emhTrade

The Electricity Authority
Via Email

04 July 2022

Financial Transmission Rights market observations - Issues paper

Summary

Thank you for the opportunity to make a submission on your Financial Transmission Rights (FTR) market observations issue paper. Rather than respond to the Authority's questions directly, we have provided analysis of FTR market's complex interactions with the spot and ASX Futures markets, and made a few of our own observations.

Currently the Authority's observations under-emphasise the fundamental relationship between FTR payouts and spot prices. Due to this relationship and based on our initial analysis of the FTR, spot, and futures markets, it appears to us that FTRs do not consistently trade below fair value, but rather, spot prices have consistently increased beyond the expectation of participants in NZ electricity risk management markets. The Authority's observation that "FTRs tend to trade somewhat below 'fair value'" was one of the key drivers behind this paper, so we hope our work will prompt more analysis and discussion between stakeholders.

The reason there is a fundamental relationship between the FTR payouts and spot prices is because losses are included in payouts. This design has clear benefits such as energy hedging, dynamic efficiency and revenue adequacy. An obvious downside is wealth transfers from transmission customers to FTR buyers (and vice versa). Based on our current view that wealth transfers are likely to be mostly internal to the market and relatively efficient, we believe the benefits outweigh the wealth transfer downsides.

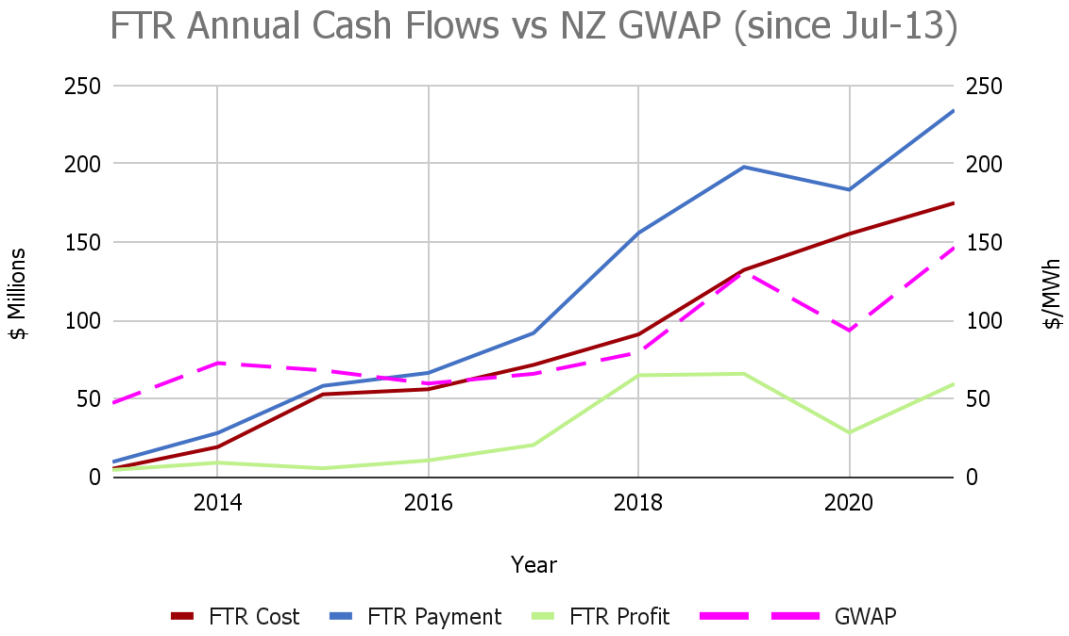
FTR wealth transfers have increased from $11m in 2014 to $68m in 2021, and we agree that any large external and/or inefficient transfers should be investigated. However, these transfers must be kept in perspective with transfers occurring from consumers to generators. From 2013 to 2017, the cost of generation averaged $2.7b per year. In 2021, this increased to $7.3b, a 170% increase. Issues with competition in the generation market are a much greater threat to NZ's electricity market and economy.

The Authority notes that "retail competition has increased over time, however it is difficult to determine the influence that FTRs have on retail competition". We expect retailers to comment on the availability and benefits of FTRs, but we would like to note there is clear evidence of significant new entrants and competition since FTRs emerged in 2013, as shown by the growth of 6 independent retailers.

There has only been one review of the FTR market since it started in 2013. In addressing these potential issues raised by generator-retailers, we would like the Authority to consider introducing regular, structured reviews to address all aspects of the market's design, encouraging input from all stakeholders.

FTRs appear to be trading at fair prices based on outcomes in the futures and spot markets

The Authority's analysis and observations miss, or at least under-emphasise, the fundamental relationship and high correlation between FTR payouts and spot prices, created because FTRs payout on the total price difference between nodes, which includes the losses between those nodes. Given that losses are modelled in SPD as a piecewise-linear cost function they behave (in aggregate) as a multiplier on spot price. We highlight this by adding GWAP (a proxy for spot prices) to the chart below which was presented in the consultation paper[1].



The Authority suggests that FTR prices in any given auction ought to reflect market expectation of FTR payouts at the time of that auction. We agree, subject to the caveat that equilibrium will be found at a level that reflects *risk adjusted* payout expectations *after expected scaling*. Given that, and the link between FTR payouts and spot prices, it follows that FTR prices ought to contain significant information about the market expectation of spot prices.

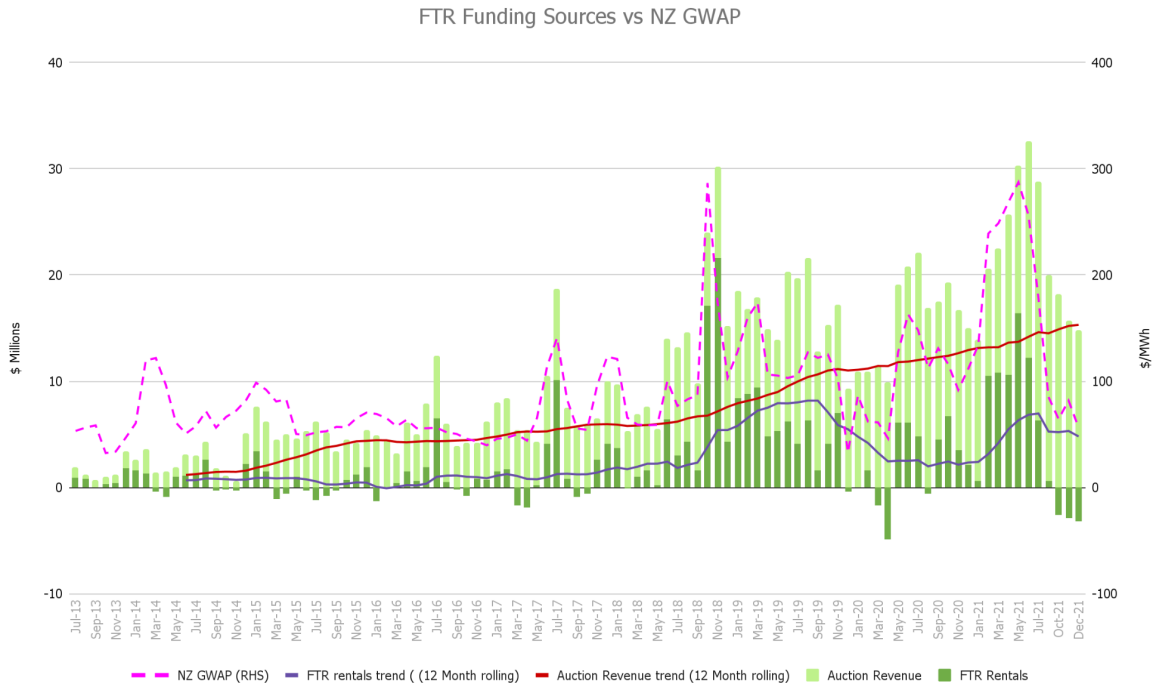
In addition, the loss component of LCE supports FTR payments when FTR auction revenues are lower than the FTR settlement amount, or auction revenues are transferred to LCE when revenues are higher than FTR settlement

As we know, LCE supports FTR payouts in months where auction revenue is lower than the expected amount. In months where the auction revenue exceeds the FTR payout, the excess revenue is added to the LCE pool. Due to the fact that the future is uncertain and that there is a tight link between FTR payouts and spot prices, we will see the following outcomes:

When spot prices are higher than expected	**When spot prices are lower than expected**
• The FTR payout will be higher than	• The FTR payout will be lower than

[1] Figure 76

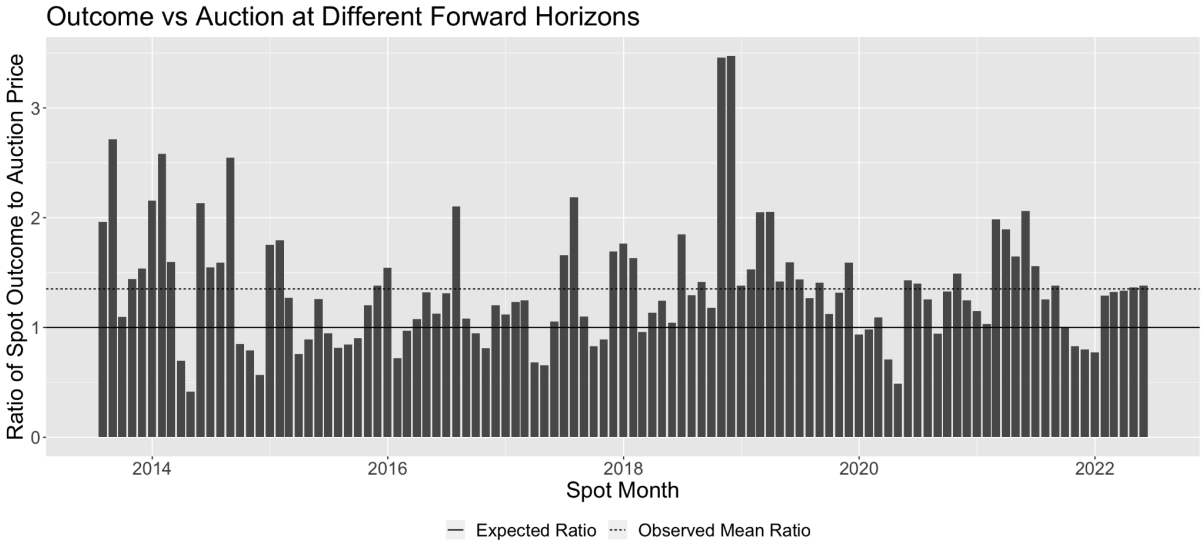
expected. • Auction Revenue will be less than the FTR payout • LCE will flow to the FTR pool	expected. • Auction Revenue will be more than the FTR payout • Auction revenue will flow to LCE recipients



This effect can be seen in the chart above (again an augmentation of a chart presented by the Authority[2]). We've added a NZ GWAP series, and more clearly show the periods in which auction revenue flows to LCE recipients.

Of course, it is reasonable to assume that there ought to be overs and unders, and that on average, in the long-run, these effects should be offset. However, The Authority has observed that FTR payouts have been consistently above the average auction price:

[2] Figure 43



A ratio of 1 would mean that auction prices reflected the spot price outcome. The Authority implies that this ratio should be 1 in the long-run. Subject to the caveat that an efficient forward market will find equilibrium at a *risk adjusted* expectation of future payouts (after scaling) we'd agree that this should happen in the long-run.

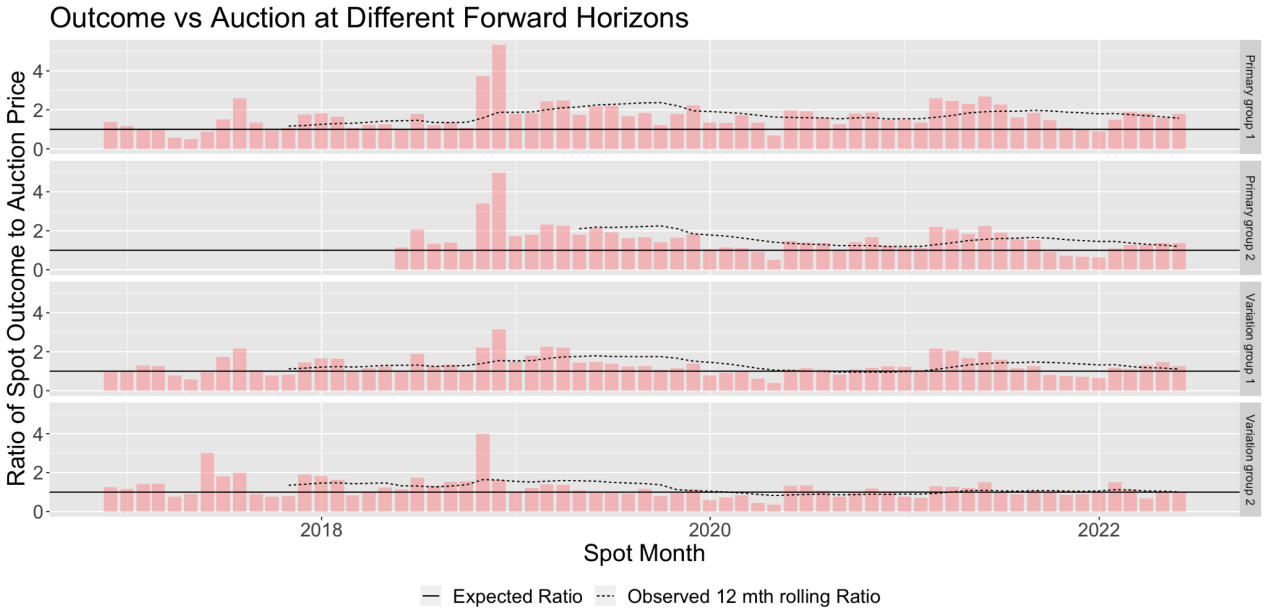
However the Authority then draws the conclusion that because the observed ratio is higher (i.e. spot market outcomes have been higher than auction prices), auction prices have been below expected prices or 'fair value'. Whilst this is a reasonable hypothesis, the Authority has not even attempted to test its validity, nor has it posited the equally reasonable hypothesis that *the market expectation is being efficiently represented in auction prices, but spot prices have consistently exceeded that expected future value*.

We expect many submitters to this consultation will make the point that 'prices have gone up, so LCE has been used', however we provide evidence below that auction prices have been a fair representation of expected prices at the time of the auction and that, in fact, spot prices have consistently exceeded expectations at the time of FTR payouts.

We can glean more insight regarding the Authority's observation if we dig a bit deeper into the data and consider *when* the auction revenue occurred. Noting that for each calendar month of spot exposure, FTRs are auctioned on 12 distinct occasions (in two 'sets' of three Primary and Variation auctions) in accordance with the FTR Calendar Policy.

The chart below shows how the spot outcome vs auction price ratio differs for each set of auctions, and how it has changed through time[3].

[3] Note that the calendar has changed through time as well. The second group of Primary auctions has only been available since 2018, and there was a transition period from Dec-17 to Mar-18 where the spot months had more than 6 Variation auctions.



It is clear that in the prompt auctions, at least since 2020, the market appears to be achieving the Authority's expectation that prices equal spot market outcomes on average and has been doing so for some time. It's relatively trivial to test whether the residual deviation is statistically significant and we can safely rule out any fundamental issue with pricing in the prompt auctions (approximately 25% of the total market).

The first variation auction prices are fairly close to spot on average, with a few periods where spot has persistently been higher (and very few where it has been lower), but overall it still appears that for longer dated auctions, there is a persistent difference between auction prices and spot outcomes. It is clear that the gap is bigger for longer maturities (where auctions were further in the past), and it is these maturities that are behind the Authority's observations.

Again, it does not necessarily follow that these auction prices have been below 'fair value'. Whilst, from the observation, that *could* be the case, so could the alternative that spot prices have been persistently above future expectations. All of the subsequent issues about whether the observed wealth transfers are efficient seems to depend on which of these is true, but the consultation paper makes no attempt to even ask the question, let alone answer it.

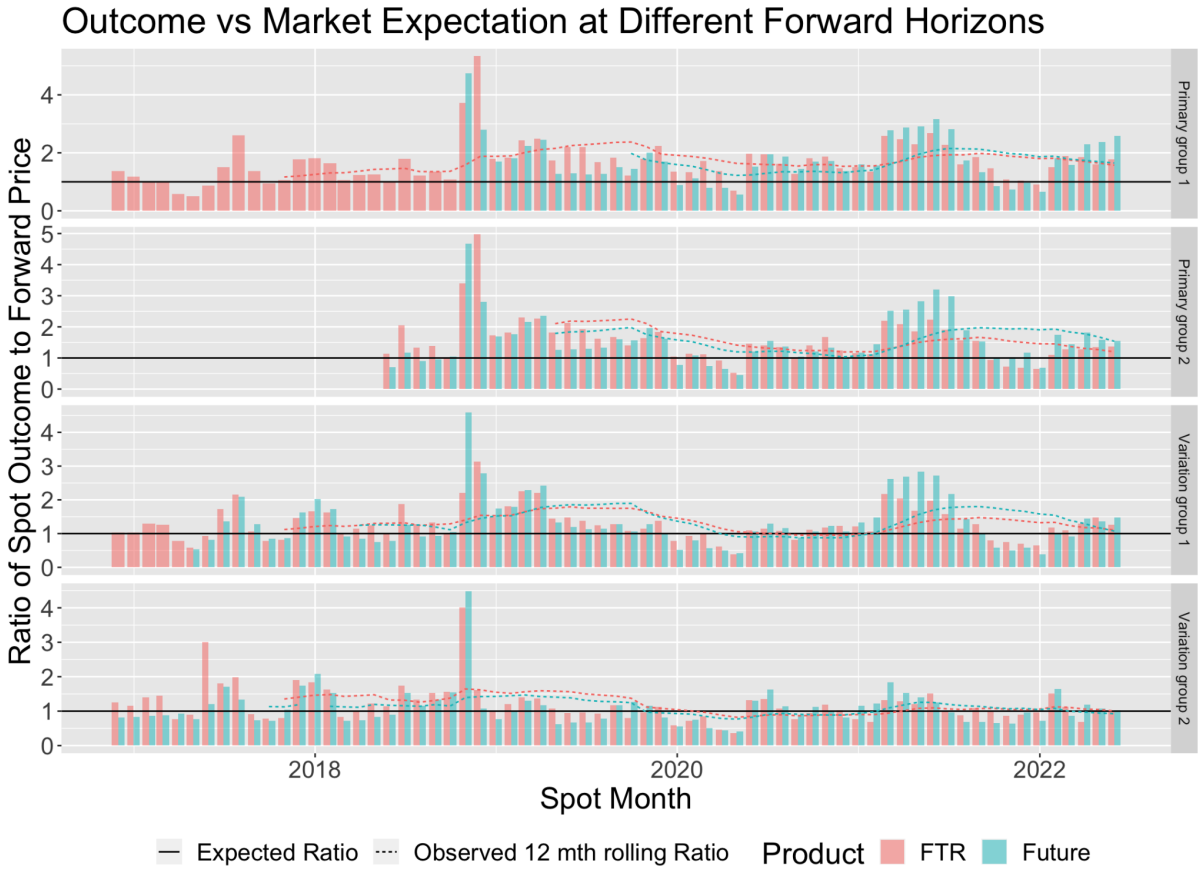
On the surface, the question of whether prices were 'fair' is completely subjective. However because FTR payouts (in aggregate) are highly correlated with spot prices, we can ask the opposite question: 'Have spot prices persistently exceeded future expectations?' and attempt to test that. Again this seems to have a subjective component, but we can measure expectation empirically by looking at the ASX Futures market. Of course, we are assuming here that the ASX market is at least *workably competitive* and can be relied upon to not be consistently trading below market expectations.[4]

To test, we imagine a risk management market participant. If this participant were to purchase one dollar's worth of FTRs[5] in each auction for a future each spot month, and on the same day of each

[4] There are of course many participants that argue that futures prices trade above fair value, but given that the Authority has not raised concerns that the futures market, with a value many multiples that of the FTR market, is trading *below* fair value, we'll take it as a safe assumption. We also note that the futures market has prices made each day by market makers.

[5] Value weighted across the FTRs sold in that auction for that spot month.

auction, purchase one dollar's worth of futures[6] for the same spot month, if FTRs are consistently trading below fair value, then we would expect to consistently see the dollar of FTRs be worth more than the dollar of Futures if held to spot settlement. The chart below clearly shows that this isn't the case[7].



The data show that at longer maturity horizons, spot price outcomes have also been consistently higher than the market expectation of ASX market participants. This strongly suggests that the issue is not that FTRs have been consistently trading below fair value, but rather that spot outcomes have consistently exceeded market expectations. In fact, the data actually shows that FTRs have traded closer to actual spot outcomes than futures have.

Again, assuming the ASX Futures market is competitive and not trading below fair value, the evidence shows that FTRs trade at 'fair value' and that spot market outcomes have consistently, for at least the last three years, exceeded the expectations of market participants.

Another empirical test that we can apply is to the predictive value of the prices observed. Essentially, is there bias in the error between auction prices and spot outcomes? The answer is, of course, yes, but if the extent of this bias is less than or equal to that of a known 'fair price', then the issue is not with the auction prices, but rather with the spot market outcomes. We observe that the forecasting error associated with FTRs is the same or less than that of Futures prices. Thus it can't be that they are trading below 'fair value'.

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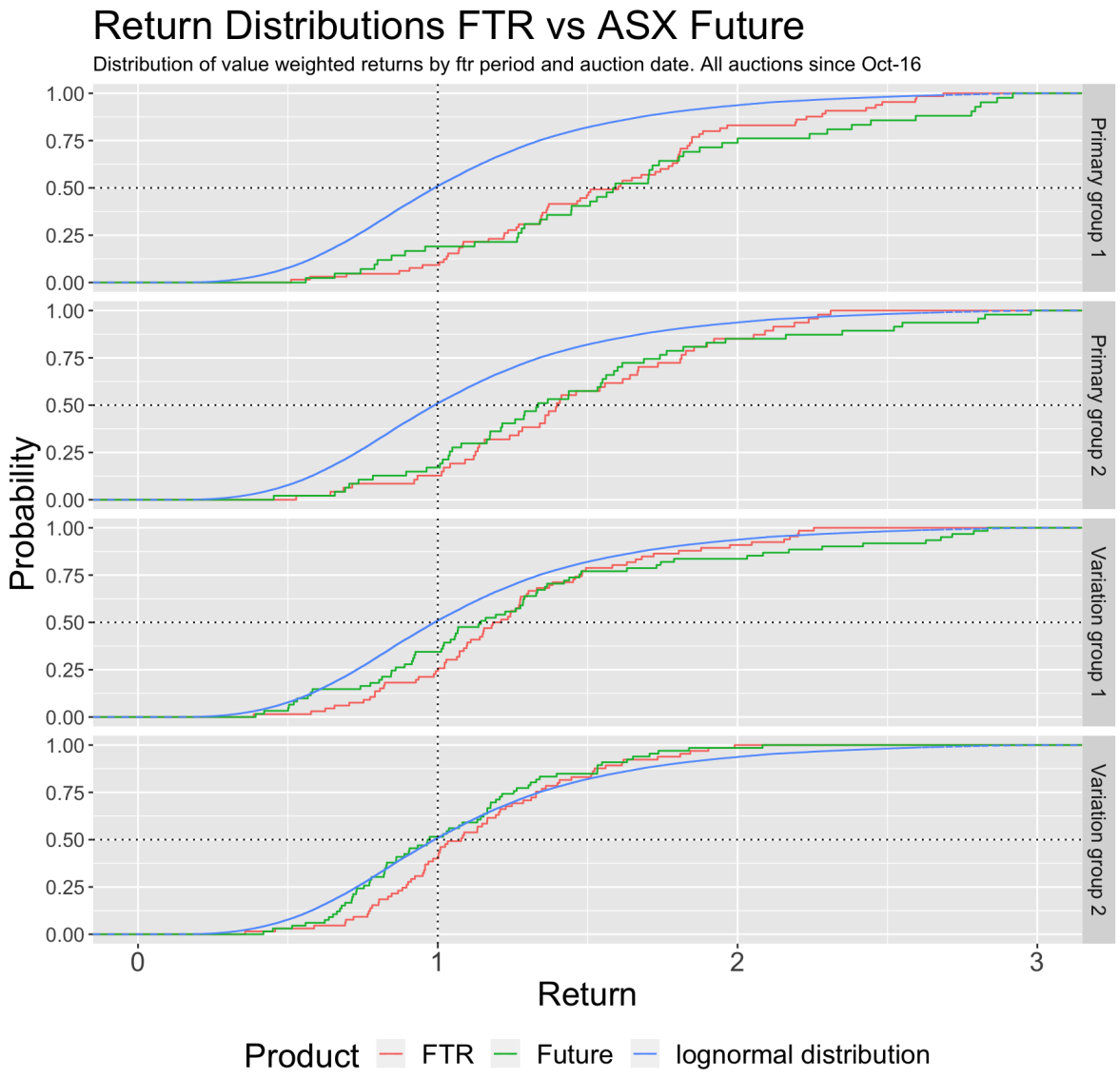
[6] Weighted by price across the closing price of BEN and OTA futures for that spot month. We use monthly contracts if available, quarters if not. There is a negligible shape impact for quarters, which we ignore.

[7] Unfortunately, we were only able to access ASX data going back to Oct-16 for this analysis

Uncertainty in future values of assets is frequently modelled using a lognormal return distribution to represent the value of an asset relative to the value today. The charts below show the cumulative density function of an example return distribution[8]. The slope of this function is representative of the uncertainty of future values. In an efficient market (ignoring risk premia), we would expect the mean of this distribution to be 1[9] and for it to become wider for longer maturities.



Again, we see significant deviation from what we would intuitively expect, returns to be centred around 1. This shows that, for longer dated maturities FTR prices have consistently under-predicted FTR payouts. The glaringly obvious gap is presumably why the Authority is undertaking the review. However, if we compare the distributions to those observed in the Futures market, we can quite

[8] We used a volatility parameter of 33% for Variation 1, 45% for Variation 2 and 60% for each of the Primary groups. These values were based on our experience with spot market and futures volatility. Expected volatility is as debatable as expected price, but will only change the shape of the distribution, not the mean or skew, so the exact choice is immaterial for the purpose of this discussion.

[9] Multiplied by the expected scaling factor, in the case of FTRs, and after accounting for any cost-of-carry such as margin requirements.

clearly see the same bias. In fact, the return distributions look almost identical. If Futures prices represent the market expectation of spot prices, we can be comfortable that FTR prices do as well.

Our strong view, based on this evidence, is that FTRs do not consistently trade below fair value but rather, spot prices have consistently increased beyond the expectation of participants in NZ electricity risk management markets.

Applying losses to FTR payouts has pros and cons

As discussed above, the FTR market is currently designed to include losses in the calculation of FTR payouts, and LCE is used to support payouts. There are some major pros and cons to applying losses to FTR payouts:

Pros	Cons
• **Energy hedging**: FTRs can provide a hedge for the spot market, leading to greater liquidity and dynamic efficiency benefits • **Revenue adequacy**: FTRs payouts are more certain	• **Wealth transfers**: Large transfers can occur between transmission customers and FTR buyers in both directions

Energy hedging

The FTR market was primarily designed to provide a hedge for transmission constraints, encouraging wholesale competition in regions that have LPR. FTRs payouts are calculated from the difference between spot prices at two FTR nodes. A higher spot price means a higher loss excess, a higher price difference, and ultimately a higher FTR payout. So, if spot prices rise, FTR buyers receive a higher payout (and vice versa). FTRs can therefore provide a hedge for the spot market, especially when purchased in high volumes; for example, approximately 12MW of BEN_ISL FTRs will provide a very good hedge for 1MW of energy at BEN[10]. Arguably FTRs provide better hedges than futures because they have exposure to shape and, because the clearing is integrated to the spot market, they may have more favourable cash flow implications for spot purchasers[11].

Either certain generator-retailers do not understand that large FTRs purchases can provide an energy hedge for independent retailers, or they do understand but are unsure how to respond to these new entrants who are using the FTR market in a sophisticated manner, assisting retail competition. At this point we'd like to note an important discrepancy in the argument of Meridian and Genesis against financial participants like Haast and emhTrade.

These generator-retailers have raised concerns about the availability of FTRs due the activity of 'speculators', with Genesis suggesting "cornering of the FTR market". Such "cornering" would indicate the price of FTRs are unfairly high, preventing their purchase. However, these parties also claim that 'speculators' are making unreasonable profits, indicating FTR prices are too low[12]. The

[10] See Appendix for more detail on the usefulness of FTRs as energy hedges.

[11] The lack of margin offsetting between ASX Futures and spot purchases has been a long standing issue that has proved very challenging to resolve.

[12] In a letter to the Authority dated 4 September 2020, Genesis state that "Although FTRs are a useful risk management tool in theory, in our experience they have been unavailable at terms that make them an effective or cost efficient option." suggesting they are unavailable at fair prices (or that they are unwilling to pay fair prices), and also state that "FTRs are partially funded by all retailers and generators through the loss and constraint excess reserves. The FTR market was not intended to

only reasonable, logical position is that neither Genesis or Meridian expect to or are prepared to pay fair prices. Presumably this is because they can no longer take the much cheaper (and less efficient) option of using generation offers to manage location risk. A point that is laboured in both of their referenced letters to the Authority.

We believe the FTR market's energy hedging feature is highly valuable because it helps to increase liquidity in the wholesale market, an ongoing issue and one the EA is currently addressing via the commercial market making scheme. The reason we believe FTRs assist liquidity is that it allows traders to arbitrage the FTR and futures markets. For example, a trader can buy a BEN_ISL FTR and sell a BEN future if they have a view that the implied energy prices differ across markets.

FTR trading, leading to cross market liquidity between FTRs and futures, provides wider dynamic efficiency benefits. This includes improving discovery of fair prices, lowering the cost of market making (there is intrinsic market making, reducing the need for market marking schemes) and, in our view, assisting retail competition. We will contact the EA to explain these liquidity and dynamic efficiency benefits in more detail.

Revenue adequacy

A key reason LCE was included in the original FTR market design was to ensure adequate funding to cover (most) FTR payouts[13], therefore giving FTR buyers confidence in the market. There were concerns revenue adequacy would be an issue due to NZ's high price volatility. Price volatility continues to be an issue today, and will become a greater issue as NZ's proportion of renewable generation increases.

We believe this 'revenue adequacy' feature is an important one, however the way revenue (in)adequacy levels are managed by the FTR market should be revisited as part of a structured market review.

Wealth transfers

When the FTR market was first established, it was acknowledged by the EA and wider industry there would be wealth transfers from FTR buyers to transmission customers (and vice versa), however this was deemed worthwhile due to other benefits including LPR management, energy hedging and 'revenue adequacy'. In effect, there are two potential wealth transfer issues the EA's paper has raised:

- **External wealth transfers**: transfers from customers to financial participants that aren't retained within the wholesale market (based on the EA's obvious concern that some parties are "consistently profiting from FTRs")
- **Inefficient wealth transfers**: transfers from customers to FTR buyers are excessive (based on the EA's observation that "FTRs tend to trade somewhat below 'fair value'")

On external wealth transfers, it is our view that a significant portion of transfers to financial participants ('speculators') are likely to be retained in the wholesale market due to their energy hedging activities. Financial participants like emhTrade trade actively arbitrage across multiple markets. Gains in one market are often offset by losses in another. We acknowledge that large

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allow this capital to be syphoned off by speculators.". In a similar letter, dated 8 October 2020, Meridian state that "...speculation in a finite number of FTR instruments and drives up the cost of FTR instruments" and that "Speculation also directly extracts capital from the LCE pool..".

[13] Paragraph 3.19, page 8, "Financial Transmission Rights market observations" paper, Electricity Authority, 24 May 2022

external transfers would be a poor outcome and erode confidence in the market so we support changes to further improve the market's transparency as part of a structured review.

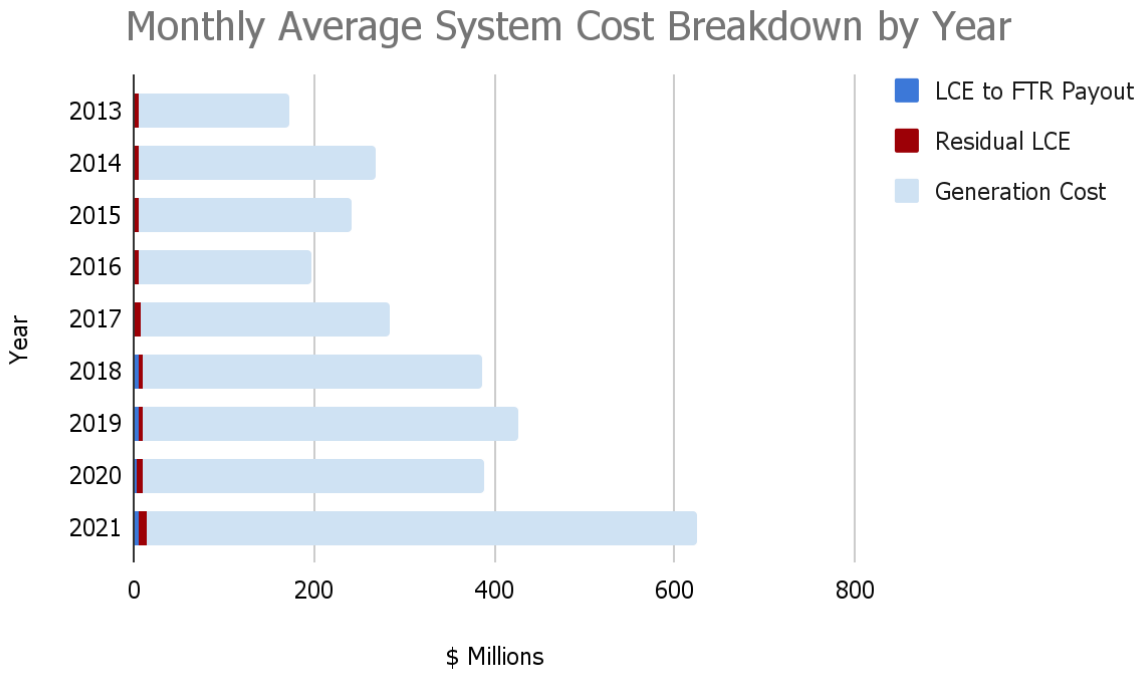
On inefficient transfers, we have shown strong evidence that FTR's are trading at fair prices, therefore transfers from customers to buyers are efficient (albeit large). Again, the reason these transfers have typically occurred in this direction, and have been large, is because spot prices have consistently exceeded the market's expectations.

Based on the view that wealth transfers are likely to be mostly internal and relatively efficient, we believe that the benefits of applying losses to FTRs outweigh the wealth transfer downsides.

Wealth transfers from consumers to generators are a greater threat to NZ's electricity market and economy

To date the FTR market has created wealth transfers from transmission customers to FTR buyers, increasing from $11m 2014 (first full year) to $68m in 2021 (ignoring Aug-21 where final prices have not yet been published). These transfers have been created due to the increased size of the FTR market (more nodes) and, in our view, spot prices consistently exceeding market expectations.

Higher than expected spot price rises underscores an issue that we believe is a much greater threat to NZ's electricity market and the wider economy. Average annual spot prices have increased 140% from 2014 to 2021 (from $75.41/MWh to $181.14/MWh), creating a huge wealth transfer between electricity consumers and generators that is orders of magnitude higher than FTR wealth transfers, as illustrated below[14].



[14] Chart includes data since Jul-13 and excludes Aug-21 because final prices have not yet been published. Similarly, 2021 GWAP of $181.14 does not include Aug-21

From 2013 to 2017, the cost of generation averaged $2.7b per year. In 2021, this increased to $7.3b, a 170% increase. These cost increases are starting to directly impact commercial and industrial (C&I) and residential customers. In 2022, some C&I customers are exposed to energy cost increases of ~50% (for a 5 year term) to ~100% (for a 1-2 year term).

We agree if there is firm evidence of large external and inefficient wealth transfers in the FTR market, this should be investigated. However, we note the Authority must keep this issue in perspective given the significant challenges emerging in the generation market, and the Authority's statutory role to benefit consumers, increase competition, minimise costs and support an efficient transition to a renewable energy system.

Significant new retail competition has entered the market since 2013

The EA has observed that "retail competition has increased over time, however it is difficult to determine the influence that FTRs have on retail competition". We expect that independent retailers will provide the EA specific with insight into the availability and benefits of FTRs. However, we would like to note there is clear evidence of significant new entrants and increased retail competition since the FTR market emerged in 2013, as illustrated by the growth of 6 independent retailers.

The FTR market requires regular, structured reviews

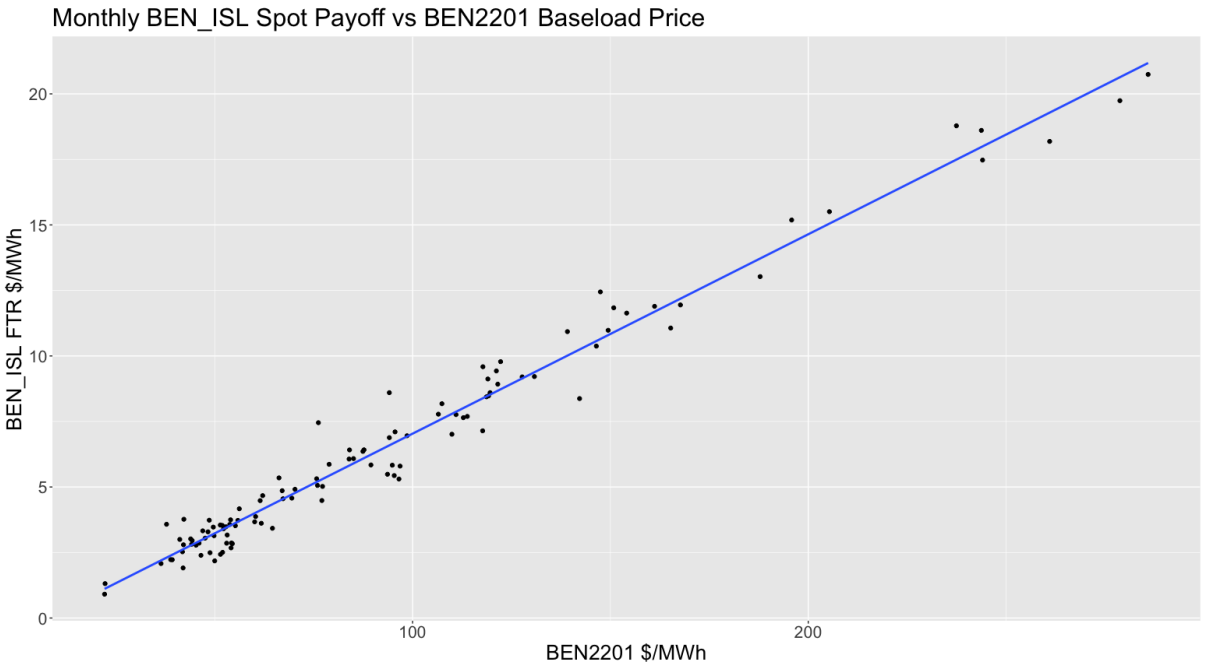
Since the FTR market started in 2013 there has only been one formal review, a post-implementation review in 2019, which found that "overall the FTR has been successful in increasing competition in the retail electricity market".

This latest review appears to have been incited by the concerns of certain generator-retailers and, while it's important these concerns are addressed, we believe it would be more beneficial for the market to have regular, structured reviews to address all aspects of the market's design, including: FTR payout structure (inclusion of losses), revenue (in)adequacy settings, FTR node changes, market transparency, voting framework. These reviews should be scheduled well in advance, have clear objectives, encourage input from all stakeholders, and be time bound. We have various ideas on how the FTR market can be improved and we look forward to sharing these in due course.

Appendix: Energy hedging example

As we have shown, almost all FTRs contain an exposure to underlying energy prices due to the inclusion of losses in their payouts. The Authority has identified some FTR paths that, due to the fact that flows are virtually always in the same direction, on rarely constrained circuits, are highly correlated with energy prices. We refer to these products as being *high delta* FTRs[15]. The example given in the paper was the BEN_ISL path.

The chart below shows the payout of BEN_ISL option FTRs (ignoring scaling) vs the BEN2201 price.



We can make a relatively unsophisticated, but very accurate hedge from this simply by using the slope of the line. From this data that slope is 0.086. Thus, for every MW of baseload energy at BEN2201 that we aim to hedge, we would buy 1/0.086, or 11.6 MW of BEN_ISL FTRs. This is a ratio of 11.6 to 1. A party seeking to hedge 10 MW would therefore buy approximately 116MW of these FTRs. Other products, like BEN_KIK or ISL_KIK have different slopes but similar effects.
Other FTR products can then be used to *move* the hedge around the country (i.e. hedge the location risk from BEN).

To a lesser degree, all FTRs have this energy hedge baked in, although uncertainty in flow direction becomes dominant on most paths. This allows arbitrageurs, including emhTrade, to actively trade any implied differences between FTR and Futures prices.

The chart above does show residual risk from using such a crude approach though (therefore we wouldn't expect BEN_ISL prices to perfectly match futures, even after adjusting for the capital requirements and expected scaling factor).

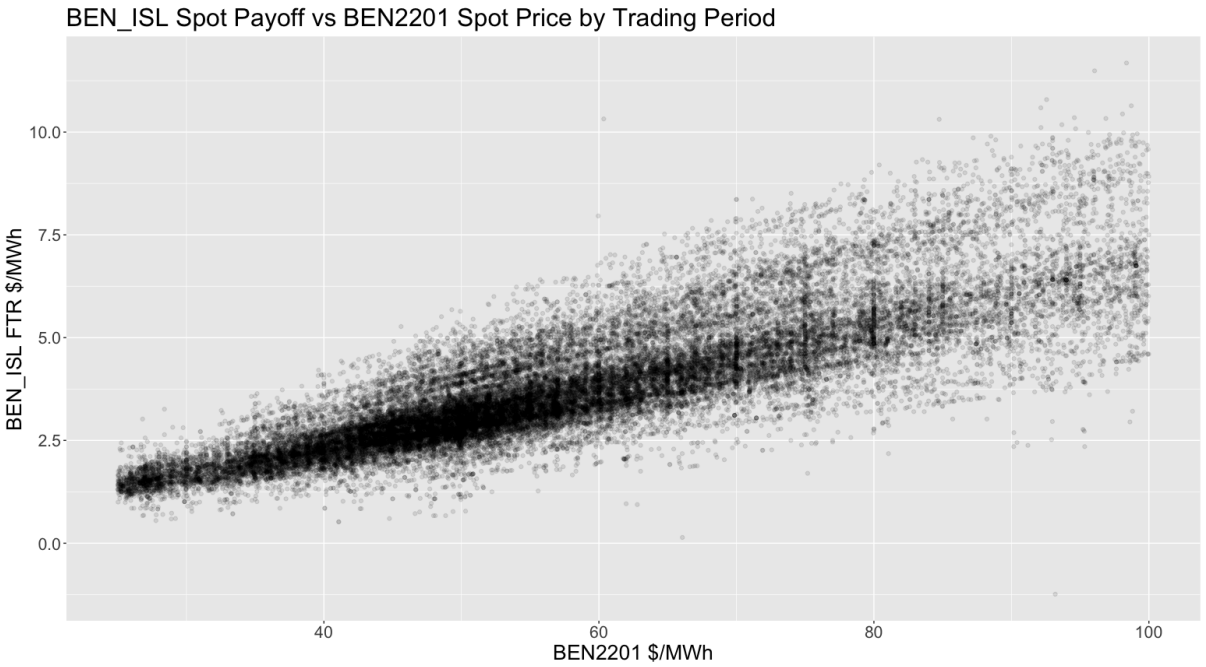
However if we dig deeper into the relationship we can see that a component of this residual risk arises from exposure to demand. This is due to the fact that losses increase with flow on transmission circuits, and the flow on uni-directional paths is highly correlated with demand. Thus, in

[15] Using terminology from options and other financial markets that describes the situation where the change in the value of the product with respect to a change in the value of the underlying is near 1. The underlying in our case being baseload energy prices.

periods of high demand, flow will increase, and the marginal cost of losses will also increase. Thus, FTRs are better than Futures for some participants in that they actually have exposure to the *shape* of prices. That is to say that they more closely approximate a load following hedge than the ASX Futures.

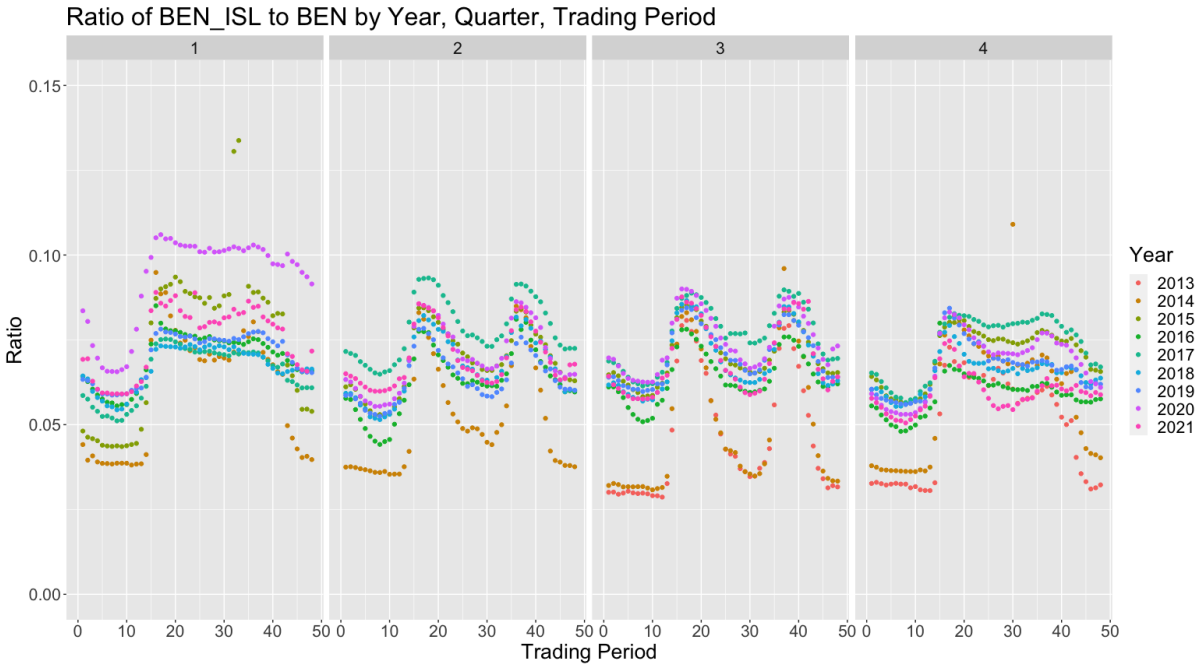
This is due to the fact that losses increase with flow on transmission circuits, and the flow on uni-directional paths is highly correlated with demand. Thus, in periods of high demand, flow will increase, and the marginal cost of losses will also increase.

In SPD, losses are modelled with a piecewise linear function. If we look at BEN_ISL vs BEN price by trading period (and zoom in) we see 'rays' emerging from the data. The points on these rays are at the same point on the loss function curve (they have the same marginal cost of losses on circuits between BEN and ISL)[16] steeper rays will be data points from trading periods with higher demand.



Because of this correlation with demand at trading period granularity, these FTRs provide a payoff structure that closely resembles a load following hedge. We can see this effect in the chart below if we look at the ratio of BEN_ISL to BEN and the seasonality exhibited (both within day and across the year).

[16] The vertical lines that appear in the data are due to the fact that offer tranches tend to coalesce near round numbers. A vertical line is where many data points have the same price at BEN, likely because Benmore station was the marginal generator.



Again, we can see that this isn't a perfect hedge and that the ratios seem to change through the years. This is expected due to changes in grid topography and demand. Indeed, if and when generation increases on the downstream side, this will also change the optimal hedge ratio and uncertainty. However it is very clear that these products are likely to be extremely useful for those parties that have made the investment in technical capability to incorporate them into their business.

Our view is that innovators in risk management, whether operating as retailers or financial participants, will continue to find these sorts of relationships, and will conduct detailed analysis on future expectations. Because of the detailed way in which the FTR market allows for exposures to aspects of the transmission system and underlying energy prices, expectations can be expressed in incredible detail (that is, risk can be disaggregated into many components), and prices will be implied and signalled to reveal expectations for each of those components.