Review of Recommended Values for Scheduling and Dispatch Policy Parameters 2022

Long Notice Adjustment Factor & System Imbalance Flattening Factor (LNAF and SIFF)

Report to the Regulatory Authorities

Date of Submission July 30th 2021

EIRGRID SONI

Contents

Licence Obligation

As part of the SONI transmission system operator licence condition 22A part 7 and the EirGrid transmission system operator licence condition 10A part 7, we are obliged to provide a report annually or as requested by the Authority/Commission: “The Licensee shall provide a report to the Authority/Commission on an annual basis or whenever so required by the Authority/Commission on the performance of its scheduling and dispatch process resulting from the current values of the scheduling and dispatch policy parameters. The Licensee may propose changes to the values of those policy parameters, or their replacement with different parameters. After publication of the Licensee’s report and following consultation with such persons as the Authority/Commission believes appropriate, the Authority/Commission may determine that the values of the policy parameters shall change, or that different policy parameters shall be used. Such a determination shall specify the date from which any such changes shall take effect and may specify transitional arrangements to be applied by the Licensee.”

In accordance with this condition in the two licences we are providing this report on the performance of the current scheduling and dispatch parameters for LNAF and SIFF. In this report we propose recommended values for 2022 based on operational data that we have gathered covering the period June 2020 to May 2021.

LNAF and SIFF High Level Intent

As outlined in the studies carried out into LNAF and SIFF values prior to go-live (Recommended LNAF and SIFF values), the aim of the LNAF and SIFF is to apply a weighting to the costs of offline generators and thereby reduce the propensity for taking early commitment actions in the scheduling process. This is to prevent the Transmission System Operators (TSOs) from taking actions on units prior to gate closure for energy balancing reasons, which could foreclose the ability of participants to trade in the still-open intraday marketplaces to reduce energy imbalances.

In the latest TSO review (here) provided to recommend values for these parameters, values of zero were recommended and the decision used these recommended values. As part of the RAs decision paper (here), published 11th November 2020, the following was stated:

"These parameters will apply from 1st January until 31 December 2021. A consultation may be carried out in August 2021 to determine the values to apply from January 2022. The Trading and Settlement Code provides for the RAs amending the values of parameters where necessary outside the normal parameter-setting process. While this would only arise in exceptional circumstances, the SEM Committee has obligations to balance regulatory certainty with ensuring that no unnecessary consumer harm arises. On this basis, the RAs will keep all parameters under observation and may propose changes in the interim if necessary, via consultation."

This review presents high level analysis carried out to evaluate the need to apply LNAF and SIFF values, and the potential risks of applying them, based on SEM operational data.

Measures Impacting on Trading, Early Actions and Margins

As a result of the UK's withdrawal from the EU, Day-Ahead markets running from 31 December 2020 do not include any SEM-GB interconnection capacity. This has had an effect on the relative volumes and prices traded in the respective markets, and should be kept in mind when interpreting the results.

The Covid-19 pandemic coincided with the review period for this report (June 2020 to May 2021) and as with most businesses, measures were put in place at generation sites to help implement adequate infection control policy. This resulted in the TSOs in Ireland and Northern Ireland providing additional notice for synchronisation of generators as follows:

"*EirGrid and SONI will, subject to system conditions, provide additional notice of intended unit synchronisation and desynchronisation decisions to facility operators in order to accommodate their amended operational practices. COVID-19 has resulted in restrictions in working arrangements at some generation facilities.*"

This mitigation has been published in the weekly constraint updates (here) since the measures were implemented in April 2020. As discussed in a later chapter on Early Actions, this mitigation measure has appeared to have had an impact on dispatch and this should be considered when interpreting the results.

To manage the generation margin outlook for the winter 2020/2021 and 2021/2022 periods, transmission constraint groups (TCGs) have been in place in the scheduling tool throughout the review period for this report to manage run hours of generators, giving rise to other generators running in their place. A security of supply constraint was additionally in place since April 2021 stipulating that some units must remain synchronised due to tight margins. As explained in the section on Early Actions, these TCGs and generation margin concerns have given rise to a greater number of early actions.

Ex-ante Markets

In order to characterise the ex-ante markets we have looked at the volumes and the prices traded in the respective markets, and also the supplier clearance level in the day-ahead market. As can be seen in Figure 1, prior to December 31st 2020 the volumes in the Intraday markets (IDA1/ IDA2 and IDA3) represent a small percentage of the overall volume with the majority of trading executed in the Day Ahead Market (DAM). Following the end of the Brexit transition period, there is an increase in the relative volumes traded in IDA1, but as can be seen from Figure 1 a large proportion of the trading is still executed in the DAM.

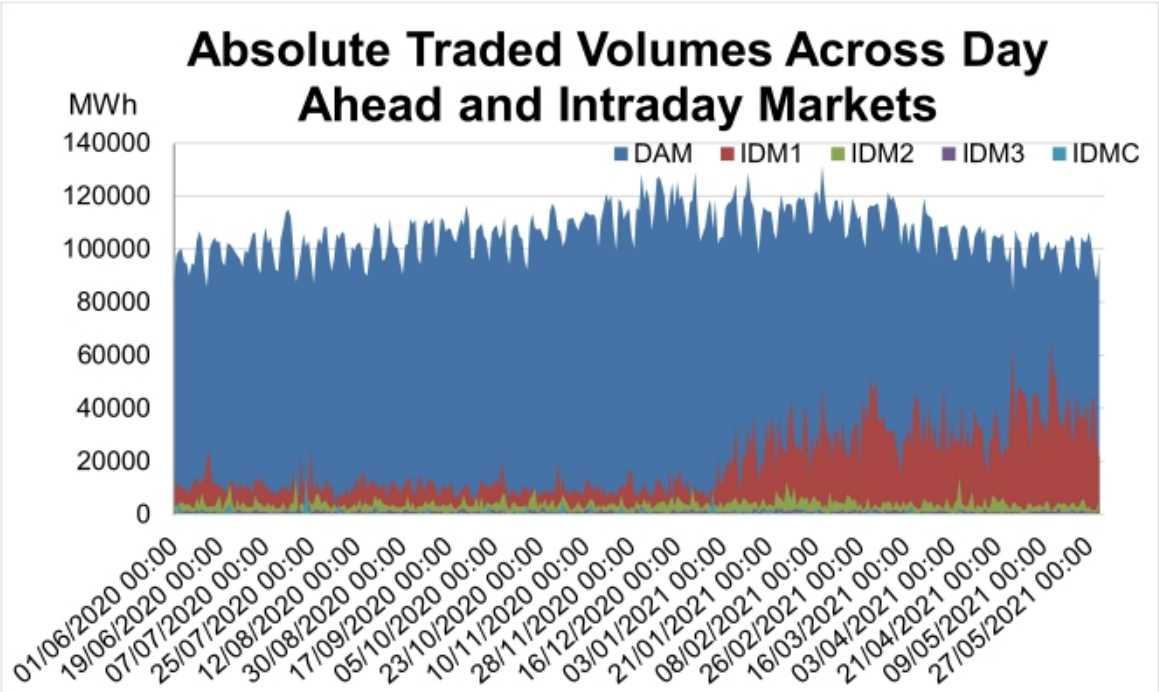

Figure 1: Traded Volumes across Intraday Markets

The volumes alone do not indicate whether there is liquidity at price levels which are sufficient for all of the bids to buy to clear. One means of determining if sufficient liquidity exists in auctions from sellers is if the prices from the different intraday auctions generally follow the shape and magnitude of the day-ahead market price profile (see figure 2). This is because with a lack of liquidity from sellers in those markets it would be expected that the price would diverge from the day-ahead market price, even in circumstances of relatively benign conditions, not just in cases where events that drive trading to avoid exposure to the imbalance price e.g. a generator tripping. However for the majority of the time the prices in each of these markets are relatively convergent. This is indicated by the intraday auction prices often being the same level as prices in the same periods in the day-ahead auctions. The profile of prices also follows a similar shape to the

DAM (see Figure 2). There are certain days where this did not happen, in particular around the evening peak hours. The majority of these can be explained by the actions of a single participant trading a large amount in a slightly different way, but the analysis shows that the primary trend is for convergence of prices, in particular between the DAM and IDA1 and IDA2.

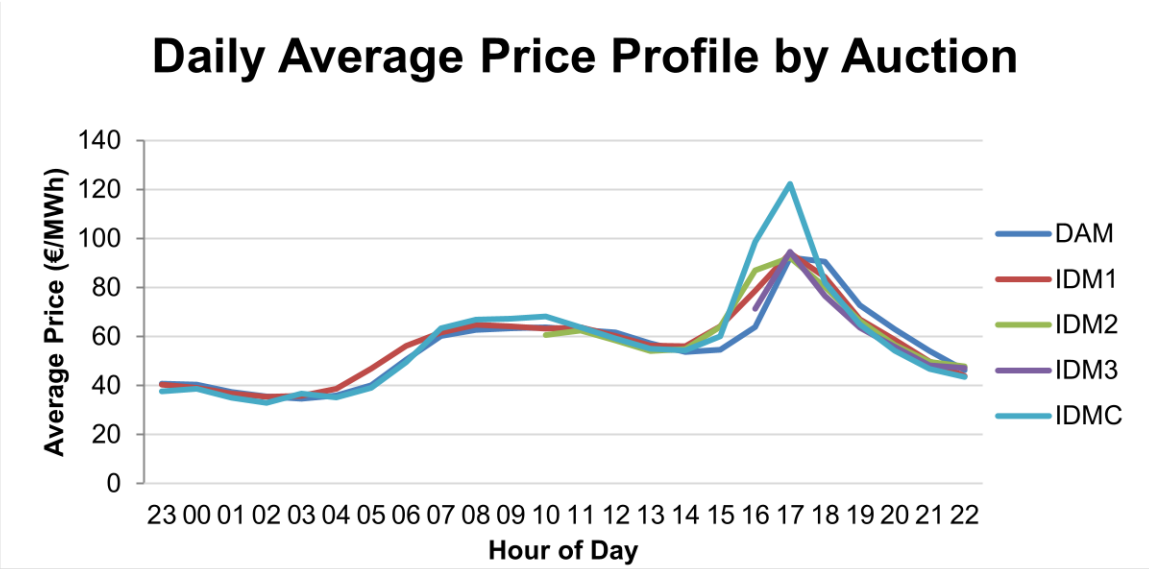

Figure 2: Price convergence between Intraday and Day Ahead Auctions based on daily average price for data covering 01/06/20 to 31/05/21

Another indication of a need for an LNAF is whether there are major drivers of imbalances causing the market to be short in a way which is forecastable and therefore could be reasonably corrected through intraday trading. One indication of this is whether or not there is sufficient liquidity in the intraday markets from units offering to sell, and the extent to which purchases (bids to buy) clear in the DAM. If a bid does not clear day-ahead then this may indicate that there will be attempts to buy this volume in an intraday market. If there is a large requirement to buy there would be an even higher need for liquidity in offers to sell in the intraday market, if there are low requirements to buy then there is less of a need for intraday offers. As per Figure 3, supplier purchases have been found to clear at very high levels in the DAM, averaging approximately 99.34%. This was a slight increase on the average seen in last year's report (average supplier purchase clearance rate of 99.25% May 2019 – May 2020). The minimum of supplier clearance was 97.1% and this was also an increase from last year's reporting period minimum supplier clearance % (May 2019 to May 2020 minimum was 96.7%). This indicates that the requirement for large volumes to sell in intraday is not high given that most of the required volume purchases from a major potential driver of imbalances are cleared in the DAM.

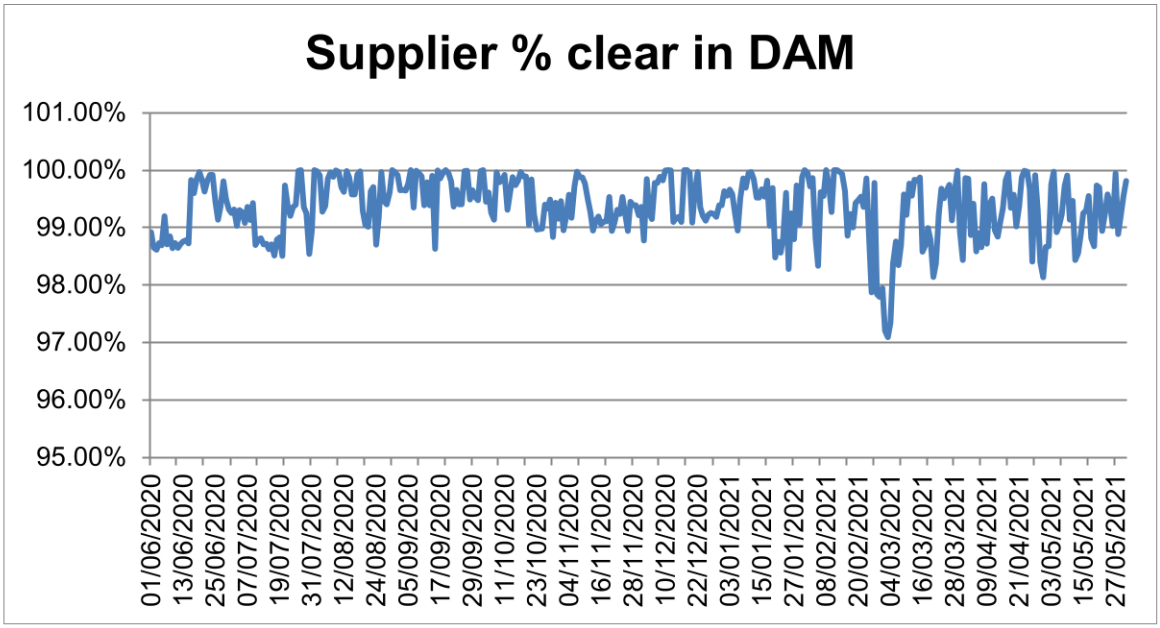

Figure 3: Supplier % cleared in Day Ahead Market

Non-Energy vs Energy Volumes

One of the primary risks outlined in the first studies carried out into LNAF and SIFF values was the potential impact on constraint costs, or the costs of non-energy actions. The ratio of non-energy to energy action volumes is an important metric to determine the potential impact applying LNAF could have. This is because part of the intention of LNAF is to apply in situations where the energy imbalance is relatively high, while attempting not to increase the cost of non-energy actions. If there are situations where the energy action volumes are consistently greater than the non-energy volumes there would be a more clear case where the application of LNAFs should not overly impact the non-energy volumes. In this case, the times where this LNAF would apply would be periods where the energy volumes are high and therefore the ratio of non-energy to energy volumes low, and the times where the LNAF would not apply would be periods where the energy volumes are low and therefore the ratio high.

A comparison of the non-energy vs energy volumes was carried out to calculate a ratio of the volumes. The following assumptions were made to categorise volumes into energy and non-energy. The first item in the ratio was the absolute value of the Net Imbalance Volume in each half hour (i.e. netting all positive and negative quantities in an Imbalance Settlement Period to give the total residual volume which represents the energy imbalance and therefore total volume of energy balancing actions). This was compared with the difference between the sum of the absolute value of all volumes and the Net Imbalance Volume (i.e. all negatives and positives were considered as positives, and with the volume of energy balancing actions taken away, this was intended to represent the volume of non-energy balancing actions). When considered on a net basis across the whole period from June 2020 – May 2021, and when considered on a net basis separately for each Day within that period, the ratio of non-energy to energy actions was found to be consistently high, i.e. there are much greater volumes of non-energy actions taken than energy actions (see Figure 4).

Comparing the non-energy and energy volumes totalled over the whole period, the ratio of non-energy to energy volumes was calculated as 4.8. A more suitable timeframe over which to consider the averaging of high and low ratios is over a Trading Day (see Figure 4). While certain half hours may have high or low ratios, the LNAF is most effective when considered over a number of periods together, because the action an LNAF is trying to avoid, starting a long notice unit to meet an imbalance, normally requires delivery of energy over a number of hours. If a day generally has high imbalances and low non-energy to energy ratio, there would be a good case to apply an LNAF in that day. This is one reason why SIFF considers a daily imbalance value, and is set once a day. From the analysis carried out, the daily average ratio of non-energy volumes to energy volumes was 5.6, with a maximum daily ratio of 24.6 and a minimum of 1.1. With a standard deviation of 3 from the daily average 5.6, this indicates that the ratio of non-energy to energy volumes across a Trading Day is consistently high (also see Figure 5). Given this, the application of an LNAF at any level of imbalance

would very likely have the unintended consequence of increasing the cost of the larger relative volume of non-energy actions in the market. This could lead to an increase in the Dispatch Balancing costs for the TSOs and ultimately increase the cost for consumers.

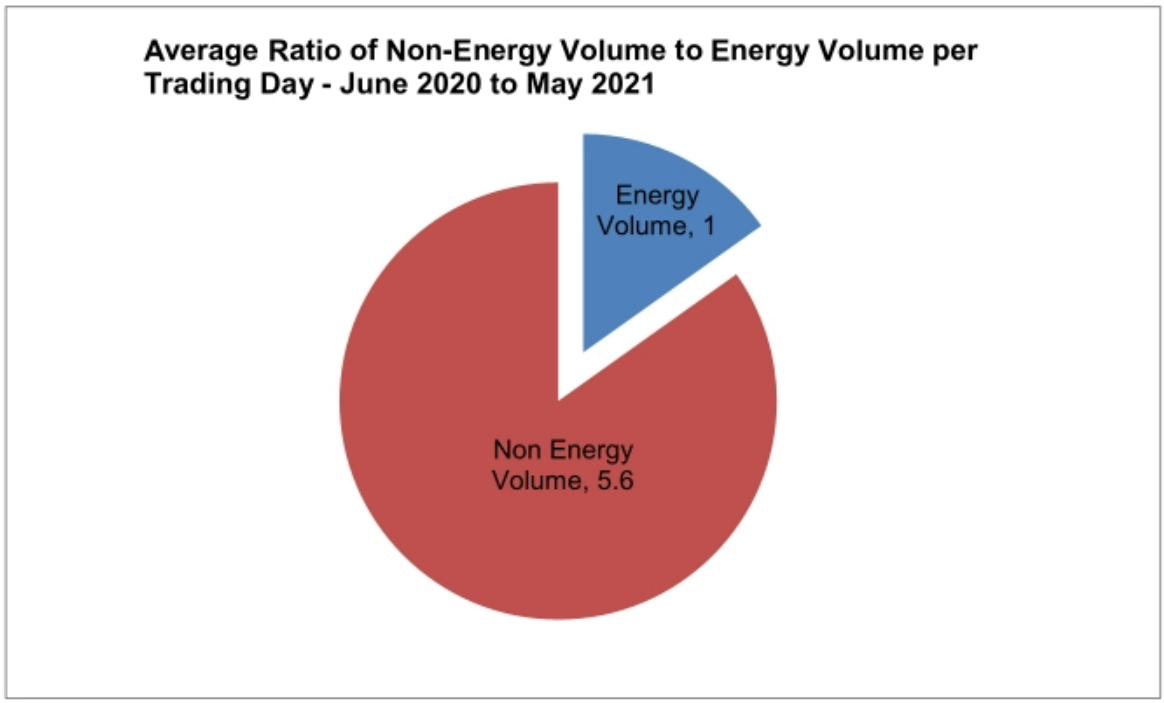

Figure 4: Ratio of Non-Energy volume to Energy Volume

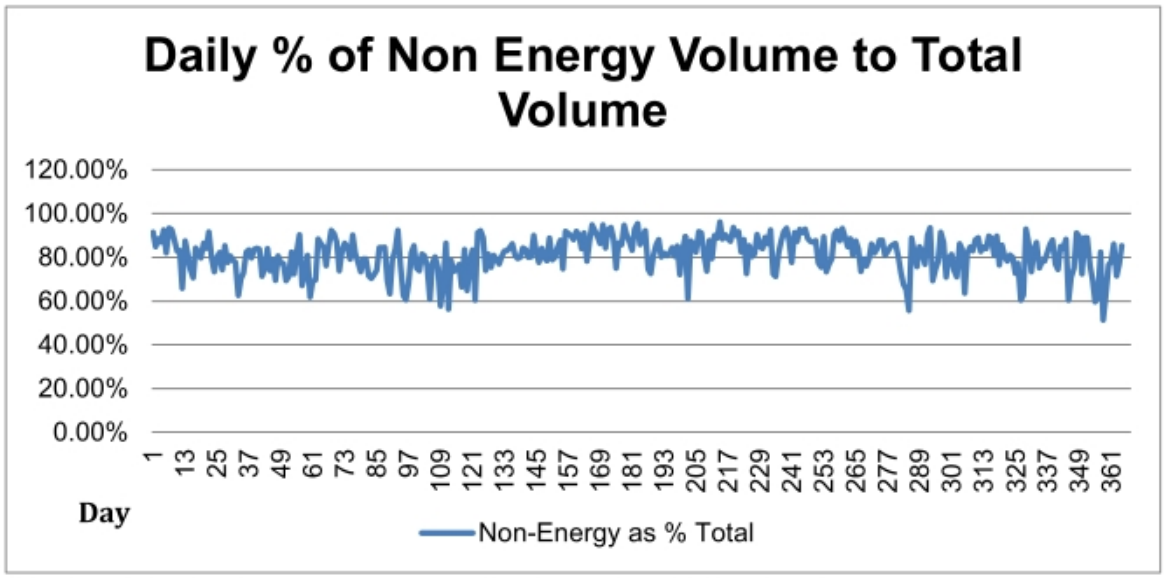

Figure 5: Daily % of Non-Energy Volume to Total Volume

Early Actions

A main driver for implementing LNAF/SIFF is to avoid the propensity for early issuance of instructions to synchronise units by the TSOs. As a result of the LNAF/SIFF adjusted schedule being biased towards committing more short notice plant, this would in turn have an effect on the issuance of early actions as their notification times would be lower. For this review we analysed the synchronisation instructions issued during the report review period to quantify whether the early issuance of instructions to synchronise was evident. This would be classified as the last time to call approach that is taken by the TSOs so as to avoid any possible untoward interaction with the energy markets discussed in previous chapters of this review. The objective here is that by quantifying the instructions based on real data for long notice units that are early we can determine if there is a pattern that would establish the need for the application of the LNAF/SIFF parameters.

Based on operational data for dispatch instructions from June 2020 to May 2021 we have carried out analysis on the synchronisation instructions issue time compared to the effective time. As there is no specific criteria for defining how an early action by the TSOs would be classified we can refer to the last time to instruct for a unit.

The last time to instruct for the TSOs is the latest time the TSOs can issue a sync instruction to a unit to be online at the required target scheduled MW. For example the 18:00 LTS run which is published at 20:00 shows a unit required at 06:00 the following morning. If the unit has a cold notification time of 7 hours the latest we can issue the sync to the unit is 23:00 so if the unit was issued a sync at 22:00 this would be calculated as being 1 hour in advance of the notification time (as shown on figures 6 and 7) or 1 hour “Early”.

This analysis was completed using the market technical offer data notification times for hot, warm and cold heat states. Out of a total of 7199 synchronisation instructions (covering all dispatchable units from June 2020 to May 2021), 96% were issued within 1 hour of the notification time or last time to instruct.

The following analysis and Figures 6 and 7 cover synchronisation instructions to units (non-priority dispatch) on the island where the relevant notification time is greater than 1 hour. This is to capture synchronisation decisions that would be affected by LNAF/SIFF. These instructions represent approximately 10% of all synchronisation instructions that were issued in the period from June 2020 to May 2021.

As units can sometimes synchronise faster than their normal notification time (if for example they are on the border of a heat boundary, or if a verbal instruction was given before the electronic dispatch instruction), for the purposes of this analysis any instructions for units that synchronised faster than indicated by their

technical offer data were included and the instructions were assumed to be on time (i.e. not early).

It must be taken into account that as the granularity of the scheduling tool for Long Term Scheduling is 30 minutes, the advisory time for issuing the synchronisation instruction is to the nearest 30 minutes. It also needs to be considered that each LTS scheduling run, of which there are generally 6 per day, can take a number of hours to process. The TSOs need to be aware that while the next schedule may show a different unit commitment outcome, waiting for the next schedule to complete may cause a unit to have passed its last time to instruct thus leaving that unit effectively unavailable for the required delivery period. The risk associated with not having long notice units available needs to be considered by the TSOs and any associated impact on margin and replacement reserves which are discussed in a later chapter (Impact on Margin).

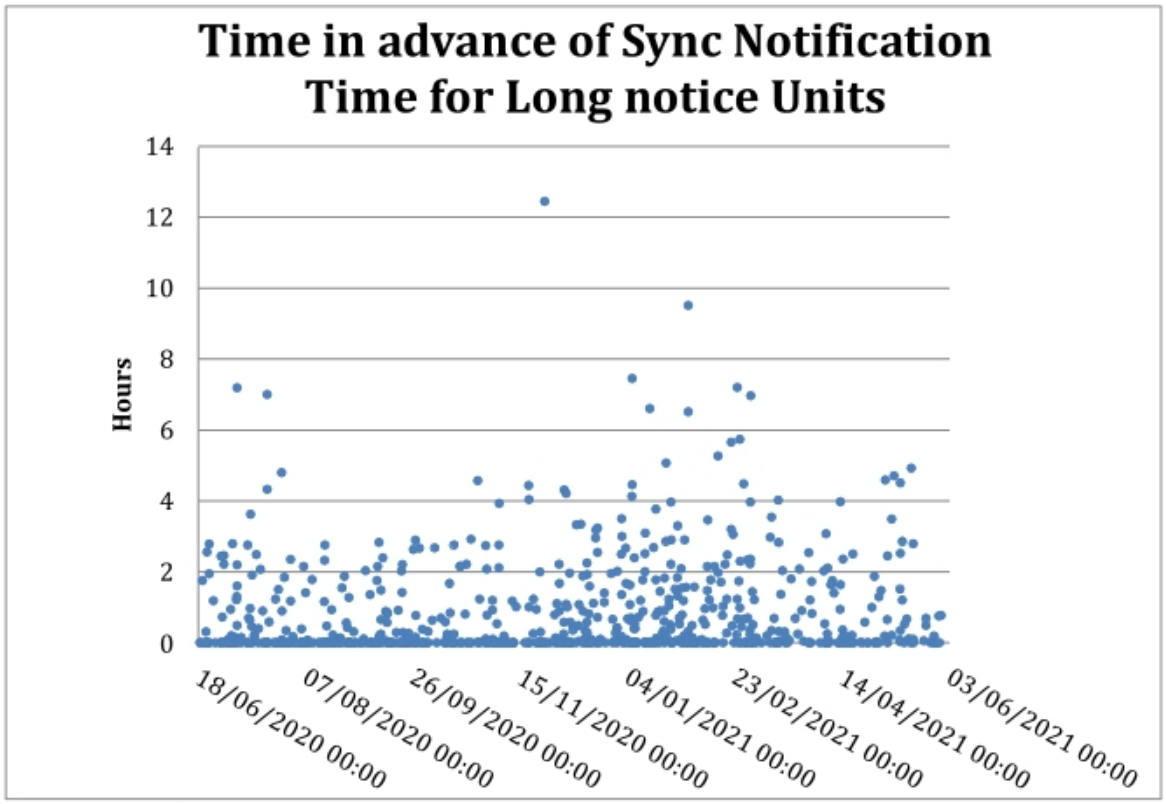

Figure 6: Sync times in advance of heat state dependent notification time

Figure 7 shows 75% of the long notice synchronisation instructions were issued in the hour before the last time to instruct. This percentage is comparable to the data observed in last year's reporting period. However, there were 29 instances where units were issued synchronisation instructions greater than 4 hours in advance of the notification time, an increase on the 18 seen in last year's reporting period. There were nine instructions greater than 6 hours in advance of the notification time.

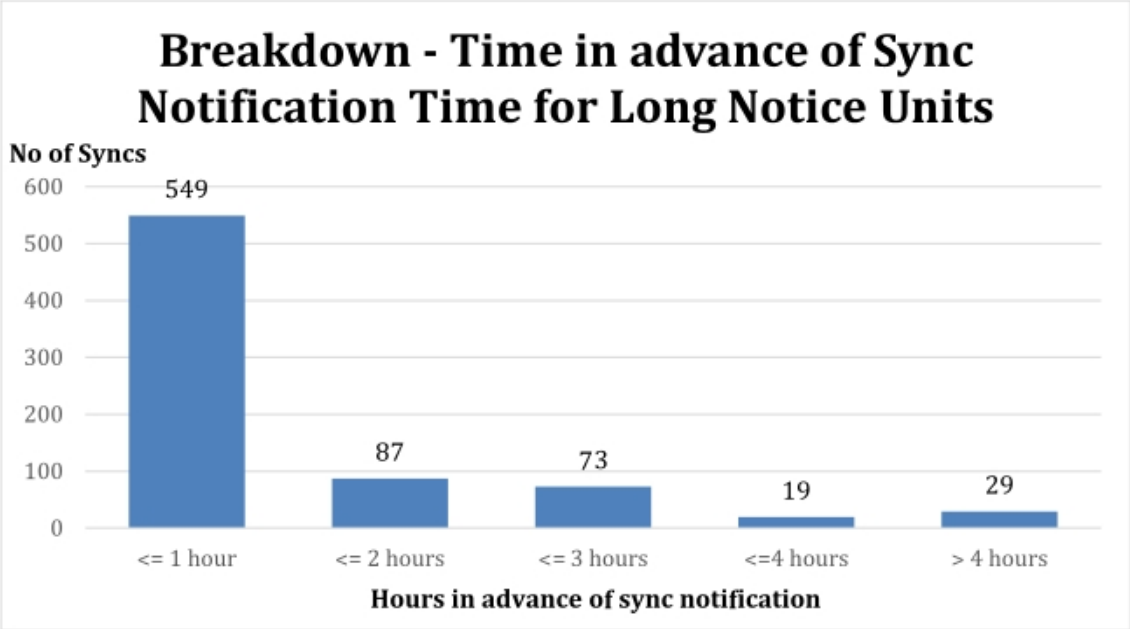

Figure 7: Number of syncs with respect to hours before notification time

There are a number of factors that can give rise to early dispatch instructions being issued. These include the following:

- The Covid-19 pandemic measures described on page 5 above provided for additional notice of intended synchronisation. These measures applied for 2 months over the period May 2019 – May 2020, but were in place for the entire period covered in this report.

- In some cases a unit in a cold heat state was required on the system due to binding system constraints. In a case where there is a binding constraint on the system the unit may be sent a synchronisation instruction in advance of the notification time as further scheduling runs will not change the requirement for the unit. Note that long-term forced outages of generating units for the period covered by this report have amplified this issue.

- On days where capacity margins are very low (such as when a system alert would be likely), typically all available long notice generation is scheduled to run to ensure there is sufficient generation to meet the load and reserve requirements. In this case, a unit may be sent a synchronisation instruction in advance of the notification time as further scheduling runs will not change the requirement for the unit.

Note that these factors tend to act together so it is not possible to ascribe a single reason for early notice to all affected instructions. For example, COVID measures alone might require a small increase in notice, but when there are system

security implications of a failure to start, it is prudent to provide additional notice to minimise the risk to the system.

Scheduling Considerations

There are some further observations for consideration based on experience from operating the scheduling software since Go Live.

Effect on scheduler solve times with additional constraints - There is empirical evidence that increasing the costs of production of units (by weighting the start-up costs) could lead to longer solve times that could have a detrimental effect on the timely production of operational schedules. It could also impact on the accuracy of the optimisation with larger MIP (mixed integer programming) gaps as the solver tries to decide between starting a large unit with a weighted start-up cost versus breaching other constraints with penalty costs.

There is a balance to be struck between applying a weighting factor to start-up costs and also solving all the other constraints in the optimisation (load, inertia, ROCOF, network contingencies, reserve, generator technical parameters etc.). Also as different technologies are added to the scheduling system (e.g. solar/battery) and reserve categories (e.g. co-optimisation of FFR and ramping margin) there will be an additional burden on the solver in terms of the number of constraints which could directly affect the solve time. If LNAF were to be implemented the impact on the solve times for schedules would need to be assessed within current operational timelines.

Transparency of scheduling results/Market participants – A weighted factor for start-up costs makes the interpretation of the scheduling results more difficult as the source of commercial offer data has been changed. Sanity checking of commitment decisions is based on checking the commercial offer data and other constraints for the unit (reserve provision etc.). LNAF would make interpretation of the scheduler results more difficult as to the reason why a particular unit was being committed.

Interaction of Simple/Complex commercial offer data with LNAF adjusted complex data – As detailed in the balancing market principle statement (BMPS), the Long Term Scheduler (LTS) and Real Time Commitment (RTC) both use complex commercial offer data. There is already a push pull scenario with the schedulers showing advisory syncs for short notice plant based on complex data. However, when it comes to dispatching these units, simple prices, which are typically higher, are used to form the merit order lists. Increasing the start-up costs of long notice plant would add another level of complexity here which may lead to a lack of transparency in scheduling and dispatch decisions.

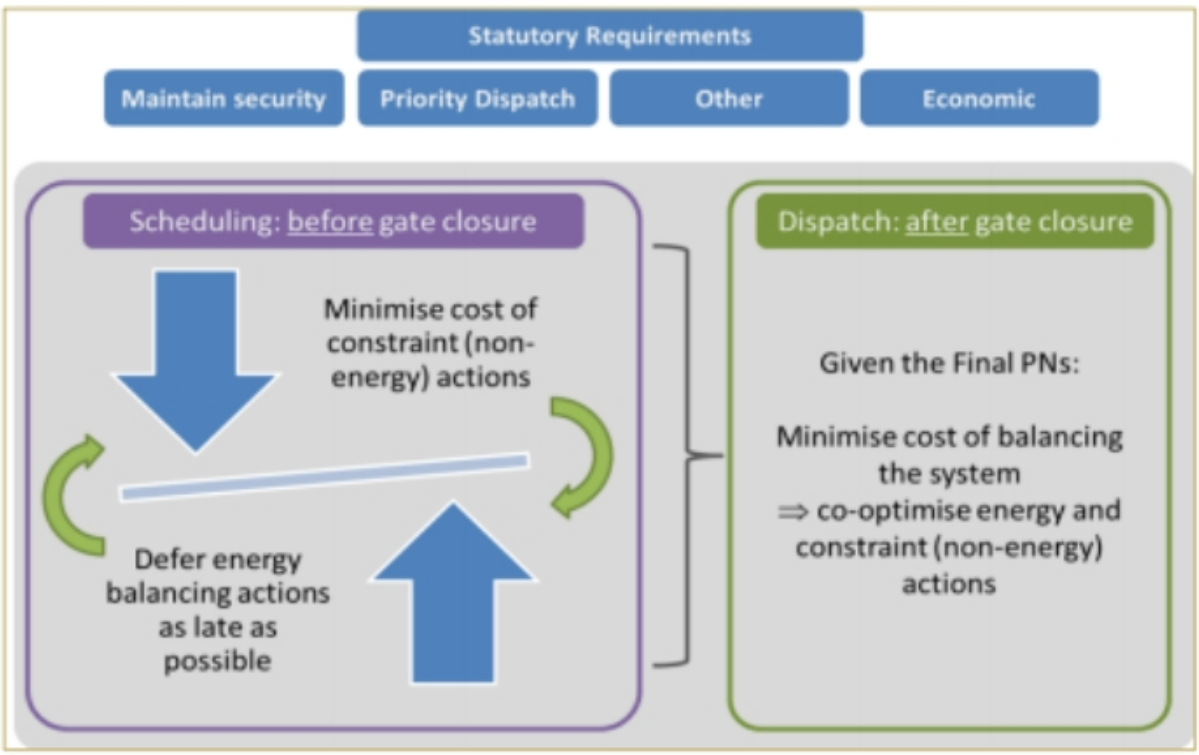

Figure 8: Illustration of balance between multiple objectives in single optimization

Figure 8 is an illustration that was shown as part of the original report into LNAF & SIFF and attempts to show the balance of statutory obligations and system security/economics.

Impact on Margin

As discussed in the previous report on LNAF and SIFF parameters there is an interaction between applying an increase in start-up costs and the generation margin. The application of LNAFs will tend to utilise more short notice units to provide energy and reserve (replacing the energy and reserve provided by the longer notice units which are not scheduled to run) and so will reduce the availability of spare short notice units. If the notification time passes for the longer notice units these units are now effectively unavailable for commitment in the scheduling tool.

The result is that during abnormal events it may not be possible to meet reserve requirements (reserve scarcity) and it may not be possible to meet all demand requirements (unserved energy) leading to a potential system alert status.

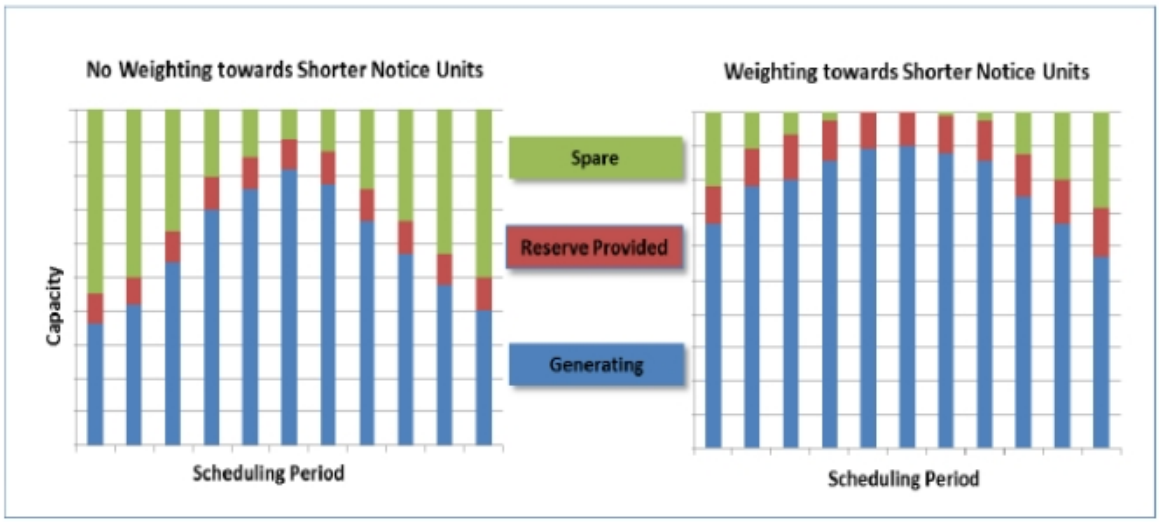

Figure 9: Illustration of Impact on Margin/Replacement Reserve for bias towards short notice plant using LNAF

As illustrated in Figure 9 the amount of spare MW capacity from short notice fast acting plant will reduce if those units are already online for energy provision. This in turn will put pressure on meeting the replacement reserve requirements needed on the island.

For this year's report we also used data based on the EirGrid planned generator outage information for the period covering June 2020 to March 2021 to perform sensitivity analysis on the margin to identify the effect of a long notice unit's unavailability due to heat state notification time.

For this analysis, the margin calculation was based on a daily average value for availability and the forecast demand peak for each month in the review period

and was tested for the increasing loss of availability due to a long notice unit's heat state notification timing out for dispatch at the peak.

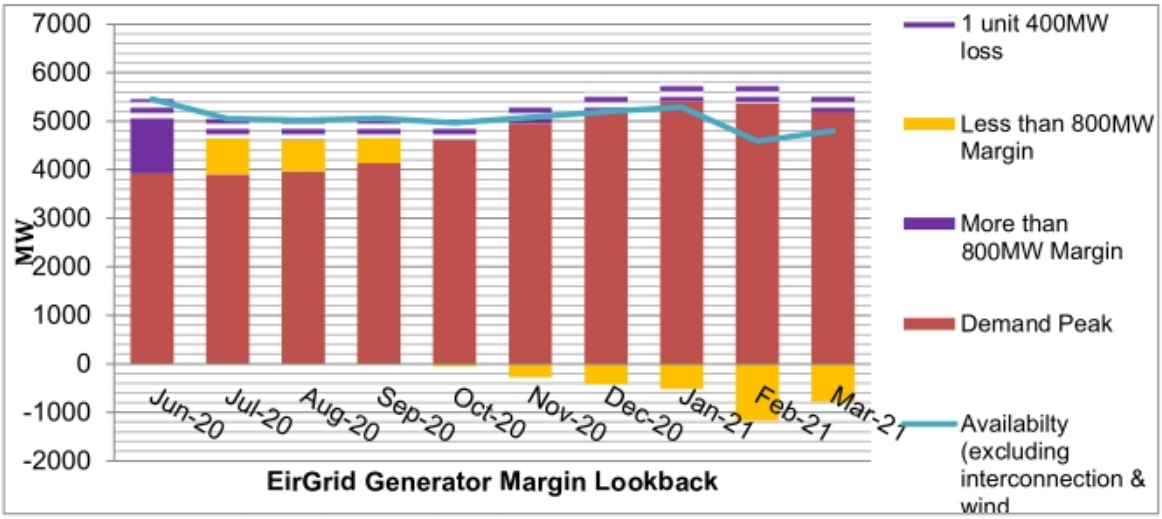

Figure 10: Margin with a 400MW loss of availability due to a long notice unit heat state timeout

As can be seen from Figure 10 above the adjusted margin (if LNAF had been in use) would have been less than 800MW[1] every month with the exception of June 2020, and would have been negative at times over the winter period.

In reality, the system margin was very low at times over winter 2020 – 2021, which resulted in a number of system alerts being issued. The application of a non-zero LNAF parameter would have had the effect of further increasing the risk to the margin by adding a scheduling bias to short-notice generation thereby reducing the availability of offline long-notice plant because of notification period timeout. This would have likely increased the number of system alerts issued in winter 2020 – 2021.

Based on the analysis of historical data, and in the context of current and forecast tight generation capacity margins, a non-zero LNAF parameter could have significant security of supply implications.

[1] The margin threshold of 800MW is based on the simple rule of a notional largest single infeed of 400MW and the replacement reserve of 400MW.

Recommendation

The analysis presented on the operation of the balancing market since go-live suggests that it has not had a negative impact on trading in the intraday markets, given that a number of indicators seem to show relatively healthy liquidity in offers to sell relative to the bids to buy. The analysis also suggests that there is a relatively large risk of unintentionally increasing the non-energy actions, even in periods with relatively high imbalance volumes, given that the volumes of non-energy actions are consistently relatively much higher than the volumes of energy actions in each Trading Day.

Also taking into account the operational data showing that synchronisation instructions are being issued in a timely manner with respect to the heat state dependent notification times it is clear that unnecessary early dispatch actions have not been a significant feature of the balancing market during the period from June 2020 to May 2021. It is the opinion of the TSOs that the majority of the early actions greater than 4 hours were necessary and prudent in light of the Covid-19 measures, transmission constraints, and security of supply considerations that influence the scheduling process during the reporting period. The application of LNAF/SIFF parameters would not preclude these types of actions and would introduce a cost factor to the optimisation solution with little benefit.

Non-zero LNAF and SIFF parameters has the potential to reduce system margin due to biasing the schedule towards shorter-notice generators and causing long-notice units to be "timed out", particularly following unplanned generator unavailability. In light of the current outlook for winter 2021, the application of non-zero LNAF or SIFF parameters would likely have negative consequences for security of supply.

Therefore it is recommended that we continue not to utilise LNAF or SIFF functionality for 2022. In terms of the values which give rise to this, it would mean continuing to apply values of zero for LNAF and SIFF. For subsequent years, if there are any changes to the metrics for determining whether the LNAF and SIFF are needed due to decreased relative liquidity in the intraday markets or decreased risk of increasing non-energy costs, then more detailed analysis of suitable values for LNAF and SIFF can be carried out.

Scheduling and Dispatch Policy Parameter	Recommended Value for 2022 (same as 2021)
LNAF	**0**
SIFF	**0**

Acronyms

BMPS	Balancing Market Principles Statement
DAM	Day Ahead Market
FFR	Fast Frequency Response
IDA1	Intraday 1
IDA2	Intraday 2
IDA3	Intraday 3
IDC	Intraday Continuous
LNAF	Long Notice Adjustment Factor
LTS	Long Term Scheduling
ROCOF	Rate Of Change Of Frequency
RTC	Real Time Commitment
RTD	Real Time Dispatch
SIFF	System Imbalance Flattening Factor
TCG	Transmission Constraint Group
TCG Sec_NB	Security of Supply TCG