Memorandum

Date	8 December 2021
To:	Alistair Dixon
From:	Kieran Murray, Toby Stevenson, David Reeve
Re:	**Retirement of fossil fuel powered plant**

In addition to your question on the implications for contract markets of transition toward 100% renewable market you have asked

> What if any factors might lead to 'last resort' plant (e.g. Rankine units) to be retired before new renewable capacity is available? Put another way, if it is socially beneficial for plant to defer retirement, what factors might block that from occurring via free contracting?

Initially we used the same approach as the previous question and that exercise is shown in the appendix. We developed a narrative around contracting for last resort plant to date and the prospects during the transition based on the insight gained from that initial exercise.

Contracting for last resort plant.

The factors contributing to the contracting of last resort plant are many and nuanced and not restricted to price, contract, market risk management, and revenue. Politics plays a significant role, as does company reputation.

The question applies to all plant that could be considered last resort thermal.[1] For this narrative we focus on the Huntly Rankine units, as the factors at play are most acute for these units. The other last resort thermal (Huntly unit 6, Stratford peakers, TCC, and Whirinaki) suffer most of the same effects but generally to a lesser degree.[2]

The issues are most acute for the Huntly Rankines because:

- They provide large discretionary capacity that is necessary to cover dry year risk.
- They provide not only last resort capacity but also most of the last resort fuel, i.e. coal.[3]
- The performance of these units has been exceptional, but they have had a long hard life for this type of plant and are nearing end of life.

[1] Some peaking hydro units could be considered last resort plant as well, but the discussion is limited to thermal.
[2] Huntly unit 5 and Nova units are still mostly baseload plant but may become more marginal.
[3] Whirinaki also provides a fuel independent of the gas market but is a lot smaller and much more expensive.

- They are, arguably, the 'hottest political potato' with their large potential GHG emissions but are heavily relied upon for security of supply.
- Their large unit sizes, minimum loads, and location can 'move' the market significantly.
- Through their size and location, they provide essential security and voltage support to Auckland.

The dynamics around Genesis's decisions about the Rankines leading to today[4]

After the 2003 high price event, Genesis came under many pressures, including strong political pressure, to ensure a supply of coal for Huntly with no contractual underwrite to reflect its historical role in security of supply in New Zealand. With supply contracts based on demand growth consistent with the 1973 to 2007 period significant amounts of coal were delivered accordingly leading to a large stockpile. With demand flattening from 2007, and renewable projects still being completed, the stockpile became a commercial exposure. This stockpile weakened the incentives for other market participants to contract with Genesis for security of supply, it simply wasn't credible that Genesis wouldn't use every opportunity to deploy the stockpile regardless of whether it was contracted or not.

Genesis's actions at the time may have increased the perceived value of contracts with the Rankine units as a result of:

- Reducing the stockpile as quickly as practical.
- Retiring one unit and 'mothballing' another.
- Announcing the retirement of the other units but being prepared to reverse this decision.

Other large generators took similar approaches which we expect reflected similar reasons, e.g. Contact exited out of all gas supply contracts, and has also been very public about the critical mid-life refurbishment decisions for TCC.

These actions are potentially risky for Genesis and other thermal operators. Regardless of whether it is financially rational to move to just in time delivery and/or socially optimal to maintain some strategic reserve of coal, Genesis, or other thermal generators, could be caught out with a just in time approach to thermal fuel (i.e. coal) delivery. What they are effectively weighing up is the merit of maintaining a real chance of electricity generation shortfall so counterparties have an incentive to contract, while ensuring the thermal units (especially the Rankines) can run when they need to.

The dry year event of 2008 led to another set of changes in the market, which included the establishment of the Electricity Authority per the Electricity Industry Act 2010. The new arrangements also included the customer compensation scheme, which greatly changed the incentives for hydro operators' management of the hydro reservoirs and, therefore, changed the large hydro operators' incentives to contract for security of supply. This led to some new contract arrangements, the most significant of which was the Genesis-Meridian swaption.

These changes led to a new "game" on the buy side of security of supply contracts. In the first contract round the party with the largest stranded asset risk (Genesis) contracts with the party with the largest exposure to dry year risk (Meridian). Further contracts may be struck between Genesis and other large

[4] We have not fact checked this narrative with Genesis. Our aim is to inform the question we have been asked which relates to the tensions around the timing of retirement of large thermal units as we transition to low emissions (100% renewable) electricity generation.

hydro operators. However, at the point where any party that might benefit from a security of supply contract with Genesis expects the residual cost to Genesis of supplying the Rankines has fallen below the cost of the political and reputational risk of an energy supply shortfall, then that party's incentive to contract reduces significantly.

This dynamic is still evident today. Genesis (and to a lesser extent other thermal operators) has to continually signal that there is a cost of business which, if reached, would lead to the system ending up in energy shortfall while all but the largest buyer(s) try to judge the point where this is not true.

Looking to the future

As the contracting game plays out to its conclusion, where large thermal units are removed from service, a few factors make the problem more acute. Some of these factors act to increase the cost to owners of retaining large thermal plant in service while some factors will act to reduce the price other parties are willing to pay to contract for security of supply from thermal plant.

Factors increasing the cost to owners of large thermal plant:

- The brand damage to those parties that continue to operate thermal units i.e. that burn fossil fuel, will increase.
- The role of new technology, e.g. grid-scale batteries and distributed energy resources, will become more certain, which could further reduce thermal load factors.
- The likelihood of catastrophic failure of one, or more, of these large thermal units increases.
- The costs and risks to retain thermal units in service are likely to increase significantly.
- As more renewable generation enters the market the load factors of the thermal units should reduce.

Factors reducing the price at which parties are willing to contract with thermal plant:

- The brand damage to those parties that contract with thermal units i.e. that burn fossil fuel, will increase.
- The role of new technology, e.g. grid-scale batteries and distributed energy resources, will become more certain, which could increase alternative security of supply services.
- The likelihood of catastrophic failure of one, or more, of these large thermal units increases. If these risks are then added to Force Majeure clauses in contracts, then this makes the contracts less valuable to buyers.
- As the electrification of transport and industrial process heat increases then both security of supply and cost will become more important. Generally, this increased cost of risk should increase buyers' willingness to pay for a contract. However, it may also influence the buyers' incentives to act strategically by thinking that thermal plant may come under more pressure to stay in the market in this scenario and be, as a result, more keen to strike contracts with buyers.
- The effects of climate change (perceived or real) are uncertain. Warmer winters could lead to better matching of hydro inflow to demand reducing willingness to pay for thermal output.
- If the Government perceives the threat to security of supply to be too great, they may develop interventions (and are already preparing for this possibility with the NZ Battery project). Some market participants could form a view that state sponsored security of supply solutions will be

less costly or more freely available than contracting with existing providers and might prefer to wait.

What is not included in the lists above are factors that might increase buyers' preparedness to pay to contract for security of supply for thermal plant, as our brief is to consider only the factors that might impede contracting. Other factors may increase the willingness of parties to contract.[5] Combined, all of these factors lead to the following observations:

- The residual security of supply services (that must be met by ageing thermal units during the transitional period) could be perceived as more or less valuable.
- The factors in the table above could lead the costs of providing security of supply from thermal to increase significantly and for the cashflow implications to become acute (e.g. long periods of cost with very short periods of payoff).
- The perceptions of security of supply risk could still diverge significantly between potential buyers of contracts and providers of the service.
- If it is the case that greater reliance on electrification, increased market risk, and increased political uncertainty outweighs the factors discussed in the table buyers may still contract. (This only applies in scenario 1 of our original framework which is attached in the appendix.)

Addressing the Authority's question

In an ideal market, thermal plant would exit at the socially optimal time. However, the electricity market, and particularly the contracts market, are not ideal and are strongly affected by externalities as described above. Where externalities are empirical and observable then a market will generally be able to price them. Some of the externalities above are empirical but not, or not yet, observable. An expectation of how some of the externalities will manifest themselves can only be based on judgement and perception. In this context there must be a risk of sub-optimal exit of thermal generation.

Market inefficiencies could play out under two broad paths:

1. Perceptions of risk might narrow between market participants making it more likely that deals, or other arrangements, can be brokered. That is, the perception of the level of risk could increase significantly for the buyers or sellers of thermal security making one side of potential arrangements more willing to meet the terms and conditions of the other side. Depending on how much unpriceable externalities were affecting these perceptions of risk then the result may not be socially optimal but would, at least, ensure the exit of thermal plant was after the socially optimal point.

2. On the other path perceptions of cost could exceed perceptions of risk, or the perceptions between parties could continue to be apart. In this case it would be increasingly difficult to conclude sufficient arrangements anywhere on the contracting spectrum and exit earlier than the optimum would be more likely.

[5] For example, as electrification of transport and industrial process heat increases then both security of supply and cost will become more important, and the early retirement of a large thermal unit could have a dramatic effect on security of supply and market prices at the margin

Appendix: initial analytic approach.

This table is the initial approach that informed the narrative in the text above. The takeaway from this table is, in short, free contracting is likely to be difficult in scenario 1, will be difficult in scenario 2 and won't happen at all in scenario 3.

	1. Transitioning to 100% renewable electricity	**2. 100% renewable with restraints on high prices**	**3. 100% renewable with government entry into the wholesale market**
What-factors might lead to 'last resort' plant (e.g. Rankine units) to be retired before new renewable capacity is available?	**Retirement factors** 1. Ability for generator to cover their own load some other way 2. **Risk of inability** to recover costs via contract i.e. the "standoff" 3. **Risk of inability** to recover of costs via spot 4. Cost of keeping units in service becomes prohibitive 5. Catastrophic failure 6. The view that using coal/gas/diesel is inconsistent with generators' brands 7. Absence of political pressure to remain in service	**Retirement factors** 1. Ability for generator to cover their own load some other way 2. **Unlikely** to recovery of costs via contract i.e. the "standoff" 3. **Unlikely** to recover of costs via spot 4. Cost of keeping units in service becomes prohibitive 5. Catastrophic failure 6. The view that using coal/gas/diesel is inconsistent with generators' brands 7. Absence of political pressure to remain in service	[For this scenario we assume the solution is SI based e.g. Lake Onslow PHES.] **Retirement factors** 1. Completely different scenario from scenarios 1. and 2. 2. The case for the fossil fuel power plants shifts away from DYR to NI firming and peak products Disincentives to free contracting • In this world where the case for the fossil fuel plants focuses on NI firming and peaking products the stand-off over price and lack of willingness to tailor products may remain in force. • Pricing pressure becomes more acute because of lower load factors

	1. Transitioning to 100% renewable electricity	2. 100% renewable with restraints on high prices	3. 100% renewable with government entry into the wholesale market
Why might free contracting not support deferred retirement (especially when it may be socially beneficial)	**Disincentives to free contracting** • Beneficiaries **reluctant to** pay seller's price • Sellers won't tailor contracts to buyer requirement • Price of contracts offered may become prohibitive (cost of keeping in service) • Generator able to cover own load in some other way • VI entity reduces retail load creating more supply of contracts which, if not filled, would increase the likelihood of retirement • Risk of catastrophic failure may lead to unattractive FM clauses • The view that using coal/gas/diesel is inconsistent with generators' brands	**Disincentives to free contracting** • Beneficiaries **won't** pay seller's price • Sellers won't tailor contracts to buyer requirement • Price of contracts offered may become prohibitive (cost of keeping in service) • Generator able to cover own load in some other way • VI entity reduces retail load creating more supply of contracts which, if not filled, would increase the likelihood of retirement • Risk of catastrophic failure may lead to unattractive FM clauses • The view that using coal/gas/diesel is inconsistent with generators' brands	