Appendix A

Charts and Tables for

Efficiency of the New Zealand wholesale electricity market 2008-2017
Results assuming MBIE gas costs
Time weighted average prices North Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average prices South Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average prices North Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average prices South Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical

Chart showing data from January 2014 to December 2014.
Time weighted average prices North Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average prices North Island (2015$/MWh) with low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average prices South Island (2015$/MWh) with low gas cost

- Risk neutral
- Low risk averse
- High risk averse
- Historical

Date range: 01/15 to 12/15
Simulated Ricardian rents ($M) assuming low gas cost

- risk neutral
- low risk averse
- high risk averse
- historical

North Island and South Island storage in 2015
Ten-year simulation results
<table>
<thead>
<tr>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
</tr>
<tr>
<td>counterfactual</td>
<td>3,386</td>
<td>396</td>
</tr>
<tr>
<td>historical</td>
<td>4,255</td>
<td>388</td>
</tr>
<tr>
<td>difference</td>
<td>-410</td>
<td>7</td>
</tr>
</tbody>
</table>

(a) Risk neutral

<table>
<thead>
<tr>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
</tr>
<tr>
<td>counterfactual</td>
<td>4,001</td>
<td>419</td>
</tr>
<tr>
<td>historical</td>
<td>4,255</td>
<td>433</td>
</tr>
<tr>
<td>difference</td>
<td>-294</td>
<td>-14</td>
</tr>
</tbody>
</table>

(b) Low risk aversion

<table>
<thead>
<tr>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
</tr>
<tr>
<td>counterfactual</td>
<td>3,768</td>
<td>346</td>
</tr>
<tr>
<td>historical</td>
<td>4,255</td>
<td>333</td>
</tr>
<tr>
<td>difference</td>
<td>-527</td>
<td>13</td>
</tr>
</tbody>
</table>

(c) High risk aversion
<table>
<thead>
<tr>
<th></th>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
<td>Lost load (MWh)</td>
</tr>
<tr>
<td>counterfactual</td>
<td>3,768</td>
<td>348</td>
<td>36,785</td>
</tr>
<tr>
<td>historical</td>
<td>4,295</td>
<td>333</td>
<td>119</td>
</tr>
<tr>
<td>difference</td>
<td>-527</td>
<td>13</td>
<td>36,666</td>
</tr>
</tbody>
</table>

(a) Risk neutral

<table>
<thead>
<tr>
<th></th>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
<td>Lost load (MWh)</td>
</tr>
<tr>
<td>counterfactual</td>
<td>3,886</td>
<td>396</td>
<td>208</td>
</tr>
<tr>
<td>historical</td>
<td>4,295</td>
<td>388</td>
<td>119</td>
</tr>
<tr>
<td>difference</td>
<td>-410</td>
<td>7</td>
<td>89</td>
</tr>
</tbody>
</table>

(b) Low risk aversion

<table>
<thead>
<tr>
<th></th>
<th>Operating Costs ($M)</th>
<th>Generation [GWh]</th>
<th>Average prices [$/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
<td>Lost load (MWh)</td>
</tr>
<tr>
<td>counterfactual</td>
<td>4,001</td>
<td>419</td>
<td>210</td>
</tr>
<tr>
<td>historical</td>
<td>4,295</td>
<td>433</td>
<td>119</td>
</tr>
<tr>
<td>difference</td>
<td>-294</td>
<td>-14</td>
<td>91</td>
</tr>
</tbody>
</table>

(c) High risk aversion
<table>
<thead>
<tr>
<th></th>
<th>risk neutral</th>
<th>low risk averse</th>
<th>high risk averse</th>
<th>historical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>28,251</td>
<td>22,485</td>
<td>21,864</td>
<td>26,409</td>
</tr>
<tr>
<td>Cost</td>
<td>3,768</td>
<td>3,836</td>
<td>4,001</td>
<td>4,295</td>
</tr>
<tr>
<td>Rent</td>
<td>24,483</td>
<td>18,599</td>
<td>17,863</td>
<td>22,114</td>
</tr>
<tr>
<td>Difference</td>
<td>2,369</td>
<td>-3,515</td>
<td>-4,251</td>
<td>0</td>
</tr>
</tbody>
</table>
Extra Plots
Storage
North Island and South Island storage in 2008

- risk neutral
- low risk averse
- high risk averse
- historical

Millions

1/1/2008 to 12/31/2008
North Island and South Island storage in 2012

[Graph showing storage levels over time for different scenarios: risk neutral, low risk averse, high risk averse, historical.]
North Island and South Island storage in 2014

[Graph showing storage levels from January 1, 2014, to December 31, 2014, with different lines representing different risk scenarios.]
North Island and South Island storage in 2016

Millions

1/01/2016 to 1/12/2016

- risk neutral
- low risk averse
- high risk averse
- historical
Extra ten-year simulation results
MBIE costs
North Island Storage (MBIE fuel costs)

- Low risk averse
- Historical

Millions

Daily average South Island wholesale price ($/MWh)
Results assuming FNZC gas costs
Time weighted average prices North Is (2015$/MWh) with high gas cost

- Risk neutral
- Low risk averse
- High risk averse
- Historical
<table>
<thead>
<tr>
<th></th>
<th>(2015$M)</th>
<th>risk neutral</th>
<th>low risk averse</th>
<th>high risk averse</th>
<th>historical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings</td>
<td>-5833</td>
<td>-7088</td>
<td>-8253</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Old slides with prices (nominal)
Big run using FNZC gas costs
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal cost</td>
<td>Future cost</td>
<td>Lost load (MWh)</td>
</tr>
<tr>
<td>counterfactual</td>
<td>5,046</td>
<td>-503</td>
<td>208</td>
</tr>
<tr>
<td>historical</td>
<td>5,800</td>
<td>-531</td>
<td>119</td>
</tr>
<tr>
<td>difference</td>
<td>-754</td>
<td>28</td>
<td>90</td>
</tr>
</tbody>
</table>
Storage
North Island and South Island storage in 2010

The chart shows the storage levels for North Island and South Island in 2010, comparing different risk scenarios: risk neutral, low risk averse, high risk averse, and historical data. The storage levels are measured in millions of units, with dates ranging from January 1, 2010, to December 31, 2010.
North Island and South Island storage in 2013
North Island and South Island storage in 2014
Old slides with prices (nominal)
Time weighted average price of SI in 2008

- Risk neutral
- Low risk averse
- High risk averse
- Historical
Time weighted average price of NI in 2010

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average price of SI in 2011

- Risk neutral
- Low risk averse
- High risk averse
- Historical
Time weighted average price of NI in 2012
Time weighted average price of SI in 2012

- Risk neutral
- Low risk averse
- High risk averse
- Historical
Time weighted average price of SI in 2013
Time weighted average price of NI in 2016

- risk neutral
- low risk averse
- high risk averse
- historical
Time weighted average price of SI in 2016

- risk neutral
- low risk averse
- high risk averse
- historical