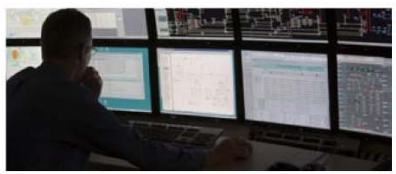
Commissioning
Huntly Unit 5

Industry briefing

20 November 06

TRANSPOWER



SYSTEM OPERATOR

Agenda

- Welcome – Kieran Devine, GM System Operations
- Introduction (5 min)
- Technical changes (15-20 min)
  - Risks covered
  - Tool changes
- Operational process (15-20 min)
- Scenarios and impact analysis (15 min)
- Questions and discussion (45 min)
- Close

Introduction

Dan Twigg
Risk & Performance Manager

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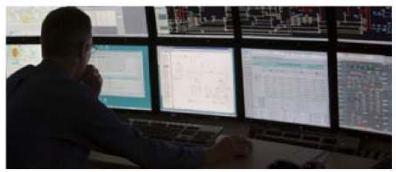


SYSTEM OPERATOR

Huntly U5 commissioning objectives

- Commission the plant to:
  - demonstrate asset capability
  - confirm asset can be connected to grid
  - retain secure power system
  - comply with the rules (Part C and Part G)
  - meet Genesis's economic objectives
  - meet industry/community winter 2007 expectations.

Huntly U5 commissioning
Relevant factors in SO approach

- Commissioning 385 MW on NZ system.
- Unclutched single shaft CCGT.
- Commissioning in developed electricity market.
- Commissioning in ‘low demand’ summer period.
- Industry/community interest.

Huntly U5 commissioning: approach

1. SO internal resources - substantial
    - Technical.
    - Market.
    - Operational.
    - Compliance.
    - Project management.

Huntly U5 commissioning: approach

2. External resources
   - Technical oversight. SKM (UK) engaged to advise on technical issues:
     - comment on plant owner information
     - review commissioning plans
     - ride thru capability/stability
     - international perspective.
   - Risk Management. F Stoks engaged to advise on risk management approach:
     - internal preparedness of Transpower (grid; IT; SO procedures; planning; unexpected events)
     - joint Genesis/Transpower planning meetings
     - internal SO risk management plan (based on Genesis commissioning schedule).

Huntly U5 commissioning: approach

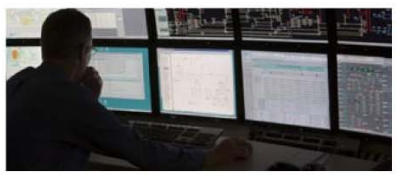
- Reasonable and prudent operator:
  - prime responsibility to industry/public
  - SO determines this.
- Responsible for secure, economic dispatch.
- Have determined commissioning risk:
  - CE until satisfied risk is reduced to ECE.
- Policy statement applies; consistent approach by SO.

Technical changes required to manage the commissioning of Huntly U5

Steven Nutt

Senior Investigations Engineer

Risks covered



Risks to the system during commissioning

- Huntly U5 is a single shaft Combined Cycle Gas Turbine (CCGT) with a generating capacity of 385MW
  - **HLY5 an unproven generator; under frequency performance yet to be established**
  - **The tripping of HLY5 as a single contingent event is covered by usual practices**
  - **The major risk in commissioning HLY5 is that the unit trips or reduces load significantly at the same time as another generator trips (secondary contingent event)**
  - **Commissioning taking place at low demand period (December, January and February).**

Period of Risk

- A period of risk has been identified by Genesis and Mitsubishi when HLY5 may trip as a secondary event which is during combustion tuning (they have identified this as a low risk).

- This risk has to be managed by the System Operator.

Options considered for managing risk during commissioning

1. Covering HLY5 as a Secondary Contingent Event (CE) at all times during commissioning.

2. Covering HLY5 as a Secondary Extended Contingent Event (ECE) at all times during commissioning.

3. Treating HLY5 the same as a commissioned generator at all times during commissioning.

4. Covering HLY5 as a Secondary CE, ECE or normal risk during the course of commissioning (depending on the risk).

- Option 4 is our chosen option as a reasonable and prudent operator.

Types of risk covered

When covered	Type of Risk		Result
Usual practice	Contingent Event	Loss of the single largest generator or one pole of the HVDC link	Reserves bought to limit the fall in system frequency to 48Hz
	Extended Contingent Event	Loss of the HVDC Bipole	Reserves bought plus AUFLS to limit the fall in system frequency to 47Hz
Additional to usual practice during HLY5 commiss-ioning	Secondary Contingent Event	Loss of the single largest generator or one pole of the HVDC link plus HLY5	Reserves bought to limit the fall in system frequency to 48Hz
	Secondary Extended Contingent Event	Loss of the single largest generator or the HVDC Bipole plus HLY5	Reserves bought plus AUFLS to limit the fall in system frequency to 47Hz

Secondary Contingent Event Risks

- Reserves purchased to limit system frequency excursion to no lower than 48 Hz.
- CE Risks: -
  - largest other generator + HLY5
  - HVDC Pole + HLY5.

Transition between Secondary Contingent Event and Extended Contingent Event

- A series of System Ride Through tests planned to establish under frequency performance of HLY5 and confirm that unit will not trip or significantly reduce in output as a result of a frequency disturbance

  - test will be carried out by Genesis with the agreement of the System Operator. Test will involve dropping the system frequency to 49.4Hz
  - on successful completion of each test HLY5 will be cleared to generate at a specific load level as a secondary ECE.

Secondary Extended Contingent Event Risks

- ECE Risks modelled to 47 Hz so the fall in system frequency is arrested by use of scheduled reserves and operation of Automatic Under Frequency Load Shedding (AUFLS)
  - largest other generator + HLY5
  - HVDC Bipole + HLY5.
- ECE assessed less likely to trip for an other event.

Tool changes

Options considered for covering Secondary CE and ECE events in Scheduling and *Real* Time

1. Cover HLY5 as a secondary CE at all times.
2. Change Scheduling and Dispatch model.
3. Change under frequency targets in the RMT software.
4. Require the system conditions for HLY5 to be ideal
   - demand level
   - plant mix
   - HVDC levels.
5. Having 3 generator models in RMT and SPD to model HLY5 at either secondary CE, ECE or normal risk.

Options considered for covering new CE and ECE events in Scheduling and *Real* Time (cont.)

6. Dispatching greater amounts of reserve than specified in RMT.
7. Use a spreadsheet to manually calculate level of reserve required.
8. Modify the front end of RMT to enable the programme to change the risk level of secondary CE and ECE.

- Option 8 is our chosen option.

Changes to the Reserve Management Tool

- Modifications carried out to enable
  - secondary CE tripping and
  - secondary ECE tripping of two generators
  - secondary ECE tripping of a generator and the HVDC bipole.

- Consider a synchronous generator as part of ECE risk in RMT.

Changes to the Scheduling, Pricing and Dispatch Tool

- There are to be no changes to the Scheduling, Pricing and Dispatch tool (SPD).

- The changes that have been carried out to RMT do not require any modifications to SPD.

Options considered for modelling Huntly unit 5 in SPD

1. Model HLY5 as a risk generator. The effects of this are:
   - HLY5 generation could be reduced by SPD (as other risk setters could be)
   - when HLY5 is at a high output and is a secondary CE risk there is a problem with SPD double accounting the risk. This could lead to infeasibilities in SPD.

2. Not modelling HLY5 as a risk generator. The effects of this are:
   - HLY5 generation will not be reduced by SPD. Other generators could be reduced in output if there is insufficient reserve available, but the results of RMT studies are stable.

- <u>Option 2</u> is our chosen option.

Discretionary constraints

- RMT results come from previous SDPQ.
- Discretionary constraints are required in dispatch to ensure the risk does not exceed the level for which reserves have been procured.
- Discretionary maximum constraints on generation will be applied when:
  - HLY5 is the largest AC CE risk, and
  - the AC ECE is the binding risk or could be the binding constraint if output on another generator is increased.
- At minimum, will constrain to level in last SDPQ prior to trading period.

Other Issues

- Voltage stability in Zone 1
  - changes to voltage stability tool to cater for CE, ECE and Normal operation.
- Time of Commissioning (December, January and February).
- Planned Drop load tests.

Operational process for Huntly Unit 5 commissioning

Andrew Twaddle

Operations Manager

Overview

- Business as usual during HLY5 commissioning.
- Operational instruction developed for Coordination Centre staff detailing process to be used during HLY5 commissioning, this includes:
  - changes to Reserve Management Tool
  - managing system security i.e. Zone 1 voltage stability
  - deficit of energy and/or reserves in the schedules
  - communications, to both internal and external stakeholders.
- Coordination Centre staff currently being trained in the process and tool changes.

Publication of the Schedules

- No changes in the current process.
- Pre-Dispatch Schedule (PDS) will continue to be produced and published every 2 hours from 13:00 today through to 23:59 tomorrow:
  - maximum MW risk in each island
  - total reserve scheduled in each island.

Publication of the Schedules

- Schedule of Dispatch Prices and Quantities (SDPQ) will continue to be produced and published every 30 minutes from 13:00
  - covers 8 trading periods i.e. the current and the next 7
  - provides a closer-to-real-time view of scheduled quantities and prices
  - uses the load forecast instead of bids.

Deficit of energy and/or reserves

More than 2 hrs from real-time

- Situation will be monitored. However, no action will be taken other than the routine process of confirming the inputs into the schedule:
  - load forecast
  - modelling of grid asset outages in SPD
  - constraints.

- Intended that participants will react to pricing signals using the market mechanisms prior to gate closure.

Deficit of energy and/or reserves

Within 2 hours of real-time

- HLY5 setting the contingent event risk (contingent event as defined on slide 14):
  - HLY5 output reduced to the level of reserves available
  - RMT/SPDQ re-solved to ensure prices now feasible
  - if feasible, constraint entered in dispatch to limit HLY5 generation for the trading period concerned
  - if infeasible, process repeated, lowering HLY5 output until a feasible solution is obtained.

Deficit of energy and/or reserves

Within 2 hours of real-time

- HLY5 is the secondary contingent event risk:
  - HLY5 output reduced to level of secondary extended contingent event
  - RMT/SPDQ re-solved to ensure prices now feasible
  - if feasible, constraint entered in dispatch to limit HLY5 generation for the trading period concerned
  - if infeasible, process repeated, lowering HLY5 output until a feasible solution is obtained.

Deficit of energy and/or reserves

Within 2 hours of real-time

- HLY5 is assessed as the secondary extended contingent event risk:
  - HLY5 output reduced
  - RMT/SPDQ re-solved to ensure prices now feasible
  - if feasible, constraint entered in dispatch to limit HLY5 generation for the trading period concerned
  - if infeasible, process repeated, lowering HLY5 output until a feasible solution is obtained.

Deficit of energy and/or reserves

Within the current trading period

- Output of HLY5 reduced:
  - dispatch management tool used to confirm solution now feasible
  - imported into RMT and re-solved for current trading period
  - re-solved using dispatch tool and if feasible, solution dispatched
  - if infeasible, process repeated, lowering HLY5 output until a feasible solution is obtained.
- CE Reserve Adjustment Factor will not be zeroed when HLY5 is connected to the system (deviation from policy statement; part C, schedule C4, 23.1 of the EGRs).

Backing Off Generation

- Where the solution reduces a generator's output but a bona fide or claim is made under rule G III 4.11.1 of the EGRs:
  - details recorded, constraint applied and solution re-solved
  - if feasible, solution dispatched
  - if infeasible:
    - and generator not required for security, generator will be instructed to follow dispatch or go to a lower level of sustainable generation
    - and generator required for security, output of HLY5 will be reduced for the current trading period and solution re-solved
  - if feasible, solution dispatched
  - if still infeasible, process repeated, lowering output of HLY5 and re-solving until a feasible solution obtained.

Notification to Participants

- Key points in HLY5 commissioning to be notified to participants:
  - date when unit initially synchronises to the system
  - dates each system ride through test to take place
  - dates each drop load test to take place
  - date when HLY5 will be treated as a normal risk.
- Communication of these dates will be via Customer Advice Notices to participants.

Scenarios and impact analysis

Lennie Palmer
Market Services Analyst

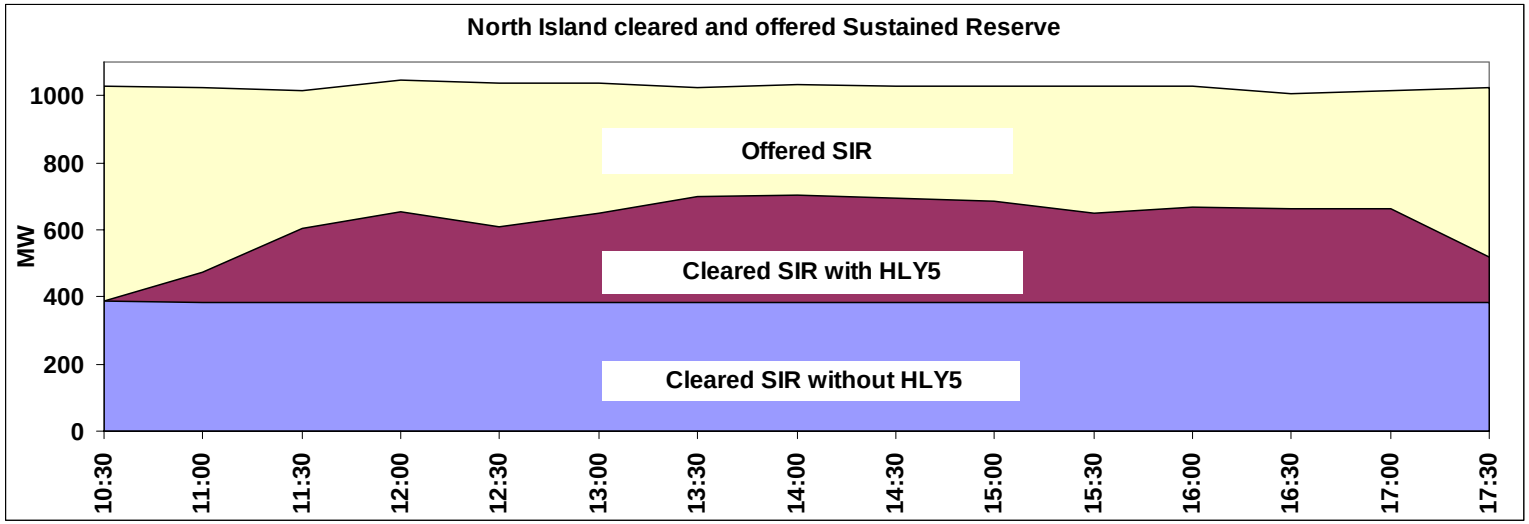
Outline

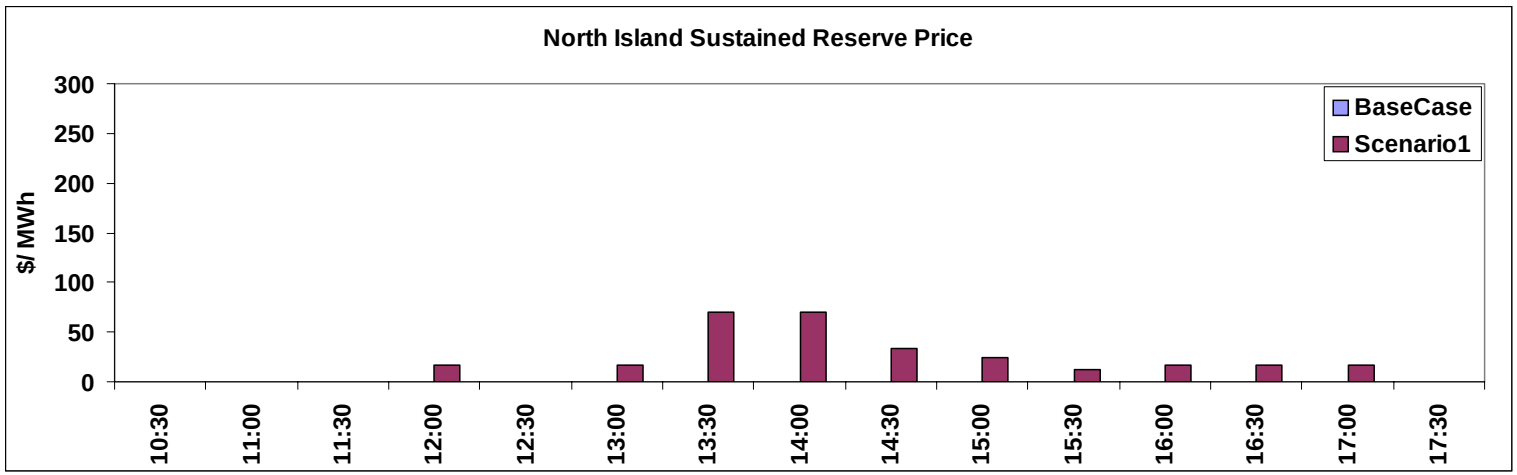
- Analysis overview
- Analysis outcomes
  - reserve quantities and prices
  - risk unit analysis
  - energy quantities and costs
- Analysis summary

Analysis overview

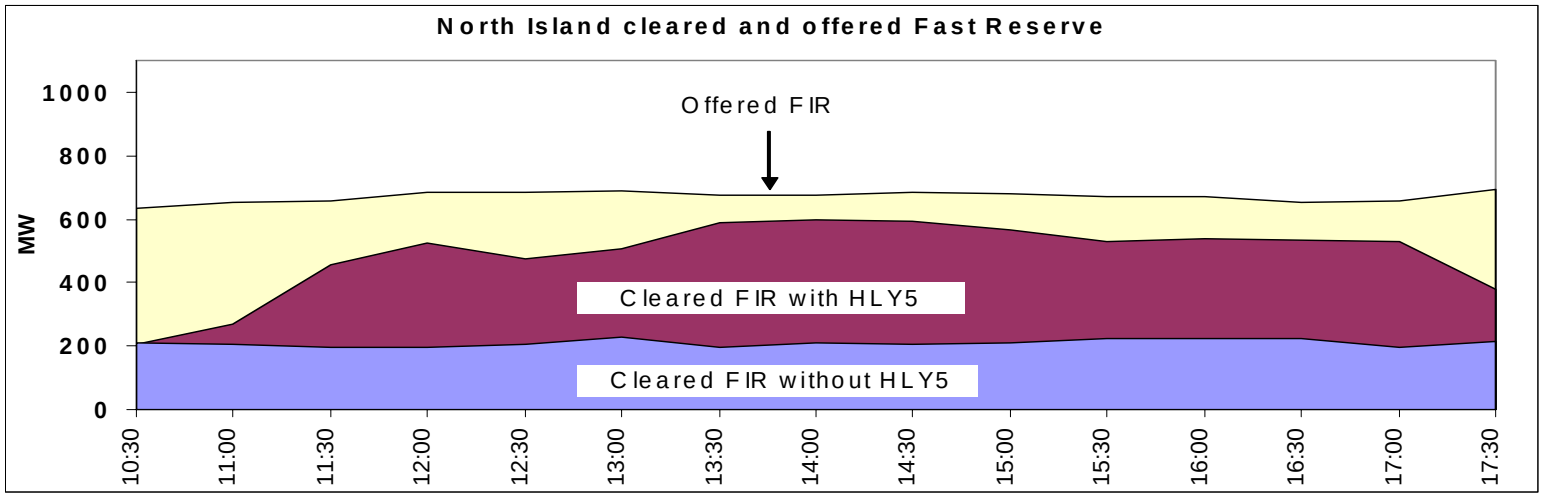
- Why analyse
  - indicative only, possible operational / market issues.
- Select comparable day from database:
  - remove constraints
  - this becomes base case.
- Include HLY5 and other expected offers:
  - in SPD HLY5 is not a ‘risk setting unit’
  - in RMT HLY5 covered as a secondary risk
  - this becomes “scenario 1”.
- Compare outputs.

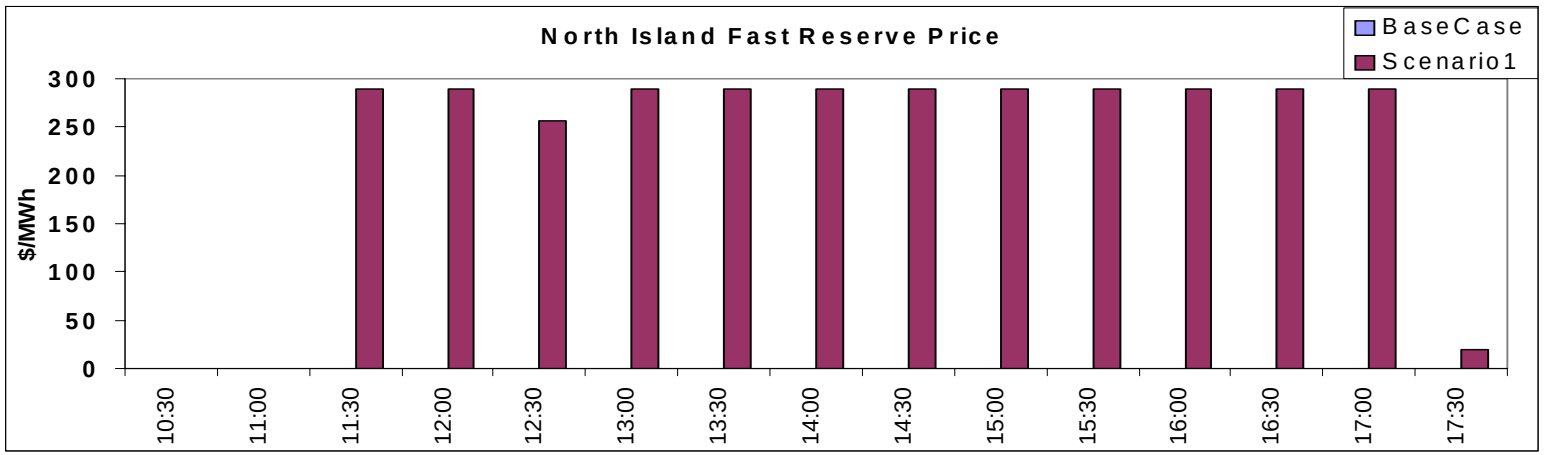
Sustained reserves – quantities and prices



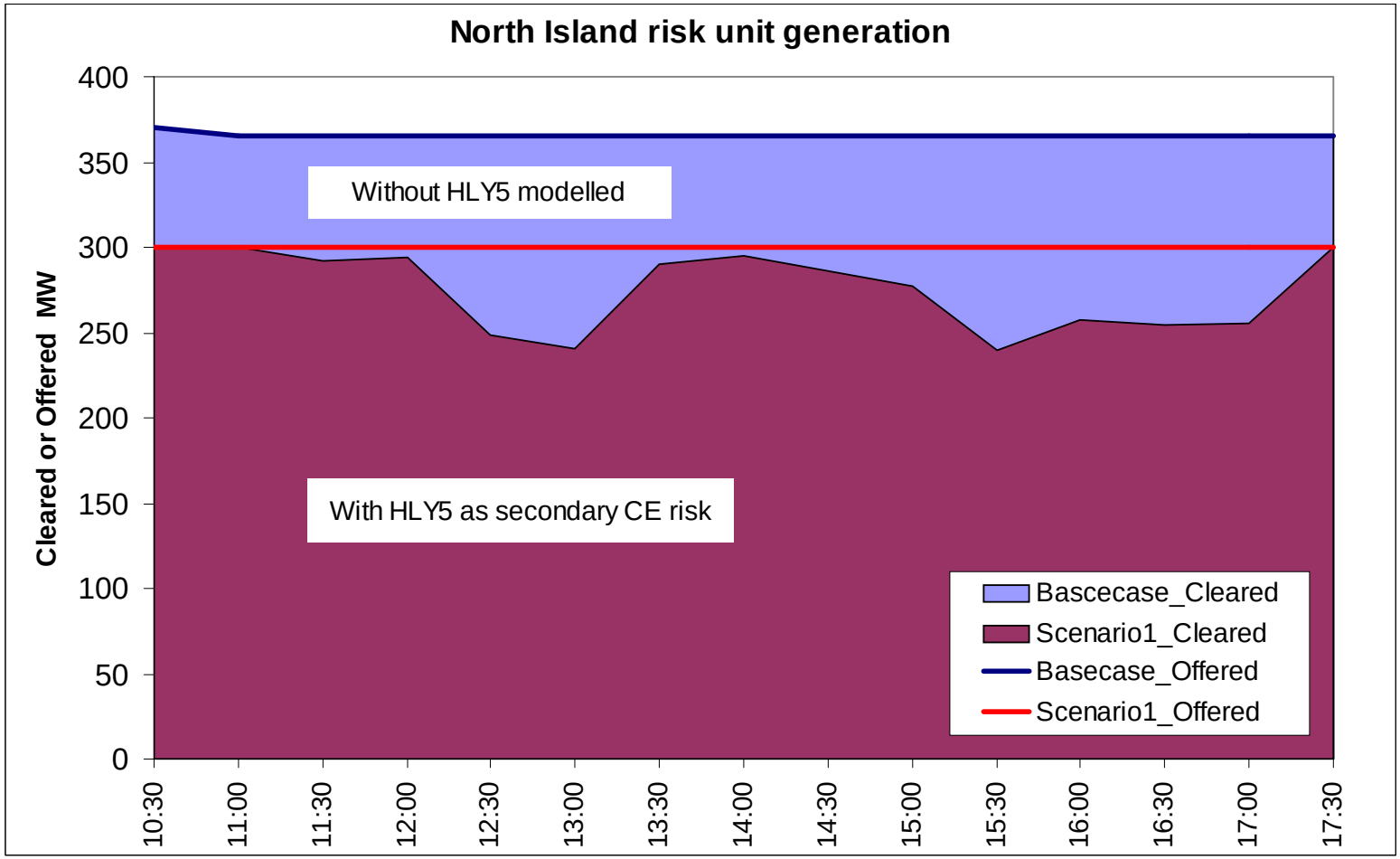


Fast reserves – quantities and prices

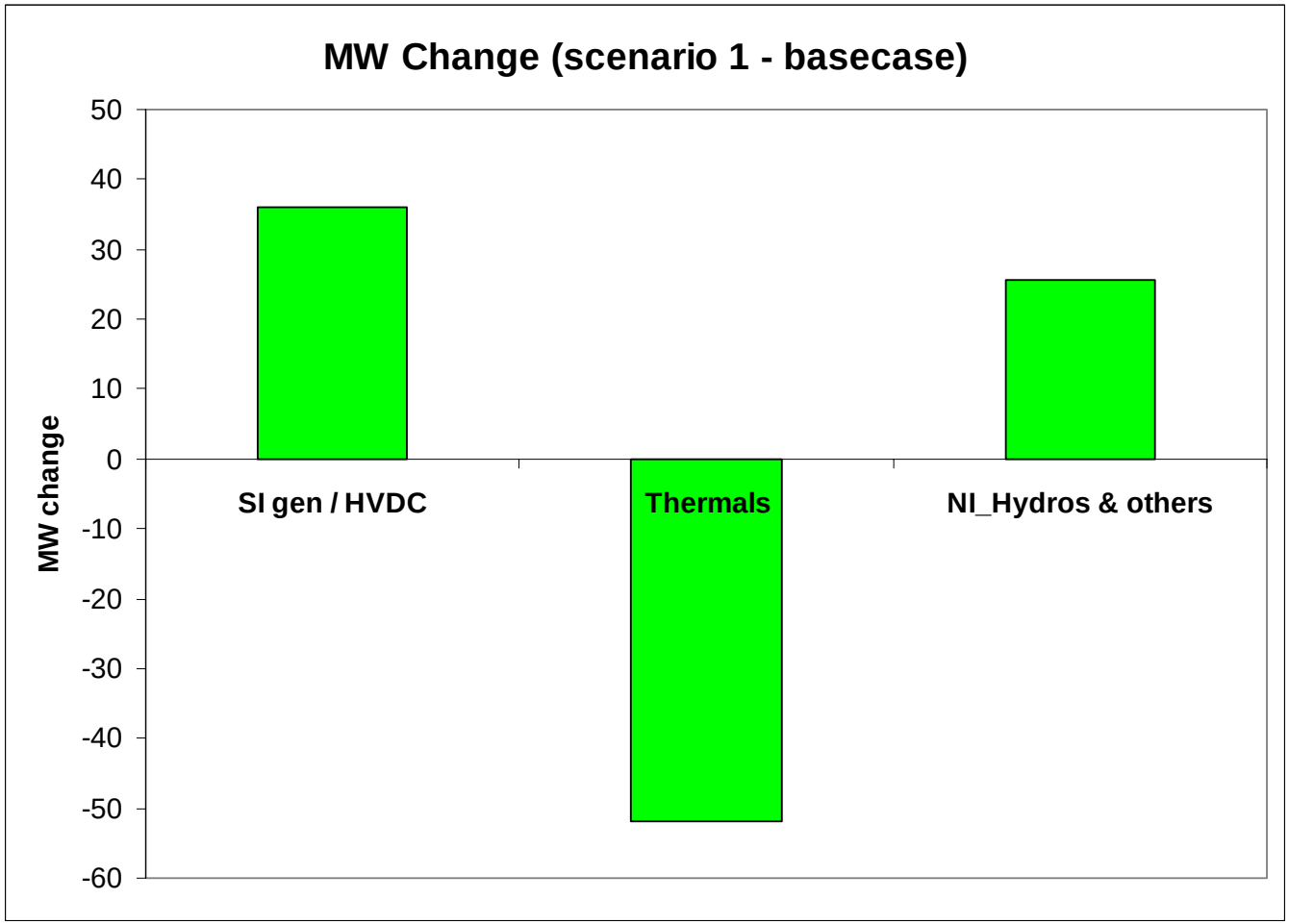




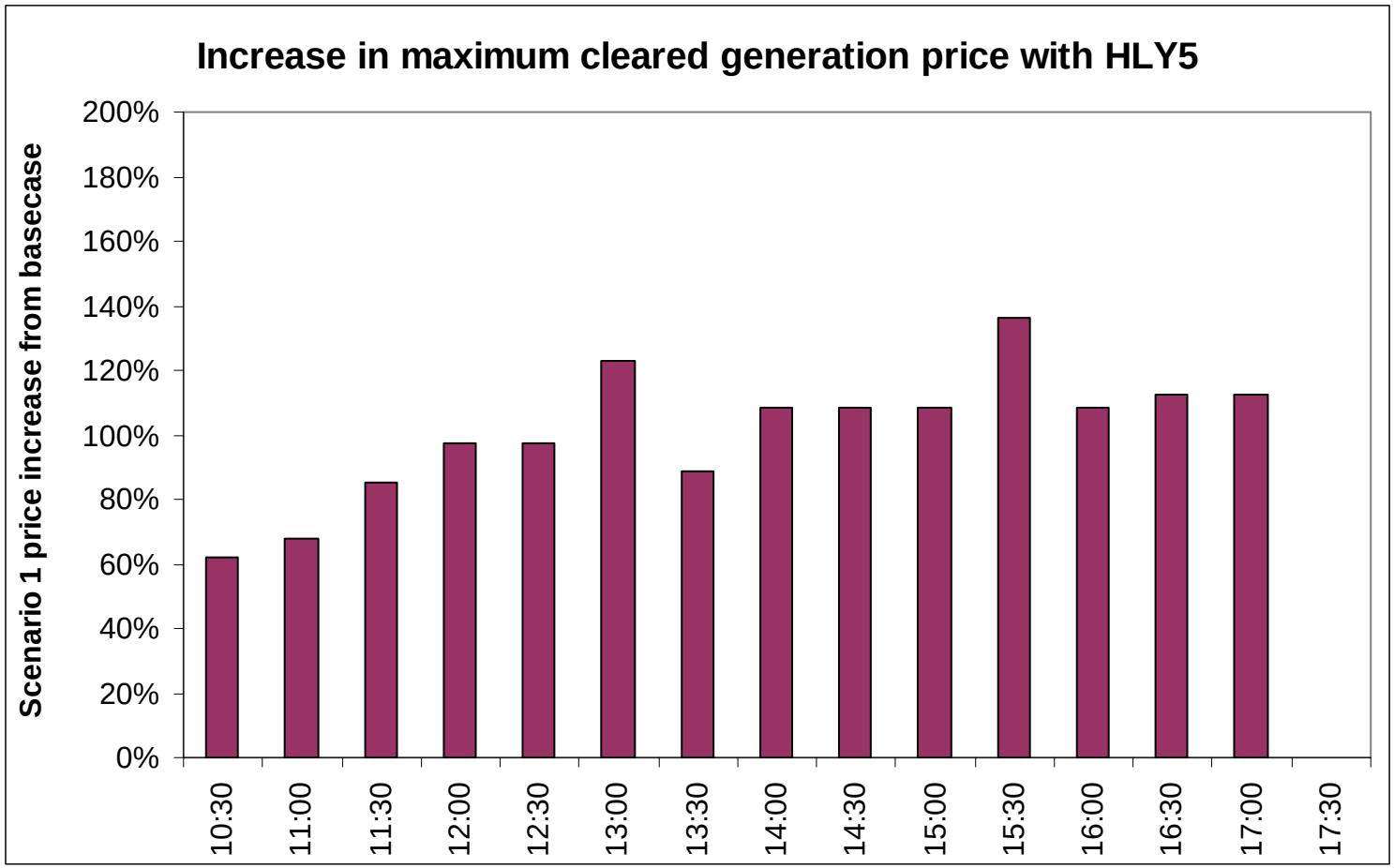
Risk units cleared MW



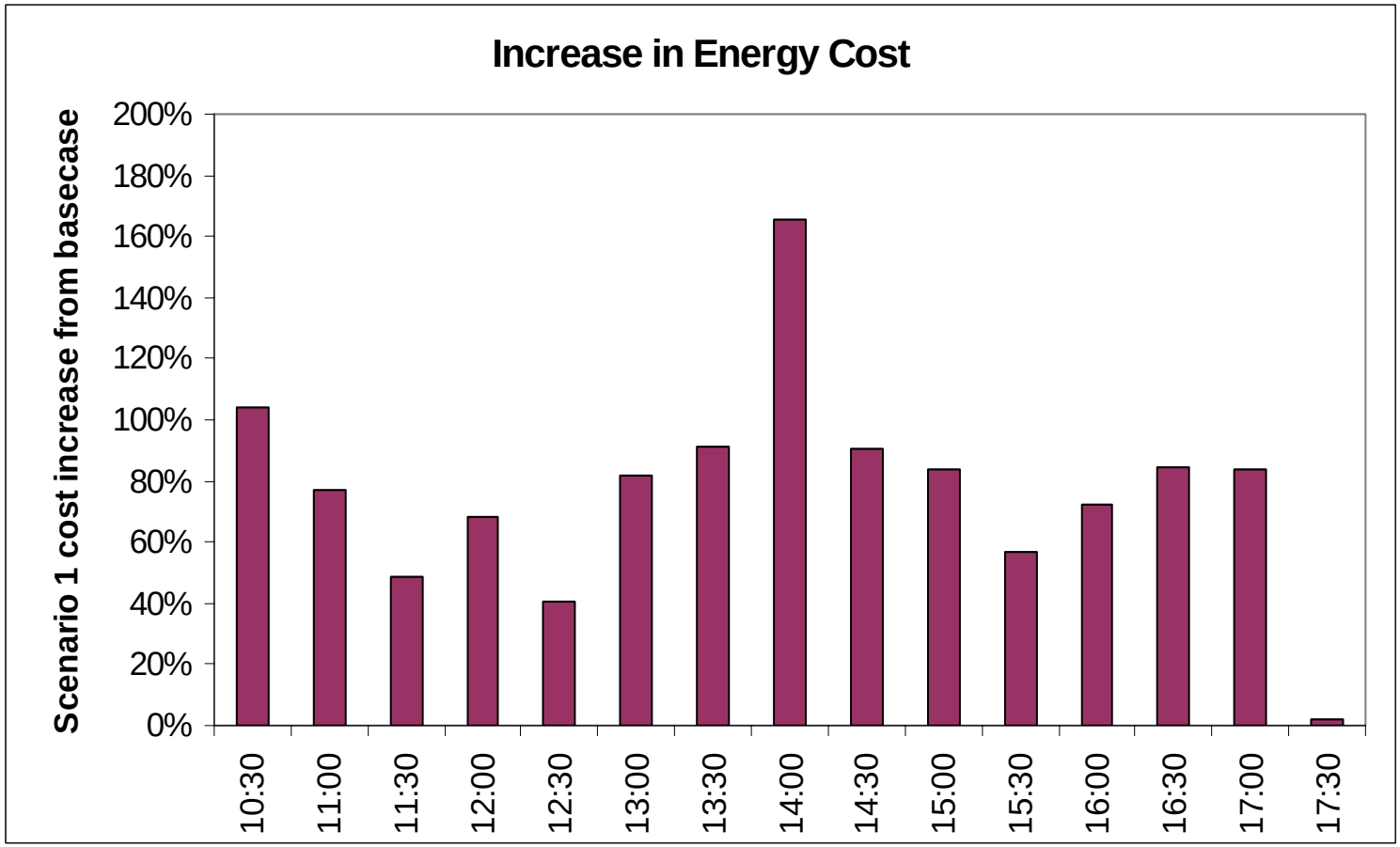
Changes to cleared energy by type



Generation maximum cleared price



Energy costs



Analysis summary

- Extra reserve is procured to cover secondary risk
- Reserves costs go up – especially FIR
- Risk units get “backed off”
- Energy costs increase
- Other
  - we believe the rules mean all reserves (including additional reserves to cover HLY5) will be allocated for payment to the industry in the normal way.

Questions and discussion