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Modelling results for LNG analysis

Concept Consulting was commissioned by MBIE to undertake modelling on potential outcomes of importing LNG. We considered a wide range of scenarios, including variations to number of Rankine units, whether additional underground gas storage would be available and how LNG would interact with domestically supplied gas.

The modelling was undertaken in multiple stages.

The results provided to MBIE are presented below.

Modelling approach

The modelling results presented here come from Concept's proprietary New Zealand electricity market model, 'ORC'. This is a model that predicts how New Zealand's electricity system will likely develop over time and forecasts the prices that could eventuate in that market. The model does this by simulating the operation of the electricity system, given certain assumptions about the level and pattern of future demand, and the resources (generation, batteries, demand response, inter-island transmission capacity etc) available to satisfy projected demand.

MBIE worked with Concept to establish a range of scenarios covering key assumptions relevant to the LNG analysis, such as future supply/demand balance, local gas production and pricing, LNG prices, future availability of aging thermal generation assets, and the addition of new gas storage.

At its core ORC is an SRMC-based[1] model that finds the least cost solution to providing enough generation and reserves to meet demand. This provided future electricity spot prices, with and without an LNG facility, under the range of scenarios developed for the analysis. The prices reflected in the results table below are time-weighted average New Zealand spot electricity prices. It's important to note that prices would be expected to vary at different times of the day or year and at different locations across the country. Nevertheless, the estimated effects on average prices are a meaningful indication of the likely impact of adding an LNG facility.

For a given modelled future year, ORC is run across 43 possible 'weather years' using fully-coincident historical hydro inflows, wind flows, sunshine, and demand levels. This allows capture of concurrence of renewable and demand 'tails' that drive outcomes at times of market stress. These are important considerations for modelling to support analysis of LNG where the distribution of outcomes across different weather conditions, particularly adverse weather years, is key to understanding the "insurance" that LNG can provide. For example, the "P95" results

[1] Short-run marginal costs in the model are the costs for each generation plant to cover fuel, variable operating and maintenance, and carbon.

presented below reflect expected spot prices in an extreme adverse weather year (approximately 1-in-20 year events), whereas the “P50” results reflect expected spot prices for the median year.

ORC includes a detailed gas supply model. This considers the effect of gas storage, gas diversion from other major users, and limited flexibility from gas fields. This assists understanding of how forecast LNG impacts might change if additional gas storage came into the New Zealand system.

ORC can be run in two “modes”, both of which have been used to support this LNG analysis:

- in near-term mode (1-3 years ahead), generation build is an input assumption, and the model solves for prices with the specified generation fleet. For this LNG analysis, we have looked at the 2028 year, and constructed several sets of input assumptions to cover possible scenarios, such as supply/demand being imbalanced, the loss of one of the three Rankines, the addition of gas storage, and local gas prices being tied to LNG prices.
- in long-term mode (5+ years ahead), the model optimises the building of the generation fleet based on input assumptions for cost trajectories and volumes of system resources that can be developed (or retired). The model builds sufficient new system resources (renewable or thermal stations, batteries) such that developers receive revenue adequacy for their projects. We have looked at the 2035 year, and constructed a similar range of scenarios.

A key feature of ORC is that it operates fully chronologically using an hourly timestep. This allows it to include important dispatch and capacity considerations involved with running the New Zealand electricity system such as “slow start” thermal operation, station outages (important given our aging thermal assets), and optimised grid battery operation and EV charging.

It’s important to acknowledge some limitations of the modelling approach, in particular:

- ORC represents a collective “NZ Inc” approach, and does not capture individual market participant behaviours that might be driven by other factors such as portfolio effects across other aspects of participants’ business
- it does not model the different risk preferences of different parties – some might be more risk neutral whereas others might be more risk averse when making investment decisions
- some real-world uncertainties are not included in the model’s decision-making, such as uncertainties in future fuel costs, carbon costs, capital costs, interest rates, exchange rates, market rule changes. Each of these is reflected in the assumptions for a given scenario. Understanding the potential effect of variations in these elements would require running multiple different scenarios with these elements varied. This has not been done for this modelling exercise.
- analysis is generally based on public information sources – it is possible there is relevant information known to generation plant owners and other market participants that is not reflected in this analysis that could affect the results

- while the model has used 43 weather years, as a representative sample of possible weather outcomes, there could be outcomes that fall outside of this range
- the transmission grid will continue to be upgraded to reduce the effects of transmission constraints
- demand is assumed to persist even after very large prices for extended periods, that is, there is demand response modelled but it is assumed the demand does not permanently exit the market but will come back when prices reduce

Scenarios

The scenario IDs in the results tables can be interpreted as follows:

- ‘Base’ indicates that both the renewable supply / demand balance, and NZ gas deliverability are as per the respective base assumptions
- hiD indicates a 2028 scenario with only committed renewable build and high demand
- underS indicates an under-supply of renewables
- lowG indicates low NZ gas deliverability
- The following elements in the suffix string are as follows:
  - wT or nT = with Tariki or no Tariki, respectively
  - 2R or 3R = 2 Rankines or 3 Rankines, respectively
  - NZ=L or NZ≤L = NZ gas price is set to LNG gas price, or a split gas market, respectively
  - noL, wL25, and wL20 = no LNG, with LNG priced at either $25/GJ or $20/GJ

Prices

We modelled prices for each scenario. Table 1 summarises annual price outcomes.

Table 1 – Annual Modelled Prices ($/MWh)

Scenario	Avg (mean)	Stdev	Max	Min	Volatility	P90%	BlackSwan[2] or Max	BS year	P95%	P50%
2028 base nT.3R.NZ≤L noL	145	45	280	59	31%	204	280		215	141
2028 base nT.3R.NZ≤L wL20	140	38	219	58	27%	199	219		206	139
2028 base nT.3R.NZ≤L wL25	142	40	232	58	28%	203	232		215	139

[2] Some pairs of scenarios included a “black swan” year in which low inflows coincided with a complete Huntly station outage over winter. This year was not included when calculating other summary value.

Scenario	Avg (mean)	Stdev	Max	Min	Volatility	P90%	BlackSwan[2] or Max	BS year	P95%	P50%
2028 base wT.3R.NZ=L noL	124	33	192	56	27%	166	285	29	181	124
2028 base wT.3R.NZ=L wL25	143	37	216	66	26%	186	274	29	201	144
2028 hiD nT.2R.NZ≤L noL	256	115	539	110	45%	465	539		501	217
2028 hiD nT.2R.NZ≤L wL20	229	94	542	111	41%	353	542		447	199
2028 hiD nT.3R.NZ≤L noL	211	64	394	107	30%	294	394		338	200
2028 hiD nT.3R.NZ≤L wL20	197	50	358	107	26%	259	358		280	189
2028 underS wT.3R.NZ=L noL	179	40	286	104	22%	229	556	29	244	175
2028 underS wT.3R.NZ=L wL25	193	36	286	117	19%	229	386	29	252	195
2030 base wT.2R.NZ=L noL	95	37	178	37	39%	153	293	29	160	90
2030 base wT.2R.NZ=L wL25	100	39	189	36	39%	163	290	29	171	94
2030 lowG nT.2R.NZ=L noL	95	45	239	33	48%	165	403	29	181	86
2030 lowG nT.2R.NZ=L wL25	100	39	189	36	39%	163	290	29	171	94
2030 underS wT.2R.NZ=L noL	141	44	251	61	31%	204	510	29	220	138
2030 underS wT.2R.NZ=L wL25	145	43	248	58	30%	204	376	29	216	144
2035 base nT.2R.NZ≤L noL	108	65	303	33	60%	192	303		256	93
2035 base nT.2R.NZ≤L wL25	108	59	306	35	55%	198	306		213	94
2035 base nT.3R.NZ≤L noL	105	53	236	35	50%	169	236		222	96
2035 base nT.3R.NZ≤L wL25	105	49	237	36	46%	170	237		189	96
2035 base wT.2R.NZ=L noL	100	42	191	37	42%	164	340	29	167	95
2035 base wT.2R.NZ=L wL25	101	42	191	36	42%	166	327	29	171	97
2035 base wT.2R.NZ≤L noL	107	59	301	35	55%	196	301		206	91
2035 lowG nT.2R.NZ=L noL	95	53	240	29	56%	174	730	29	193	83
2035 lowG nT.2R.NZ=L wL25	101	42	191	36	42%	166	327	29	171	97
2035 underS nT.2R.NZ≤L noL	159	83	395	49	52%	285	395		328	141
2035 underS nT.2R.NZ≤L wL25	151	73	381	49	48%	262	381		285	138
2035 underS wT.2R.NZ=L noL	143	52	264	54	36%	213	599	29	226	141
2035 underS wT.2R.NZ=L wL25	144	49	263	51	34%	209	404	29	217	146
2035 base wT.2R.NZ≤L wL25	107	57	298	36	53%	195	298		204	94

Emissions

We also modelled emissions. Table 2 shows modelled annual emissions.

Table 2 - Modelled annual emissions

	Fuel consumption (PJ/yr)			Emissions (ktCO2/yr)			
Scenario description	Coal	Gas[3]	Diesel	Coal	Gas	Diesel	Total
2028 base nT.3R.NZ≤L noL	5.9	9.0	0.1	523	475	5	1,003
2028 base nT.3R.NZ≤L wL20	5.1	9.3	0.3	458	493	23	974
2028 base nT.3R.NZ≤L wL25	5.4	9.2	0.2	486	487	14	987
2028 base wT.3R.NZ=L noL	3.7	8.9	0.1	329	471	5	804
2028 base wT.3R.NZ=L wL25	6.0	6.3	0.1	534	335	5	874
2028 hiD nT.3R.NZ≤L noL	12.4	12.6	0.2	1,101	668	13	1,782
2028 hiD nT.3R.NZ≤L wL20	10.6	13.6	0.8	942	720	58	1,721
2028 underS wT.3R.NZ=L noL	9.3	13.5	0.2	826	717	12	1,555
2028 underS wT.3R.NZ=L wL25	11.6	11.2	0.1	1,031	596	6	1,632
2030 base wT.2R.NZ=L noL	1.7	5.4	0.1	155	288	7	449
2030 base wT.2R.NZ=L wL25	2.2	4.1	0.1	200	218	7	424
2030 lowG nT.2R.NZ=L noL	2.1	4.0	0.2	185	211	13	410
2030 underS wT.2R.NZ=L noL	3.6	8.6	0.2	324	458	13	795
2030 underS wT.2R.NZ=L wL25	4.3	6.8	0.1	386	362	9	757
2035 base nT.2R.NZ≤L noL	2.4	3.2	0.2	218	169	12	399
2035 base nT.2R.NZ≤L wL25	2.3	3.2	0.3	201	168	22	391
2035 base nT.3R.NZ≤L noL	3.5	3.4	0.1	308	178	9	495
2035 base nT.3R.NZ≤L wL25	3.1	3.5	0.3	277	186	18	481
2035 base wT.2R.NZ=L noL	1.9	4.1	0.2	167	217	11	394
2035 base wT.2R.NZ=L wL25	2.0	3.7	0.1	180	196	10	385
2035 base wT.2R.NZ≤L noL	2.3	3.8	0.1	208	204	9	420
2035 lowG nT.2R.NZ=L noL	2.8	1.7	0.2	250	89	16	355
2035 underS nT.2R.NZ≤L noL	4.5	4.7	0.3	399	251	20	671
2035 underS nT.2R.NZ≤L wL25	3.9	5.2	0.6	349	275	41	664
2035 underS wT.2R.NZ=L noL	3.9	5.8	0.2	345	306	17	668
2035 underS wT.2R.NZ=L wL25	3.8	6.0	0.2	338	317	11	666

[3] Domestic natural gas or LNG.

Price curve

Concept also supplied MBIE with an annual price forecast for various scenarios. This was part of our proprietary Q3 2025 price forecast. One particular combination of near-term and long-term scenarios was included in the cabinet materials from December 2025 that were published on 9th February 2026.

Figure 1 - Concept price forecast