Preface

- For reader's information, these slides were prepared for the 19th June 2019 MDAG meeting.
- They address questions raised at previous meetings.
- The intention of the slides is to help group members to better understand aspects of the market and to assist with decision making.

South Island Market Changes

David Weaver

Concept Consulting

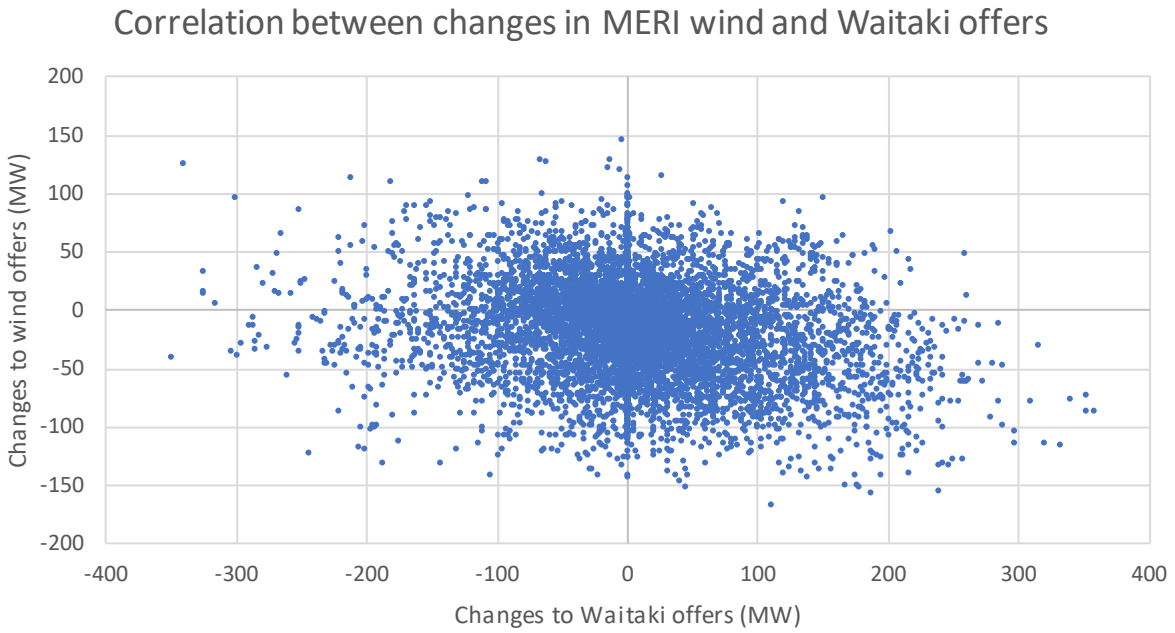
19th June 2019

Introduction

- This presentation addresses questions that arose during the MDAG meeting of 7th May 2019.
- It briefly looks at whether Waitaki offer changes are correlated with wind.
  - They appear mildly anti-correlated
- It then mostly focuses on northwards HVDC transfers and how they might have changed in recent years.
  - The analysis focuses on peak periods, as this is when prices are highest and was the focus of most discussion.
  - It looks at the time period from 1st January 2015 to 30th April 2019
- It appears that there has been a change to the utilization of the HVDC during peak periods.

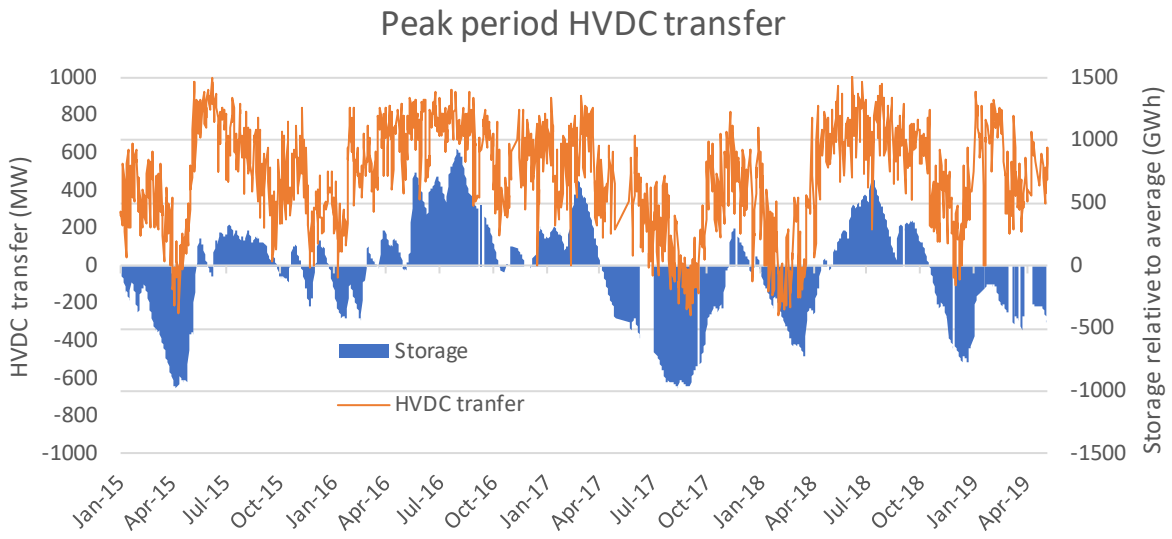
Wind and Waitaki correlation

- We hypothesize that Waitaki offers might be adjusted due to changes in wind forecasts at Meridian farms.
- There is limited correlation (-22%) between the changes to Waitaki offers and changes to wind farm offers.
- The correlation is negative, indicating that as one goes down, the other goes up. This is what would be expected if the Waitaki were compensating for changes in wind.



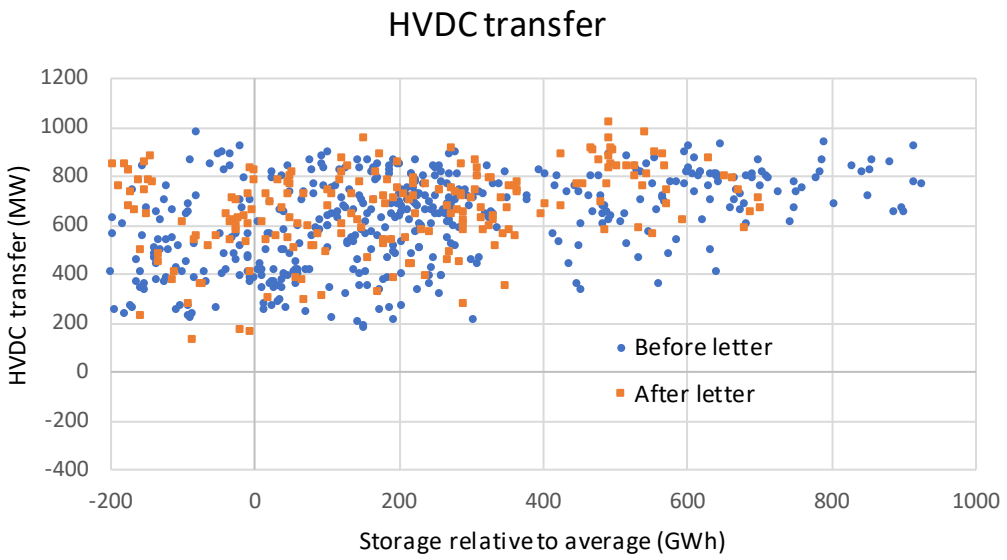
HVDC transfers: time series

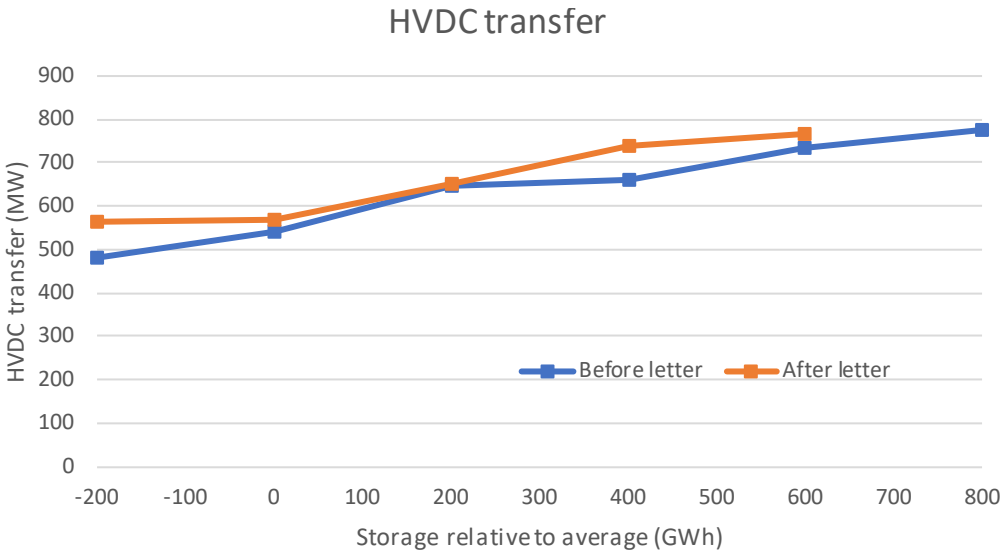
- HVDC transfers are correlated with South Island storage.
  - When storage is low, less energy is sent north.
- This is true even during peak periods
  - May seem odd, as generating during peak periods will have limited effect on energy storage
  - But measures to conserve storage may hinder ability (and need) for hydro to peak as much.



HVDC transfers: absolute

- The top graph shows the relationship between HVDC transfer and storage and only shows peak periods.
  - Dry periods are excluded because low storage may limit ability (or need) to send energy north
- The lower graph show the same information, but averaged across similar levels of storage. It's effectively a best fit line.
- "After" HVDC transfers were not systematically different to "before" transfers



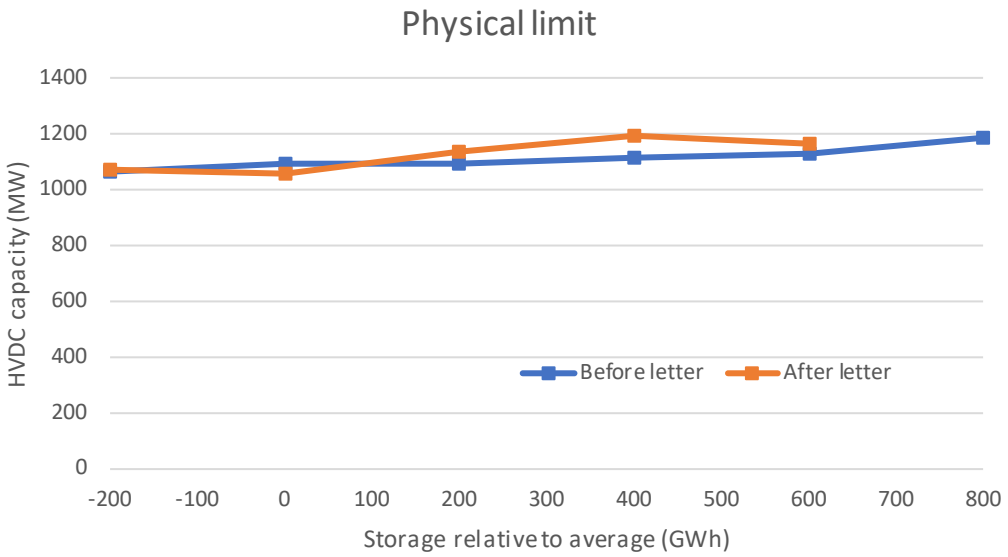


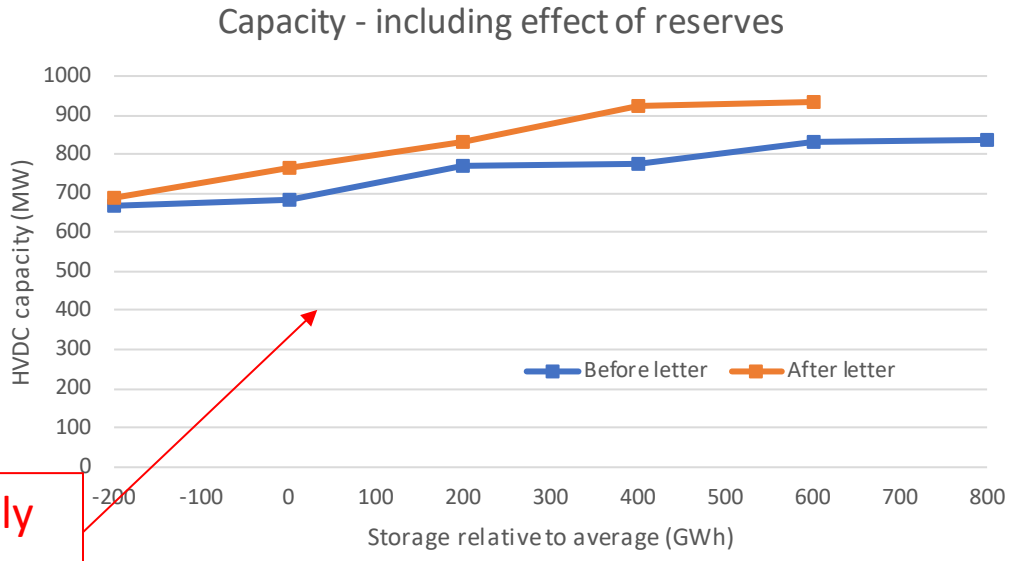
Revision – reserve sharing

- Some of the following slides have been discovered to be incorrect. They do not correctly account for reserve sharing between the two islands, which has the effect of reducing the HVDC utilization numbers shown below the correct values.
- This effect is minor and does not change the overall conclusion that there appears to have been lower utilization of the HVDC during wet periods in recent years.
- Updated slides are shows in the subsequent slide pack “HVDC utilization and FTRs”. The updated slides show price *separation* rather than price, so are not directly comparable to these.

HVDC transfers: HVDC capacity

- Transfers on the HVDC are limited by the physical capacity of the HVDC.
- They are also affected by reserves in the North Island. Once the HVDC becomes the binding risk, South Island prices are more prone to separate. (See Appendix B)
- We consider the HVDC "at capacity" when it is physically constrained or it is the binding risk in the North Island.
- Capacity, accounting for reserve, is higher in recent years.



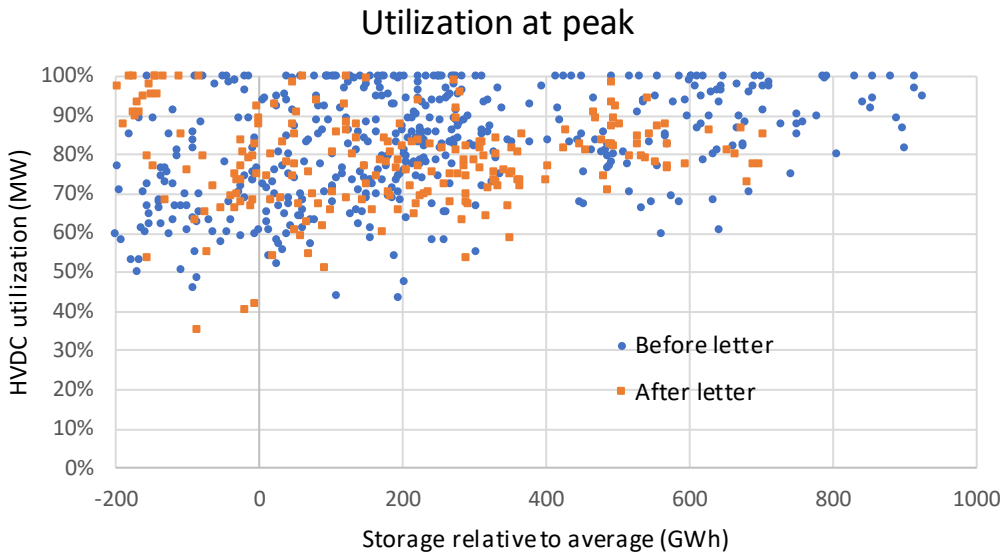


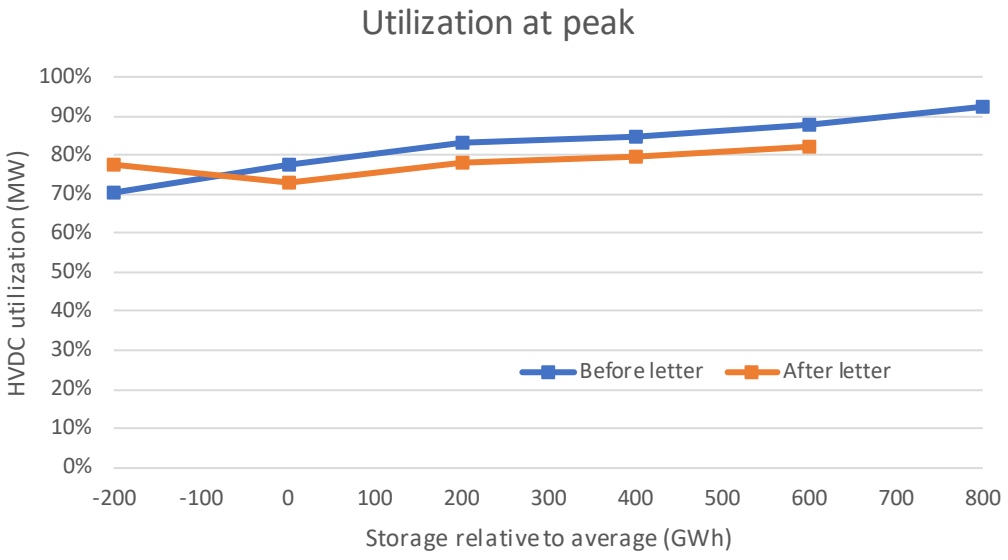
This figure does not correctly account for reserve sharing

HVDC transfers: utilization

Figures in this slide do not correctly account for reserve sharing

- Combining the previous two slides gives utilization of the HVDC during peak periods
- "After" has lower utilization than "before" across all storage levels
  - About 5% difference for most storage levels
  - Except for one data point, affected by a week in December 2018 with high transfers
- Although transfers are not lower in absolute terms, the utilization of the HVDC appears to be lower in recent years.





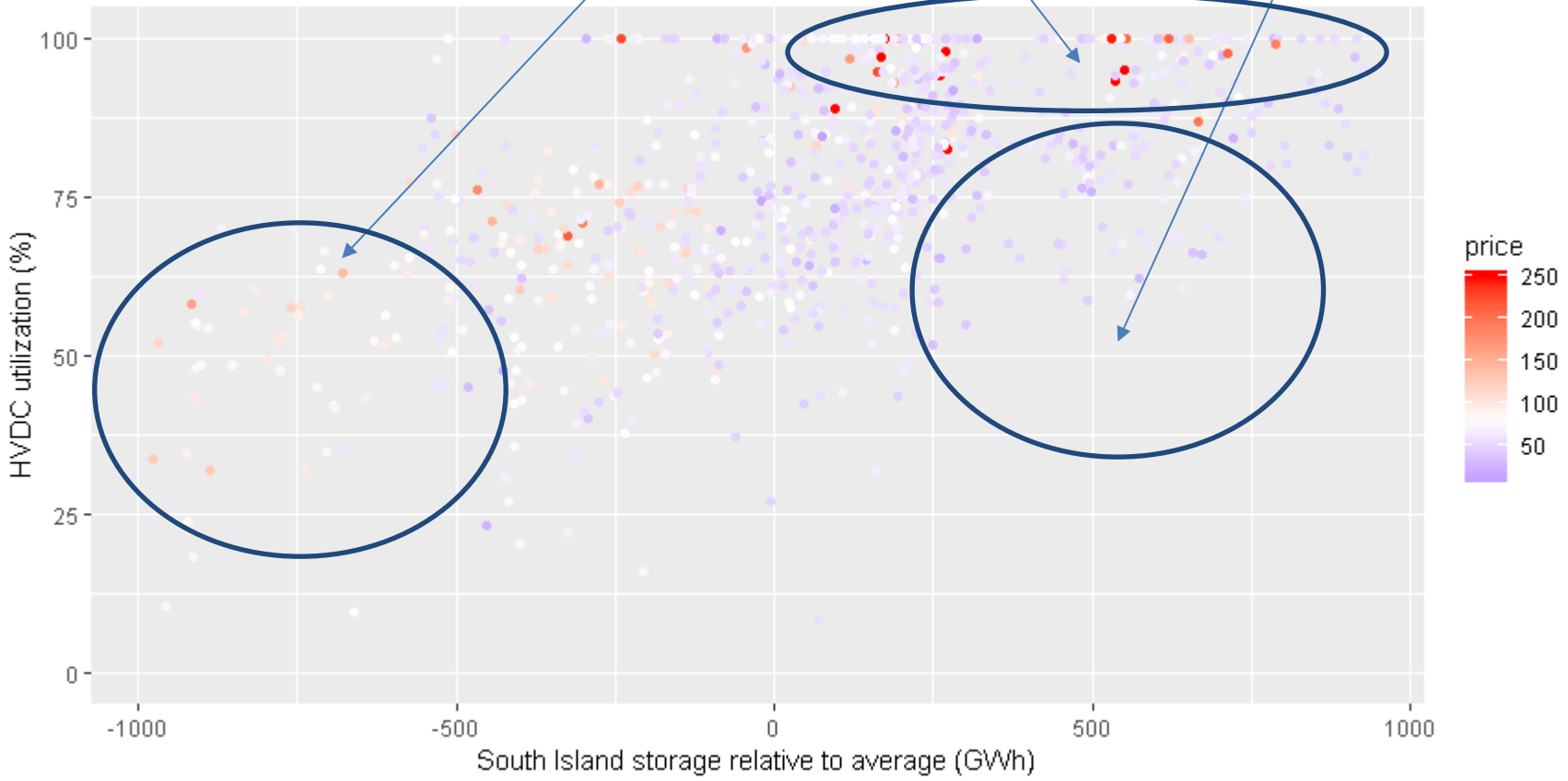
Prices during all this

- Finally, we overlaid North Island price on the final scatter plot from above
- Full data (i.e. including dry periods) shown
- Separate scatter plots are show for the “before” series and the “after” series.
- Colour is used to represent prices.
  - Red indicates high prices (capped at 250 $/MWh)
  - White indicates “normal” prices of about 80 $/MWh
  - Purple indicates low price (capped at 0 $/MWh)

“Before”

Figures in this slide do not correctly account for reserve sharing

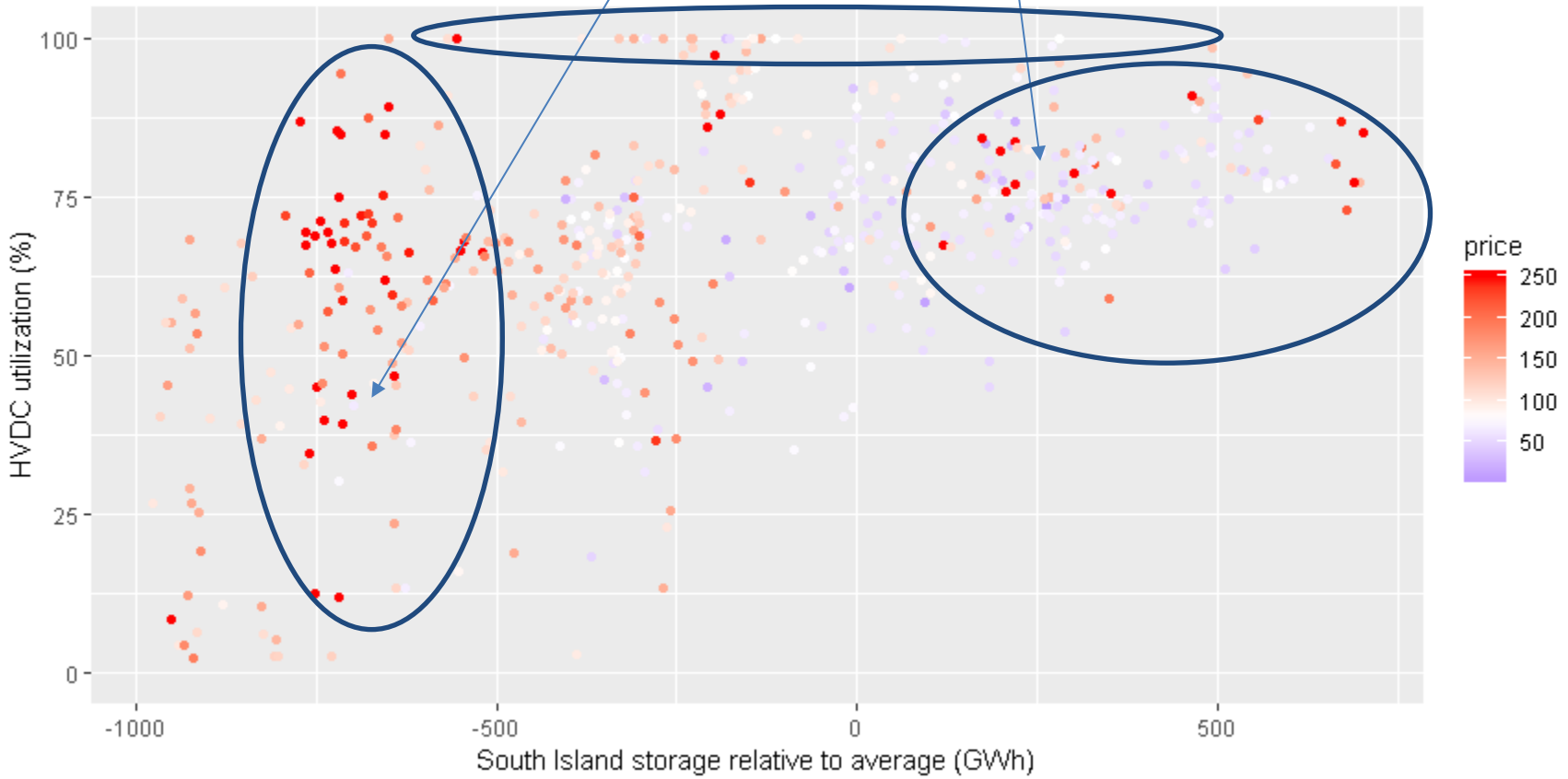
- Some high priced periods with constrained, or nearly constrained HVDC.
- Some high priced periods with low storage.
- Few periods with high storage and plenty of HVDC capacity, and none with high prices.



"After"

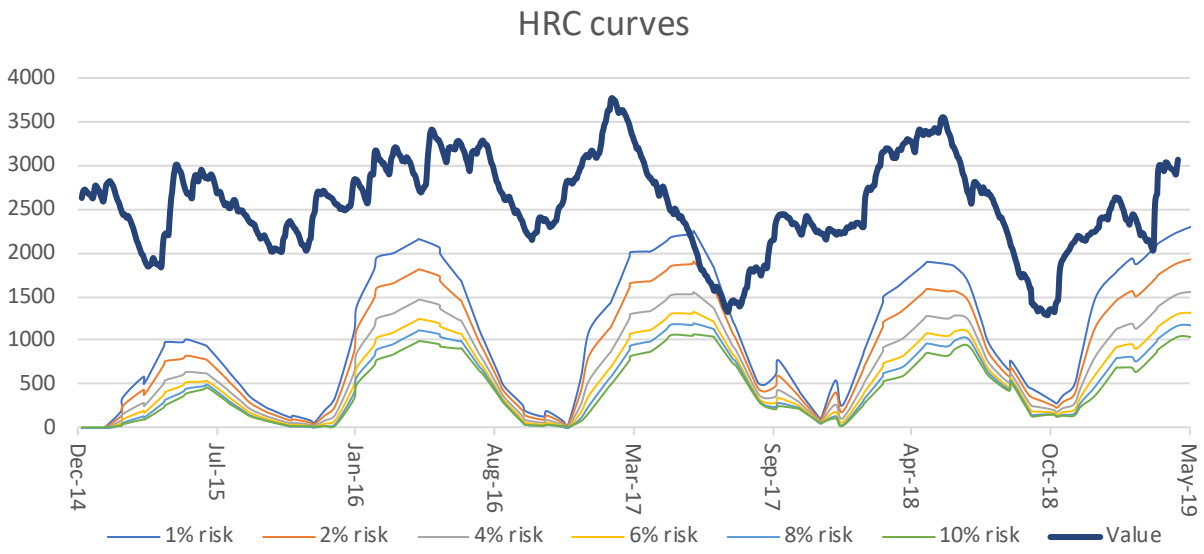
Figures in this slide do not correctly account for reserve sharing

- Many high priced periods with low storage (Pohokura outage)
- Few high priced periods with 100% utilization
- Some high priced periods with high storage and plenty of spare HVDC capacity.
  - This seems odd, but may be caused by some other risk not shown here.



Appendix A – HRC curves

- Hydrology can have a large impact on much of this analysis.
- National storage for recent years is shown for reference.

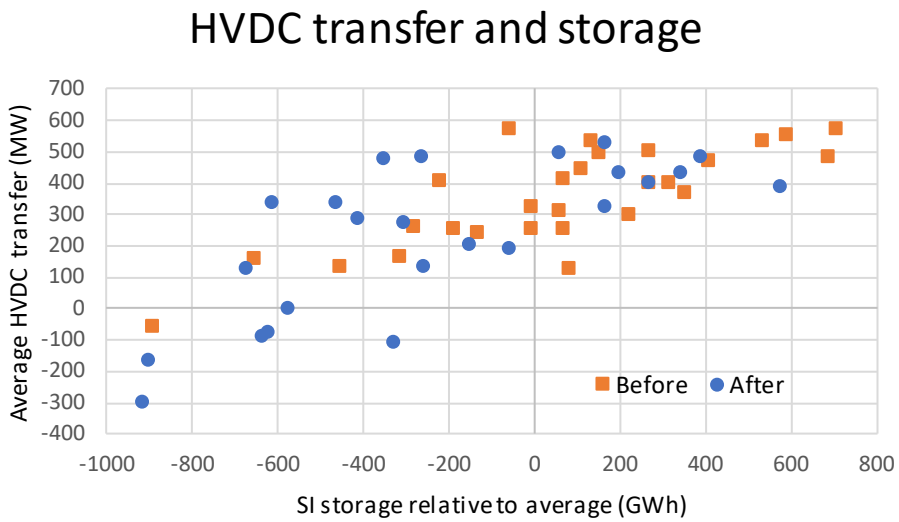


Appendix B – price separation when HVDC is binding risk

- When the HVDC is the binding risk, price separation happens much more often.

Appendix C – Tipping plot

- No obvious difference between before and after
- Similar to graphs on slide 5, but shows monthly averages, and includes all periods.



About Concept

- Concept is a specialist energy and economics consultancy that provides services to clients in New Zealand, Australia and the wider Asia-Pacific region.
- Concept provides advice on energy sector policy, business analysis, restructuring, market design, regulatory issues, energy modelling, market analysis, and technical issues.
- Combining economic rigour, leading modelling & analytical skills, and practical backgrounds in the energy sector, Concept consultants are able to provide practical solutions to client problems based on robust analysis.
- For more information, visit www.concept.co.nz or email info@concept.co.nz .

Disclaimer

- The information and opinions expressed in this presentation are believed to be accurate and complete at the time of writing.
- However, Concept and its staff shall not, and do not, accept any liability for errors or omissions in this presentation or for any consequences of reliance on its content, conclusions or any material, correspondence of any form or discussions arising out of or associated with its preparation.