

Frequency Keeping Costs

17th April 2008

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What is frequency keeping?

- is an ancillary service
- the compensatory response of a selected generator to small, second by second changes in system frequency
- independent NI and SI markets that run in parallel with the New Zealand energy market

Why do we have frequency keeping?

Part C Section II - PPOs

- allows SO to maintain system frequency within PPOs
- maintains system frequency on a second by second basis
- allows generators to operate efficiently on 'set point'

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Provider requirements I

Procurement Plan

- must be a generator
- 10 MW/min ramp rate
- objective is to:
 - manage frequency within normal band
 - eliminate frequency and time error (at least once per day)

Provider requirements II

Procurement Plan

- FK responsible for ensuring sufficient generation available
- FK not required to provide generation outside band
- dispatch in accordance with Procurement Plan

Who pays for frequency keeping?

Part C, IV, 11.4

- costs for frequency keeping allocated to purchasers
- costs allocated in proportion to load each purchaser draws each trading period
- costs pooled and apportioned across both North and South Island markets

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Cost composition

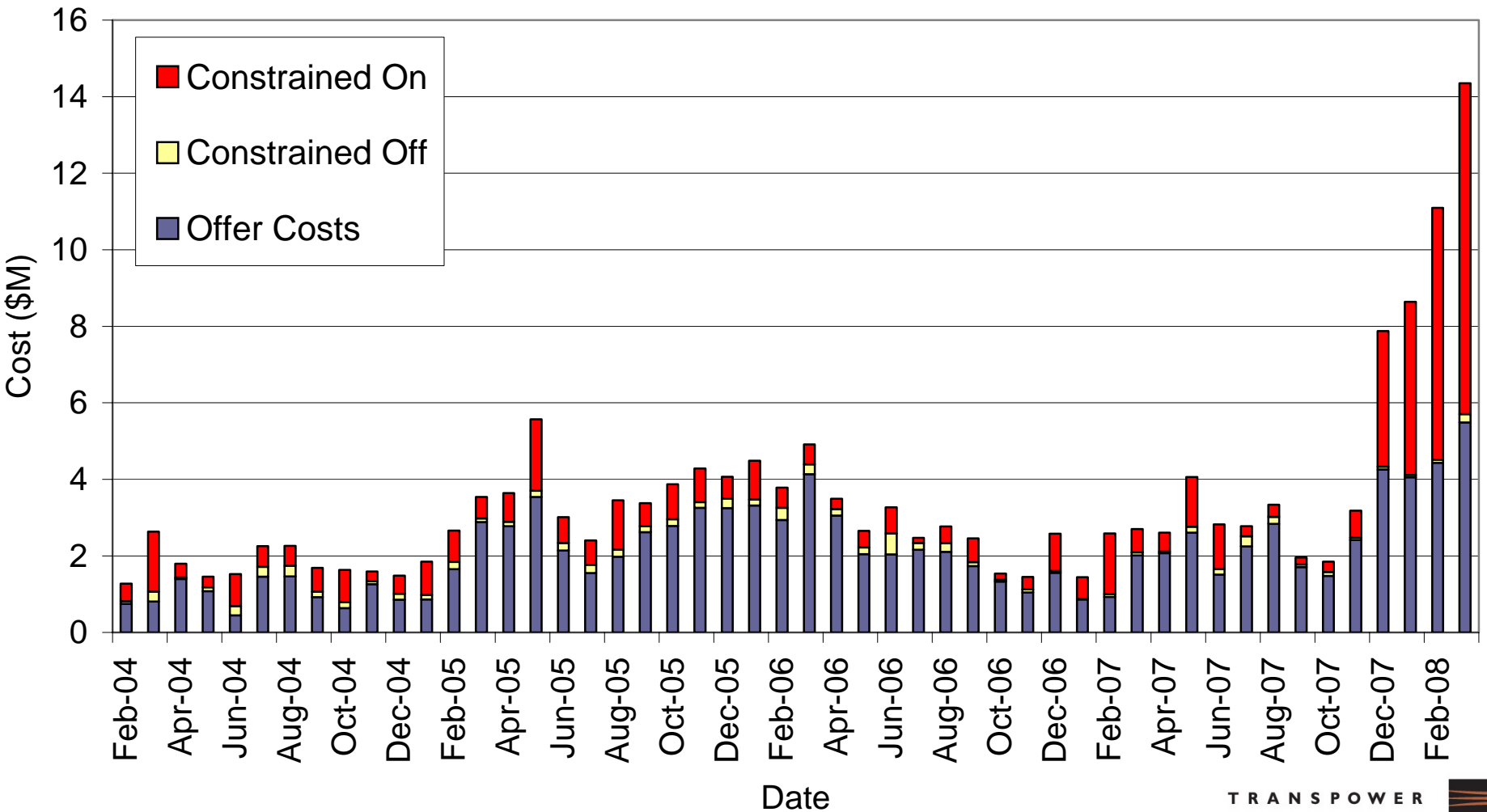
Part G,V, 4 and 5; and Procurement Plan

- frequency keeping offer payment
- constrained-on payment
- constrained-off payment

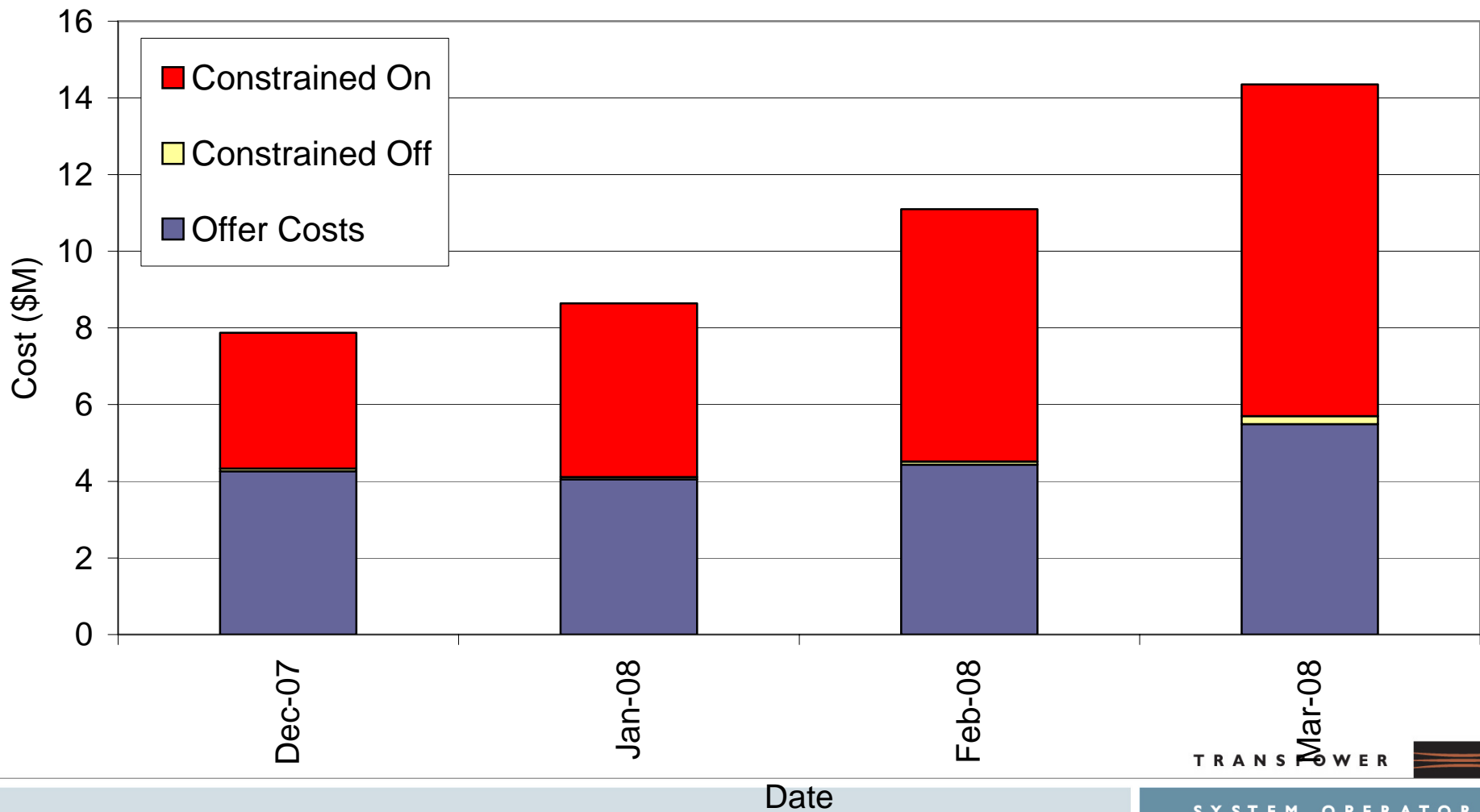
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North Island Cost Profile



North Island Cost Profile



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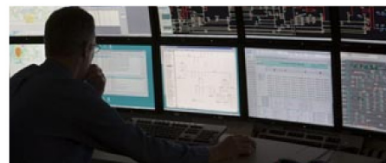
North Island costs

- rapid increase since December 2007
- increases manifest as con-on costs predominantly
- SO FK selection does not optimise con-on cost

Frequency Keeping Constrained-On Costs

*Change to be introduced
2 June 08*

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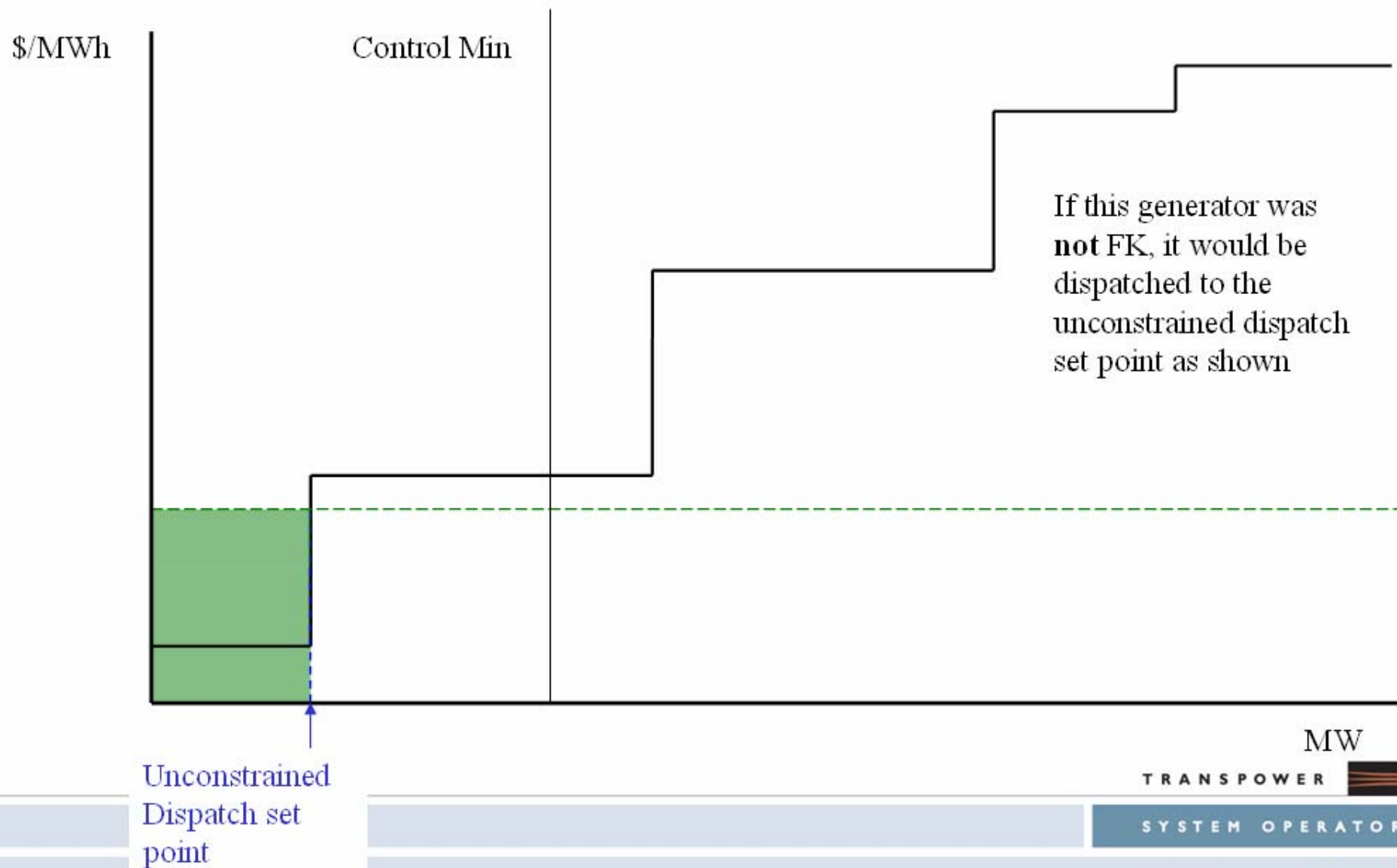
New approach to selection

- SO has existing capability to co-optimize a portion of constrained-on costs. Uses current market tools
- co-optimisation delivers some of the recommendations proposed by EC/based on FIG report
- capability has been tested and confirmed
- SO plans to commence co-optimising from 2 June 08 once all staff are trained

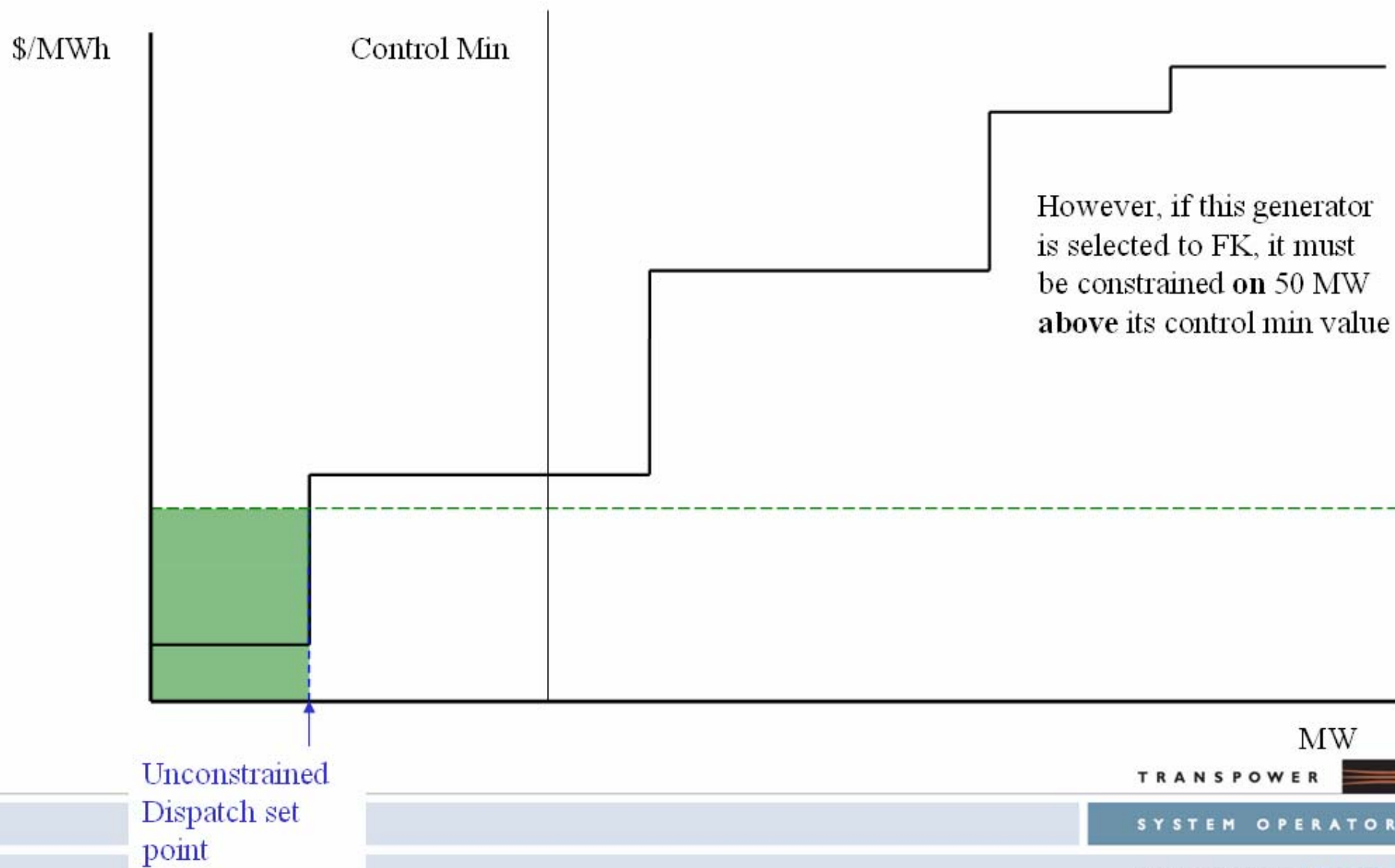
How SO co-optimises

- SO uses backup tool – Freqkemy - has co-optimisation feature coded in
- feature can identify likely costs of moving a generator to ‘centre of band’ to allow frequency keeping, and incorporates this with the FK offer as a total cost for the half hour. This is a best guess, as decision made two hours ahead of real time
- cannot co-optimize the con-on costs associated with the generator responding to frequency once within the frequency keeper band

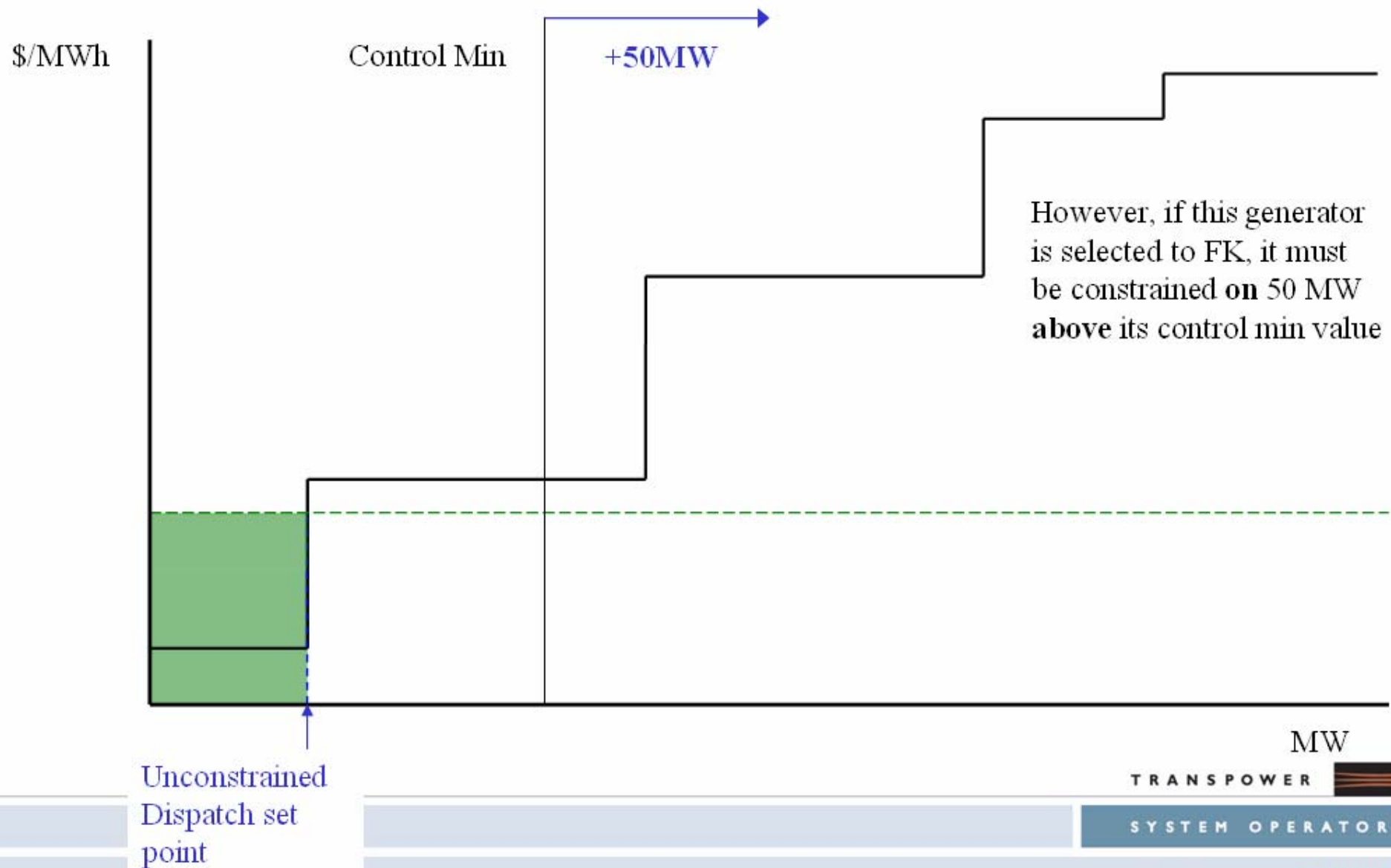
Control min and constrained on



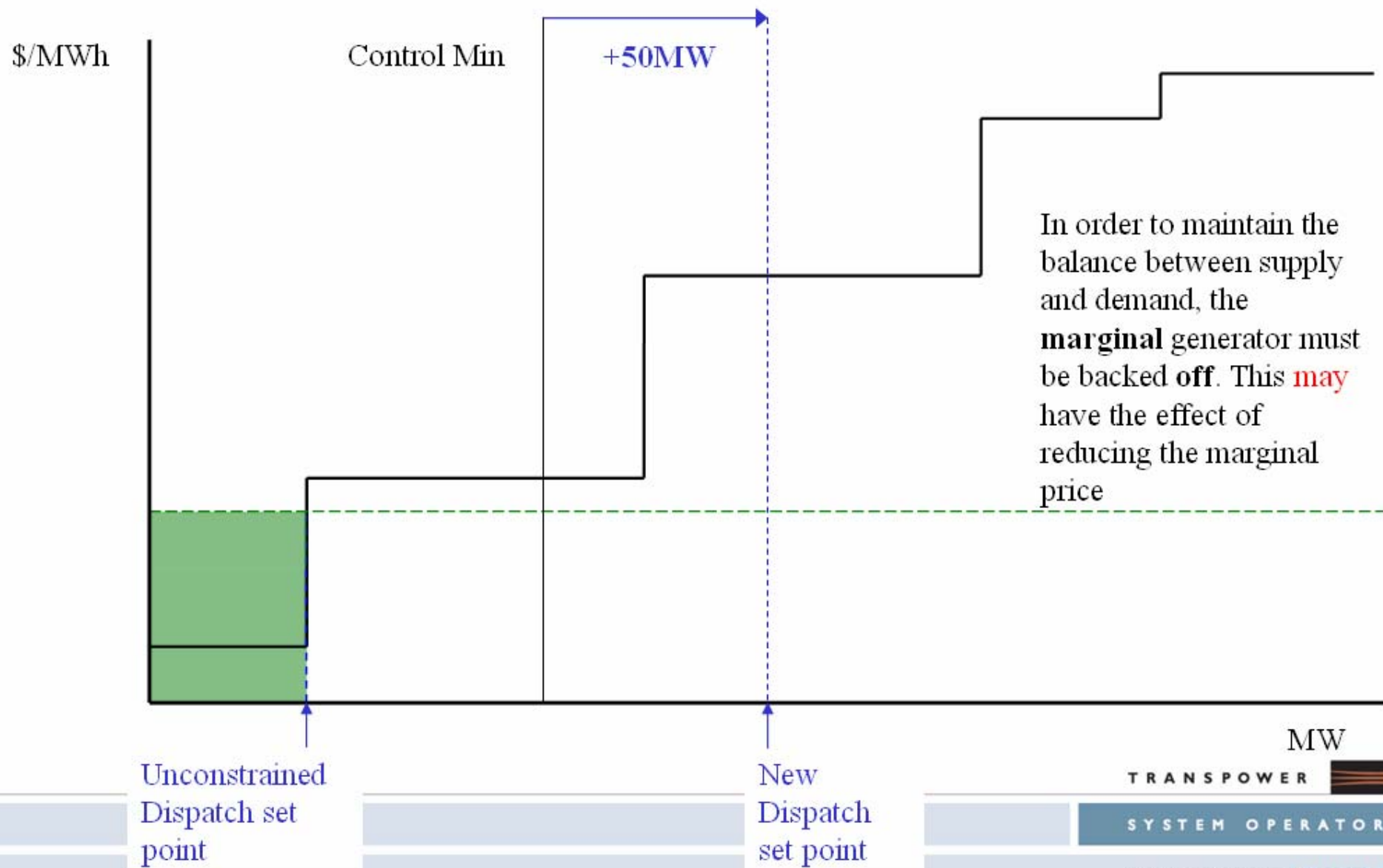
Control min and constrained on



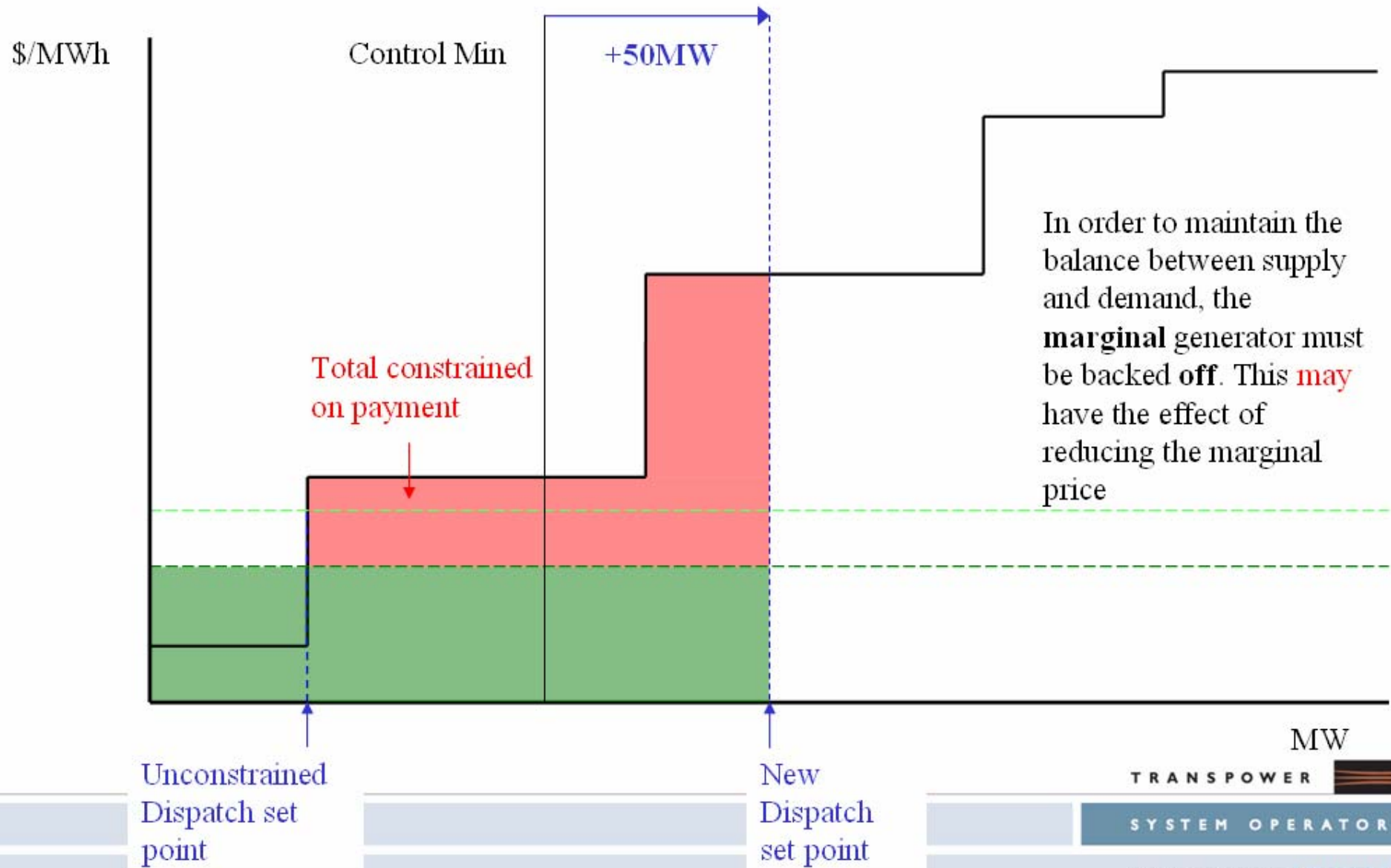
Control min and constrained on



Control min and constrained on



Control min and constrained on



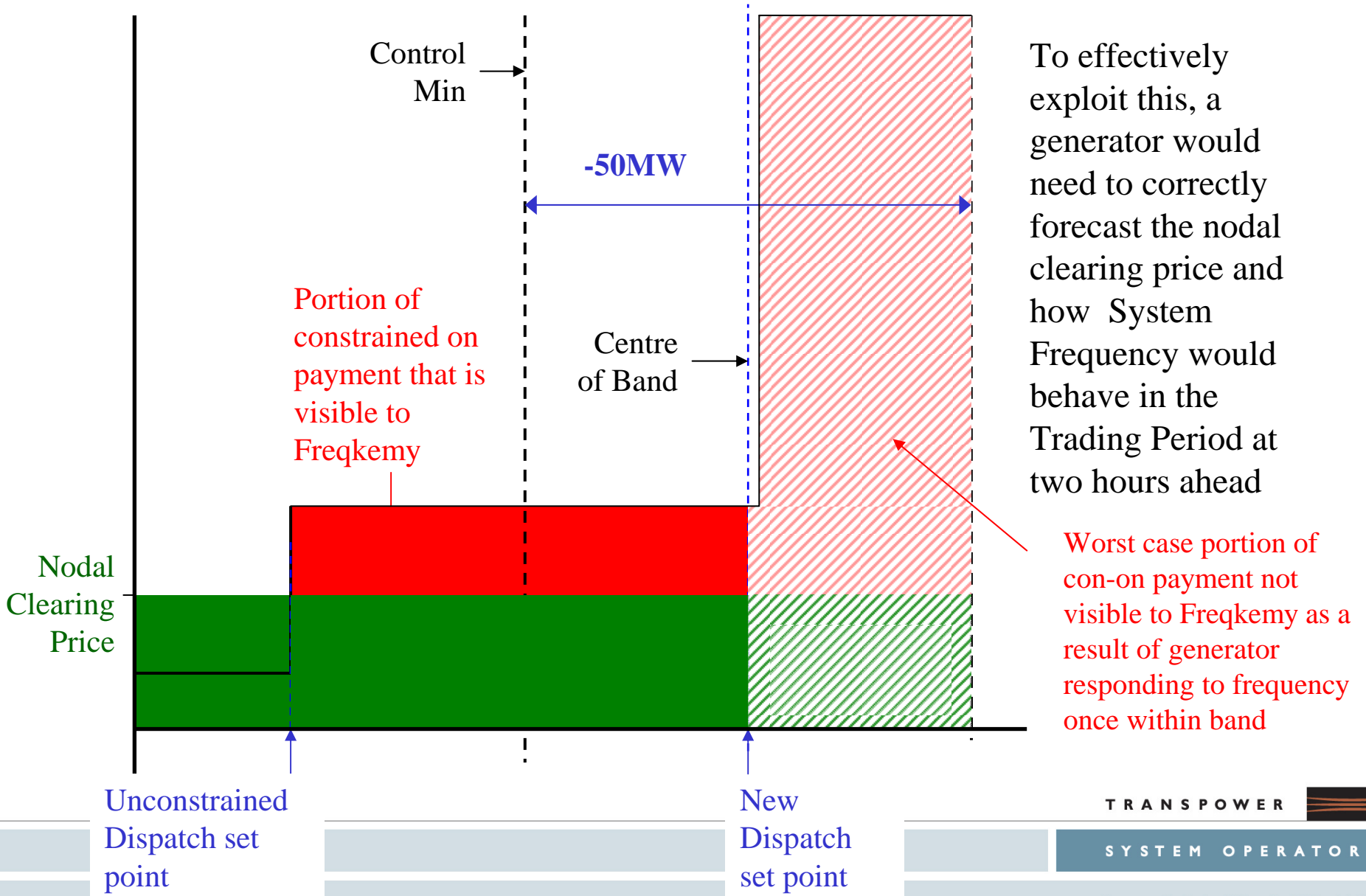
The advantages

- significantly larger proportion of associated costs visible to co-ordinator when despatches a Frequency Keeper at two hours ahead
- leads to cheapest solution being despatched more often
- SO can implement solution quickly (no rule changes)
- minimal disruption to ongoing SO projects (these include National Winter Group and MSP)
- will provide a limited 'Proof of Concept'

The disadvantages

- portion of con-on cost will remain invisible to co-ordinator (this could be exploited: see next slide)
- when MSP goes live, co-optimisation functionality will be lost until re-coded
- proposed change does not by itself address the fundamentals behind recent cost escalation

Visible vs. invisible con-on costs.



Summary

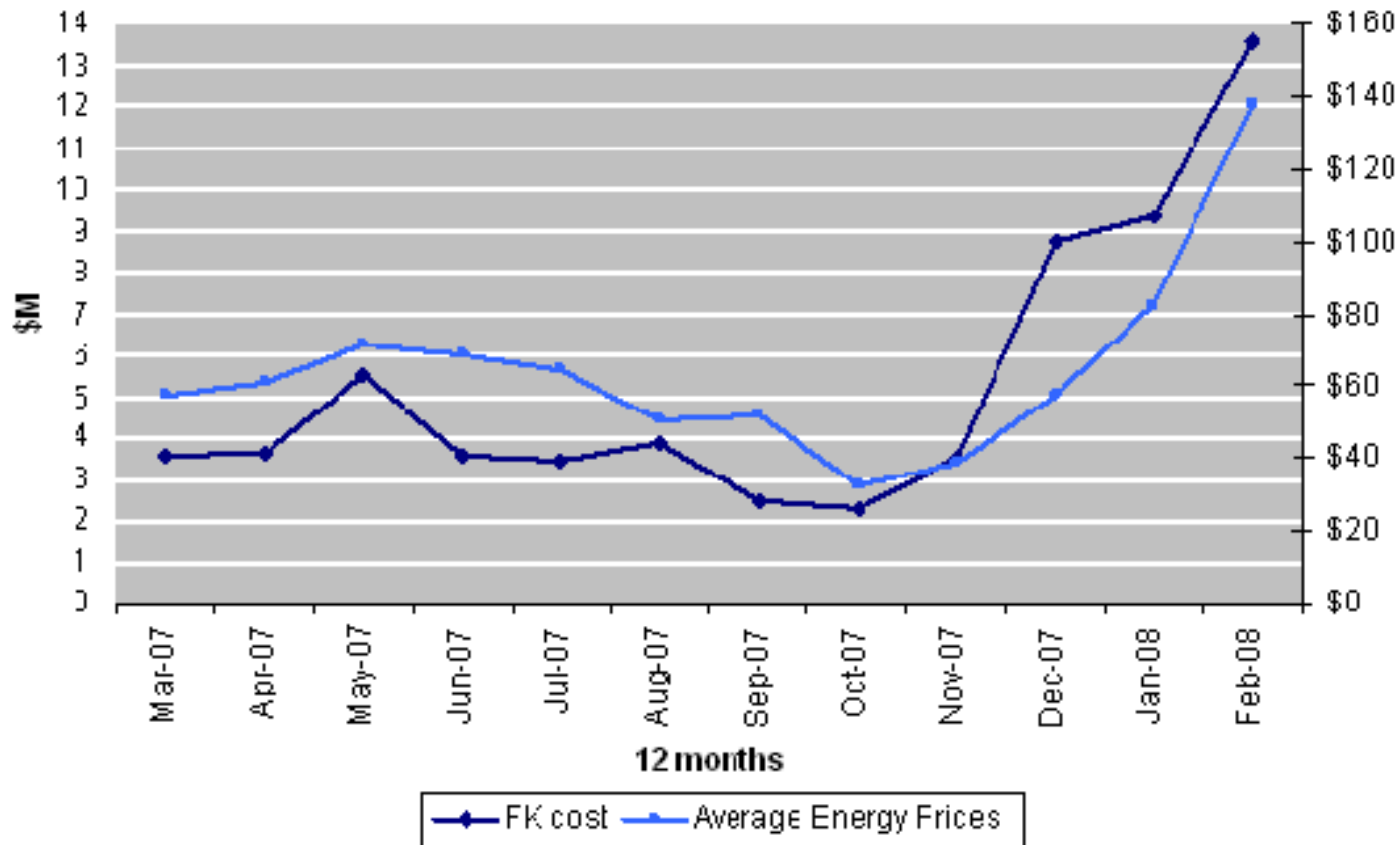
- SO is implementing a con-on co-optimisation selection methodology that will take effect in June
 - will require no changes to current billing arrangements; no accompanying rule changes
 - will still be possible to exploit these arrangements using con-on, but will be somewhat harder
 - ability to co-optimize frequency keeper selection will be lost immediately after MSP 'go live'.
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What is driving NI cost?

- rising energy prices
- threat of a dry year
- limited frequency keeper market

FK cost relationship to energy

Frequency Keeping Costs and Average Energy Prices



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How can costs be minimised? I

Short Term

- ensuring cheapest offer is dispatched
- partial implementation of FIG / EC proposal for selection criteria (see presentation to CQAG)
- additional FK providers
 - e.g. Huntly U5 or TCC in NI
- reduce quality of service

How can costs be minimised? II

Longer Term

- full implementation of FIG/EC selection proposal
 - once proof of concept confirmed
- merging the two markets (NI/SI)
 - KEMA report
- change in generator dispatch requirements
- re-allocation of FK costs

How can costs be minimised? III

Longer Term

- EC are investigating AGC
- Evolution of additional players to the FK market
- allow multiple frequency keepers

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KEMA report

- technical review
- looked at 4 options, not just AGC
- suggested interim steps as well as move to full AGC
- did not support multiple (autonomous) FK
- did not support 'no FK with faster dispatch options'

Normal frequency investigation

- undertaken by the SO
- intention was to understand FK performance better
- to develop rationale for band size, impact on reserves if frequency not tightly managed, what the actual service requirement is, etc
- currently on hold due to other immediate workload issues.

System performance

North Island

	20 April 2007	1 May 2007
Below 49.9 Hz	1.1%	1.2%
Below 49.8 Hz	<0.1%	0.1%

South Island

	22 April 2007	1 May 2007
Below 49.9 Hz	0.3%	0.3%
Below 49.8 Hz	<0.1%	<0.1

System performance - NI

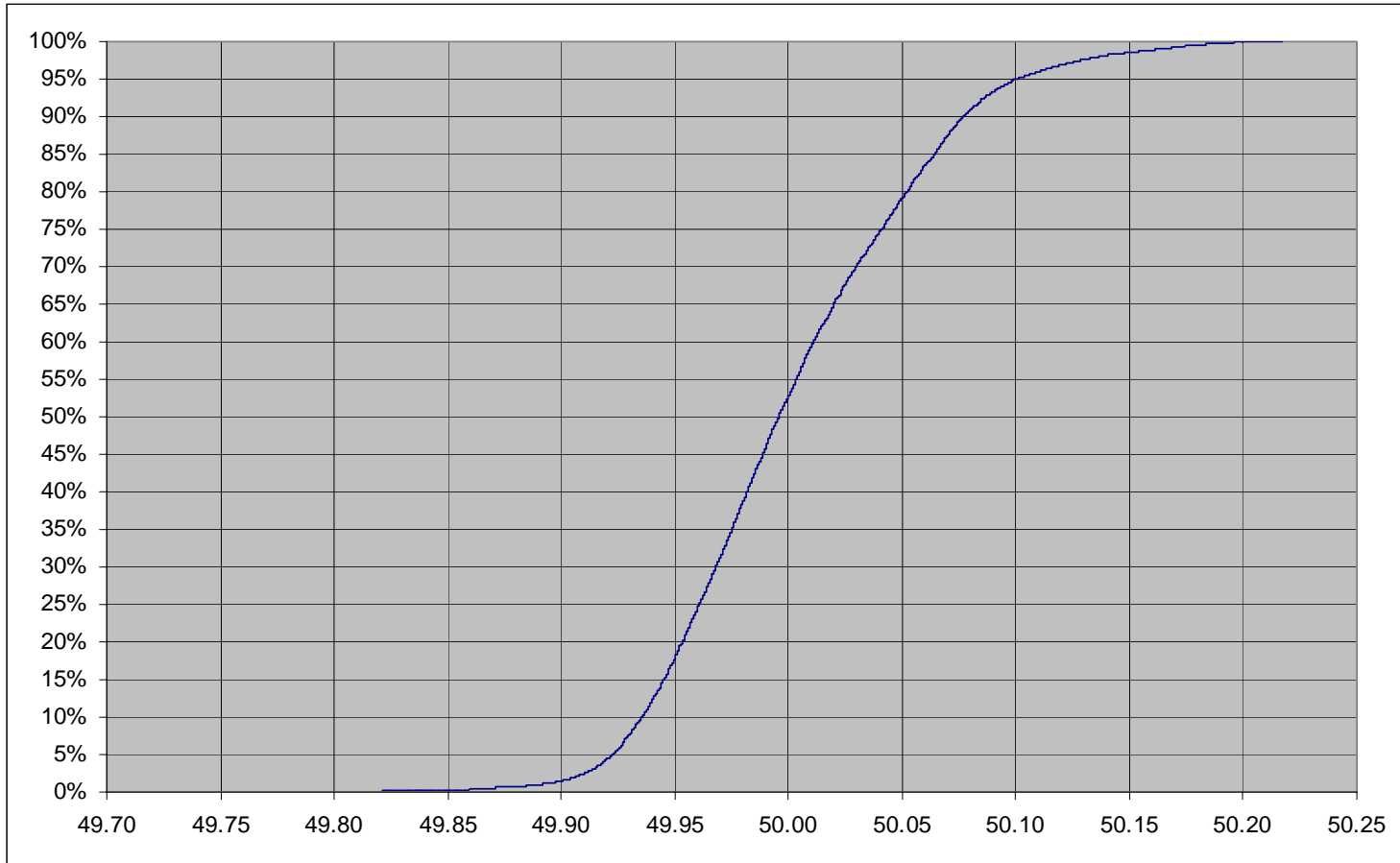
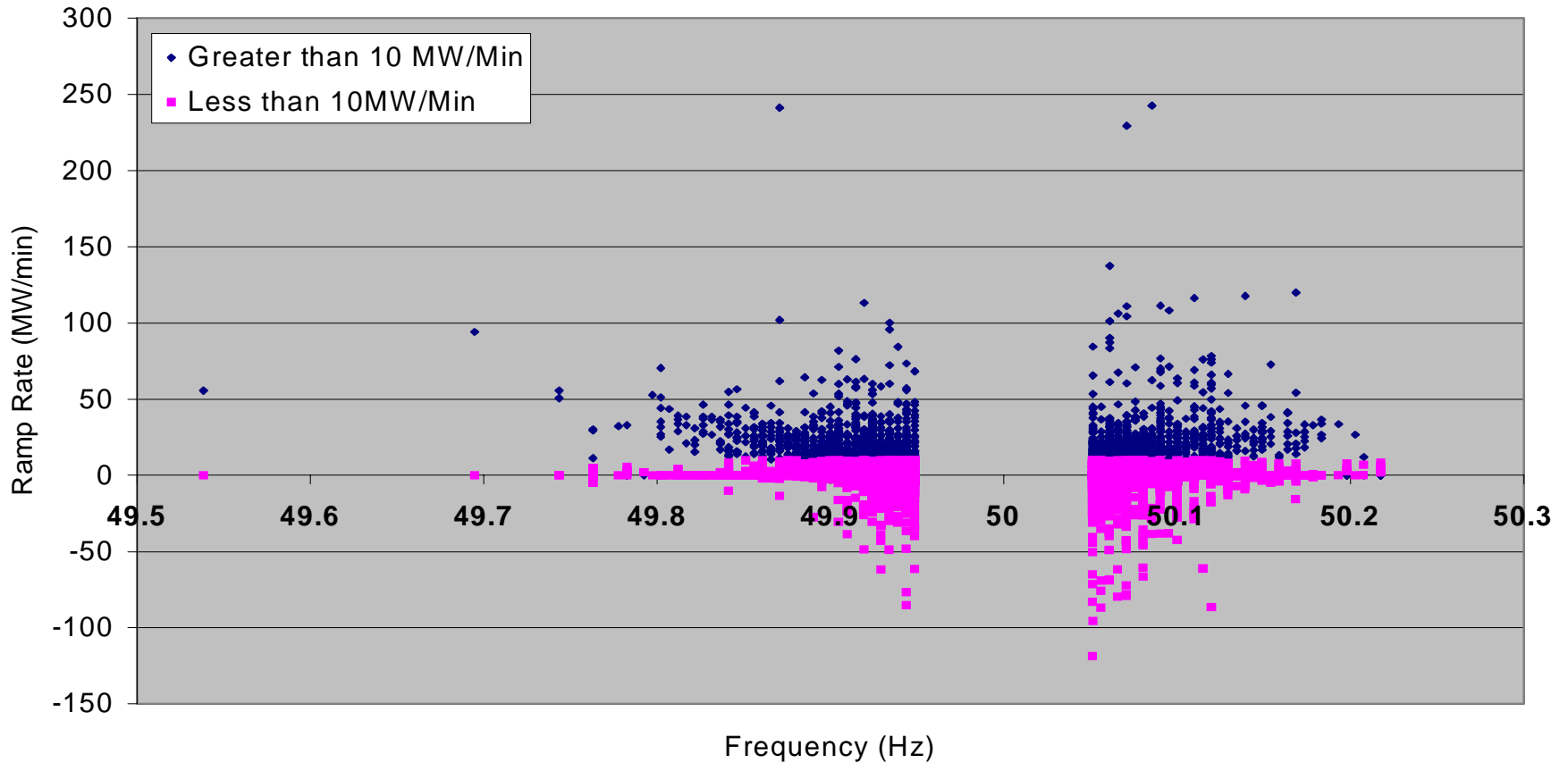


Figure One. Cumulative distribution of frequency for 1 May 2007 (North Island)

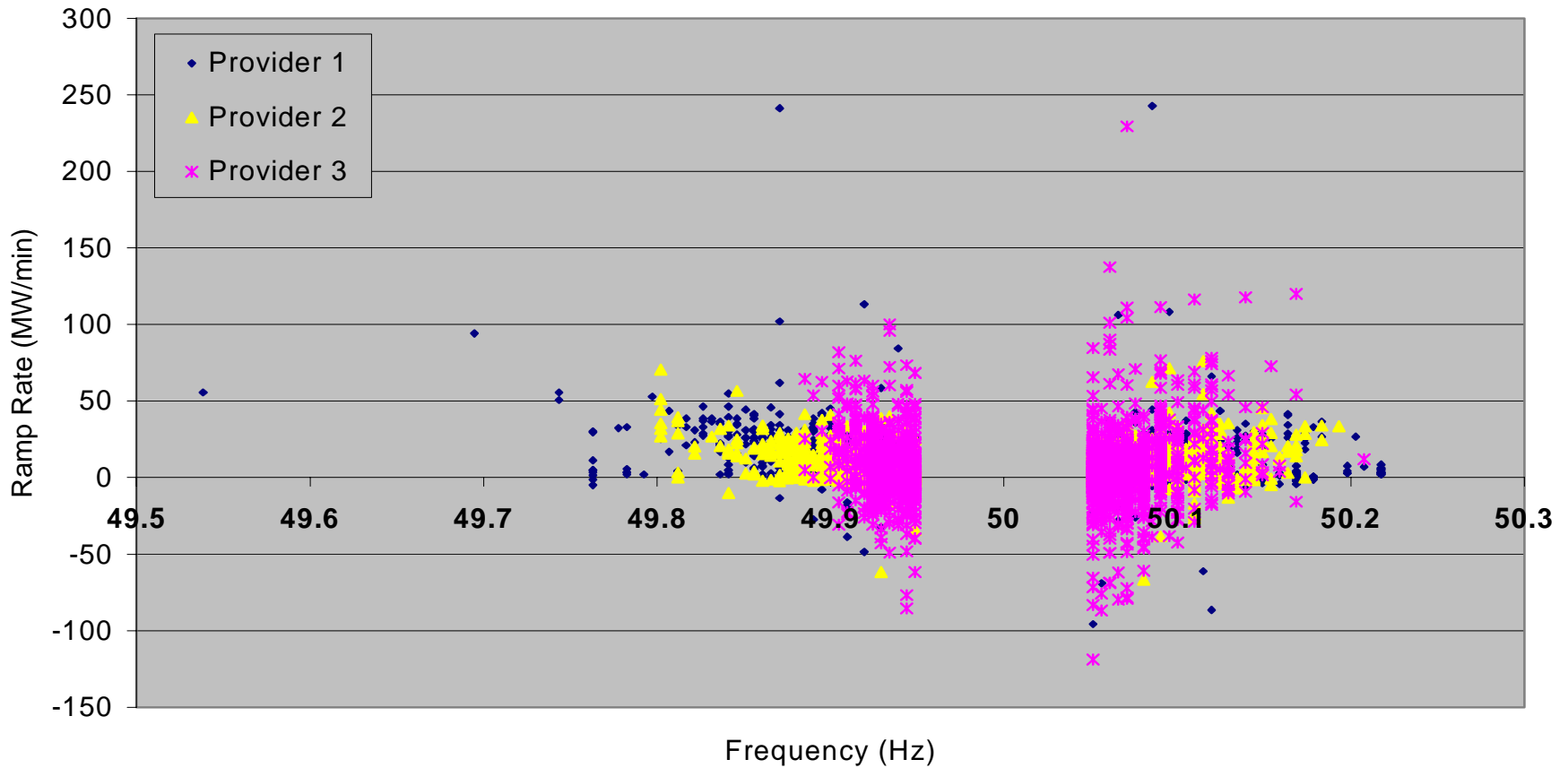
FK performance

Frequency Keeper Performance of all providers, all times and all days



Specific FK performance

Frequency Keeper Performance of all providers, all times and all days



Contributory factors to frequency

	Provider 1	Provider 2	Provider 3	Generator 4	OTHERS	HVDC
15-Feb-07	44%	0%	22%	12%	12%	27%
22-Feb-07	0%	42%	35%	8%	20%	17%
27-Feb-07	0%	0%	51%	5%	15%	12%

	Designated Frequency Keeper
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Normal frequency investigation

Impact on reserves

	Generation affected (MW)				
	2500	2000	1500	1000	500
Freq (Hz)	Extra IR required (MW)				
50	0	0	0	0	0
49.95	62	50	37	25	12
49.9	125	100	75	50	25
49.85	187	150	112	75	37
49.8	250	200	150	100	50

Table 1: Extra FIR required for different pre-event starting frequencies