Market performance quarterly review

First quarter 2019

Information paper

4 October 2019

1 Purpose of the report

1.1 This document covers a broad range of topics in the electricity market. It is published quarterly to provide visibility on the regular monitoring undertaken by the EA.

2 What's coming up

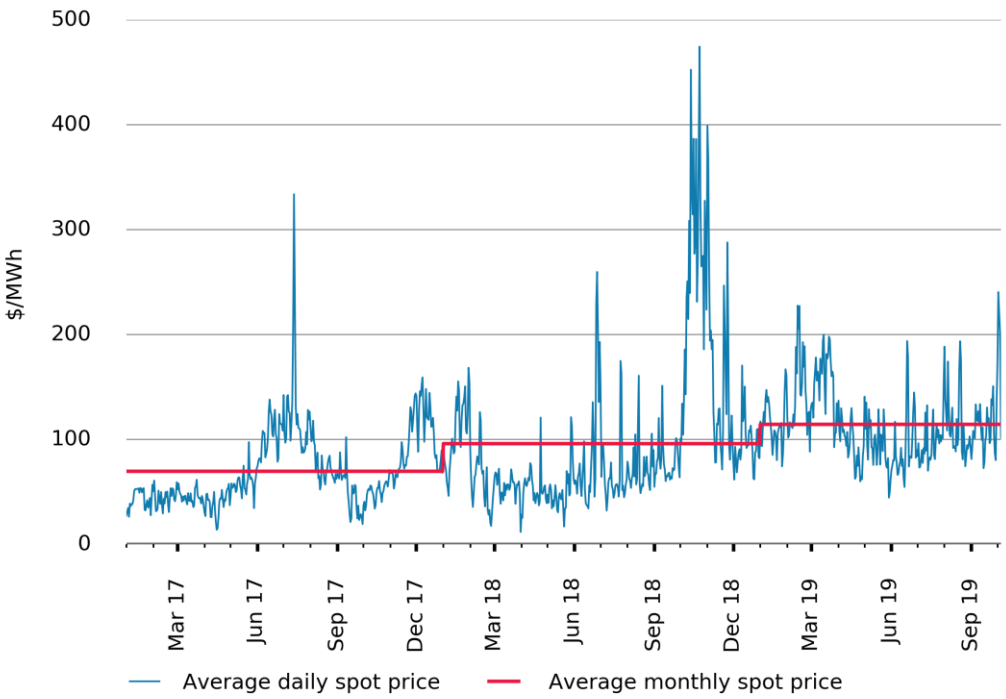
2019 spot prices remain high

2.1 Spot prices in the first quarter of 2019 were on average higher than in previous years, as seen in Figure 1. Daily spot prices were very high in February/March 2019 when both lake levels were low and Pohokura was on outage. When South Island storage increased in April 2019 the spot price decreased rapidly in response, but prices have not fallen to the average prices seen historically.

2.2 There are some possible reasons why the price has remained high: lake levels were low in the North Island, gas spot prices are still high and there is increased uncertainty, especially around gas supply.

2.3 We plan to further investigate the sustained period of high prices seen so far in 2019 to fully identify the contributing factors and to ensure that no undue use of market power is exacerbating the situation

Figure 1 Average Daily and Annual Spot prices 2017-2019



2020 Pohokura and HVDC Outage

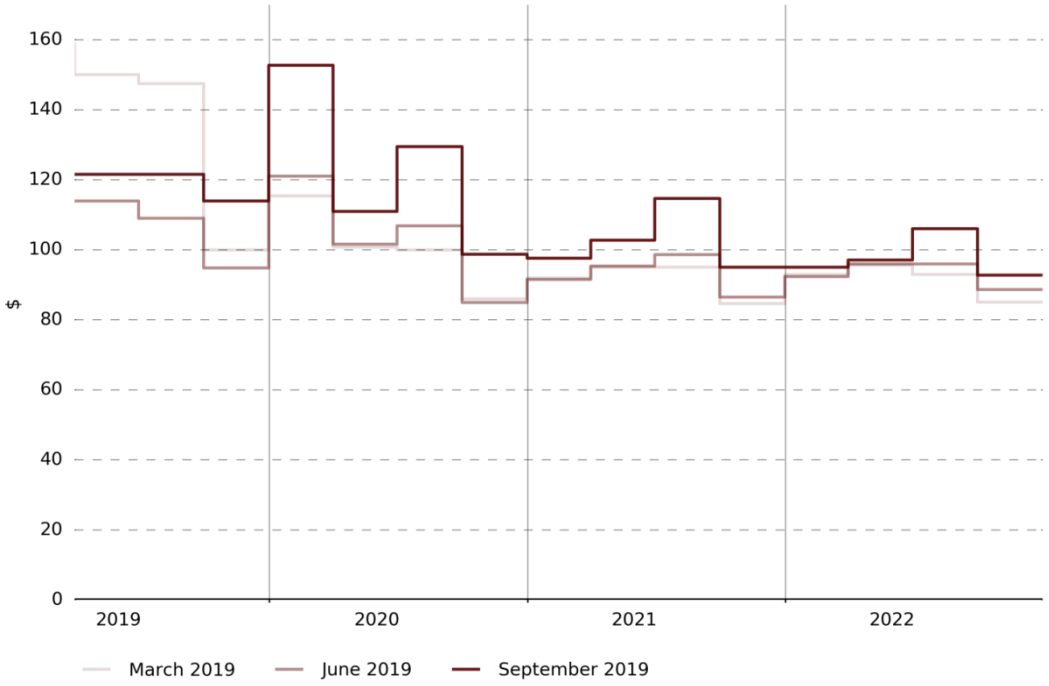
2.4 There are concurrent outages of the HVDC and the Pohokura gas production facility scheduled in the first quarter of 2020 causing very high forward prices for that quarter. The critical dates are in March when Pohokura is out from the 11th to the 24th. This is a total outage rather than the partial outages that occurred in late 2018 and early 2019. The Pohokura outage overlaps with an HVDC outage that runs from 7 January to 9 April

2020. This will mean HVDC capacity will be reduced to about half for most of this period, with four full days of total outage. Figure 2 shows the effect on the forward price curve with first quarter 2020 contracts at Otahuhu over $150/MWh.

2.5 The system operator is working with the industry to minimise the impact of the 2020 outages. Transpower has moved the bipole outages to the weekend to lower the impact. Genesis Energy has rescheduled a Rankine outage until after the HVDC and Pohokura outages are completed. The conservative scenarios used by the system operator to model security include one with no wind generation, TCC (Contact Energy's CCGT in Taranaki) not running and Huntly only running at 80 percent capacity. The September NZ generation balance (NZGB) has reported no generation shortfall for the outage period, even in this worst case scenario.

2.6 Staff are closely monitoring the situation. The Authority has sought advice from the Security and Reliability Council (SRC) on what level of concern is warranted and whether there are additional actions that the Authority, the System Operator and market participants could be taking to mitigate risk.

Figure 2: ASX quarterly hedge contract forward curve for Otahuhu during 2019



2.7 As part of a project to improve wholesale market information disclosure Authority staff are participating in Transpower's review of the planned outage coordination protocol (POCP) platform, and how it is being used to plan the outage in 2020. We are also tracking and supporting work by the Gas Industry Company on gas market disclosure. The Authority has also sought advice from the SRC on whether there are viable opportunities to improve the current regulatory and market arrangements for coordination of outages.

3 Highlights over the last quarter

3.1 **Demand up slightly.** Demand was up slightly in the first seven months of 2019 compared with the same period over the last 11 years. However, the overall picture is still one of relatively flat demand—both total and peak—since 2008. The additional potline at Tiwai contributed to the slight increase in consumption in 2019.

3.2 **Small retailers continued to gain connections.** Electric Kiwi, Vocus, Energyclub and Ecotricity continue to grow strongly. However, Flick's market share continues to suffer from the high wholesale prices.

3.3 **The spot market was heavily influenced by a combination of low hydro storage in the North Island and ongoing gas supply constraints.** Spot prices were relatively high due to a shortage of hydro fuel in March, and subsequently remained high, most likely as the result of low North Island inflows, high gas spot prices, and high demand.

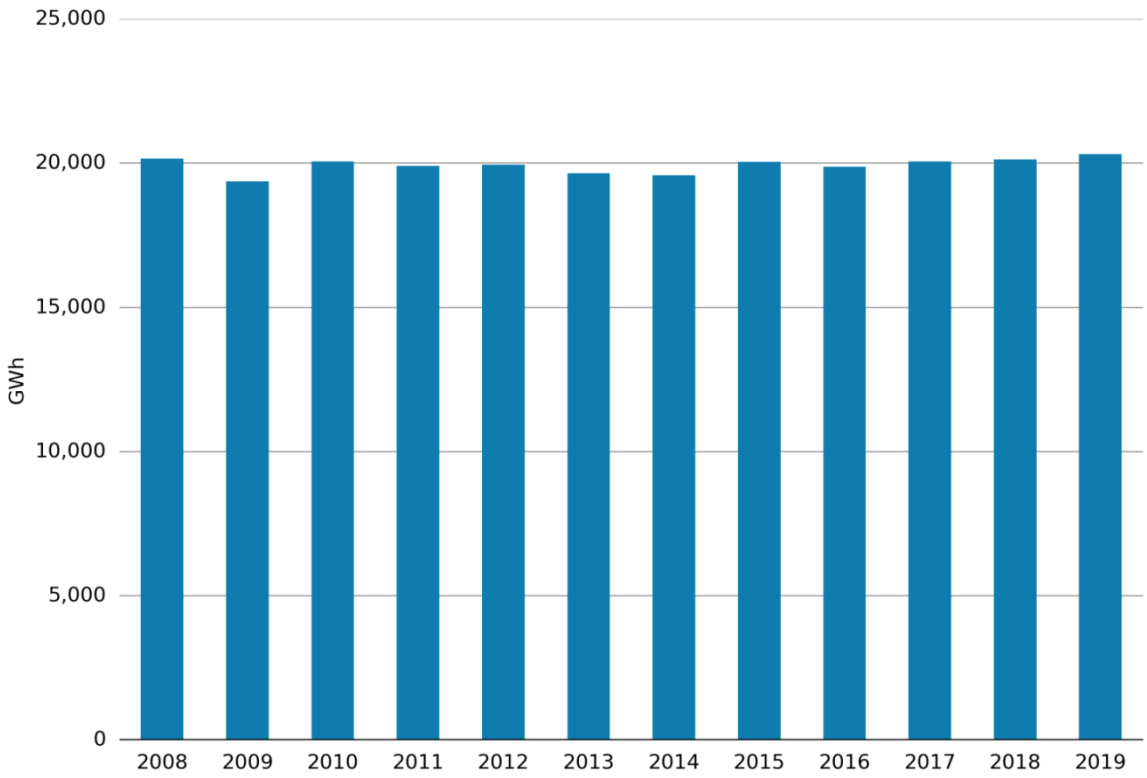
3.4 **Hedge prices responded as expected to the improving national hydro storage levels.** The forward curve spreads have tightened as portfolio stress on market makers decreased. However, concern about the concurrent HVDC and Pohokura outages are causing high forward prices for Q1 2020.

3.5 **Thermal generation was lower for most months except when hydro storage was low**. Thermal generation is usually highest during the winter months.

4 Demand

4.1 Reconciled demand was higher than average (since 2008) in all months in 2019 except May (including Tiwai demand). Total reconciled demand for the first six months of 2019 was higher than demand in the first six months of previous years from 2008 to 2018.

Figure 3: Demand for the first six months of the year since 2008



4.2 The warm weather in 2019 indicates that it is unlikely that increased demand was driven by colder temperatures, but the dry weather in the North Island could have increased irrigation load. Reconciled demand for Tiwai aluminium smelter was also above average for all months so far in 2019, since they started up a forth potline in September 2018.

4.3 The outlook for exogenous drivers of electricity demand such as GDP and population growth give a mixed picture for the future, and may add to uncertainty about future electricity demand growth.

4.4 Peak demand so far in 2019 is lower than the peak demand experienced in the past 11 years except 2014. This is due to a relatively warm winter in 2019 so far. Peak demand drives investment in infrastructure, particularly transmission, and peaking generation. A number of generation plants are under construction or seeking consent, including:

(a) Nova's 100MW thermal plant at Junction road in Taranaki

(b) Tilt Renewable's 130MW Waipipi wind farm (formerly known as Waverly) in Taranaki

(c) Mercury's 119MW Turitea wind farm in the Manawatu

(d) Contact's drilling campaign at the Tauhara steam field near Taupo, to support a final investment decision on new generation at the site

(e) Meridian seeking potential contractors for the civil works at its consented 270MW wind farm northwest of Napier.

4.5 These projects suggest that generators expect demand to increase.

5 Retail market

Recent studies

5.1 The retail market has been the subject of post-implementation reviews of the save protection scheme (view here) and the retail data project (view here). Retailers have acted in ways to undermine the benefits that were anticipated from these two projects. These lessons have, in-part, contributed to reviewing the need for a central customer database and must be kept front-of-mind in the saves and the win-backs project.

5.2 In addition, a 2017 review of The Lines Company (view here) found that the complexity and variability of the lines charges, the long delay between actions and the consequent effect on charges, and the potentially large financial impacts all contributed to the regime being difficult for consumers to adjust to. The majority of the harm caused was due to consumers making inefficient investment decisions often based on misunderstood impacts of the pricing regime.

Retail market commentary

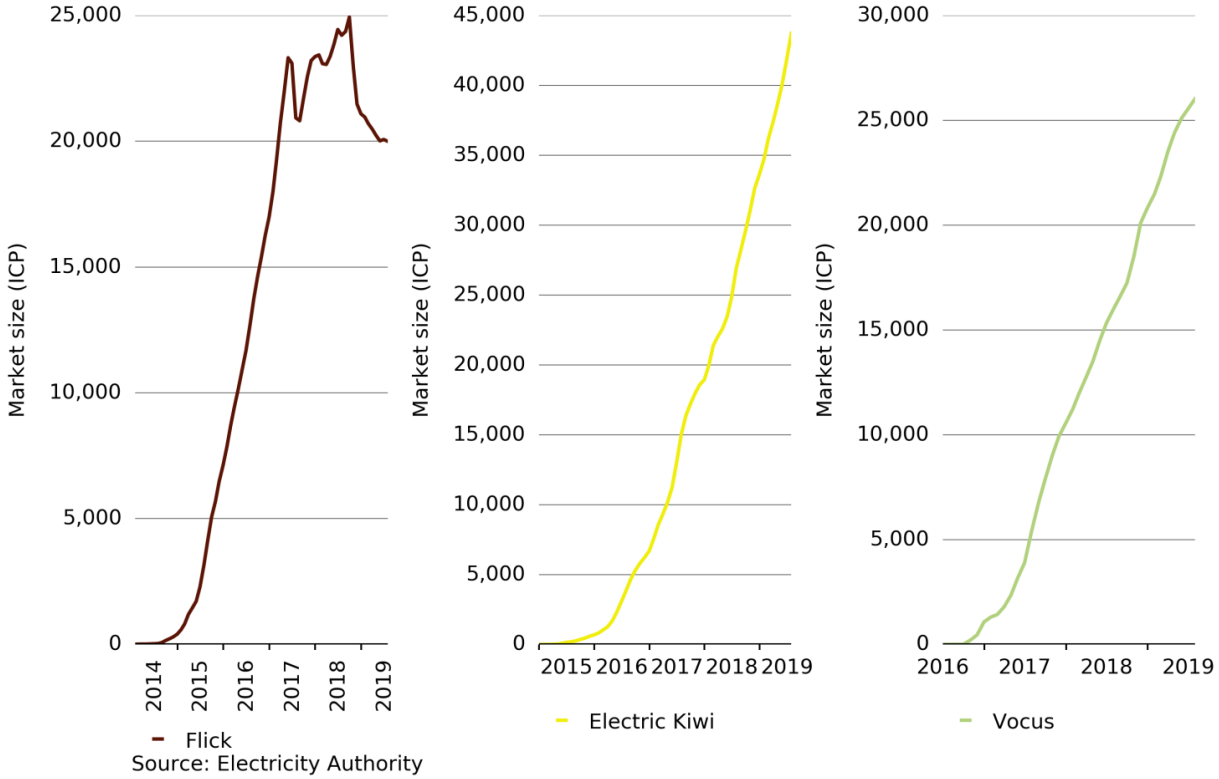
5.3 Retail market developments (all sectors) in the first seven months of 2019 include:

(a) Mercury Limited (Mercury) had the largest loss amongst all retailers, losing 14,921 connections.

(b) Electric Kiwi Limited (Electric Kiwi) gained 10,340 connections, the largest gain among all parent retailers. Electric Kiwi launched in December 2014 and is now the eighth largest retailer based on market shares. Meridian was the second highest retailer gaining connections, followed by Vocus Group (Vocus) that gained

5,311 connections. Vocus offers bundled services including power and telecommunications.

Figure 4: Market size for Flick, Electric Kiwi and Vocus



Source: Electricity Authority

5.4 In the coming year, we will keep an eye on the impact of higher hedge prices on the retail market, particularly the smaller retailers who need to buy hedges to cover risk, and if this impacts their market size.

6 Wholesale market

Recent studies

6.1 The wholesale market consists of the spot market, derivative markets and the ancillary services markets. Market Performance has done several reviews of the wholesale market over recent years. Collectively these reviews have highlighted several aspects of the wholesale market that have worked well, and others that have not worked well.

6.2 The reviews of the national market for instantaneous reserves (view here) and wholesale prudential arrangements (view here) showed benefits had been realised from these changes.

6.3 However, we have since looked into the prudential calculation and identified several possible inefficiencies regarding the price and volume used for the forward-looking component of the calculation meaning prudential payments can end up being set either too high or too low. Depending on priorities and resources we expect to request the pricing manager to review the prudential methodology later this financial year or in the next financial year.

6.4 A UTS complaint in 2018 led to scrutiny of the wholesale market information disclosure rules. The resulting report (view here) showed that the rules had obvious shortcomings and Authority staff indicated that the rules should be re-designed following the completion of the in-progress compliance investigations. This information asymmetry may not have had a material impact on markets in this particular event, but it is clear that rules would not prohibit information asymmetry that was significant.

6.5 This review also highlighted liquidity issues in the forward market. These issues were also raised in the review of winter 2017 (view here). The UTS decision paper highlighted the performance of the exchange traded forward market. It showed that the market making arrangements for ASX traded futures were more fragile than people realised.

6.6 In response to the events in spring 2018 and early 2019 Authority staff started a project to improve wholesale market information disclosure. As part of this project we are participating in Transpower's review of the planned outage coordination protocol (POCP) platform, and how it is being used to plan the outage in 2020. We are tracking and supporting work by the Gas Industry Company on gas market disclosure. This project will also evaluate the priority of work to review and improve the hedge disclosure website.

6.7 There is also a project to enhance the hedge market, particularly to create resilient and enduring market making arrangements, in order to minimise reoccurrences of the high spreads seen in late 2018/early 2019. This project is on target to release a discussion paper and meet with interested parties during October.

6.8 A review of dispatchable demand in 2018 (view here) found that the scheme had a small effect on prices as demand was able to compete with generation in the spot market. It also found that the complexity of the scheme and the reduction in control over production processes discouraged participation.

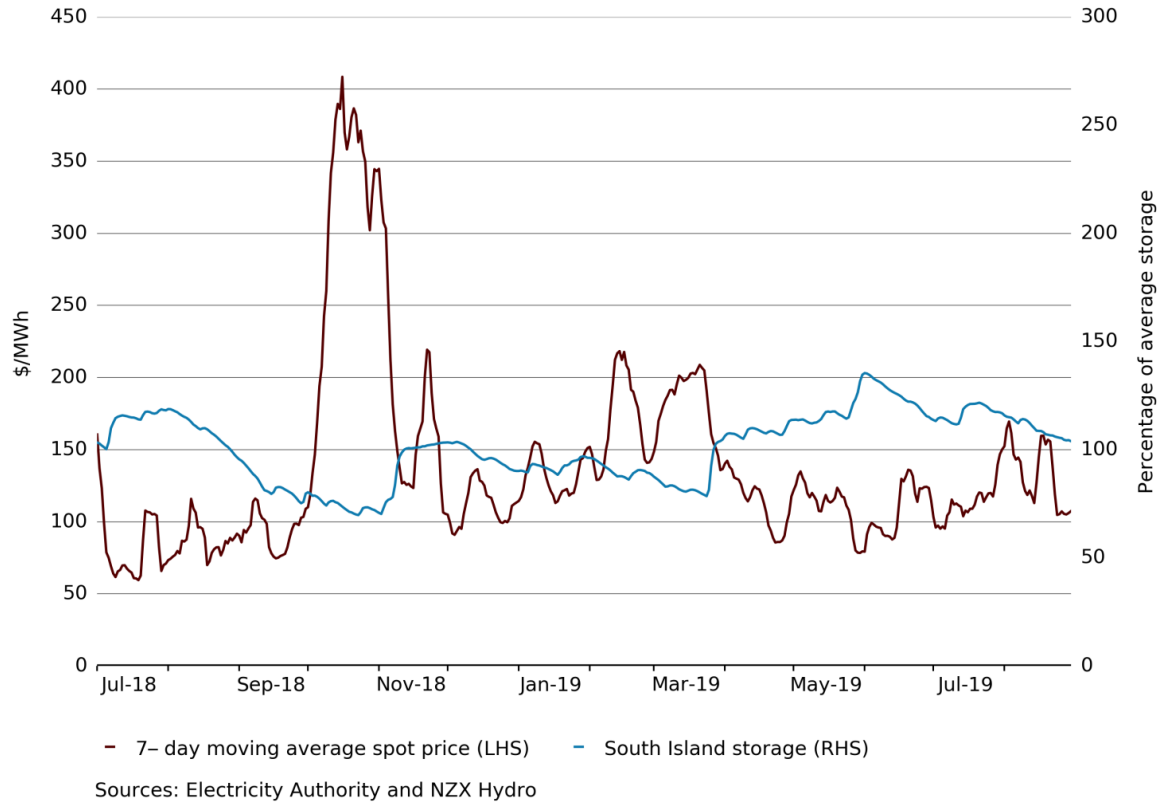
6.9 In 2016 a market performance review, which subsequently became a UTS complaint (view here), led to scrutiny of trading conduct in the wholesale market. We found that offer behaviour during the event that led to the UTS complaint was inconsistent with workable competition. As part of this review, and an earlier one in 2015 into a similar event, we found the trading conduct rules had significant shortcomings, leading to a project to review them being added to the work programme.

6.10 Authority staff are currently reviewing the FTR market, which is nearly completed and should be presented to the Authority Board early next year.

Spot market commentary

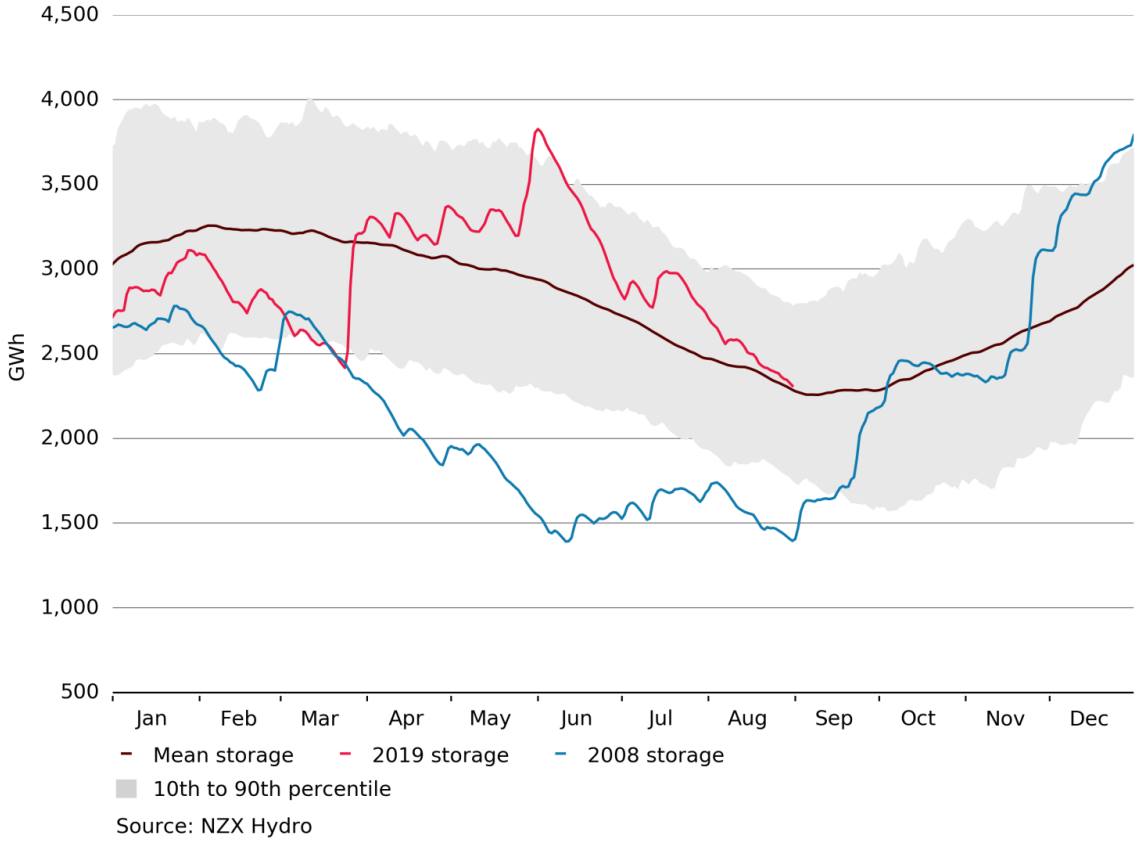
6.11 The spot market has been heavily influenced by hydro storage and thermal fuel supply. Prices were relatively high in February and March 2019. Once South Island storage began recovering from April 2019 the spot price decreased rapidly in response. However, prices did not fall to their usual level seen prior to the Pohokura outage in 2018.

Figure 5: Price and South Island storage



Sources: Electricity Authority and NZX Hydro

Figure 6: 2019 hydro storage compared with 2008 storage

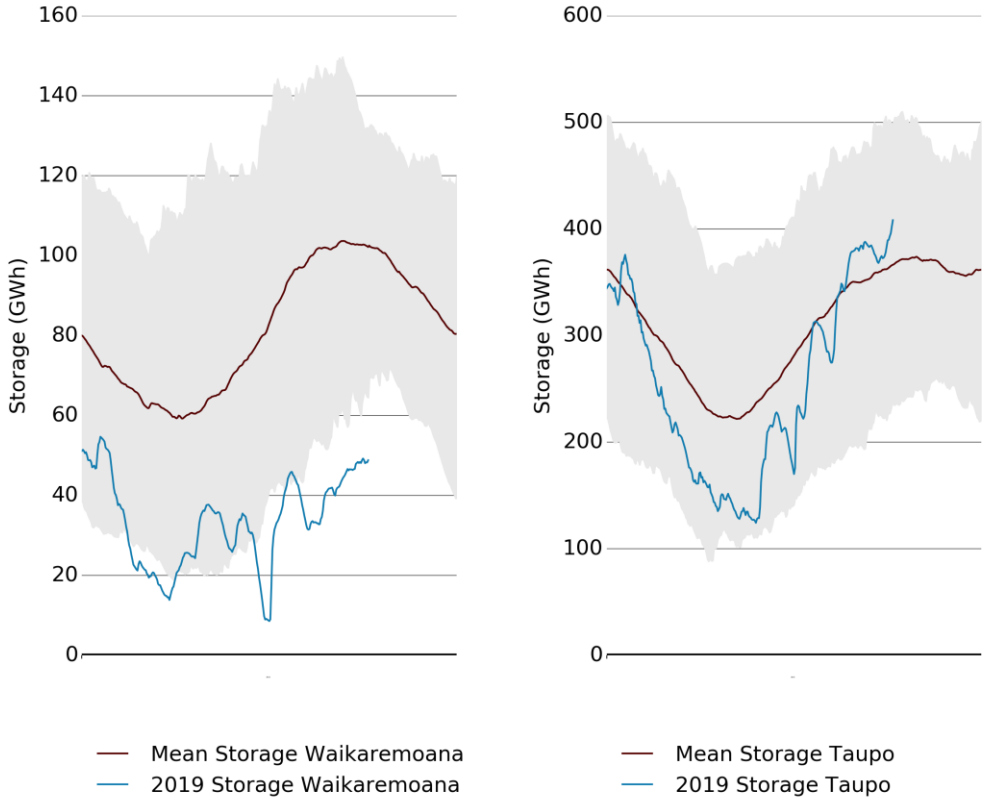


Source: NZX Hydro

6.12 Figure 6 shows New Zealand hydro storage in 2019 compared with 2008, mean storage, and the 10th and 90th percentiles. The chart shows that storage in March 2019 was slightly lower than the storage in March 2008. Storage then increased in late March and April to above mean storage until 31 August 2019.

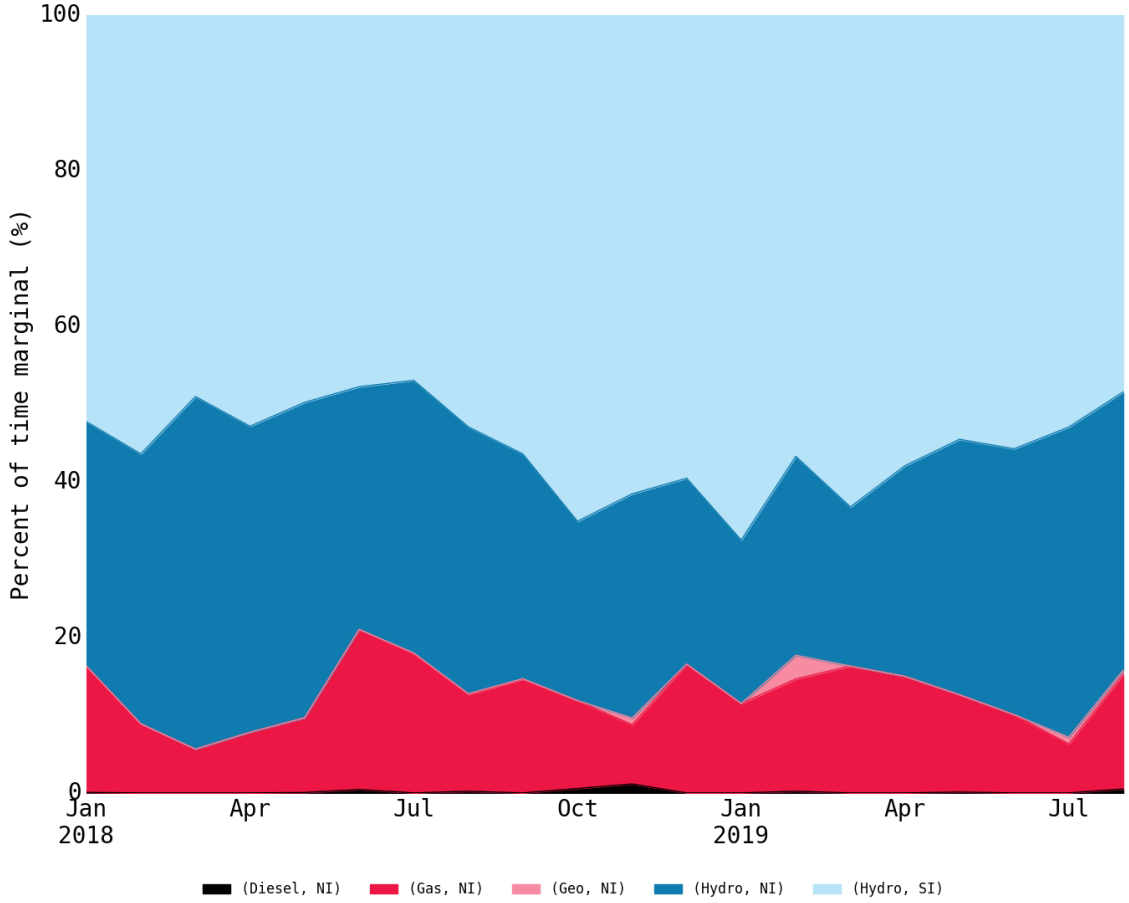
6.13 However, North Island storage has been low most of this year as a result of below average inflows. Figure 7 shows storage at Waikaremoana and Taupo respectively. Waikaremoana storage has been very low all year. Taupo storage has been below average for most of the year. This has led to prices increasingly being set by North Island hydro generators.

Figure 7: Storage at Waikaremoana and Taupo has been low all year



6.14 Figure 8 shows the marginal price setter by fuel type by island. It shows that from March North Island hydro has increasingly set the price. It also shows that since the end of June, North Island gas generation has started to set the price more.

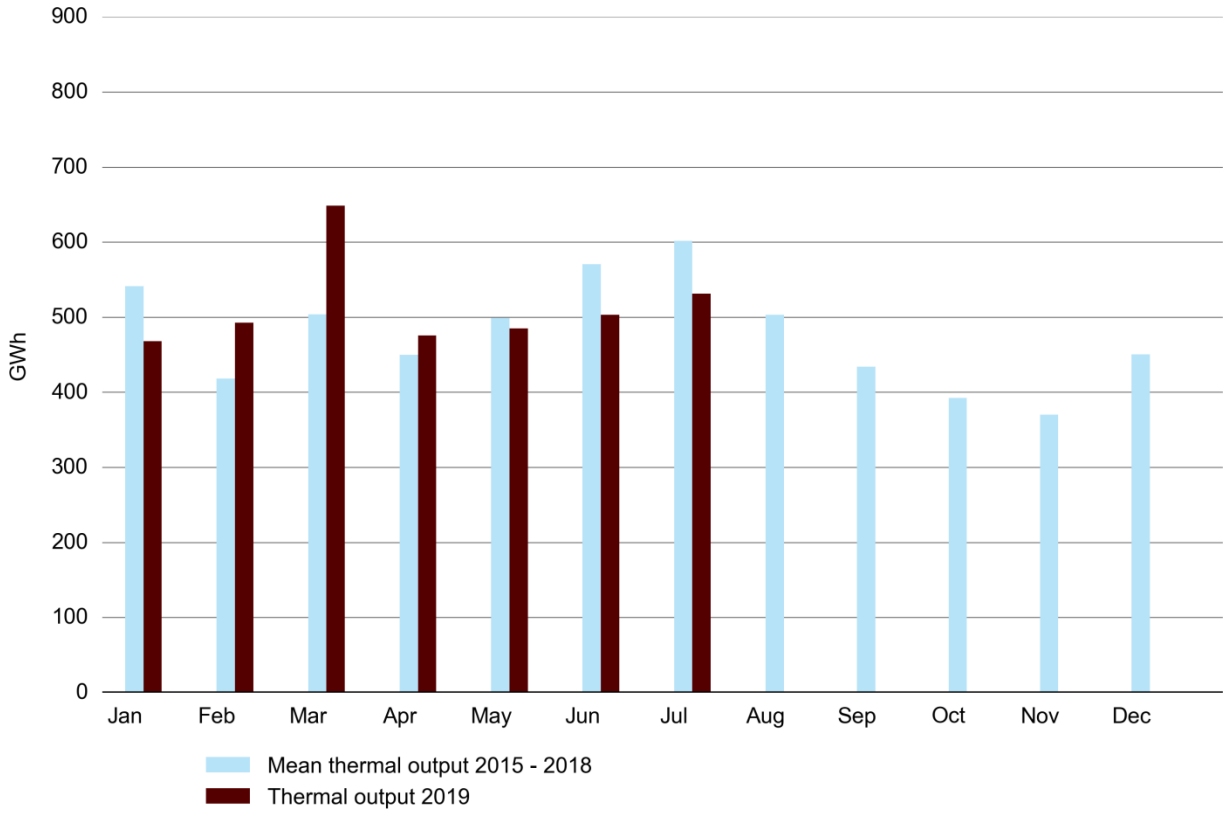
Figure 8: Spot price setting plant



6.15 Contact Energy's Stratford CCGT has been setting the price more often since June. Prior to that the North Island hydro generators on the Waikato River (Mercury) and those fed by Lake Waikaremoana (Genesis) have been setting the price.

6.16 Our gas industry analysis provider has stated that the gas market remains short of supply. Gas spot prices have been around $10/GJ and there were record volumes traded in July. $10/GJ is about double last year's price.

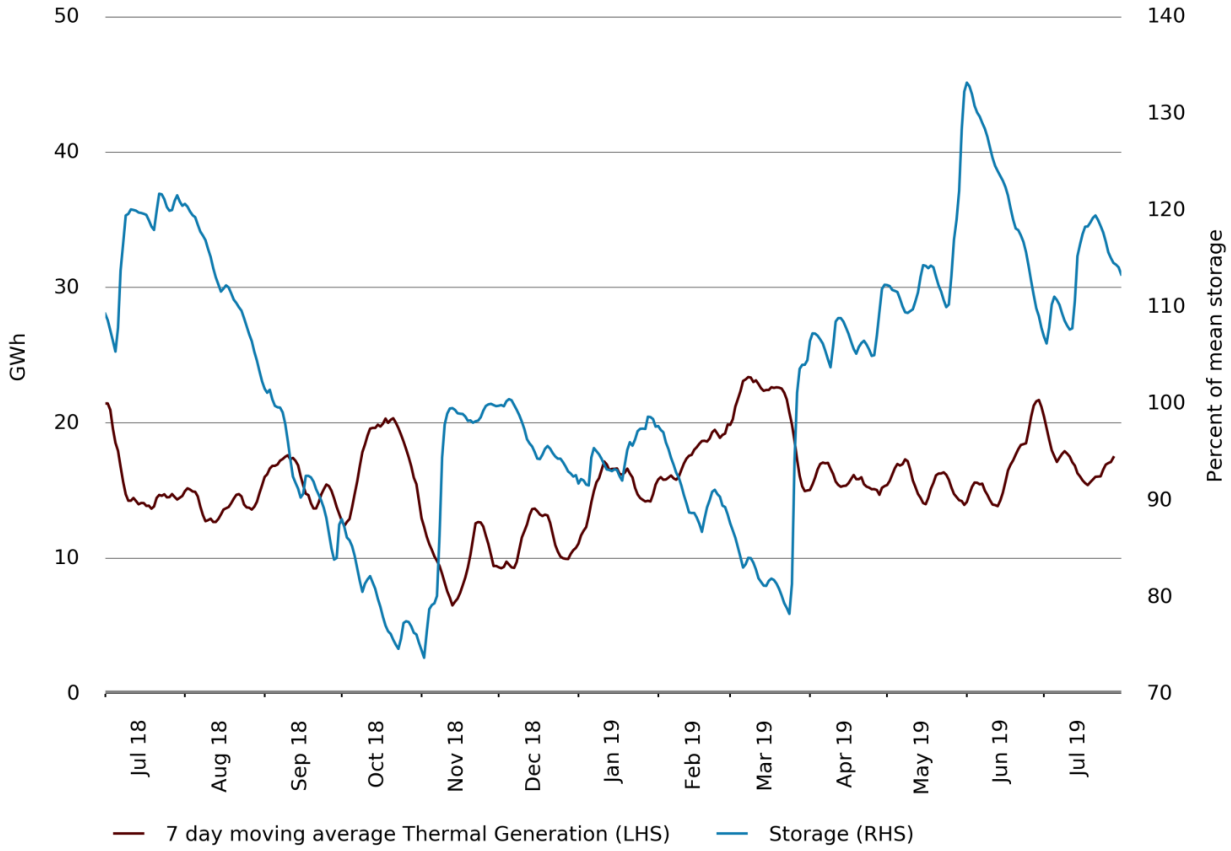
Figure 9: 2019 monthly thermal generation compared with average thermal generation



6.17 Figure 9 shows thermal generation in the first seven months of 2019 compared with average thermal generation over 2015 to 2018. It shows that, in 2019, thermal generation was higher from February to April, especially in March due to the low storage in the South Island hydro lakes and low wind generation. Thermal generation was lower over the winter months, when South Island hydro was above average.

6.18 In September 2018 Genesis began generating with a previously mothballed Rankine unit. We asked Genesis what was happening and were told that they were substituting one Rankine for another. At the end of the commissioning process, there will be two Rankine units available as has been the case for several years. In March 2019 Genesis began investigating whether three Rankine could be run simultaneously during winter 2019.

Figure 10: South Island storage and daily thermal generation

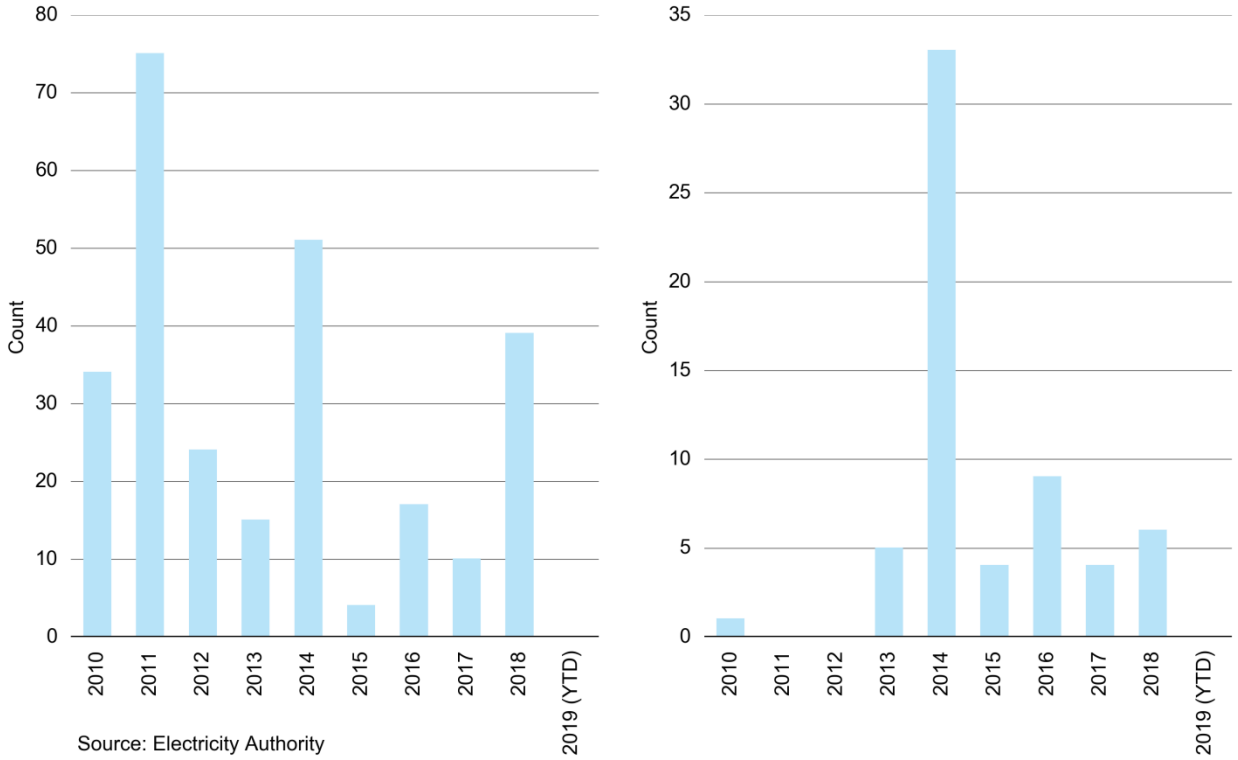


6.1 Figure 10 shows thermal generation and South Island storage from July 2018 to July 2019. The chart shows the role that thermal generation plays in firming hydro over seasonal timeframes. In October 2018 and March 2019, thermal generation increased as hydro storage decreased, consistent with Figure 9. However, due to the Pohokura outage, thermal generation was far lower than would normally be expected for the level of storage in October.

6.2 We used vSPD (vectorised scheduling pricing and dispatch) to perform the experiment of increasing demand by 2.5% and then measuring the price increase caused by that simulated demand increase. The experiment is aimed at revealing how much residual capacity there is in the market, or how steep the aggregate offer curve is beyond the point where generation was cleared. The larger the price increase, the steeper the aggregate offer curve. Figure 11 shows the count of trading periods where the spot price would have increased by more than $1,000 if there had been a 2.5% increase in demand in the North Island and in the South Island from 2010 to 31 July 2019.

6.3 The counts for 2019 until July 31 were zero in the North Island and the South Island. This suggests that there was spare capacity in the system.

Figure 11: North Island and South Island counts of trading periods where a price increase of greater than $1,000/MWh would have resulted from a 2.5% increase in demand



Derivative market commentary

6.4 Figure 12 shows trading volumes for ASX quarterly and monthly exchange traded forward contracts until 31 August 2019.[1] There were 16,816 GWh of contracts traded in the first eight months of 2019 compared with 15,438 GWh in 2018. Trading volumes in February 2019 were the highest recorded for the first eight months, with 2,707 GWh traded.

[1] Trading volumes are a measure of liquidity in the hedge market, and higher liquidity in turn should drive more competitive prices. A robust forward curve is important as the ASX price is the market's best guess of future spot prices and is therefore useful for investment decision making and shorter-term fuel decisions. We also understand that the over-the-counter market uses ASX prices as benchmarks, so the ASX price affects all aspects of the hedge market.

Figure 12: Monthly trading volumes for ASX baseload quarterly and monthly contracts

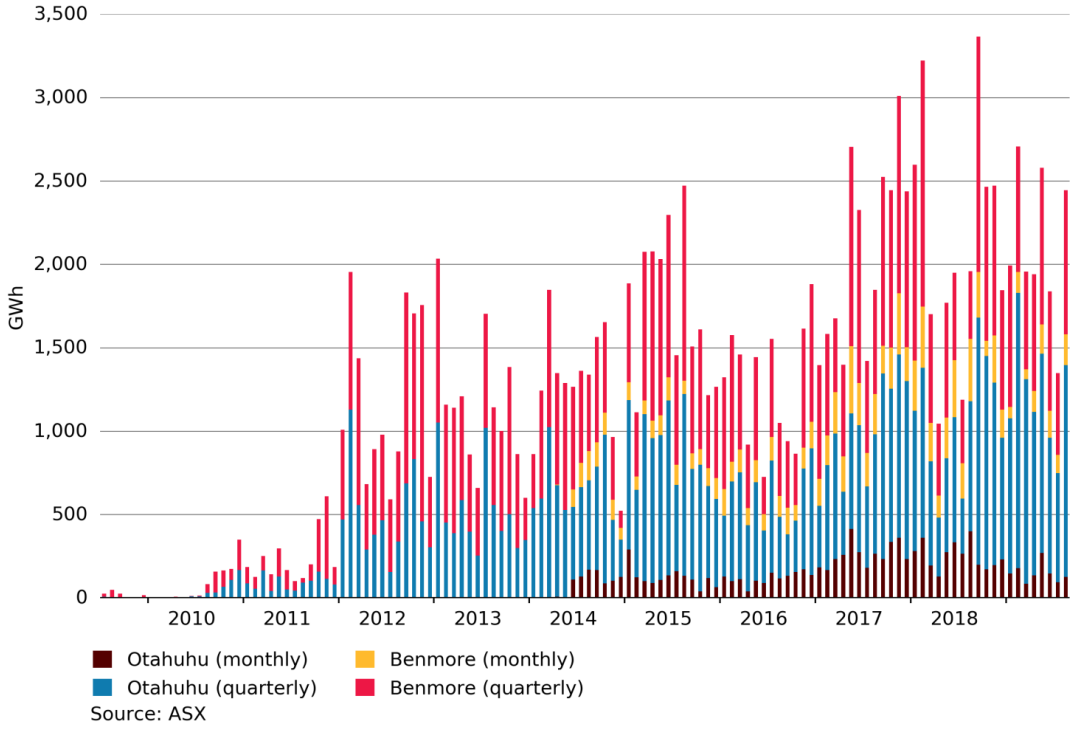
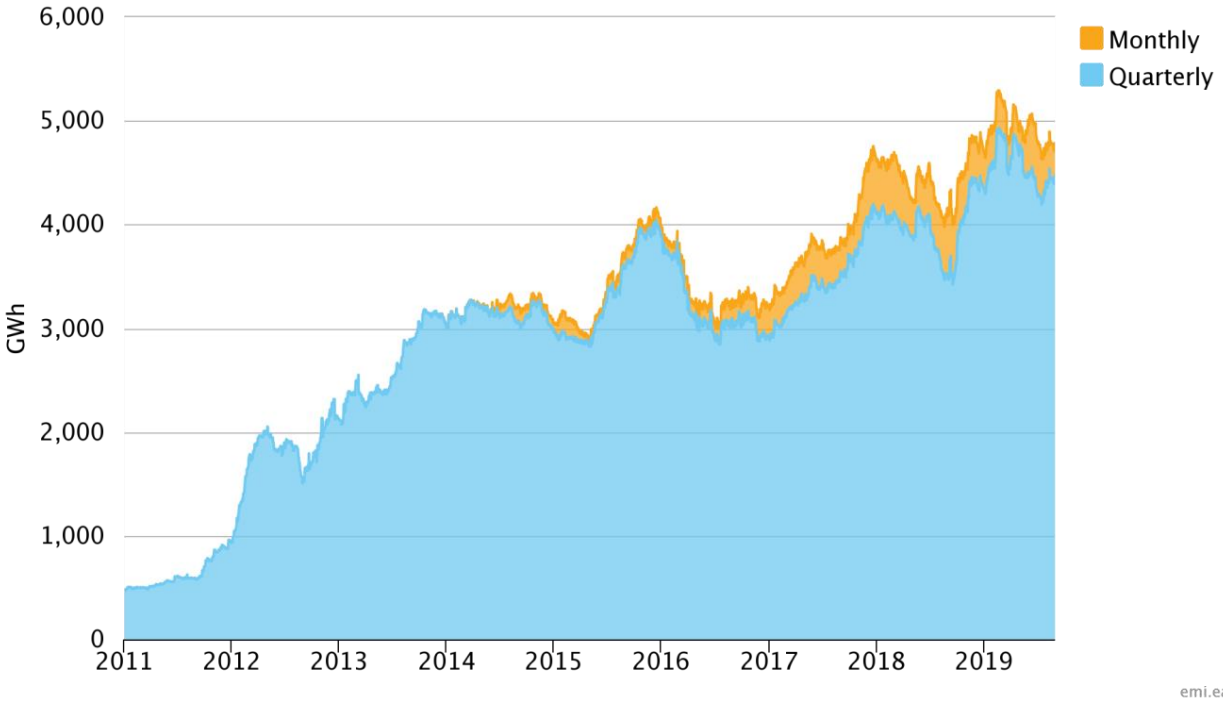


Figure 13: Unmatched open interest (UOI) of baseload exchange traded futures

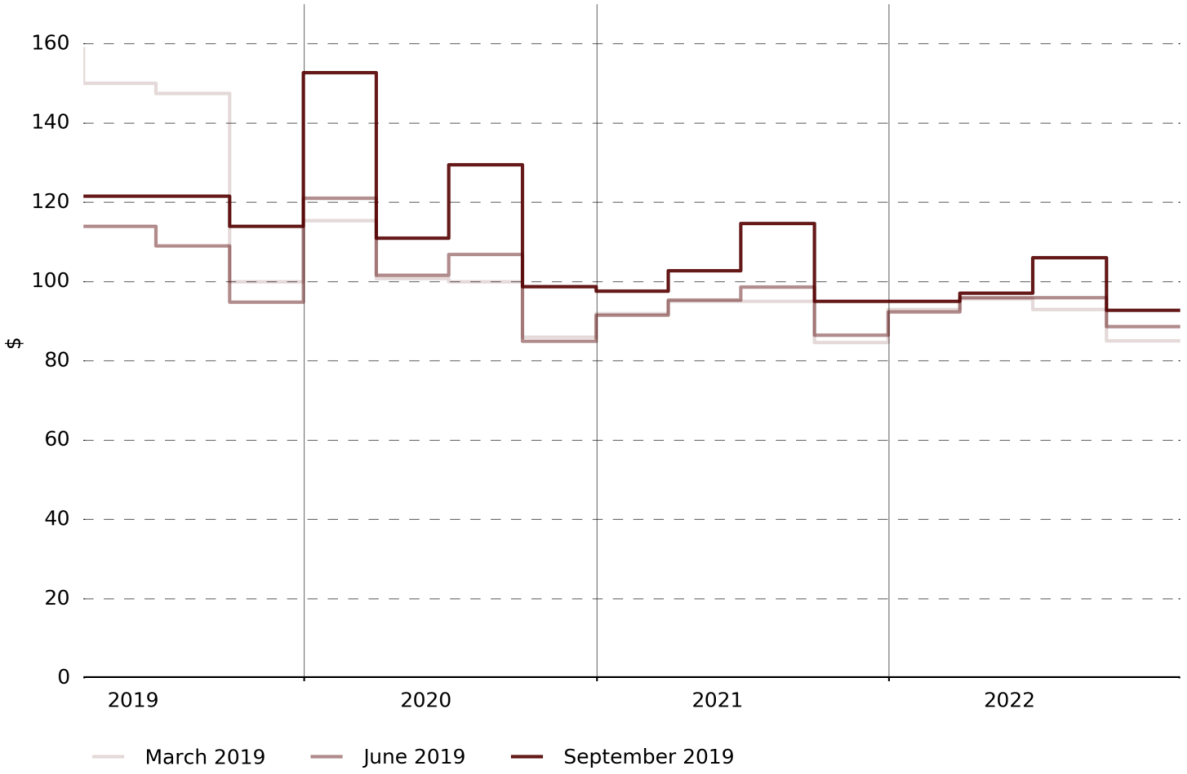


6.5 Figure 13 shows the level of UOI on exchange-traded instruments (electricity futures) traded on the ASX platform up until 31 August 2019.[2] The chart shows that quarterly UOI

[2] UOI is the total number of outstanding contracts that are held by traders at the end of each trading day. In other words, it represents the number of contracts that have not yet been exercised (in the case of options), offset (by holding a contract with a counterbalancing obligation), or expired. Open interest is an important indicator of liquidity.

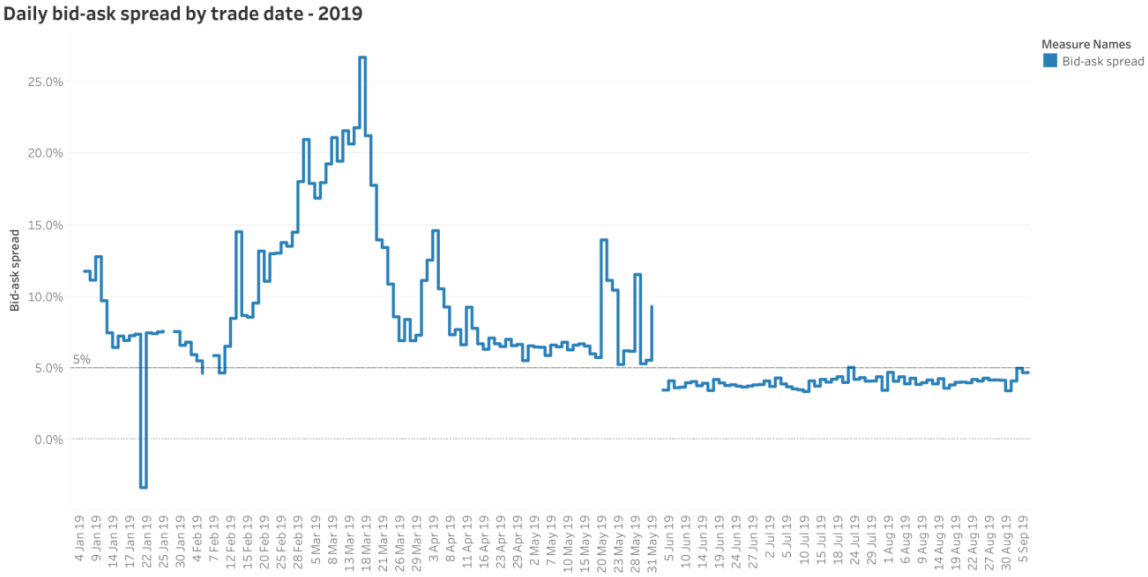
(light blue in Figure 13) peaked in February 2019 at 4,930 GWh, the highest since 2011. The first quarter of 2019's UOI is the highest quarter since 2011. Figure 13 also shows the increase in trade of monthly futures since their introduction in 2014.

Figure 14: ASX quarterly hedge contract forward curve for Otahuhu during 2019



6.6 Figure 14 shows two snapshots of the forward price curves for Otahuhu at March, June and September 2019. The chart shows that futures prices for Otahuhu ranged between $80/MWh and $160/MWh for various forward contracts, but that long dated future prices remained relatively stable. There are concurrent HVDC and Pohokura outages planned for the first quarter of 2020 which has driven up the price for the March 2020 ASX at Otahuhu.

Figure 15: ASX spreads



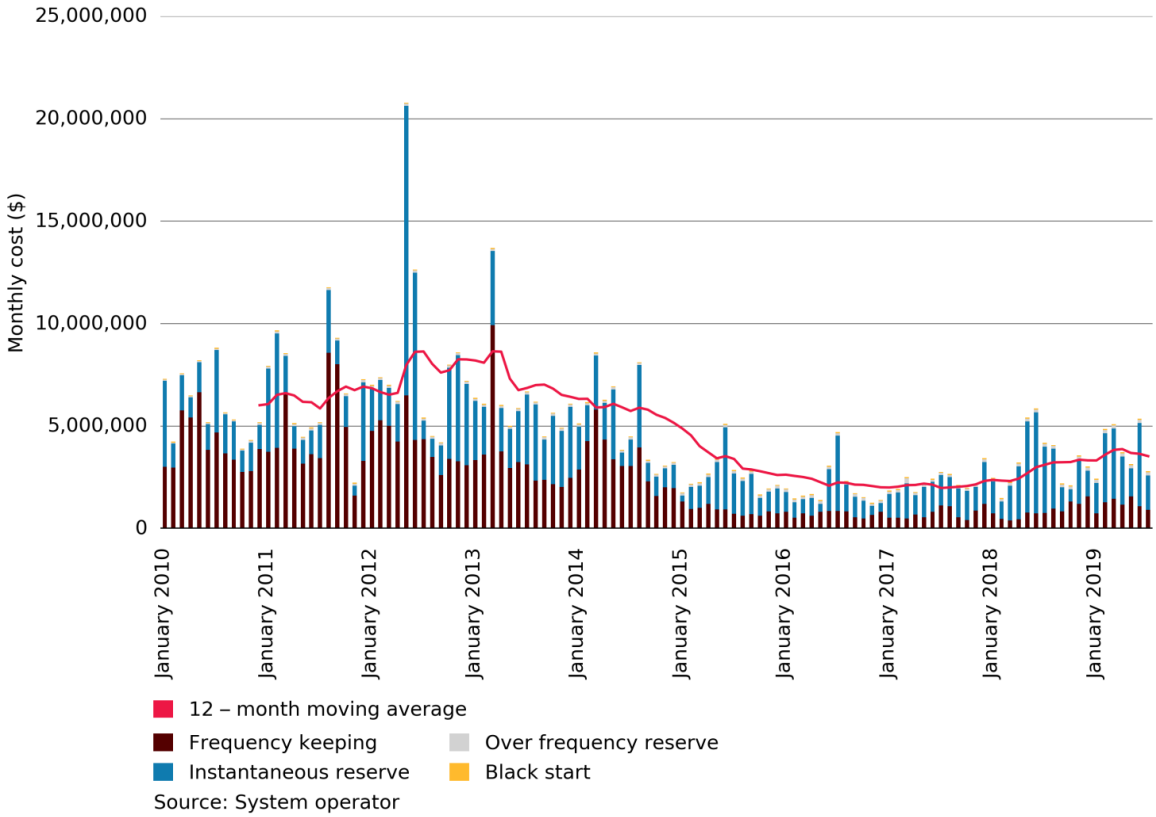
6.7 Figure 15 shows the average spreads and prices for ASX future contracts. It shows that the spreads were above 5% until June 2019 but since then the spreads have been below the five percent threshold.

Ancillary services commentary

6.8 Figure 16 shows ancillary services costs since the beginning of 2010. The moving average shows how costs have been falling since early 2013, mostly driven by decreases in frequency keeping costs.[3]

[3] Ancillary services costs have fallen since 2015 because of the system operator using Frequency Keeping Control (FKC) to support frequency keeping, which has in turn led to a reduction in the amount of frequency keeping services that are procured.

Figure 16: Monthly ancillary services costs



6.9 Reserve costs in February and March were high; when the market was constrained by low hydro storage, and in June. The higher cost of gas would increase the cost of reserves offered by gas peakers.

7 Reliability

Recent studies

7.1 We use “reliability” in this report to refer to the propensity of equipment or services to fail to function as intended. Reliability can be backwards looking in the sense that it uses data of failures that have occurred in the past. But it can also be forward looking in the sense that the past reliability performance can be an indication of future reliability performance.

7.2 Reliability metrics and trends are useful if they can be used to identify areas of interest to carry out more in-depth analysis to find root causes of issues; such as issues with risk management or maintenance practices. In this sense, the measures are more akin to a temperature gauge in a car—they indicate that there may be a problem without specifically identifying the problem.

7.3 We monitor a set of metrics: the number of excursion notices sent by the system operator; the number of under frequency events (UFEs); and forced outage data from Transpower.

7.4 Reliability is reviewed through event reviews. Three events have been investigated since 2013: automatic under-frequency load shedding (AUFLS) events in 2013 and 2017 (view

here and here), and the Penrose substation fire in 2014 (view here). These reviews have all highlighted issues with risk management in the industry. In the case of the 2017 AUFLS activation, risk mitigation measures were ineffective.

7.5 We also summarised a set of reviews done by the Australian regulators on some large security events, including the 2016 South Australian black out. This review concluded that:

(a) New Zealand's high inertial system will buffer the power system from the effects of low inertia renewable generation for some time.

(b) New Zealand's real time reserve dispatch adds resilience.

(c) Any changes to New Zealand's AUFLS system being considered as part of the extended reserves project need to be considered carefully to avoid the sort of pitfalls that the Australian events highlighted.

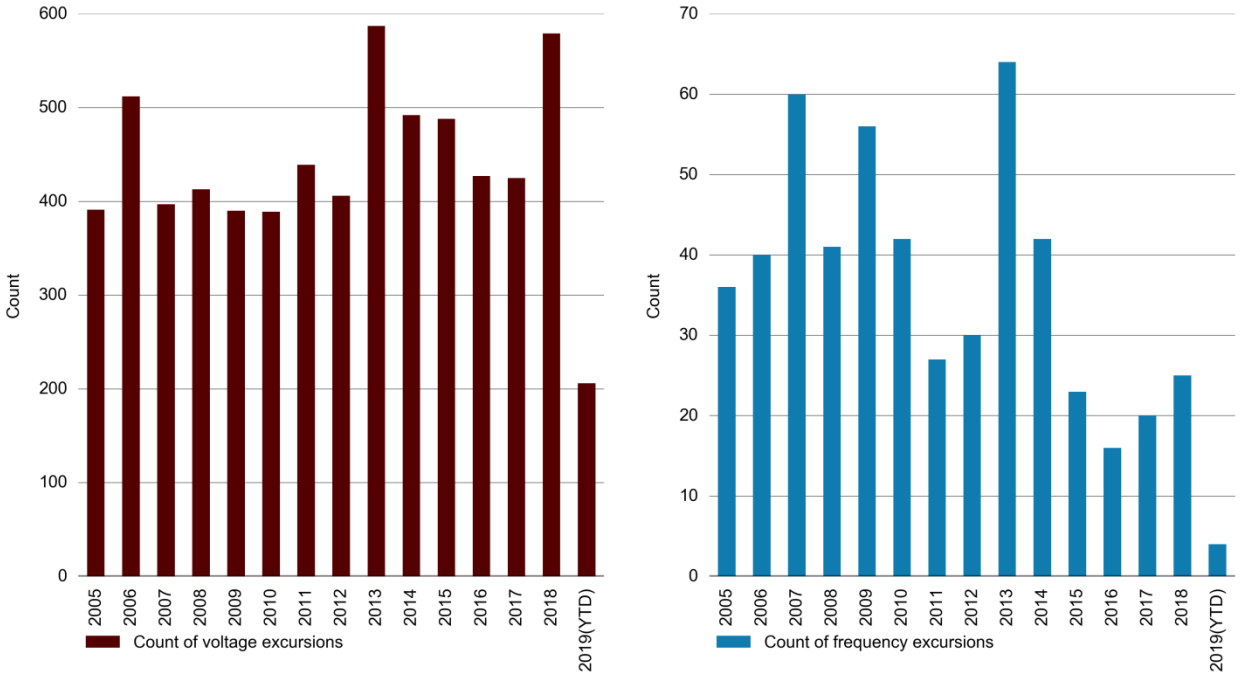
(d) The Australian incident reports are high quality compared with equivalent reports from Transpower.

Security commentary

7.6 Figure 17 shows the annual count of voltage and frequency notices respectively. Transpower sends excursion notices when voltage or frequency measures exceed stated limits. Tracking excursion notices is a source of data indicating the state of transmission and generation equipment that could raise questions and lead to more in-depth investigation.

7.7 The count of frequency excursions has been lower each year since 2015 than it was prior to 2014.

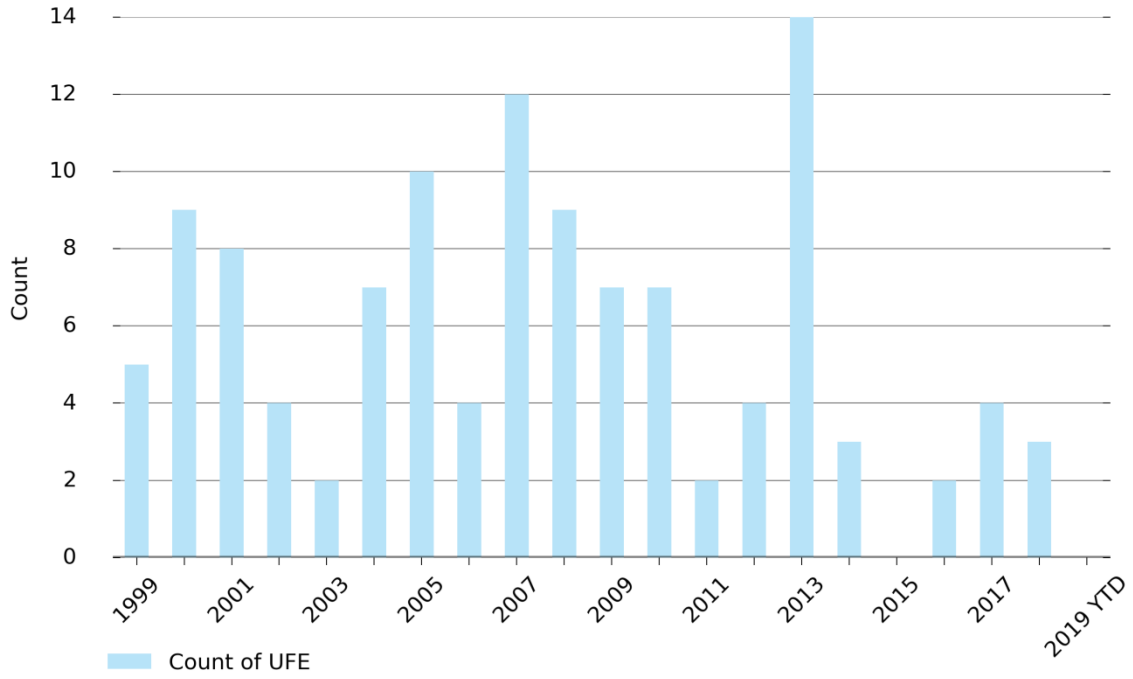
Figure 17: Voltage and frequency excursion notices from 2005 to July 2019



7.8 Figure 18 shows the number of UFEs that occurred for each year since 1999.[4] These numbers are driven, at least in part, by how much new plant is being commissioned—the spike in 2013 is most likely due to HVDC testing. Tracking the frequency of UFEs provides information on the direction of the number of incidents and enables further enquiries. No UFEs have occurred in 2019 as of 31st August 2019.

[4] A UFE occurs when the system frequency falls below 49.25 Hz. Such an event could be caused by transmission tripping and disconnecting a generator or by a fault in the generator itself.

Figure 18: Number of under frequency events (UFEs) from 1999 to July 2019



Security of supply commentary

HVDC outage and Pohokura outage

7.9 There is some concern from the sector about the planned concurrent HVDC and Pohokura outages after the HVDC outage went ahead in November 2018 during the Pohokura partial outage.

7.10 On the 22 November, the first day of the HVDC outage, demand over the peak periods was higher than expected and there was little wind generation. The information available[5] to the system operator indicated they might not be able to maintain N-1 security in all trading periods and so they requested that the grid owner bring the HVDC back into service during peak periods. The same thing happened on the 23rd of November. The outage was subsequently truncated and no work happened on the 26th or 27th of November as originally scheduled.

Hydro and snow storage is higher than average as at 31 August 2019

7.11 Currently hydro storage (Figure 6) is just above average for this time of year. Rainfall is expected to be near or above average throughout New Zealand during spring (NIWA Climate Outlook, 29 August).

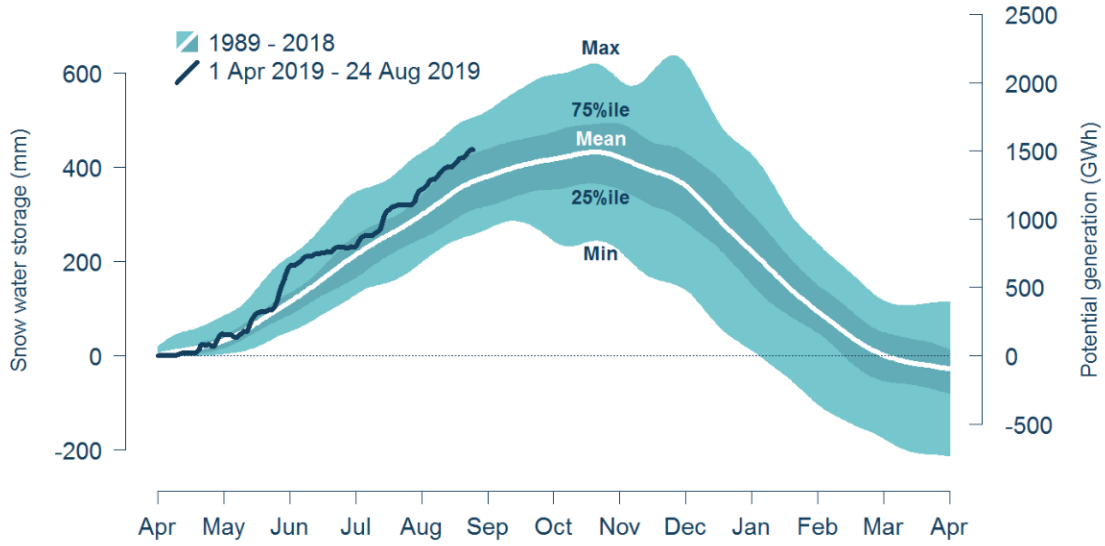
7.12 Waitaki catchment snow storage (Figure 19) has been high this year, and is already above the peak mean level around 1500GWh. For this time of year it is in the top 25% of snow storage levels seen in the past.

[5] The Whirinaki RMT error caused the FIR reserve to be over-procured when Whirinaki was running, which contributed to the decisions made during the HVDC outage in November 2018.

7.13 While seasonal snowfall and inflows from snowmelt are not directly related, this does indicate potential for high inflows from snowmelt.

7.14 At a national level there is unlikely to be any security of supply risks due to low lake levels for the rest of the year,

Figure 19: Seasonal snow storage in Waitaki catchment as at 24 August 2019



Source: Meridian Energy