Gas Contingency Simulations

NB: Slide formats are varied throughout the presentation to distinguish the work carried out independently by Vector and Contact

contact

Background

- **The Gas Industry Company (GIC) are reviewing the existing National Gas Outage and Contingency Plan (NGOCP) arrangements.**
- **A voluntary industry group was formed to examine the possible implications of a gas contingency on gas load reduction requirements. This group was formed outside the GIC's consultation process.**
- **The group is interested in gaining a better understanding of how gas contingencies are likely to impact the requirement for load reduction by gas users and what this may mean for the level of thermal generation during an event. This may enable a more co-ordinated approach to be taken when managing supplies to major users of gas in the event of a gas contingency.**

The Scenario

- Loss of Maui supply due to problems on the Maui gas field affecting whole pipeline:
  - On high dependence day - Oaonui scheduled to provide 224 TJs (actual flows from 6/9/07)
  - On moderate dependence day - Oaonui scheduled to provide 128 TJs (actual flows from 19/8/07)
  - On low dependence day - Oaonui scheduled to provide 108 TJs (actual flows from 13/10/07)
- Assumptions: As Pohokura gas is generally at full capacity, assume that there is no spare deliverability from the Pohokura gas field to supply gas.
- All scenarios are repeated with different response factors during the Phase 1 stage.

Key Assumptions of the Gas Contingency Simulation

- All peaking has been removed (i.e. all points are assumed to flow to a flat profile except to the extent they are responding to a curtailment).
- There is no Operational Imbalance (i.e. at the start of the day, before the event, nominations and flow are the same and they only differ subsequently to the extent that the response factor allows).
- The event occurs at midnight and we have only monitored it for the first 24 hours (to avoid needing new nominations for a second day).
- There are no intra-day nominations (so we start the day with a set of day-ahead nominations which everyone is flowing to and these are only revised by the curtailment).

Further Analysis

- **Contact expanded on Vector's analysis to gain an understanding of the implications of a gas contingency on the Electricity Market.**

- **Specifically, Contact has simulated the impact of a gas contingency on electricity supply and demand and on the electricity spot price.**

Process for Electricity Analysis

- **Using Vector's Contingency Simulations as input data, Contact converted the gas deliveries under each scenario (three types of gas dependencies with 50%, 75% and 100% response levels to curtailment instructions) into MW of generation capacity using heat rates[1].**

- **The actual North Island energy offers on each of the simulated days have:**
  - volumes offered by each major gas-fired plant (TCC, Otahuhu, Huntly, E3P & Southdown)
  - been capped at the simulated MWs.
  - estimated HVDC flows and Interruptible Load (IL) responses added to the base.

- **The estimated electricity prices have then been determined based on where actual electricity demand in the North Island cuts the offer "stack".**

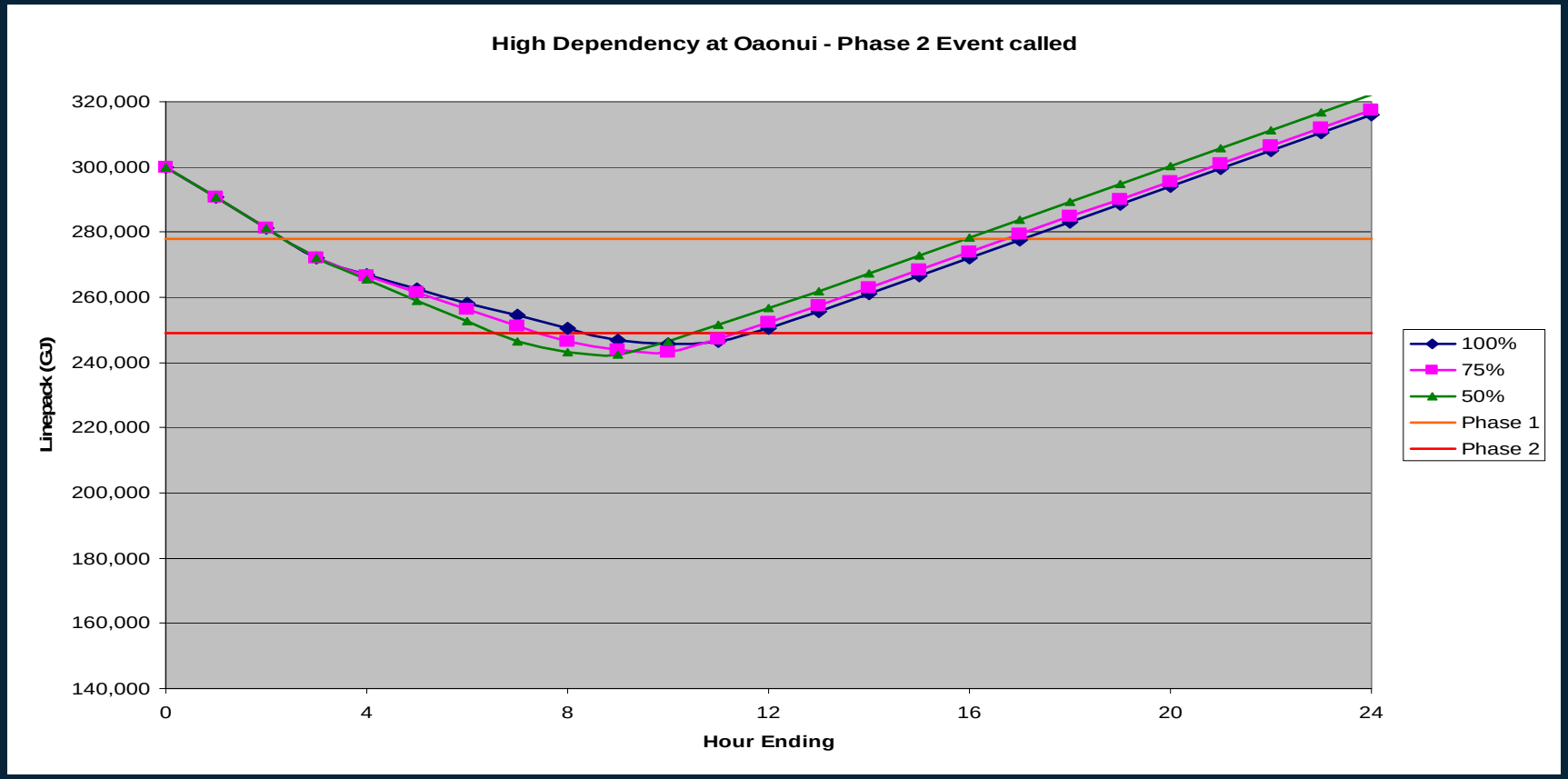
1. Heat rates taken from the Inter-Island HVDC Pole 1 replacement Investigation (HVDC-TRAN-DEV-01).

Key Assumptions of the Electricity Analysis

- **Only existing North Island offers have been used because South Island generation is restricted by the limitations of the HVDC during any event.**
- **The electricity price is set in the North Island.**
- **Huntly switches to coal as soon as required.**
- **Coal fired units at Huntly not already running are assumed to remain off due to the length of time before the units are available from a cold start.**
- **HVDC flows limited to 700 MW north and IL response limited to 250MW.**
- **Unreconciled (UNRC) data has been used for North Island demand.**

Results

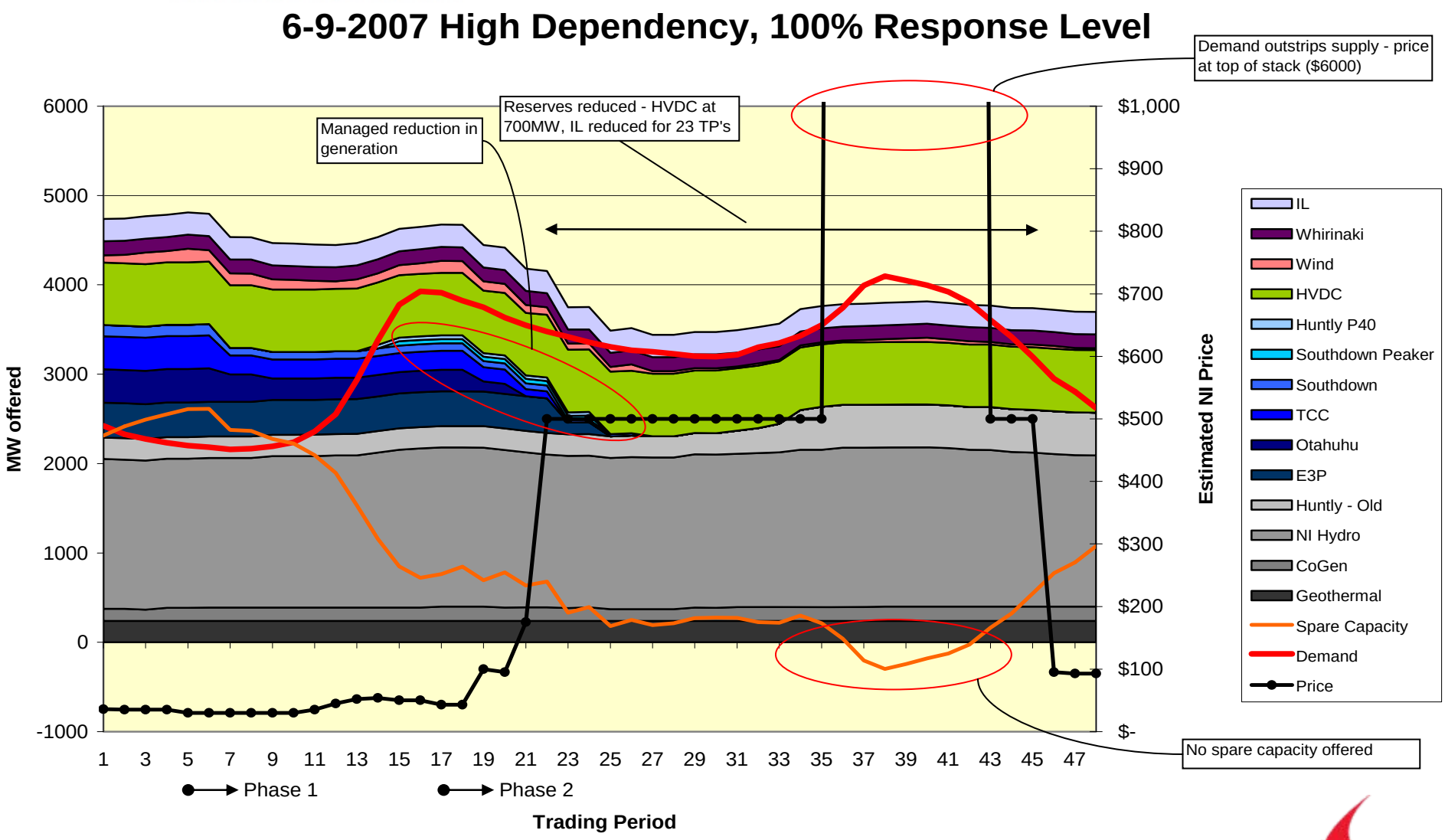
Time to Declaration of NGOCP Phase 1 & 2
High Dependency with Varied Response Levels



Phases 1 and 2 are declared earlier compared to when dependency on gas from Oaonui is medium or low.

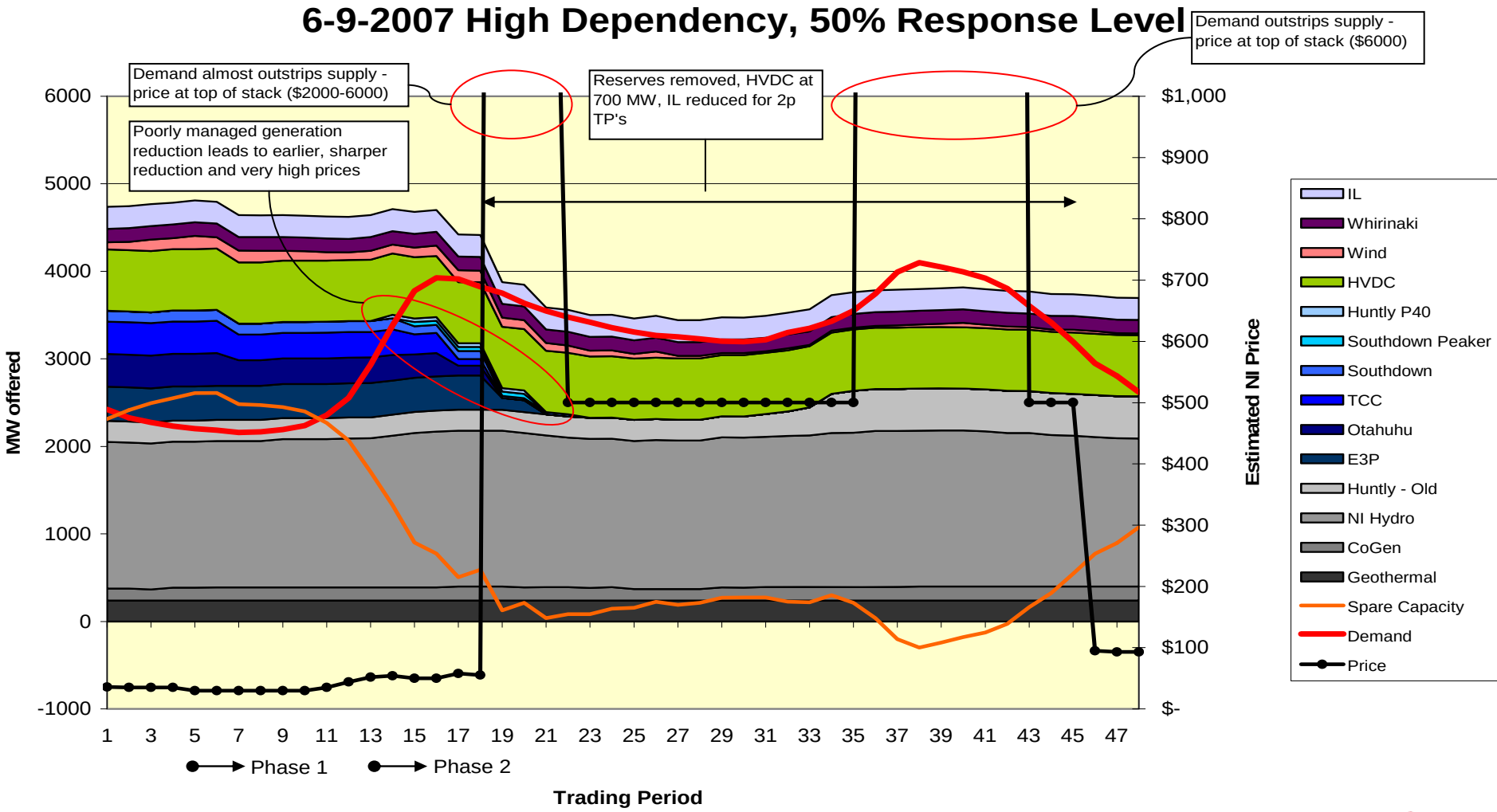
NB: With lower response levels to curtailment instructions, Phase 2 is declared earlier. Once Phase 2 is declared it is assumed that all Major Plant will respond as soon as possible under all scenarios, hence the earlier recovery under the 50% response level scenario

Effects on the Electricity Market



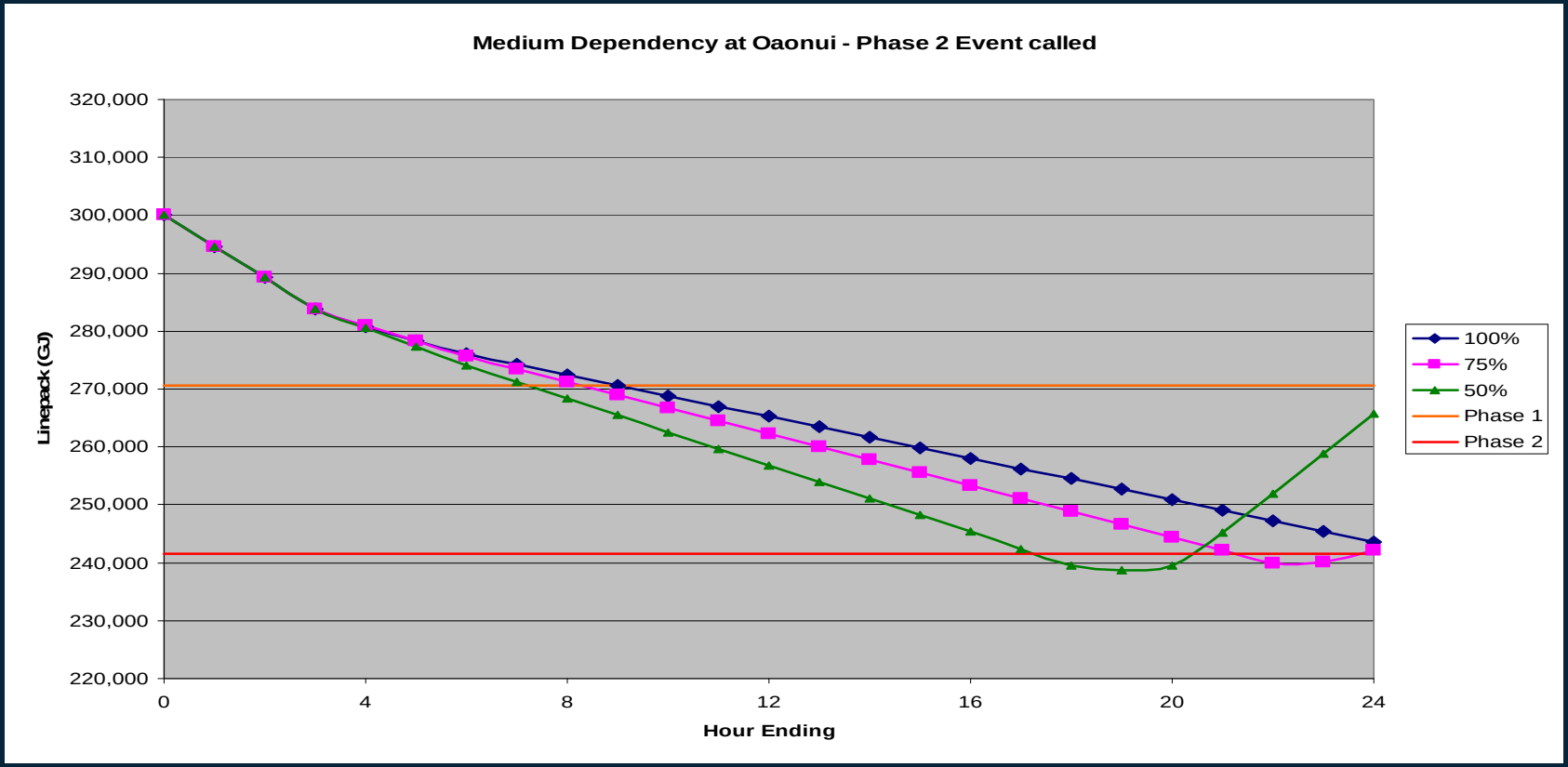
Reserves & IL reduced, demand outstrips supply over evening peak

Effects on the Electricity Market



Generation reduction now over morning peak, demand almost outstripping supply

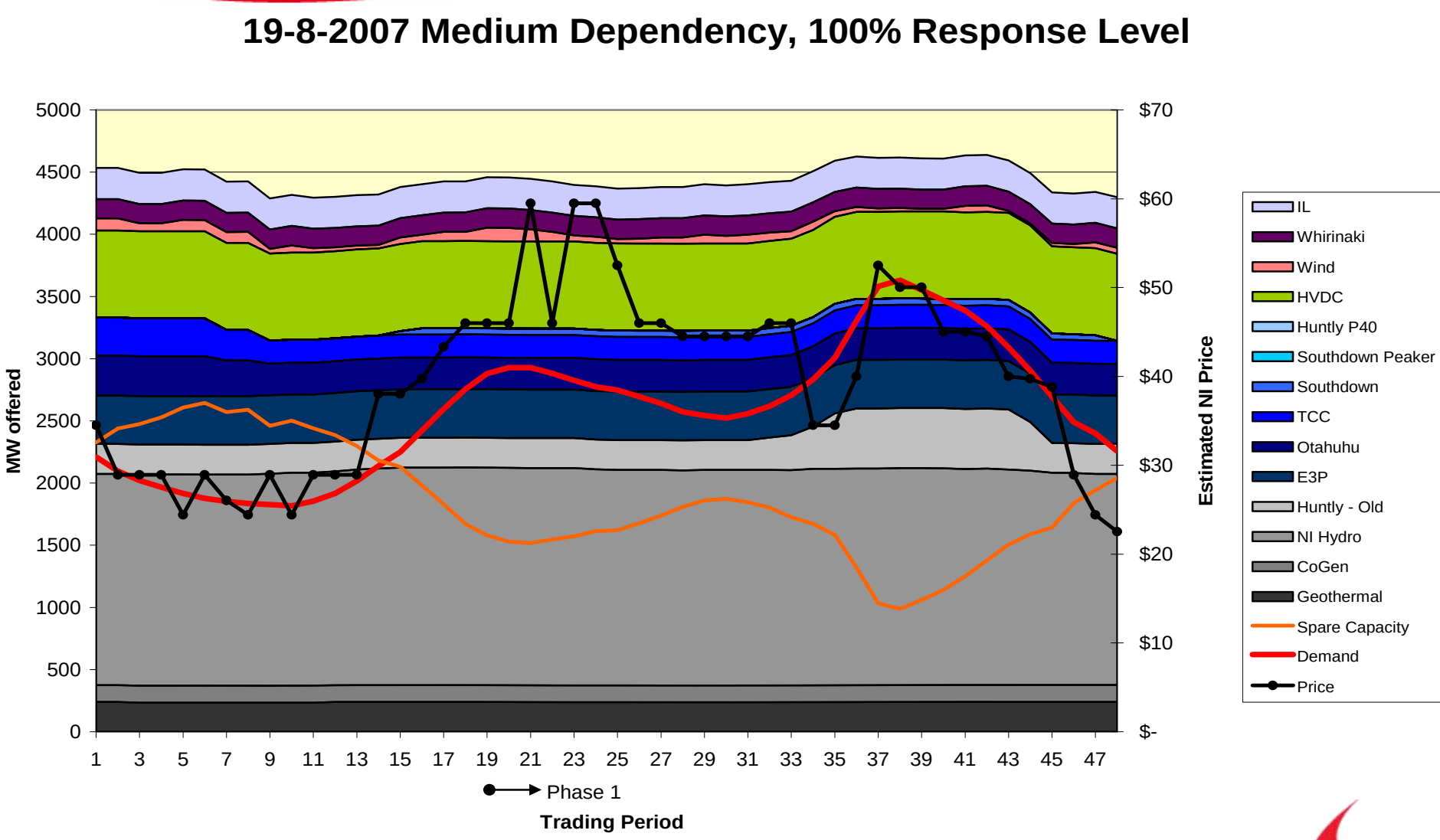
Time to Declaration of NGOCP Phase 1 & 2
Medium Dependency with Varied Response Levels



With medium dependency on gas from Oaonui, declarations of Phases 1 and 2 occur later than in the high Oaonui dependency scenario.

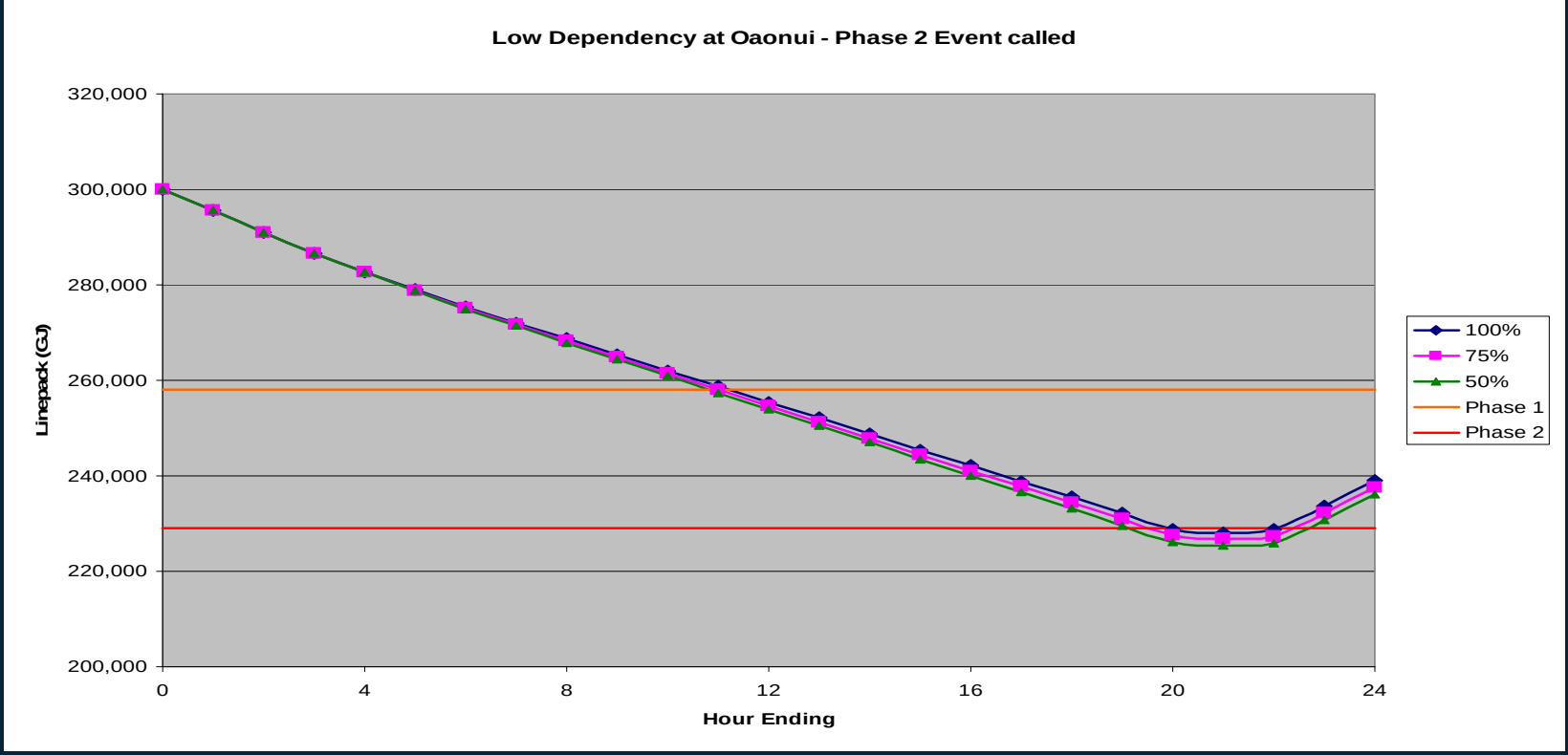
NB: With lower response levels with curtailment instructions, Phase 2 is declared earlier. Once Phase 2 is declared it is assumed that all Major Plant will respond as soon as possible under all scenarios, hence the earlier recovery under the 50% response level scenario

Effects on the Electricity Market



Phase 2 not required, no apparent problems

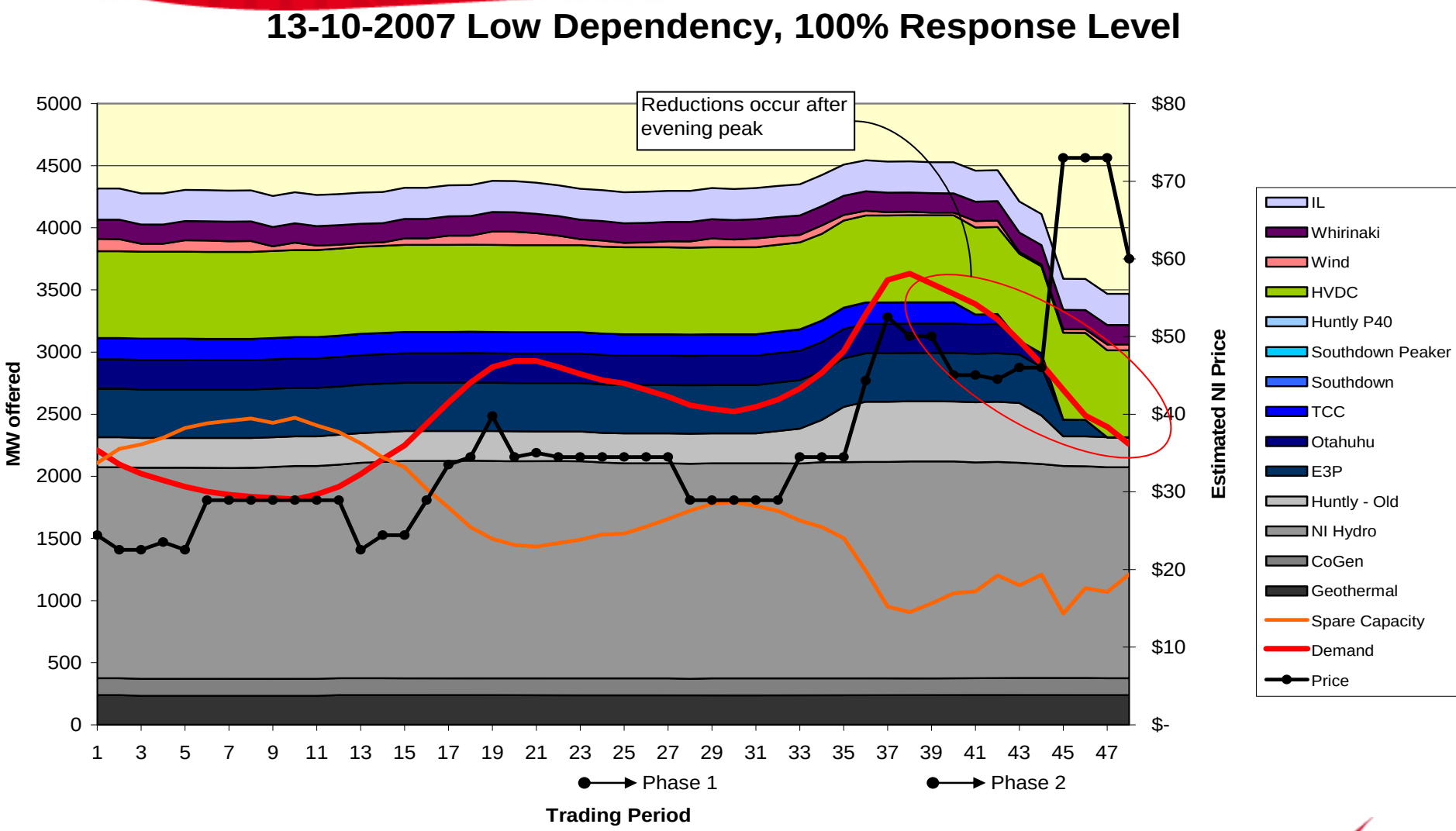
Time to Declaration of NGOCP Phase 1 & 2
Low Dependency with Varied Response Levels



The timing of the declaration of Phases 1 and 2 are similar to those for the medium Oaonui dependency scenario. Given that gas use by Major Plants prior to a contingency is already low, Major Plant operators have limited ability to reduce load to make a substantial difference.

NB: With lower response levels to curtailment instructions, Phase 2 is declared earlier. Once Phase 2 is declared it is assumed that all Major Plant will respond as soon as possible under all scenarios, hence the earlier recovery under the 50% response level scenario

Effects on the Electricity Market



Generation reduced after evening peak, possible problems for the next morning peak

Scenario Comparison

		Dependency		
		High 06/09/2007	**Medium 19/08/2007**	**Low 13/10/07**
Response Level	**100%**	Reserves & IL reduced, demand outstrips supply over evening peak	Phase 2 not required, no apparent problems	Generation reduced after evening peak, possible problems for the next morning peak
	75%	Generation reduced earlier, longer period with reduced reserve and IL	TCC & Otahuhu reduced after evening peak, possible problems for the next morning peak	Generation reduced after evening peak, possible problems for the next morning peak
	50%	Generation reduction now over morning peak, demand almost outstripping supply	Generation reduced during evening peak, price lifts	Generation reduced after evening peak, possible problems for the next morning peak

Summary

- The Contingency Simulation does serve as a useful reference point to better understand what may happen in the event of a gas contingency.

- Given the limitations of the data, assumptions and the scenarios modelled, Vector would encourage each industry stakeholder to derive their own conclusions from the Contingency Simulation.

- Vector hopes that the Contingency Simulation meets the expectations of industry stakeholders without the costs associated with engaging external advisors.

Conclusion

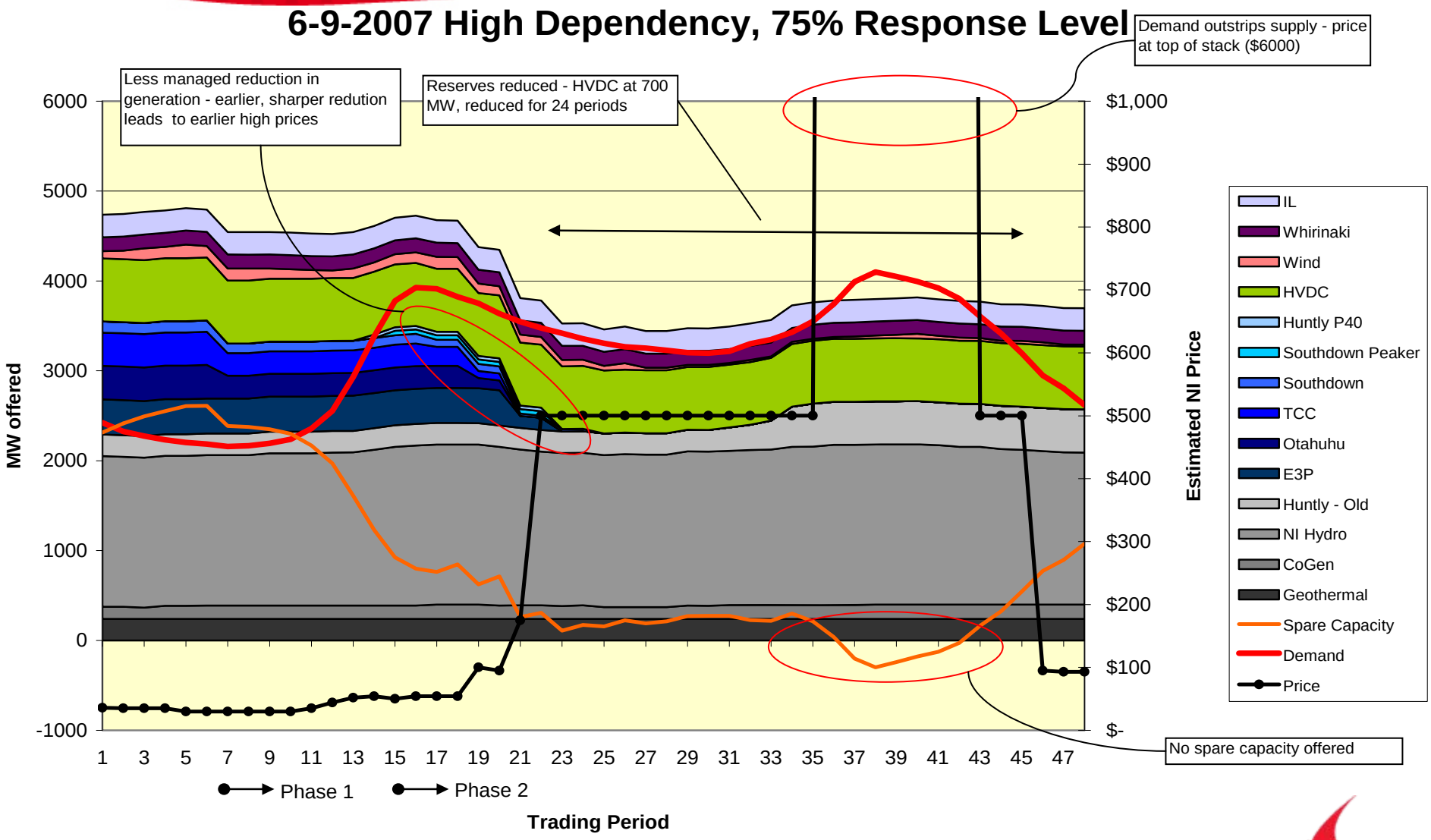
- **A contingency is only likely to affect the gas market and the electricity market if the unplanned outage relates to a field with gas production greater than 200TJ/day.**
- **An aggressive response during a Phase 1 contingency is required, so that Phase 2 is prevented from occurring.**
- **An aggressive Phase 2 response i.e. full shutdown of Major Plant will cause brown/black outs in the electricity market.**
- **There is no modelling of recovery to an unplanned outage. If recovery was modelled, electricity supply issues may not have occurred.**
- **It was unexpected that a 100% response to curtailment instructions still resulted in market issues in two out of three scenarios.**

Disclaimer

- **This presentation is intended to provide a simulation for general reference only.**
- **The contents may not reflect actual activity in a non-simulated event and accordingly should not be relied on as such.**
- **Specialist advice and guidance should be sought in relation to your own circumstances.**

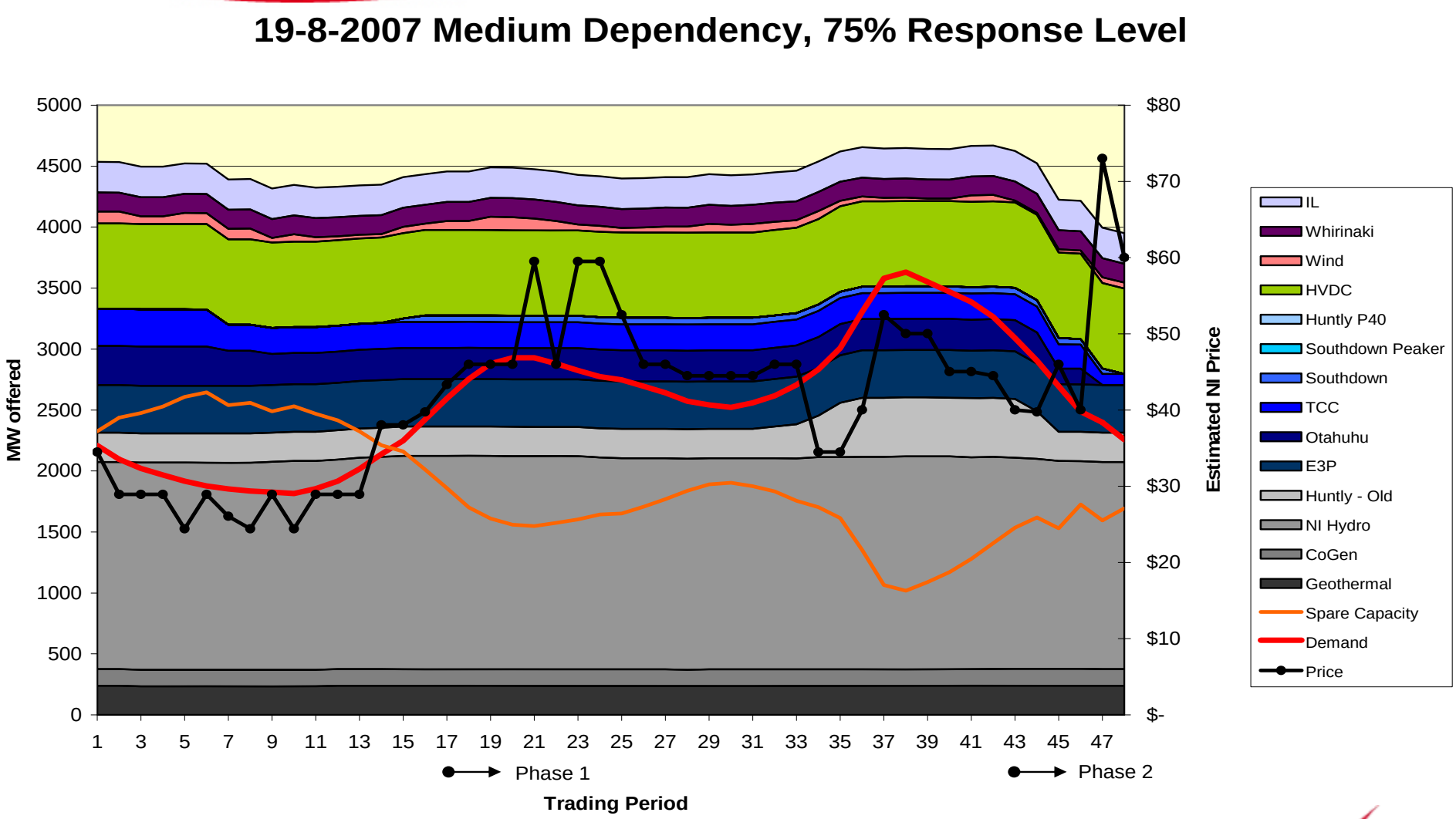
Appendices

Effects on the Electricity Market



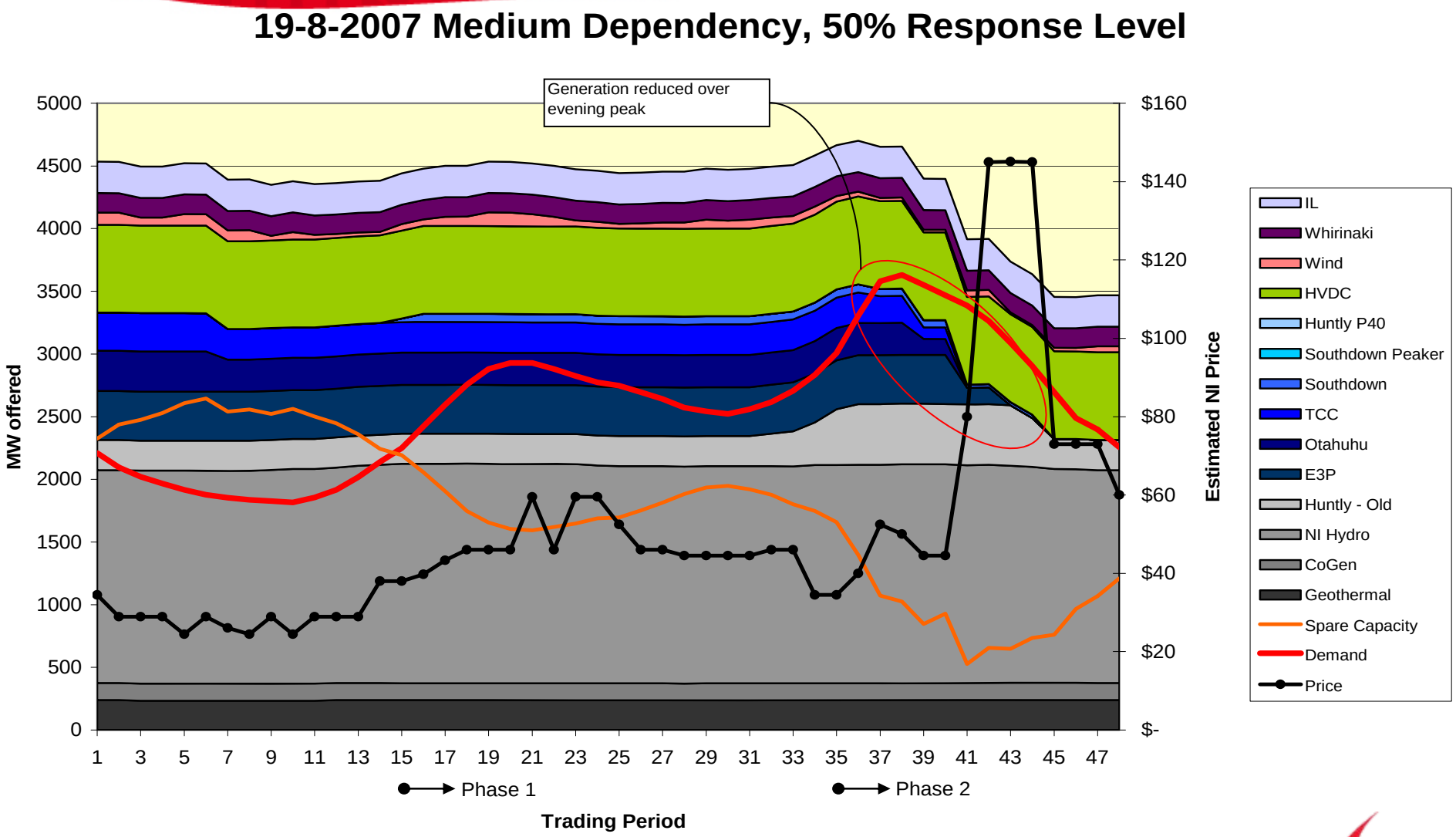
Generation reduced earlier, longer period with reduced reserve and IL

Effects on the Electricity Market



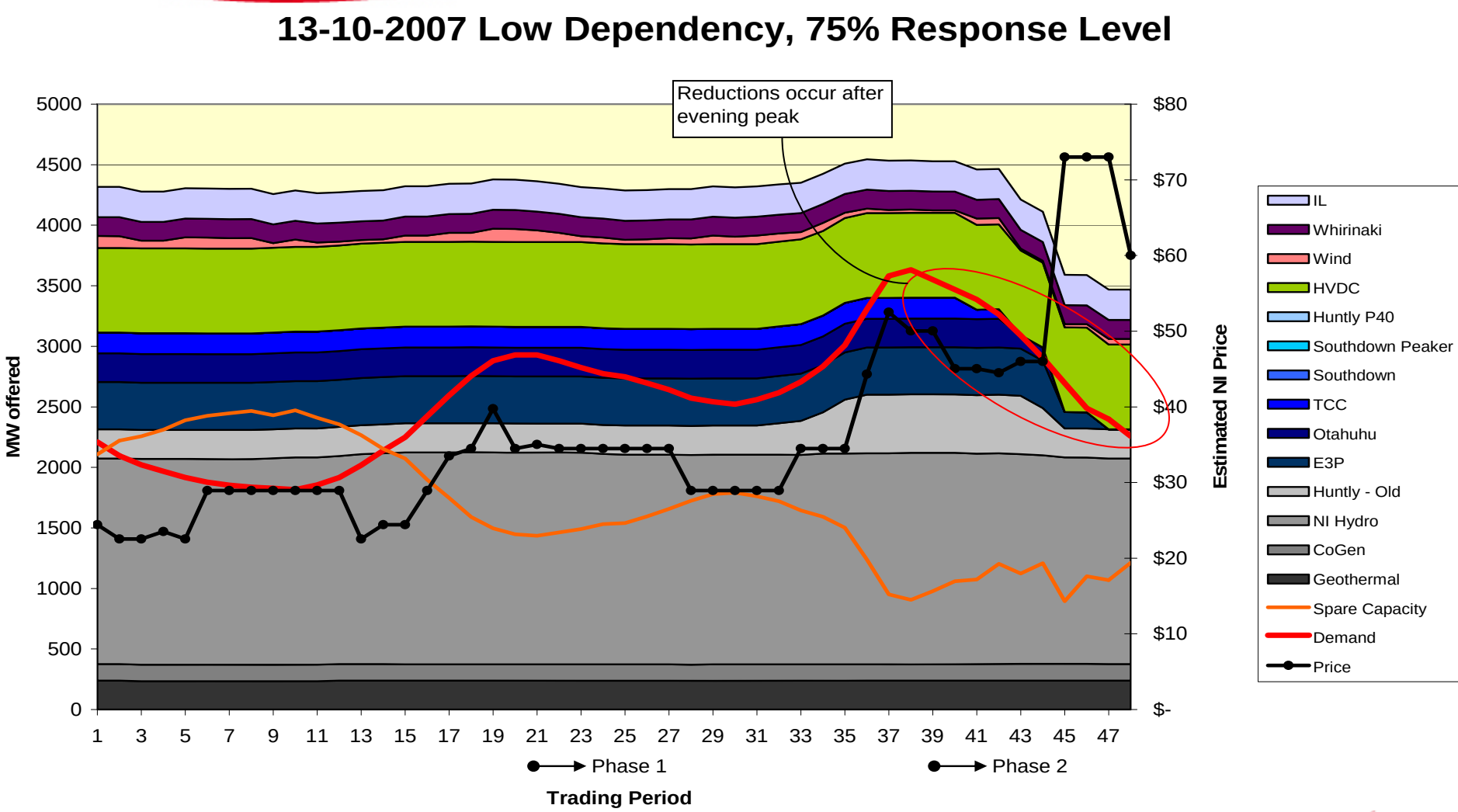
TCC & Otahuhu reduced after evening peak, possible problems for the next morning peak

Effects on the Electricity Market



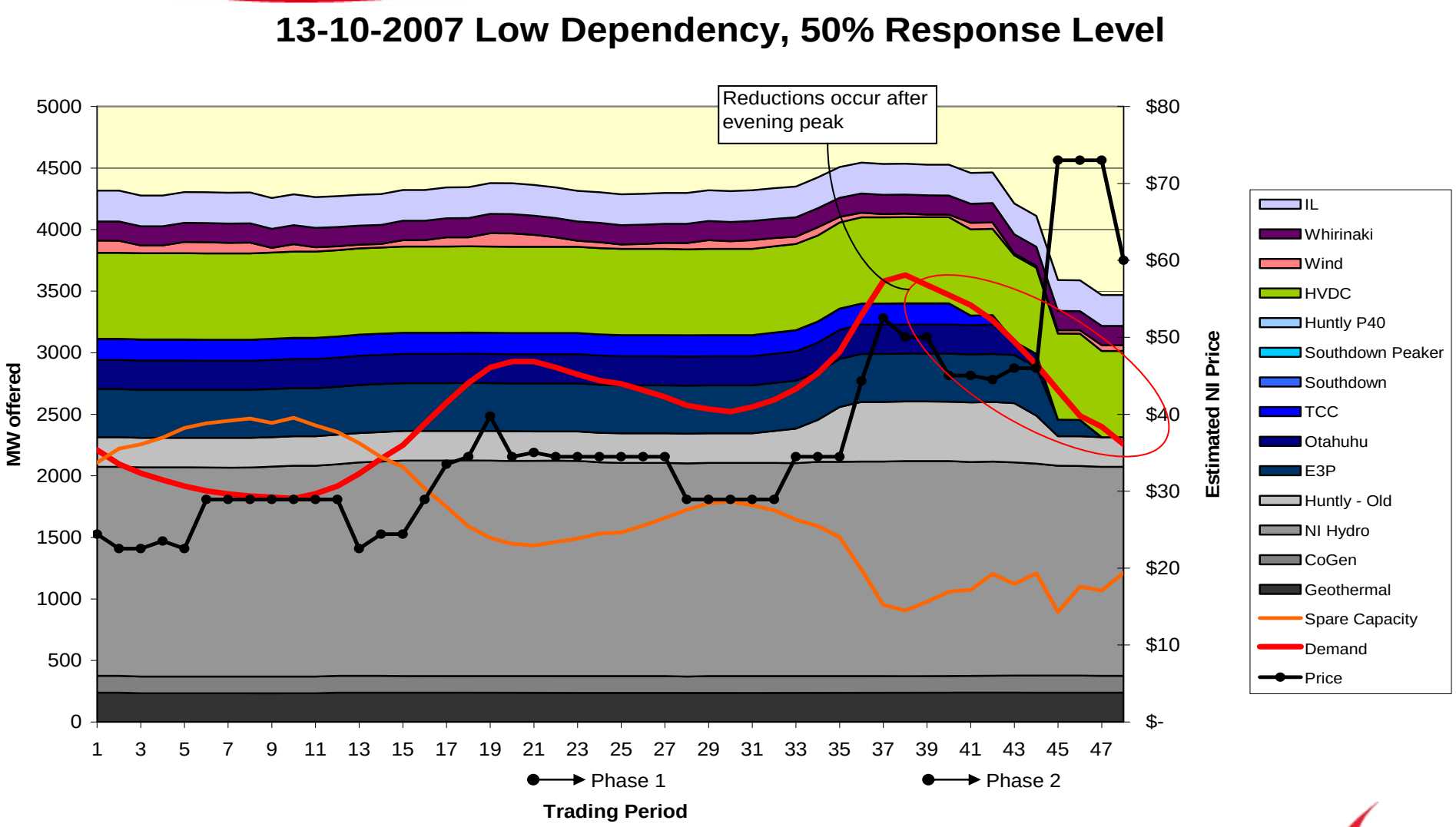
TCC & Otahuhu reduced after evening peak, possible problems for the next morning peak

Effects on the Electricity Market



Generation reduced after evening peak, possible problems for the next morning peak

Effects on the Electricity Market



Generation reduced after evening peak, possible problems for the next morning peak