FKC during Monopole
FKC – The problem

Current process when in Monopole:

• FKC is modelled On or Off depending on HVDC transfer levels.

• Turning it off changes the frequency band procured, reserve sharing, and modulation risk, outlined below.

• [https://www.transpower.co.nz/system-operator/information-industry/frequency-keeping-control-fkc-information](https://www.transpower.co.nz/system-operator/information-industry/frequency-keeping-control-fkc-information)

<table>
<thead>
<tr>
<th>HVDC transfer levels</th>
<th>FKC status</th>
<th>Changes to Modelling (Process available on the system operators website)</th>
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</table>
| When HVDC forecast **below** 70MW for 4 trading periods in the NRSS | FKC stays off | 1. **Modulation Risk** changes from 30MW to 0MW.  
2. **FIR** Sharing limits increase  
3. **SIR** Sharing  
4. **Frequency keeping bands** increase from 15MW in each island to 25MW in each island. |

• Because this is a manual change forward indications of whether FKC is on or off are not always perfect ahead of gate closure.

• This impacts certainty of forward price signals around the transition into and out of 70MW of HVDC transfer.

• **Question was asked, can we leave it off 100% of time to improve forward price signals?**
Case study

- May Monopole outage 11 May 05:00 – 12 May 17:00.
- In the base Case FKC was off on the 12th May 00:00 to 07:30, it was on for all other trading periods.
- The case was re-run with FKC off the whole time as a scenario and compared:

  1. Production Cost to compare efficiency of operating the power system
  2. Frequency Keeping costs to understand the increase cost of ancillary services
  3. Final Prices to gauge impact on prices
Production Cost Comparison

Production cost is the net benefit to NZ. (This is not wealth transfer between generators and consumers).

Over the May outage it would have been of greater benefit to have FKC switched off by $9,000.

This is very dependant on offers and relative prices of SIR vs Energy and FIR.

This can be seen in the graph, with some periods showing a positive change, some a negative.

We do not know what offers will be during the 2020 outages. But do know this number will vary.
An additional Frequency Keeping Qty of 10MW in each island is needed with FKC off in every trading period.

Using the May average price per MW, by trading period as the proxy price to buy the additional 20MW, the total frequency keeping costs increased over the life of the outage by $30k.

This is conservative as we typically see Frequency Keeping costs rise the more that is procured, rather than fall.

During the outage, based using offer when FKC on, the additional 20MW at only $20 more per MW would cost $50k.

This is still conservative, at time during the may outage the cost of frequency keeping when FKC was off was $300 per MW.
Forward price signals

Due to turning FKC on/off there is a element of uncertainty when it will be turned on/off.

To gauge an indication of the impact this could have, we compared the prices with FKC off vs FKC on.

It showed the price impact of FKC off/on was less than $10 96% of the time at HAY and BEN.

The maximum impact was $19.

Around the edges of when FKC was turned on/off price impact was always less than $10.
Summary

The results are summarized below:

<table>
<thead>
<tr>
<th>Value driver</th>
<th>Value of FKC off during 11-12 May Monopole outage</th>
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</thead>
<tbody>
<tr>
<td>Production Cost</td>
<td>+ $9k</td>
</tr>
<tr>
<td>Frequency Keeping</td>
<td>- $30 - 50k</td>
</tr>
<tr>
<td>Price signal (as indicator of FKC on market)</td>
<td>96% of the time Price impact was less than $10. Max impact $19</td>
</tr>
</tbody>
</table>

The outcome is highly dependant on offers/hydrology/demand at the time, but we have NOT found sufficient reason to warrant moving away from our current processes.