

System Operator TASC Report

TASC_016 - Frequency Keeper Selection

Investigation of the implementation of a revised frequency
keeper selection methodology in the Market System

28/10/2011



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1 Executive Summary

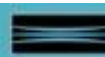
An industry participant has written to the Electricity Authority raising concerns about the increasing constrained-on costs associated with the North Island frequency keeping market and suggesting the current frequency keeper (FK) selection methodology should be reviewed.

The Authority's analysis of the August 2011 frequency keeping costs confirms that the current industry agreed frequency keeper selection methodology is not selecting the lowest cost provider. Instead, the methodology selects the frequency keeper based on the lowest ex-ante constrained cost. This is not always the lowest overall cost once constrained costs have been taken into account, particularly at times when constrained-on payments make up a high percentage of the total cost of the frequency keeping service. In August 2011, the current selection methodology resulted in the frequency keeping costs being \$5.9m higher than the least cost alternative, calculated on an ex-post basis.

One solution to this issue is to cease constrained-on payments to frequency keepers for movement within the dispatched FK band (as proposed by the Frequency Issues Group (FIG) in 2006). This is a long term solution as it would require a Code change in addition to a System Operator tools change. This work is not currently allowed for in the agreed joint work plan and therefore cannot be implemented immediately.

In the meantime, the Authority has requested the System Operator, under the Technical Advisory Services Contract (TASC), to investigate the option of modifying the selection methodology to add a calculation of *Constrained-On* cost to the top of the frequency keeping band. The first part of the investigation is to determine the cost and implementation timeline to change the System Operator's frequency keeper selection methodology to enable a maximum theoretical constrained-on cost to be calculated. This would then be added to the FK service offer cost to facilitate the selection of the overall least cost service provider for a given trading period.

The System Operator has determined that the option of modifying the selection methodology to add a calculation of constrained -on cost to the top of the frequency keeping band is feasible and could be implemented at minimal cost in a relatively short timeframe. The System Operator can implement this change by 24 November 2011, subject to the successful implementation of the Interim Variable Line Ratings (iVLR) changes and receiving notification from the Authority to proceed before 4 November 2011. The expected cost of the solution implementation is less than \$15,000.



The proposed methodology would be applied to both the North and South Island frequency keeper selection.

2 Background and Introduction

An industry participant has written to the Electricity Authority (Authority) in relation to concerns about a rise in constraint payments associated with the North Island frequency keeping (FK) service. The percentage of total North Island FK costs attributable to constraint payments has been increasing steadily since February 2011.

The current FK selection methodology does not include an ex-ante estimate of constrained-on costs. That is, the lowest overall cost outcome may not always be selected, particularly when constrained-on payments make up a high percentage of the total cost of the FK service. Analysis of FK costs by the Authority confirms that the cost in August 2011, as a result of the difference between the selected outcome and the least cost outcome, is \$5.9m higher than it may otherwise have been. While constrained-on costs were unusually high in August 2011, there is nothing to prevent similarly high costs arising in future months.

The System Operator has been requested, under the TASC, to investigate a long term solution to incorporate constrained-on costs into the FK selection methodology. The paragraphs below explain the existing methodology and the proposed changes to that methodology to better reflect constrained-on costs. A broad estimate of implementation costs and timeframes is also included.

3 Current FK selection methodology

3.1 Selection methodology

In October 2006, the System Operator presented to the Common Quality Advisory Group (CQAG), a description of the then-current FK selection process, the calculation and potential impact of constrained-on and off payments for frequency keeping on cleared energy prices. The System Operator proposed several alternatives to the existing methodology to address the constrained-on costs associated with frequency keeping. The three options presented were:

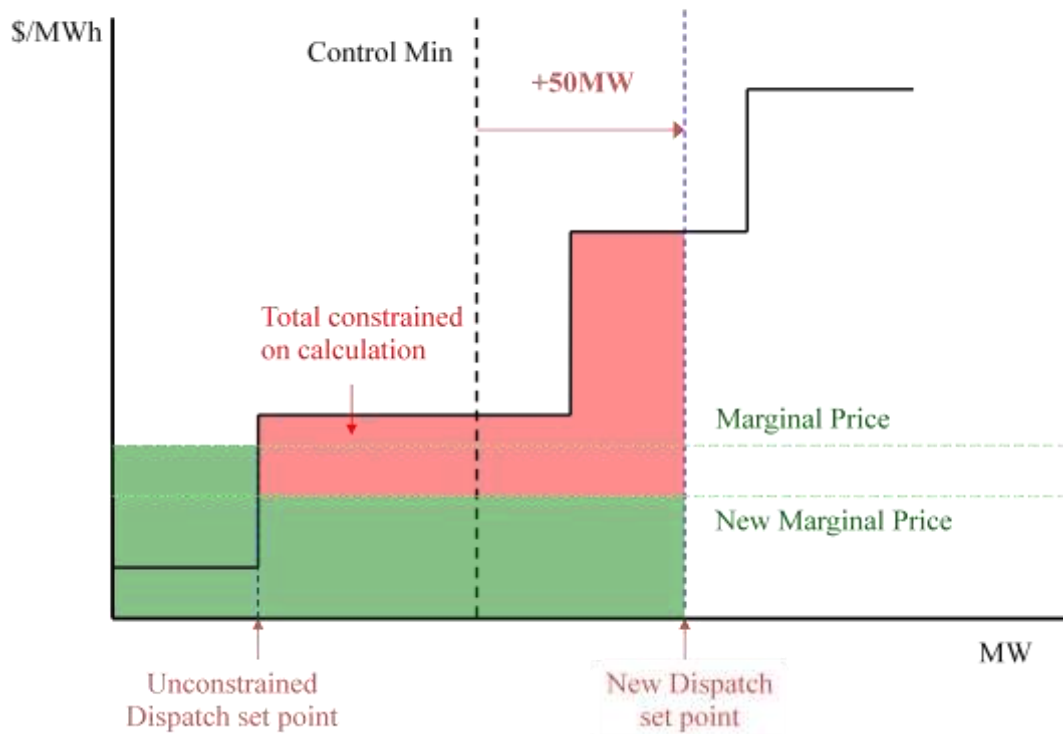
- i. Eliminate FK constrained-on payments entirely for frequency keeping
- ii. Pay constrained-on only to the dispatch set point (usually the middle of the FK band)
- iii. Pay constrained-on and use an estimate for FK selection

“Phase 1” implementation of option ii was completed in December 2007. For the purposes of selection, the constrained-on cost associated with moving the



FK dispatch point and FK band within the control min and max of the offered plant was calculated. This is illustrated below:

Control min & Constrained on



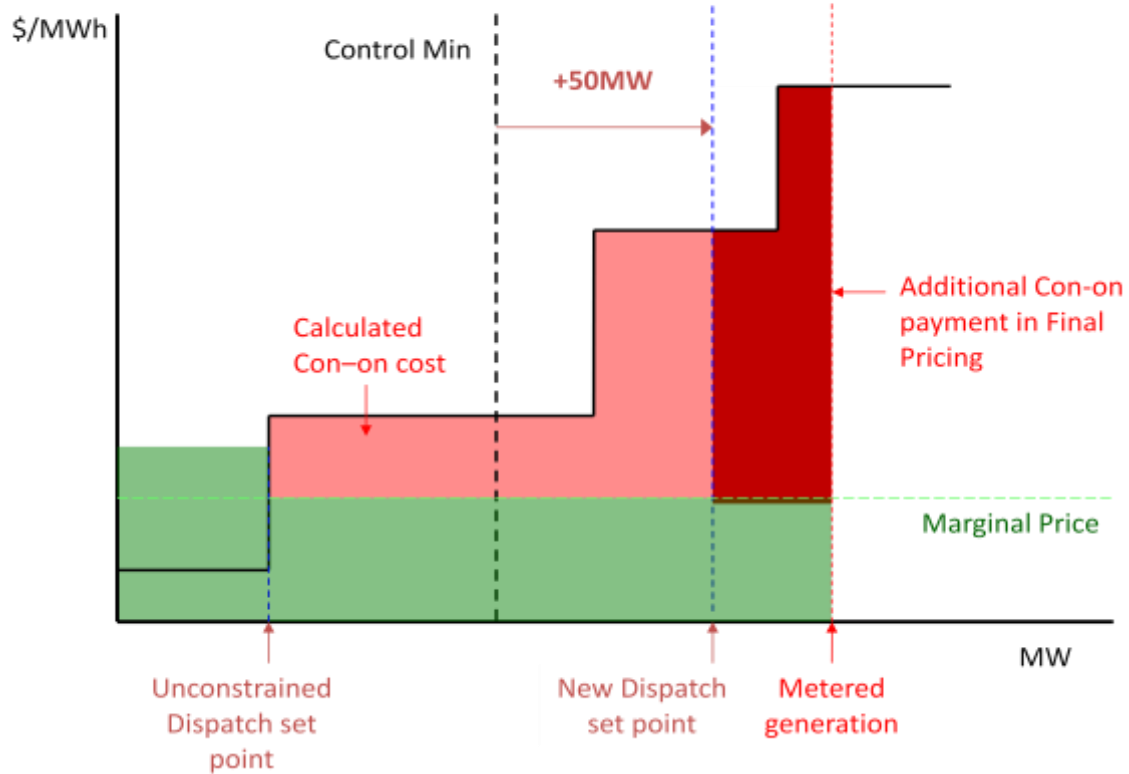
By example, the above diagram illustrates a situation where the marginal generator has been dispatched down to allow the frequency keeper to be constrained up. This has reduced the cleared market price and thus increased the calculated constrained-on payment to the frequency keeper. An update on the implementation, and its effect on the North Island FK market, was provided to the CQAG on 20 November 2008.

This solution was permanently implemented into the new market system on 17 December 2009

3.2 Constrained-on payment calculation

The selection calculation assumes the frequency keeper will, on average, remain at the centre of its dispatched FK band during the trading period. However, in practice, this is not always the case. Governor response, or the management of time error, may result in generation above the dispatched set point. This could lead to the actual constrained-on payment to the generator being significantly higher than that calculated in the frequency keeper selection process. The following diagram illustrates how this might occur.

Control min & Constrained on



The final constrained-on costs are then passed on to demand side participants in proportion to their off-take relative to the total island demand for each trading period.

Two possible solutions were considered:

- to ensure market transparency in selection and cost, FK participants should not be paid constrained-on whilst frequency-keeping, thus reflecting the true cost of frequency keeping in the market offers; or
- the System Operator should include an estimate of the final constrained-on cost in its selection methodology.

4 Change to current selection methodology

In the long term, the frequency keeper selection methodology and payment should be made based on the frequency keeper availability fee plus constrained-on costs required to get the frequency keeper to the mid-point of its band. No additional payments of constrained-on or off within the band would be made¹.

¹ Variations on this solution were proposed by the FIG in 2006

This long term solution is likely to require amendments to the Code and changes to the System Operator's software. Such changes are unlikely to be able to be implemented in the short term; the Authority is considering the timeline for a Code change.

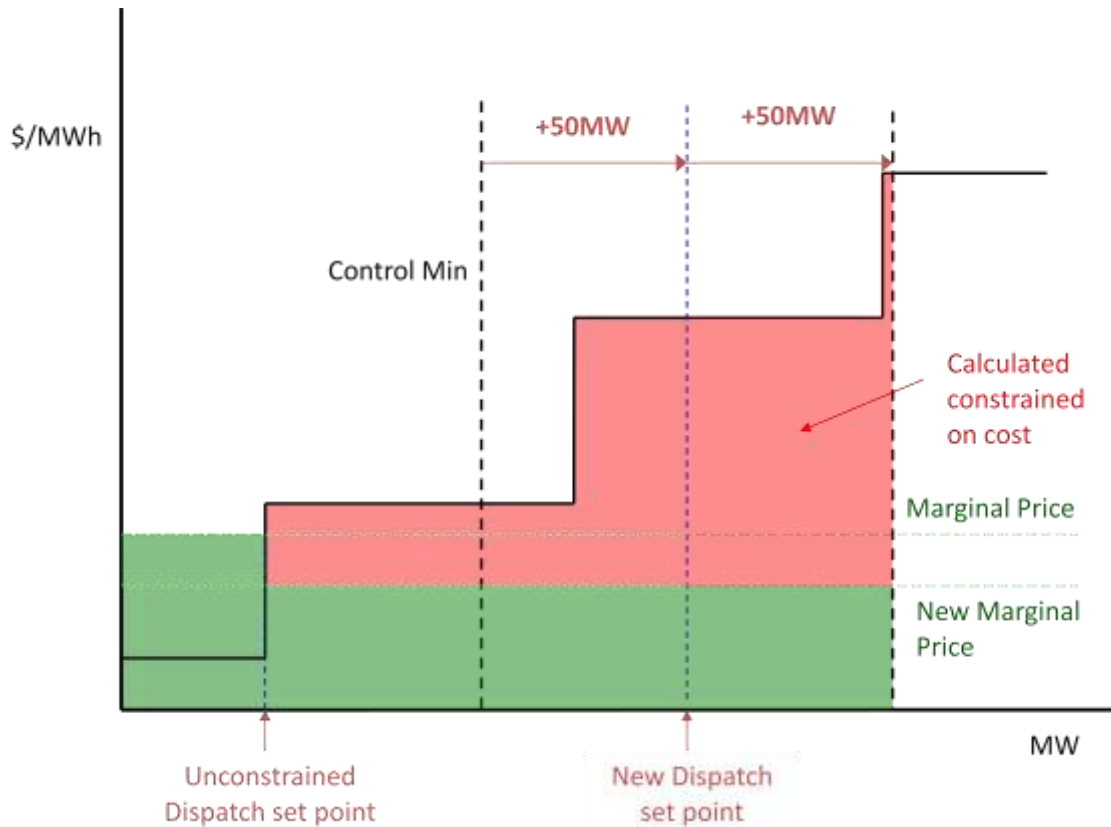
Therefore, as a short term (or interim) solution, the System Operator has considered the option to modify the selection methodology so that it is based on:

- the availability fee; plus
- constrained-on costs required to get the frequency keeper to the mid-point of its band; plus
- an estimate of the maximum constrained-on payments in the band (i.e. that the frequency keeper is operated at the top of its band throughout the trading period).

This is a conservative solution in the sense that someone might offer a high energy price at the very top of the frequency keeping band, rather than just above the mid-point as they currently do, that may never be utilised while having a lower price through most of the band. However, it is still expected to be more efficacious in selecting the lowest cost provider than the current method.

No changes would be made to the existing frequency keeping constrained-on payment calculations.

The theoretical maximum constrained-on cost for each provider would be calculated as illustrated below:



This maximum cost would then be used in conjunction with the FK service offer price to determine the least cost option for FK selection. Such approach would be designed to minimise the incentive for the frequency keeper to offer a low cost service and energy price up to the mid-point of the FK band to obtain a least cost dispatch, and then use a high priced energy offer tranche to generate constrained-on revenue in the upper half of the FK control band.

5 Implementation of the interim solution

In accordance with the TASC request, the System Operator has investigated the following with respect to the interim solution proposed in section 4:

1. the scope, cost and timetable to implement the proposal;
2. any anticipated changes in offer behaviour that could reduce the efficacy of the proposal objective to achieve the least cost frequency keeping alternative; and
3. the merits of implementing the proposal in both the North and South Islands

The results are set out below.

5.1 Proposal implementation

Implementation of the software (IT) solution has been assessed. Changes being made to the Market Database (MDB) by the iVLR project on 10 November 2011 will mean the proposed solution will be able to be applied as a 'hot-fix' i.e. does not need to be a part of a scheduled Market System release and will not require a market outage.

There are currently no resource constraints for Transpower IT or their contractors that would impact the deployment of this solution.

High level effort and timelines are summarised below:

| Task | Total cost |
|------------------------------------|------------|
| Transpower IT development and test | \$5,500 |
| Contractor development and test | \$8,000 |
| SO test | \$1,500 |
| Total | \$15000 |

Implementation is proposed for 10 – 24 November 2011 subject to notification to proceed being given by 4 November.

5.2 Changes in offer behaviour

One aim of the change is to prevent additional revenues being created that are hidden from the selection methodology at the time of service provider selection. In the new solution, by calculating the constrained-on potential earnings, the use of a high priced energy offer tranche on the upper half of their dispatched FK band to generate revenues by generating above their dispatch point will be included in their overall selection costs. It is hoped this will incentivise all participants to offer frequency keeping at a price which realistically reflects their costs to provide the service and open the frequency keeping market to more open competition.

The least cost calculation is performed on the SDPQ² schedule immediately before the relevant trading period; this prevents participants from changing their offers after selection. The System operator also publishes a schedule of frequency keeper indications based on the PDS³ every 2 hours; this gives participants a view of the likely frequency keeper selection based on the offers submitted to the market

² Schedule of Dispatch Prices and Quantity

³ Pre Dispatch schedule

at the time the schedule was initiated. Both schedules will incorporate the proposed selection methodology.

Once a Frequency Keeper is selected, it will be difficult for a provider to engineer a re-dispatch of their plant within the trading period because the provider's set point is determined on a least-cost basis by the market and is subject to the energy offers of all other participants in the island as well as the island load at the time. Frequency Keeper dispatch is occasionally changed during the trading period for security reasons; such reasons and changes are not likely to be within the 'un-dispatched' FK's control, i.e. it would be difficult, if not impossible for Generator A to engineer a position where Generator B was initially chosen as service provider on a least cost basis but Generator A was then dispatched part way through a trading period to replace them. Similarly, it would be very rare for a provider to be re-dispatched upward within a trading period bringing a high priced tranche within the FK band.

To summarise, in our view, the proposed selection method will enable a more transparent view of potential total costs associated with FK service selection.

5.3 South Island Implementation of the proposal

Whilst the South Island FK market has not been subject to the same constrained-on payments as the North Island, the System Operator believes it would be prudent to have a selection methodology in the South Island that is consistent with that employed in the North Island for the following reasons:

- Leaving the current methodology in place for the South Island leaves the South Island FK market open to the current offer practices apparent in the North Island market, the outcome of which is likely to be equally unacceptable to participants.
- The constrained-on calculation is currently performed by the same code block for both islands; separating the islands would add complexity to the development of the solution and possibly delay its implementation
- Having differing selection methodologies for each island is inconsistent with the EA's long term aim of a national FK market

Thus, it is recommended that the proposed FK selection methodology is implemented in both the North and South Island FK markets.

6 Conclusion

The interim solution recommended by the System Operator is likely to address the market's apparent concerns around the rising frequency costs and their lack



of transparency in the frequency keeper selection methodology. The proposed solution can be implemented between 10 and 24 November 2011 provided the Authority provides the go-ahead before **4 November**.

The System Operator continues to support the long term solution of removing constrained-on payments to frequency keepers for movement within their dispatched FK band.