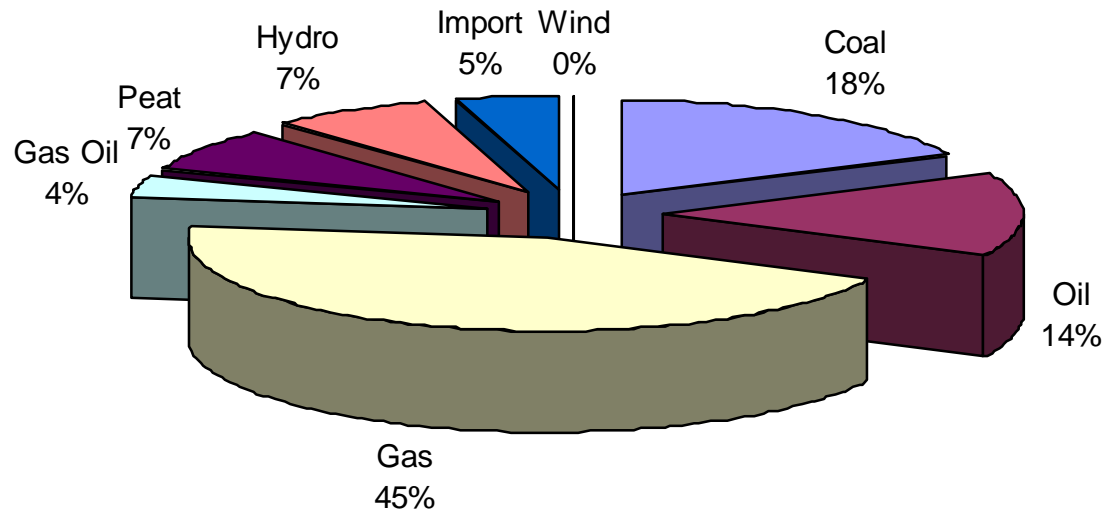
*(See 'System Records' under 'System Operations' on EirGrid.Com)*

*All figures are generated MW/MWh*

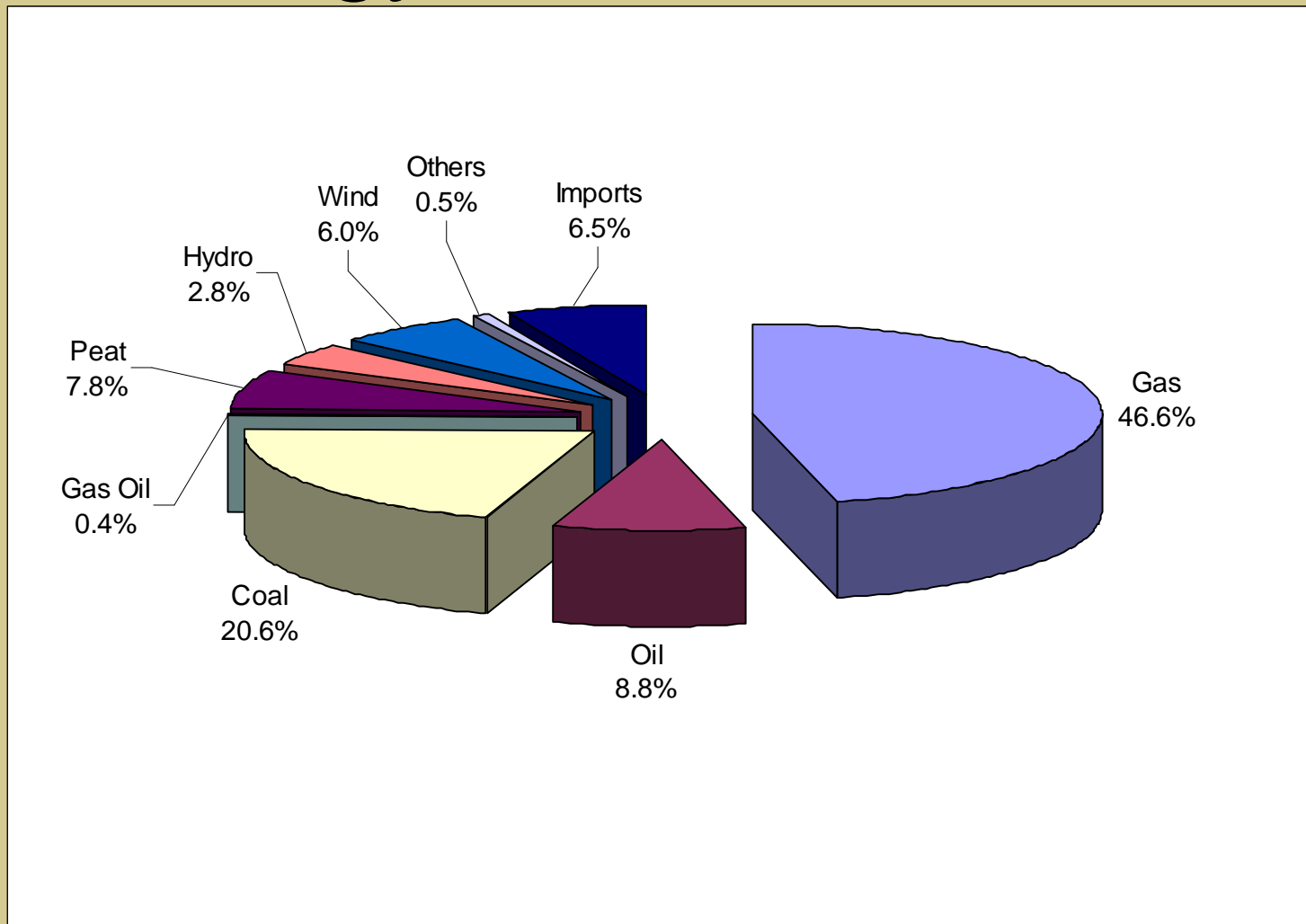
# Wind Statistics

- Wind Generating Capacity 801 MW
- Wind farms 68
- Capacity by end 2007 ~900 MW
- Peak wind output (May 18) 708 MW

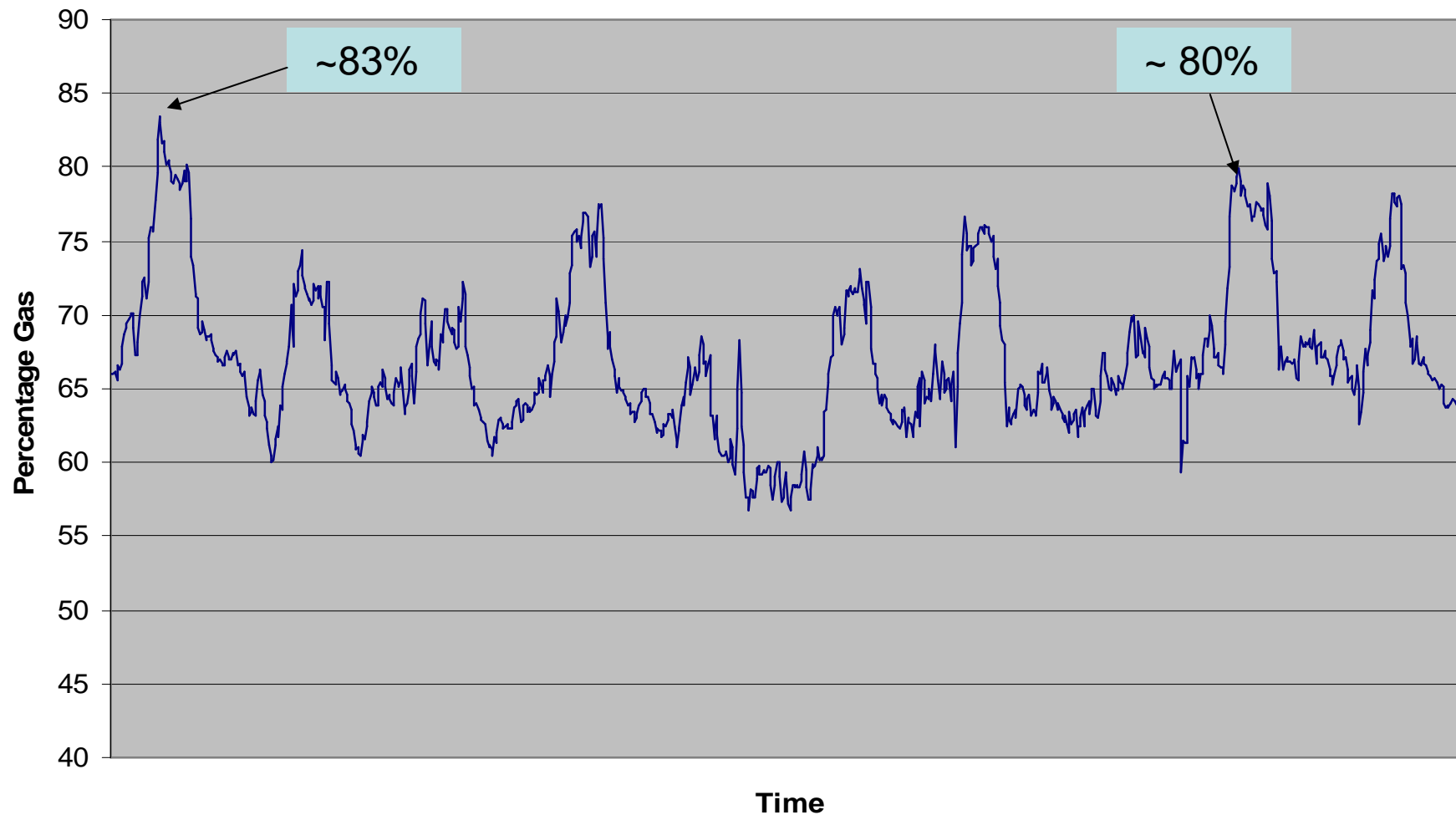
## Fuel Mix for All Time Peak of 5035 MW on Dec 19th 2006



# Energy 2006 – Fuel Mix



### Gas Plant - Percentage of Generation for 10 Days in Aug/Sept



# Plant Mix (MW and % of Installed)

- Steam 2649 MW (43%)
- Combined cycle 2475 MW (40%)
- Open cycle 359 MW (6%)
- Peakers 208 MW (3%)
- Hydro 217 MW (3%)
- Pumped storage 292 MW (5%)

*All figures are generated MW*

# Steam

- Total of 2649 MW
  - 3 x 305 MW coal units
  - 2 x 256 MW oil/gas units
  - 1 x 270 MW gas unit
  - 3 x 115 MW oil/gas units
  - 4 x 55 MW oil units
  - 150, 128 and 100 MW peat units

*All figures are generated MW*

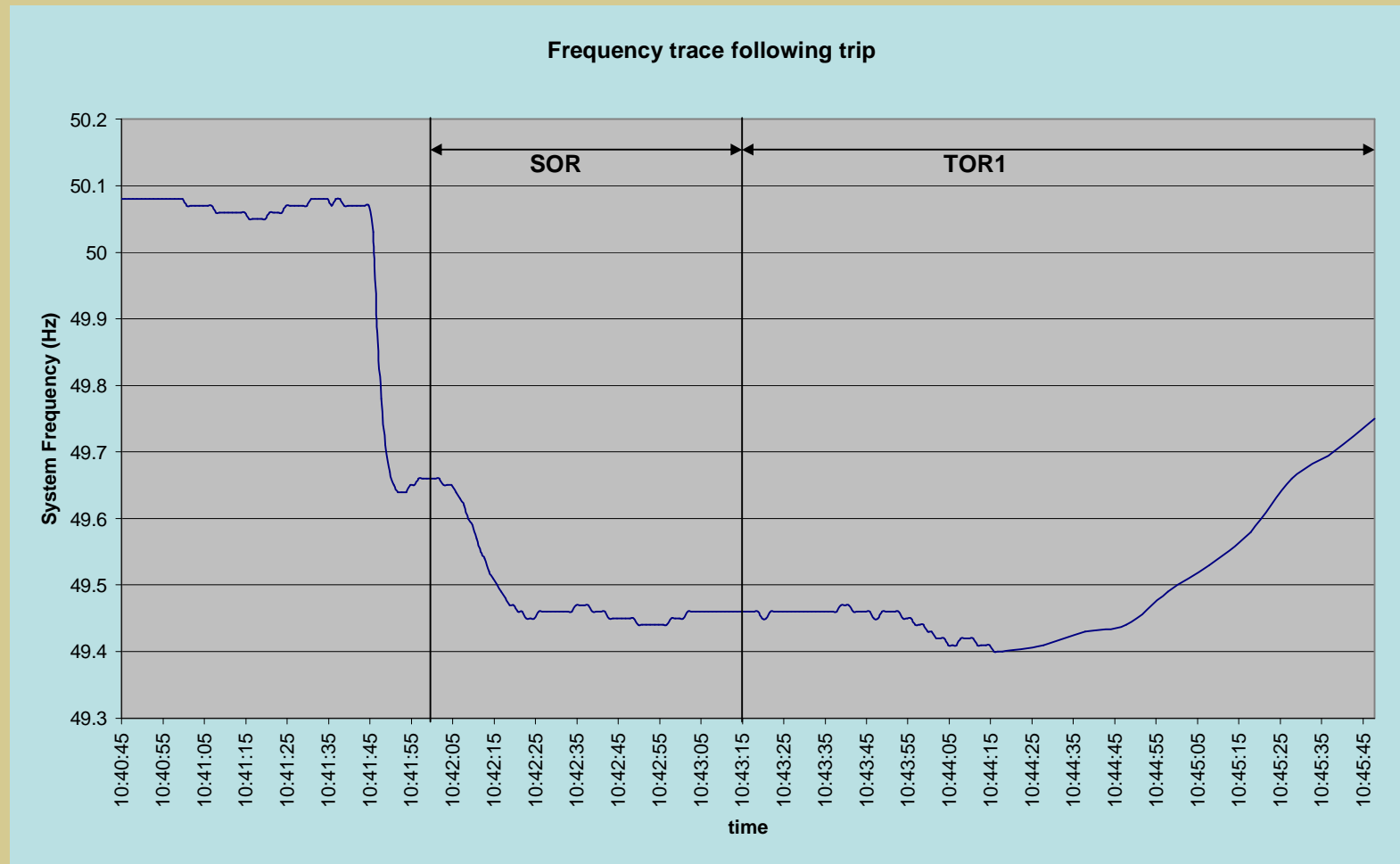
# CCGTs

- Total of 2475 MW
  - 2 x 405 MW (Single shaft)
  - 1 x 350 MW (2 shafts)
  - 1 x 385 MW (2 shafts)
  - 1 x 480 MW (3 shafts)
  - 1 x 115 MW (CT + steam unit)
  - 1 x 155 MW (CT + 3 steam units)
  - 2 x 80 MW (CTs)

*All figures are generated MW*

# System Disturbances

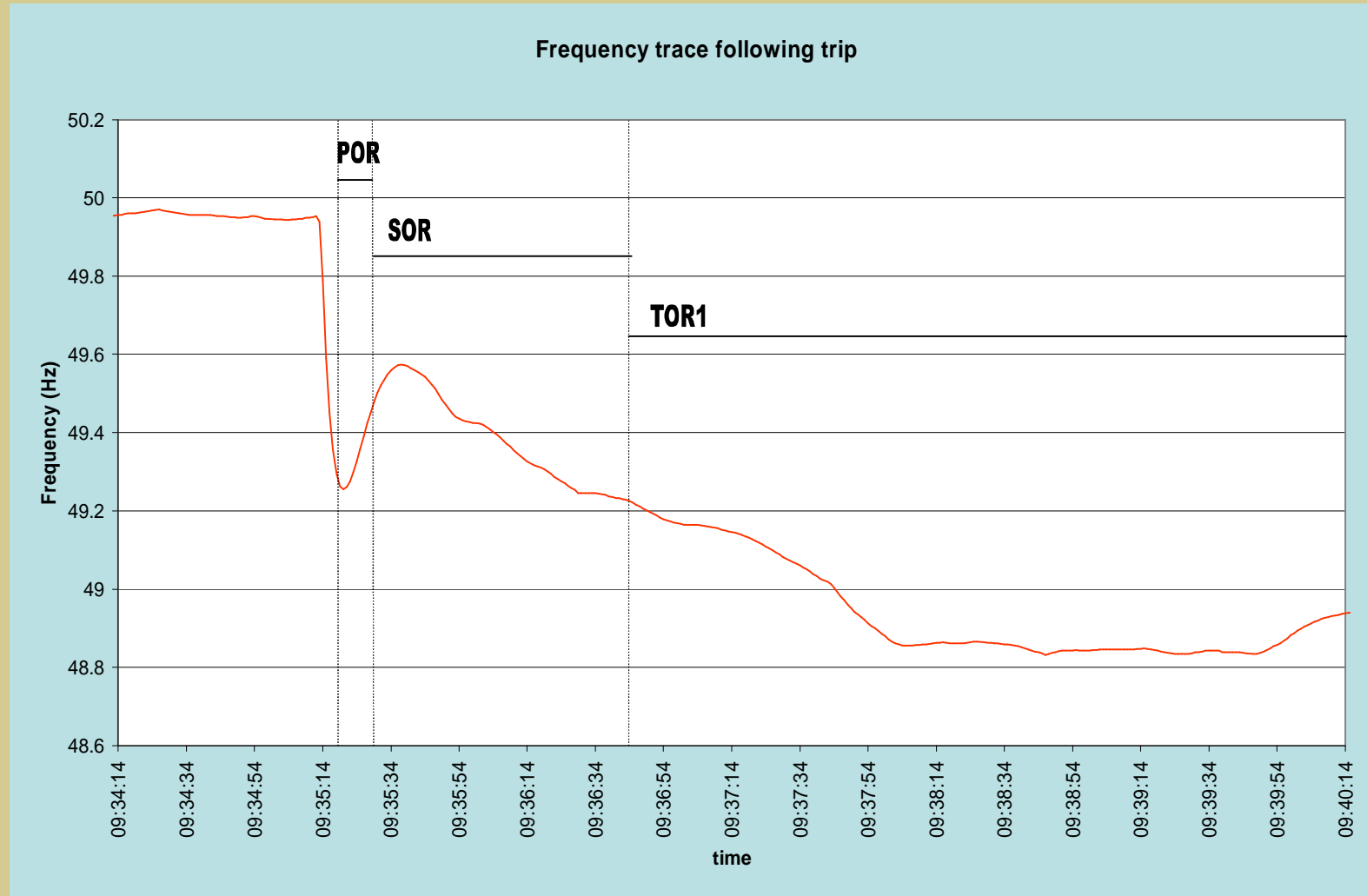
# 1. Loss of 400 MW Unit on July 1st



# Observations on July 1st

- Did not shed load
- Frequency drifted down to 49.45 Hz and remained below 49.5 Hz for almost three minutes
- Poor delivery of reserve by main providers especially Tertiary Operating Reserve 1 (*90 – 300 seconds*)

## 2. Loss of 400 MW Unit in on July 13th



# Observations on July 13th

- Initial nadir at 09:35:20 of 49.255 Hz, six seconds following incident time.
- Frequency recovered well to 49.57 Hz at 09:35:37 (+23 s post-incident).
- Frequency response worsened and drifted down to 49.23 Hz (+90 s) and further to nadir of 48.84 Hz (+247 s)
- 30 MW of load was disconnected /reconnected via LFLS/AFR

# Observations on July 13<sup>th</sup> (continued)

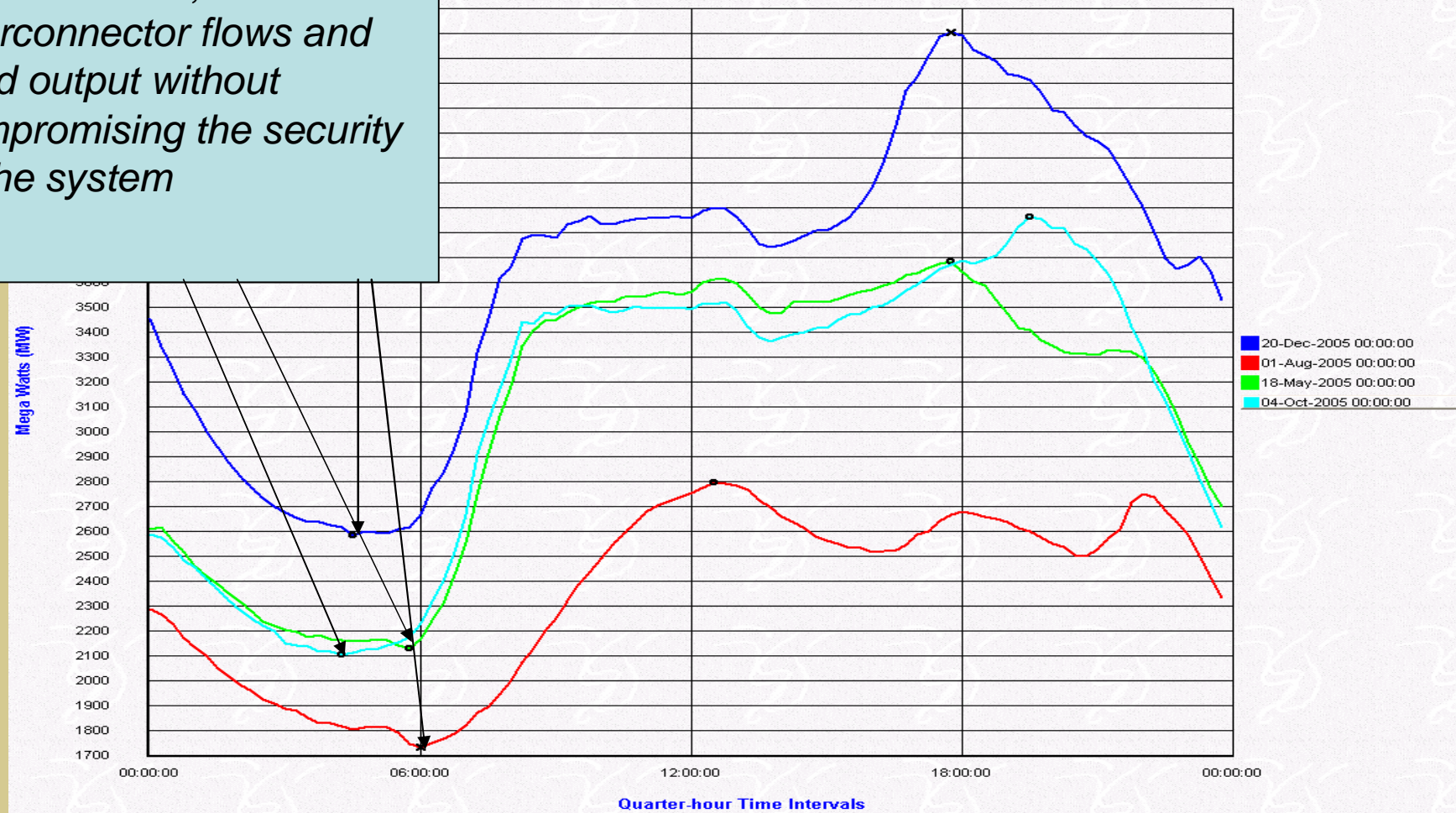
- The response across the Secondary Operating Reserve and Tertiary Operating Reserve 1 categories was inadequate.
- Sufficient SOR was scheduled but the shortfall in delivery from the generators was large and lead to the poor response across SOR.
- At the time of the event, TOR1 and TOR2 was inadequate to cover the loss. The shortfall from generators across SOR and TOR1 timescales worsened the response.

# Minimum Demand (Night Valley)

*Must be able to dispatch plant in order to meet the minimum load of the day while respecting plant characteristics, interconnector flows and wind output without compromising the security of the system*

# Minimum Demand

**Load Comparison**



# Plant Cycling Characteristics

Thermal	<ol style="list-style-type: none"><li>1. 115/55 MW plant – few difficulties</li><li>2. 256/270 MW units difficult to cycle but have low minimum loads</li><li>3. Peat units difficult to cycle</li><li>4. Coal also be difficult to cycle</li></ol>
CCGTs	<ol style="list-style-type: none"><li>1. Small CCGTs can cycle easily</li><li>2. Larger CCGTs are slow to start</li><li>3. Larger CCGTs have have high min. loads</li></ol>
Hydro, OCGTs, Peakers and Pumped Storage	<i>No issues</i>

Plant	MW
Coal	450
Oil	40
Gas/Steam	40
CCGT1	280
CCGT2	220
CCGT3	220
CCGT4	220
CCGT5	220
CCGT6	80
Peat	230
Hydro	200
Wind	400
<b>System Generation</b>	<b>2600</b>
Import from N.I.	-300
Pump	-216
<b>System Demand (SYD)</b>	<b>2684</b>
Load Forecast (LF)	<b>2500</b>
<b>Excess (SYD-LF)</b>	<b><u>184</u></b>

# Minimum Demand – Other Issues

- High minimum loads on large CCGTs, peat and coal plant will cause cycling of CCGTs in the next 6 months.
  - *Cycling of one CCGT commenced this summer even with peat plants off load.*
- Likewise high wind output may force more plant cycling
- Wind may have to be curtailed for reasons of system security

# Plant Challenges for Future

- Responsive i.e. provide regulation/reserve.
- Flexible – will have to 2 shift (cycle)
- Improved availability

END