

Transpower NZ Ltd System Operator Industry Seminar 13/15 September 2006

Pricing of the 17:30 Trading Period 19th June 2006

TRANSPOWER



SYSTEM OPERATOR
TRANSPOWER NZ LTD

24-7
instant delivery



Additional information

- The following slides contain further information and examples that were not presented in the seminars.



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

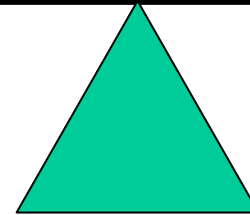
- the following price sensitivity analysis demonstrates the change in the objective function if you remove 0.01MW of offered energy from Huntly 1.



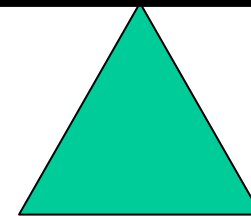
The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



$$\text{GENERATION} = \text{Metered LOAD} + \text{LOSSES}$$



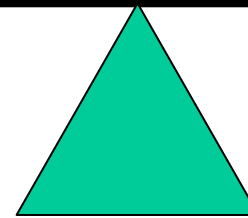
$$\text{RISK} = \text{RESERVE}$$



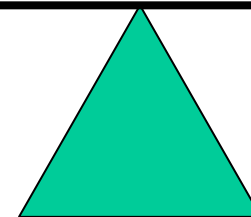
The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



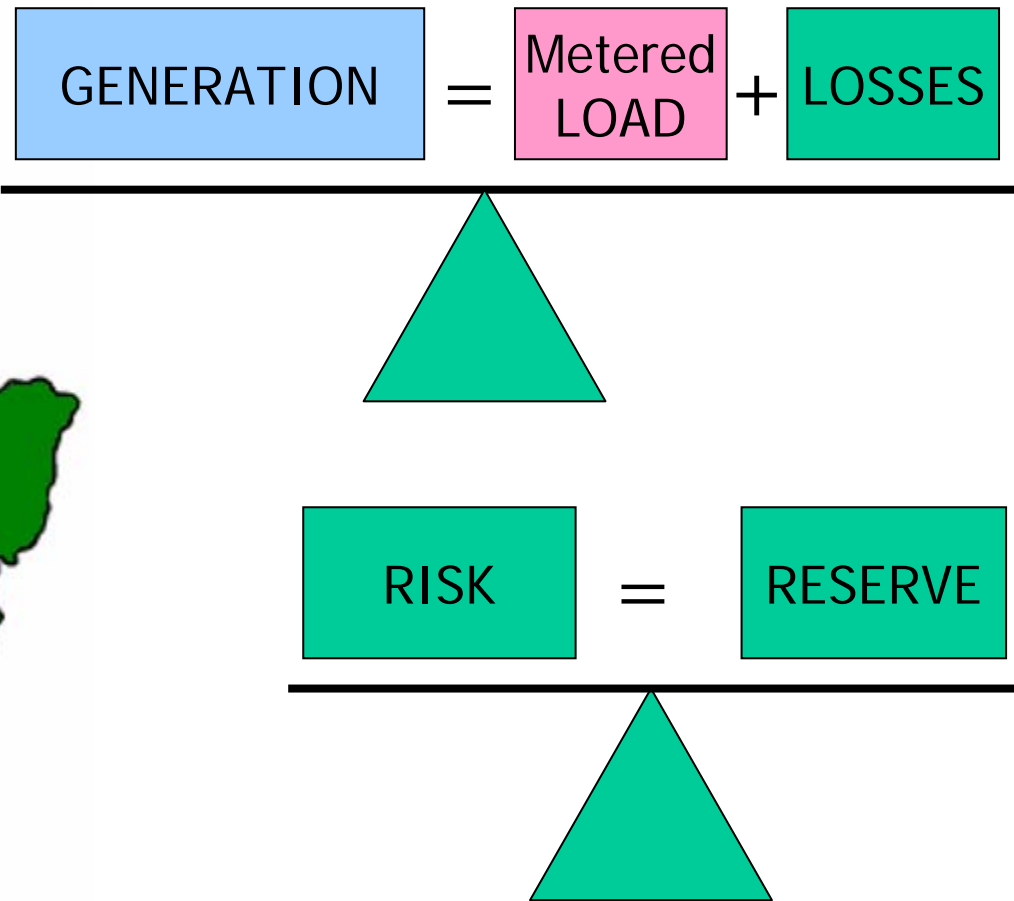
$$\text{GENERATION} = \text{Metered LOAD} + \text{LOSSES}$$



$$\text{RISK} = \text{RESERVE}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



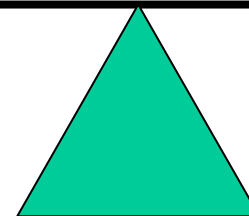
$$\Delta \text{GENERATION} = \Delta \text{LOSSES}$$

$$\text{RISK} = \text{RESERVE}$$

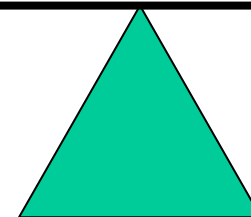
The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



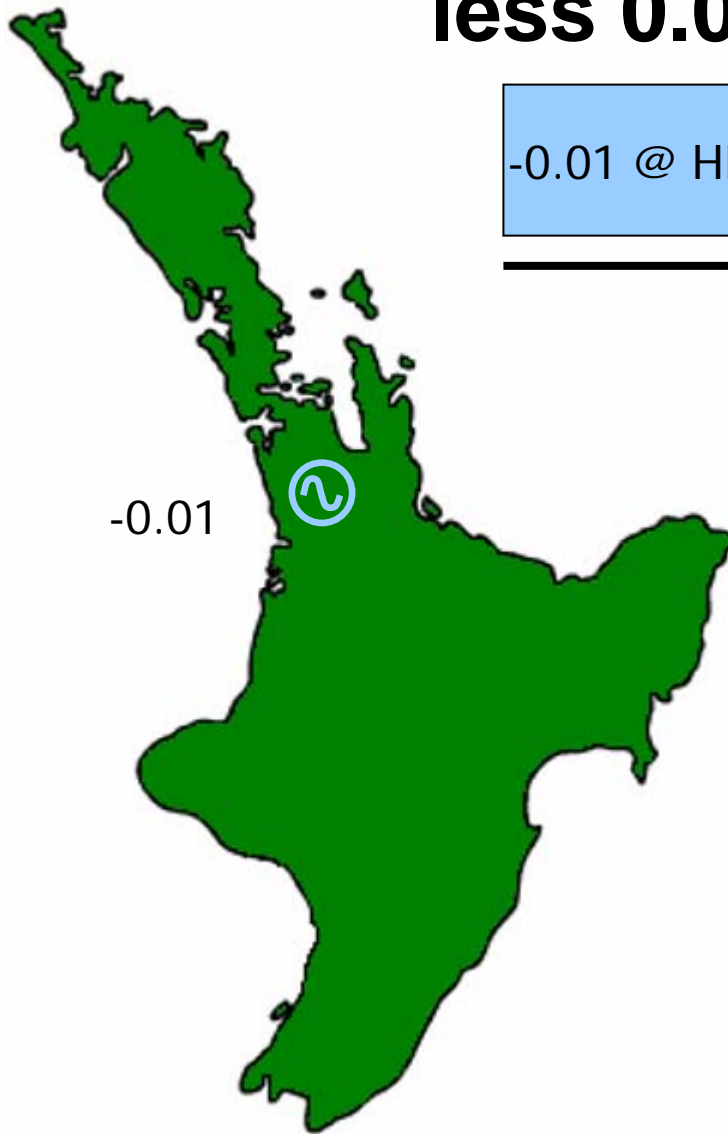
$$\Delta \text{GENERATOR 1} + \Delta \text{GENERATOR 2} = \Delta \text{LOSSES}$$



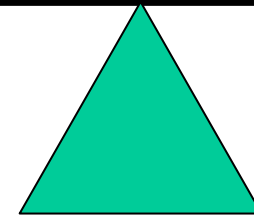
$$\text{RISK} = \text{RESERVE}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

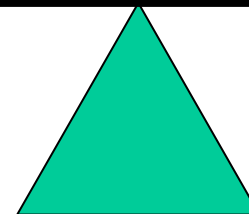


$$\boxed{-0.01 @ HLY1} + \boxed{\Delta \text{ GENERATION}} = \boxed{\Delta \text{ LOSSES}}$$



60s Reserve

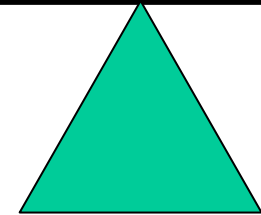
$$\boxed{\text{RISK}} = \boxed{\text{RESERVE}}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

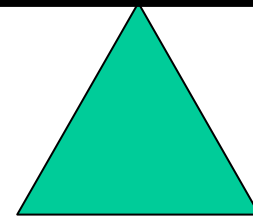


$$\boxed{-0.01 @ HLY1} + \boxed{\Delta \text{ GENERATION}} = \boxed{\Delta \text{ LOSSES}}$$



60s Reserve

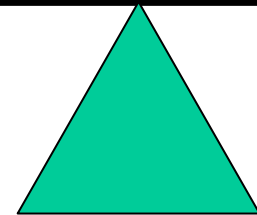
$$\boxed{\text{RISK}} = \boxed{\text{RESERVE}}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

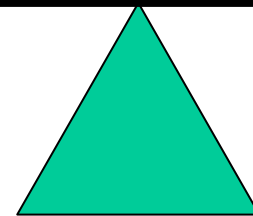


$$\boxed{-0.01 \text{ @ HLY1}} + \boxed{+@ \text{ OTC}} = \boxed{-\Delta \text{ LOSSES}}$$



60s Reserve

$$\boxed{\text{RISK}} = \boxed{\text{RESERVE}}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



$$-0.01 @ \text{ HLY1} + +@ \text{ OTC} = -\Delta \text{ LOSSES}$$

60s Reserve

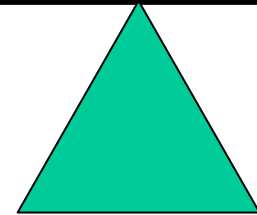
$$+ \text{ RISK} = \text{ RESERVE}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

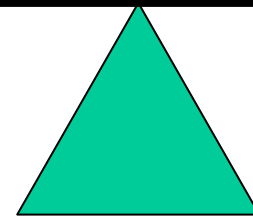


$$\boxed{-0.01 \text{ @ HLY1}} + \boxed{+ \text{ @ OTC}} = \boxed{-\Delta \text{ LOSSES}}$$



60s Reserve

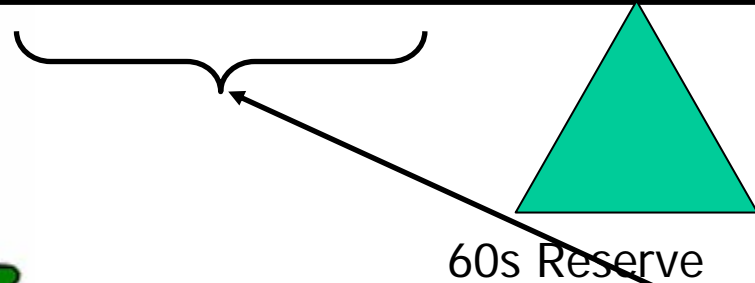
$$\boxed{+ \text{ OTC}} = \boxed{+ \text{ RESERVE}}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

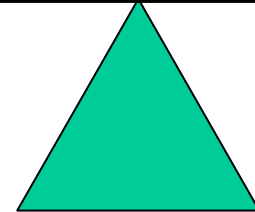


$$-0.01 @ \text{ HLY1} + +@ \text{ OTC} = -\Delta \text{ LOSSES}$$



60s Reserve

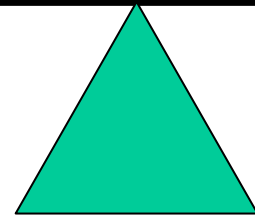
$$+ \text{ OTC} = + \text{ RESERVE}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

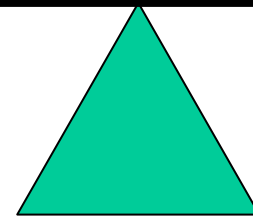


$$-0.01 \text{ @ HLY1} + \text{@ OTC} - \text{Generator 3} = -\Delta \text{ LOSSES}$$

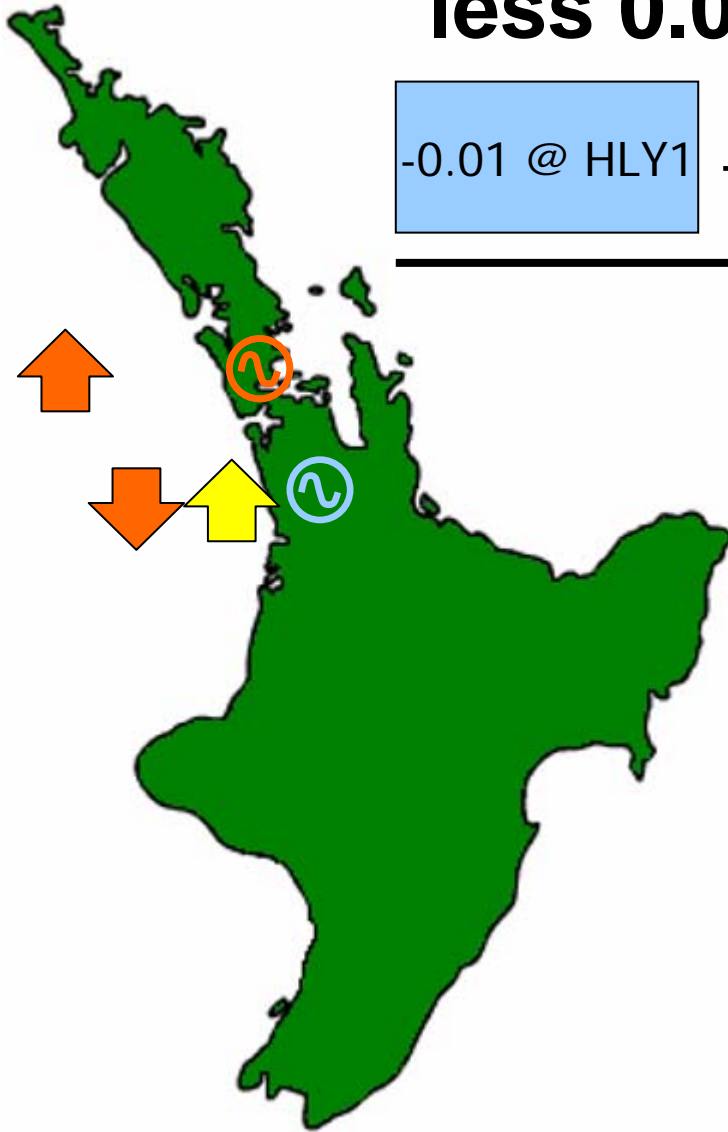


60s Reserve

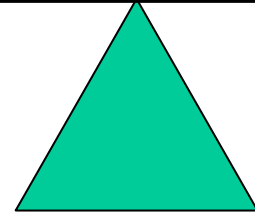
$$+ \text{OTC} = + \text{RESERVE}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

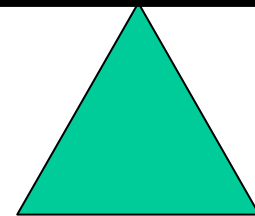


$$-0.01 @ \text{HLY1} + @ \text{OTC} - \text{HLY} = -\Delta \text{LOSSES}$$

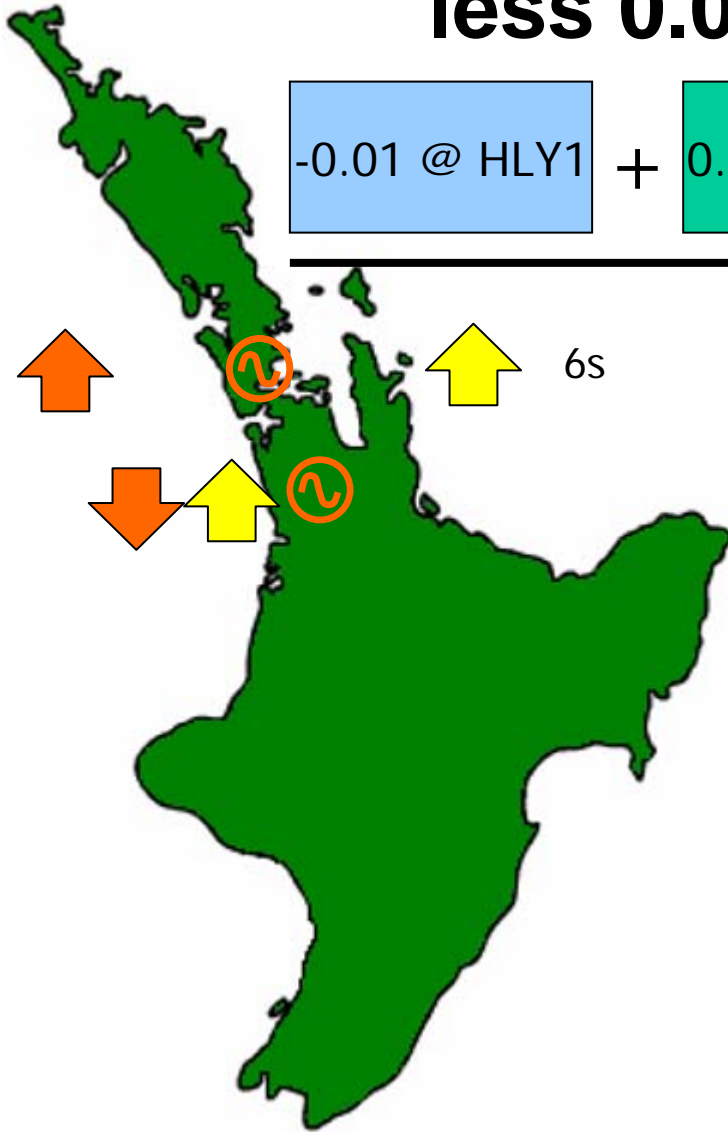


60s Reserve

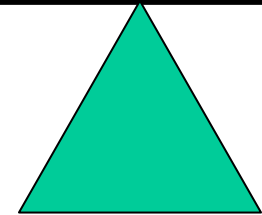
$$+ \text{OTC} = + \text{HLY}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF

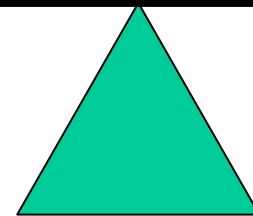


$$-0.01 @ \text{HLY1} + 0.2051 @ \text{OTC} - 0.2051 @ \text{HLY} = -0.01$$

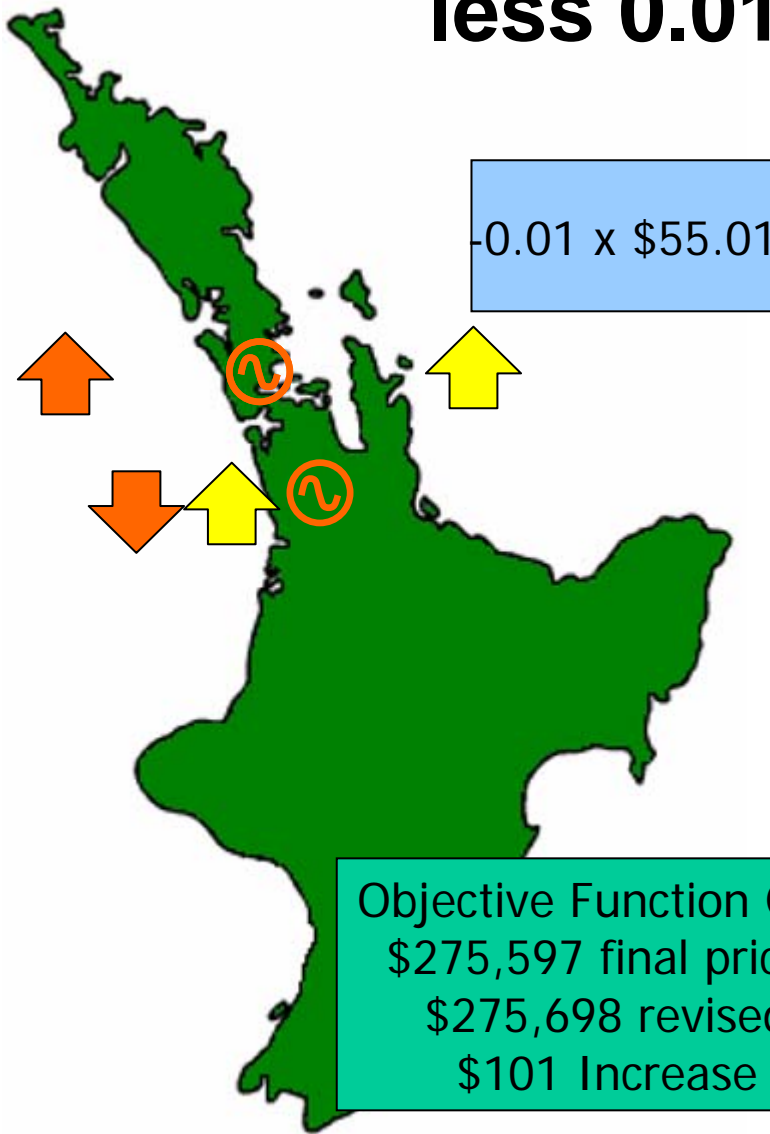


60s Reserve

$$+0.2051 @ \text{OTC} = +0.2051 @ \text{HLY}$$



The 17:30 price sensitivity – Huntly 1 less 0.01MW ENOF



Energy

$$-0.01 \times \$55.01$$

+

$$\frac{+0.2051 \times \$420}{-0.2051 \times \$55.04}$$

=

$$= \$74.30$$

60s Reserve

$$+0.2051 \times \$0.24$$

=

$$= \$0.05$$

6s Reserve

$$+0.2051 \times \$130$$

=

$$= \$26.66$$

$$= \$101.01$$



1700

System Operator Industry Seminar
Murray Henderson
Market Services
13/15 September 2006

TRANSPower



SYSTEM OPERATOR
TRANSPower NZ LTD

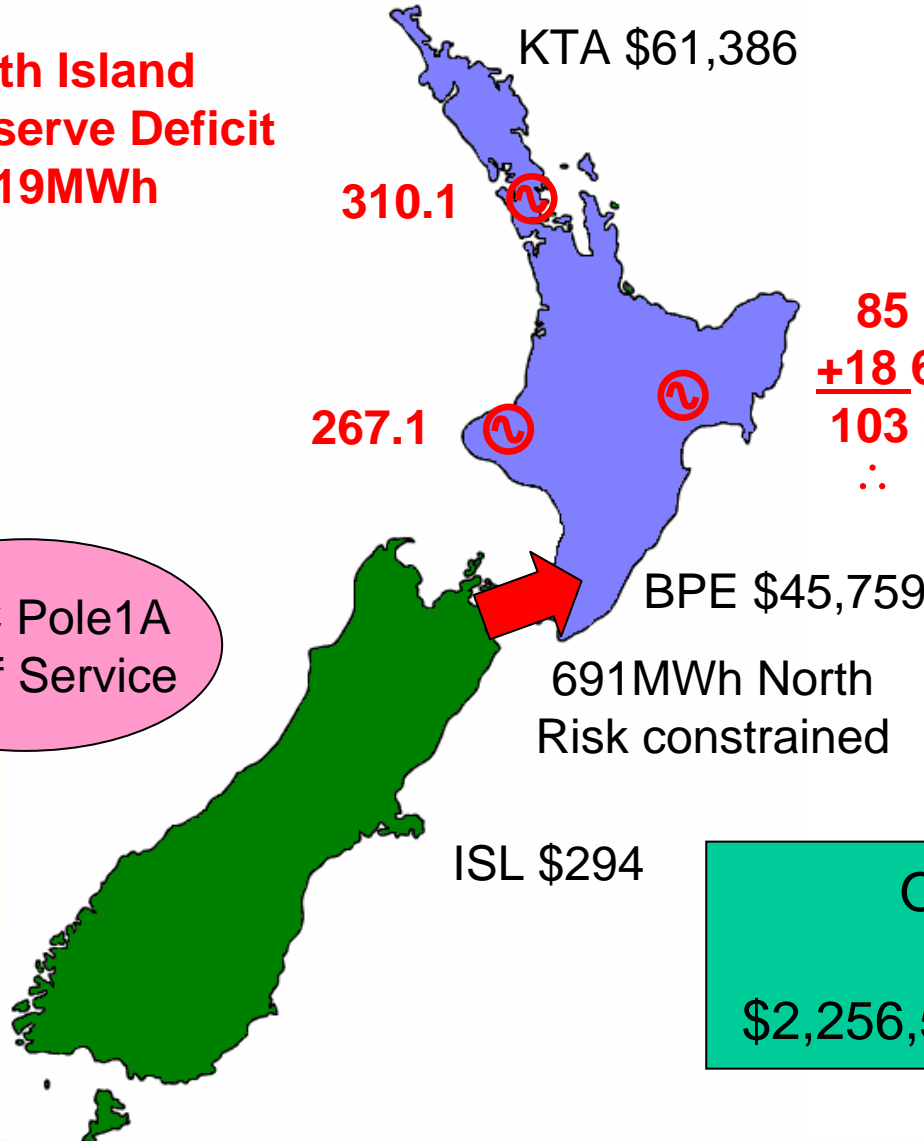
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instant delivery



The 17:00 infeasible solution

North Island
60s Reserve Deficit
2.19MWh

HVDC Pole1A
 Out of Service



North Island

- Uncleared ENOF
 OTC 67MWh
 TCC 42MWh
 WHI 5MWh

South Island

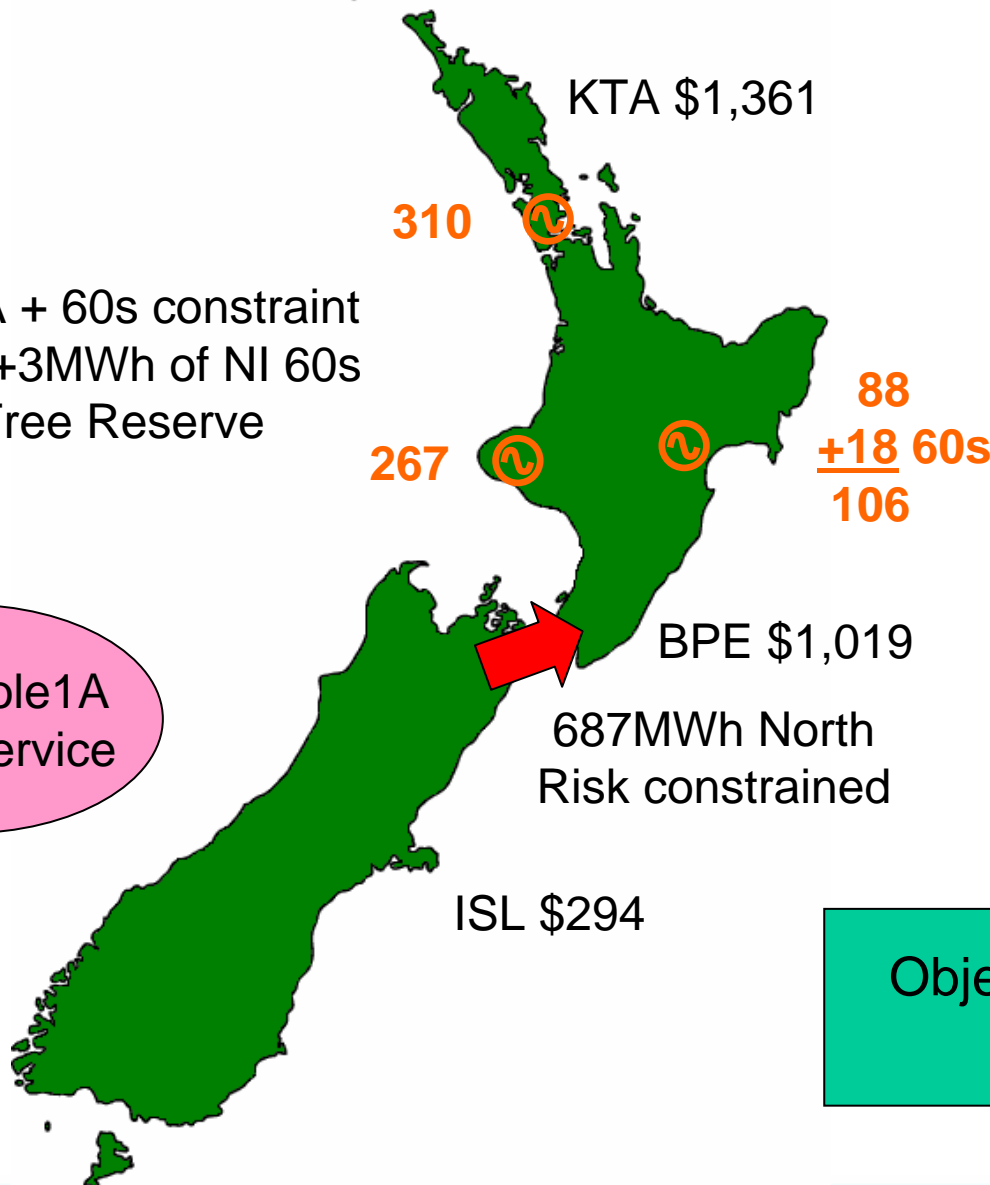
- Uncleared ENOF
 270MWh

Objective Function Cost
 \$2,545,520
 \$2,256,514 CVP + \$289,006 physical

The 17:00 feasible solution

FKK WKA + 60s constraint removed +3MWh of NI 60s Net Free Reserve

HVDC Pole1A Out of Service



North Island

- Uncleared ENOF OTC 67MWh
- TCC 42MWh
- WHI 5MWh

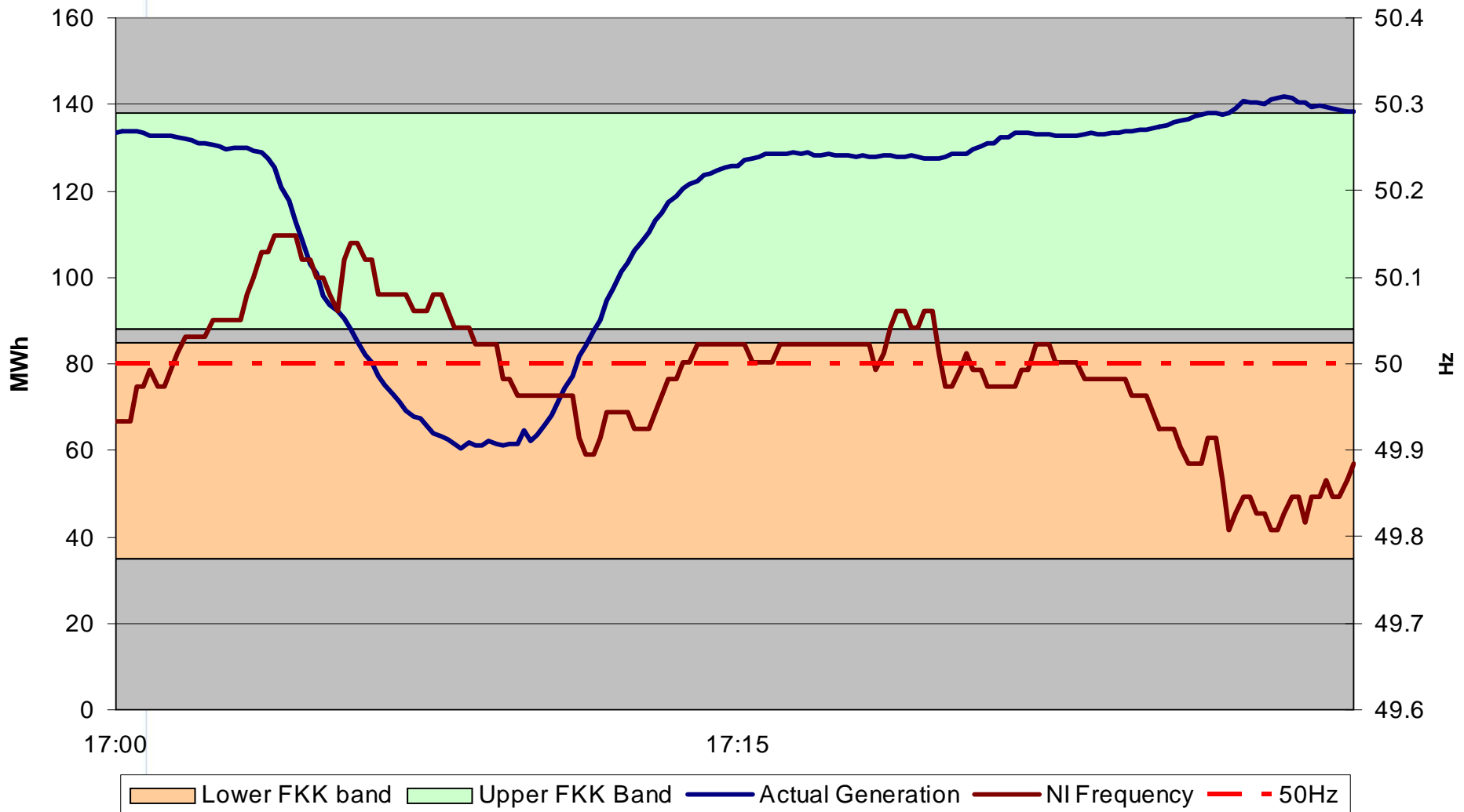
South Island

- Uncleared ENOF 270MWh

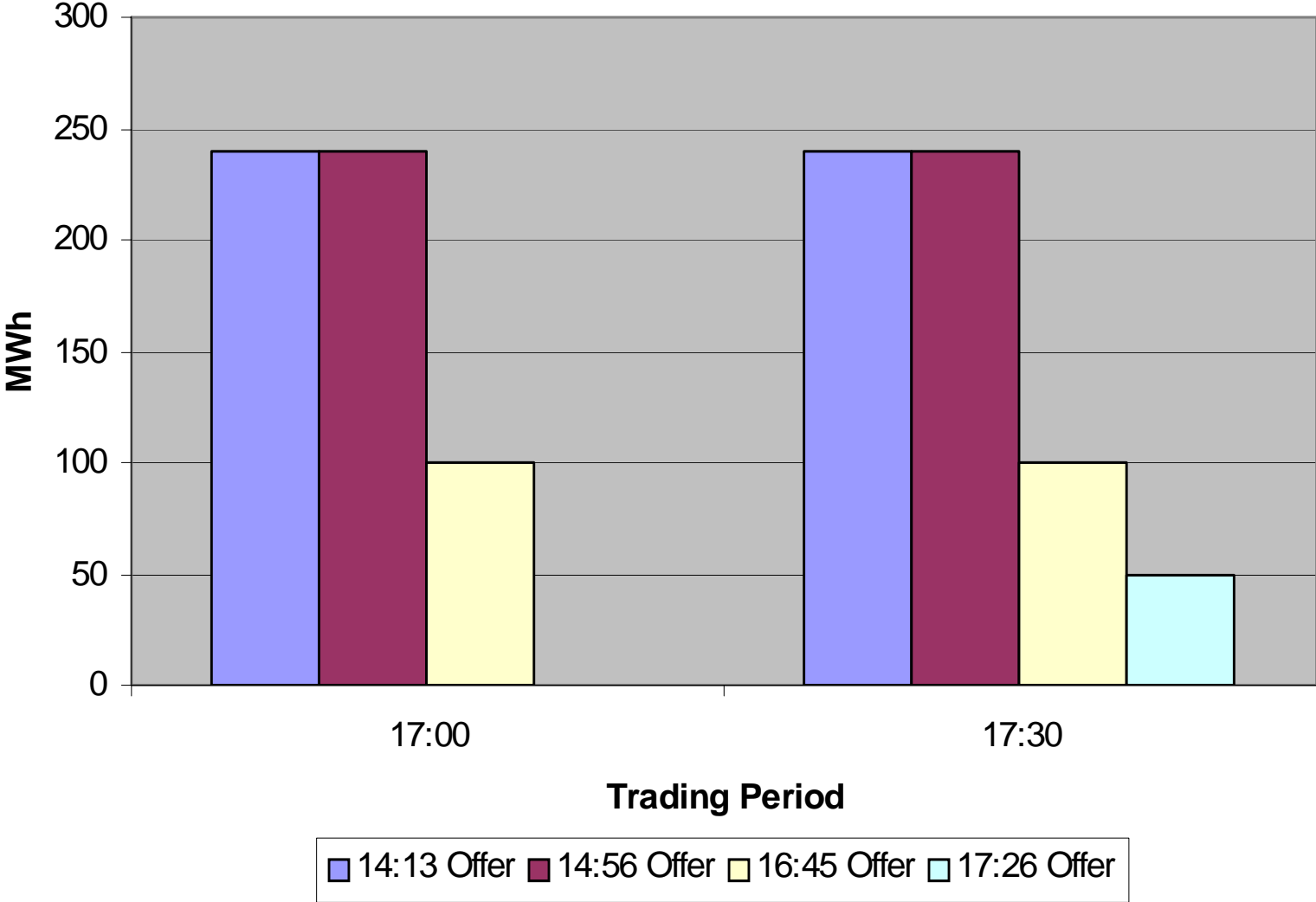
Objective Function Cost
\$287,877

Tuai actual generation vs FKK limits

Tuai FKK 1700 - 1729 19 June 06

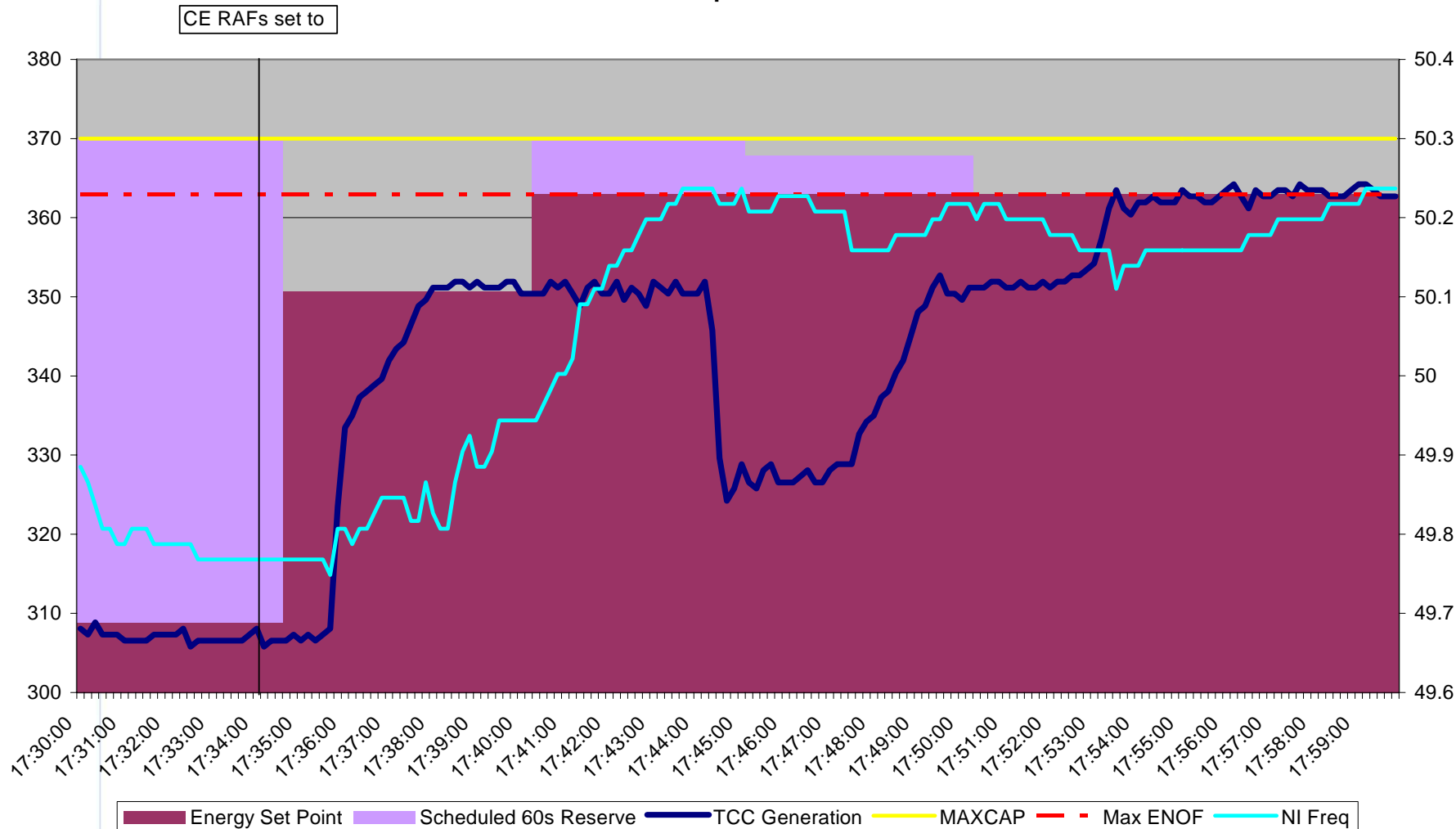


Tokaanu's bona fide reduction



TCC dispatch versus actual

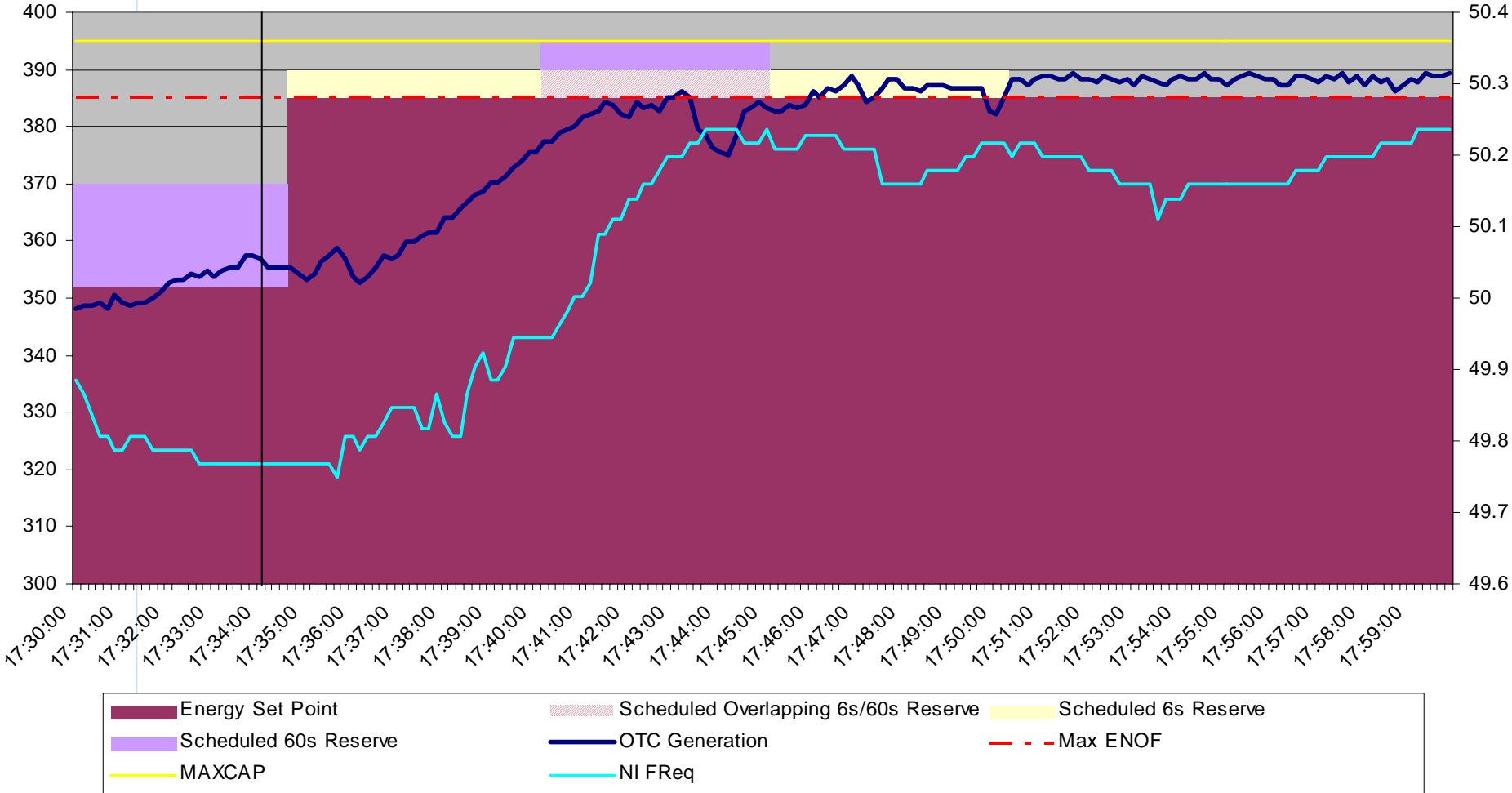
TCC TRENDR vs Dispatch Instructions 1730



OTC dispatch versus actual

OTC TRENDR vs Dispatch instructions 1730

CE RAFs set to



17:30 Trading Period

Why 23MW of North Island 60s NFR?

- Existing 60s Deficit 18.63
- Deficit Generation KTA0331 3.38
- Increase in losses 0.99
- Total 23



How SPD and RMT interact

- DC Contingent Event Risk Model

$$\text{Risk}_{\text{CE}} \geq \text{RAF}_{\text{CE}}(\text{HVDCflow} - \text{RiskOffset}_{\text{CE}})$$

- Generator Contingency Risk Model

$$\text{Risk}_{\text{Gen}} \geq \text{RAF}_{\text{Gen}}(\text{Gen} - \text{RiskOffset}_{\text{Gen}})$$

- Manual Risk

$$\text{Risk}_{\text{Man}} \geq \text{RAF}_{\text{Man}}(\text{ManualRisk} - \text{RiskOffset}_{\text{Man}})$$

- DC Extended Contingent Event Risk Model

$$\text{Risk}_{\text{ECE}} \geq \text{RAF}_{\text{ECE}}(\text{HVDCflow} - \text{RiskOffset}_{\text{ECE}})$$

