Repetitive Re-trading (RRT) by electricity storage in transmission constraint periods

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Following on from the UK government's Reformed National Pricing Delivery Plan, published in April 2026, this document provides a description of Repetitive Re-trading by electricity storage in transmission constraint periods and sets out its interactions with existing market rules such as the Transmission Constraint Licence Condition.

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1. Introduction

1.1 Electricity storage[1] has a vital role to play in ensuring the electricity sector reaches Clean Power 2030. With the growth of intermittent renewable generation, storage can help balance the electricity system at a lower cost via absorbing power in times where there is an abundance of electricity generation and delivering it back to the system when needed.

1.2 Over the last few years, we have seen the pipeline of grid scale electricity storage (primarily batteries) increase substantially. Industry estimates suggest that battery capacity has grown from approximately 1GW in 2020 to 7GW in 2026.[2] This is set to increase further as government has set out an ambition for 23GW to 27GW of grid-scale batteries in Great Britain (GB) by 2030. In addition, we have seen government give a clear steer on its ambition for increasing long duration electricity storage (LDES), including via the creation of a cap and floor regime.

1.3 We have also witnessed a sharp rise in thermal constraint costs, following the rapid expansion of wind generation over the past 10 years which has outpaced upgrades to the transmission network infrastructure. This has resulted in National Energy System Operator (NESO) frequently having to take actions to turn down renewable generation (predominately in Scotland) and replace this with gas generation (predominately in England and Wales). For financial year 2024/25, thermal constraint costs were approximately £1.7bn - a considerable increase from 2018/19 (where thermal constraint costs were approximately £0.4bn). This increase is due to continue, with NESO projecting that balancing costs could peak at £7bn in 2030.[3]

1.4 Efficient utilisation of electricity storage has the potential to lower thermal constraint costs where assets located in constrained areas of the network import power by charging or pumping during periods of surplus renewable generation, thereby reducing the extent to which renewable generation must be curtailed. Nevertheless, existing market arrangements sometimes lead to suboptimal use of storage assets, by sending ineffective signals to electricity storage operators that result in those units exacerbating constraints rather than resolving them.

1.5 Repetitive re-trading (RRT) refers to a scenario which begins with a storage asset located in a constrained area of the transmission system selling its power in the wholesale market in response to prevailing prices (which, in a national wholesale market, will frequently be positive even when there is too much generation in certain parts of the network). However, where a thermal transmission constraint is active, NESO may need to reduce the storage asset's output by accepting a bid in

[1] Electricity Storage is defined as the conversion of electrical energy into a form of energy, which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy.

[2] Modo Energy GB BESS build out Q1 2026: fleet reaches 7.2GW

[3] NESO: 2025 Annual Balancing Costs Report

the Balancing Mechanism (BM), while increasing the output of a unit elsewhere on the system to replace the lost power. As a result of being curtailed, the storage asset's generation capacity is increased, and so as long as wholesale prices remain positive it will attempt to re-sell the power in the intraday market for delivery in a subsequent settlement period. However, if the constraint still exists in that subsequent period, NESO must once more bid down the asset. This cycle continues until the constraint ends, at which point the asset is finally permitted to release its power to the transmission system.

1.6 RRT can lead to inefficient dispatch patterns and higher balancing costs. It is not a new issue – with storage assets in constrained areas of the network having had significant volumes of bids accepted in constraint periods for many years – and has been the subject of industry analysis and discussion, particularly in the context of the Government's review of electricity market arrangements.[4] However its impact on system costs and efficiency is increasing as the amount of storage connected to the network – and the volume of actions that NESO must take to manage constraints – continues to grow.

1.7 The purpose of this document is to describe why RRT occurs and to discuss how it interacts with current market rules. We also outline the ongoing initiatives and potential market reforms intended to reduce the scale of RRT and to enable storage assets to meet their potential to help resolve transmission constraints.

2. Background

Balancing Mechanism

2.1 The BM is a crucial part of the electricity system framework in GB, used by NESO to ensure that supply and demand are balanced. In the BM, 'bids' and 'offers' are collected from market participants, specifying the price in £ per MWh at which those parties would be willing to decrease or increase their expected output (or 'export') or consumption (or 'import'), as indicated through the unit's Final Physical Notification (FPN) as of one hour prior to delivery. For each half-hourly settlement period, NESO may accept sets of bids and offers, making payments to (or receiving payments from) different parties in exchange for them agreeing to alter their output or consumption to meet system needs.

Transmission constraints

2.2 As well as accepting bids and offers to address any system-wide energy imbalance, NESO also uses the BM to manage any local transmission constraints. These are limitations in the transmissions system's ability to reliably transmit power from

[4] See for example FTI's report from December 2024 - How the Current GB Wholesale Market Design Fails | FTI

where it is due to be generated to where the demand for that power is situated, and could occur as a result of factors such as the risk that the thermal rating of circuits is exceeded; the need to maintain voltage at the required levels; or the need to maintain dynamic stability.

2.3 Following the expansion of renewable generation on the system, the GB network has multiple areas that are regularly congested, such as north-to-south power flows, export constraints in the east of England, and import constraints in the south of England.[5] Constraints can frequently last for a number of hours (or even days), particularly where high wind speeds coincide with network outages or periods of low demand.

2.4 Alongside actions it takes outside the BM, NESO will often accept bids and offers in the BM to resolve these transmission constraints and ensure that power flows on each part of the transmission system remain within the necessary bounds to ensure the security and quality of supply and safe operation.

Electricity Storage

2.5 Electricity Storage is defined in the generation licence as the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy. It is the ability to absorb and store energy that separates storage assets from other forms of generation such as thermal generation eg burning gas, or intermittent renewables eg wind and solar.

2.6 Due to their ability to store power, storage assets operate differently from other forms of generation. Conventional thermal generators decide whether to generate by comparing the expected sale price with their short-run marginal costs, such as fuel, emissions and start-up costs. Intermittent renewable generators operate according to the availability of their natural resource, such as wind speeds or sunlight levels.

2.7 In contrast, storage (both long and short duration) operates by following market signals, buying electricity at as low a price as possible and then selling when prices are high, with the unit's profit driven by the difference (or 'spread') between the two. Under existing market arrangements, providers are required to choose when to export and when to import based on the single national wholesale price, which may be positive even where – for assets located in constrained parts of the network – there is too much generation in the local area. Like the majority of GB connected generation, storage assets typically have firm network access, such that they are entitled to export (or import) to the transmission system up to their full capacity

[5] NESO Reformed National Pricing Call for Input, p23

irrespective of whether it can handle their intended level of export or import – and entitled to compensation if they are prevented from doing so.

2.8 Shorter duration storage assets (such as most batteries currently operating in GB, which typically have the ability to continuously export for 1 or 2 hours at their nameplate capacity) will generally reoptimize on a number of occasions over the course of the day, revising their intended schedule to ensure that they are exporting in the most profitable periods, and charging when power is cheapest. While assets may flip between importing and exporting multiple times in a day, excessive cycling will generally be avoided, due to the degradation impact this could have on the battery. Pricing and dispatch and decisions for battery assets generally rely on algorithms, with varying levels of involvement from traders.

2.9 By contrast, longer duration assets (such as pumped storage units, which are able to import or export for substantially longer periods of time) are able to take advantage of sustained high prices by exporting for long periods. They will typically optimise over longer time horizons (eg considering reservoir levels across a period of days or possibly even weeks).

2.10 It should also be noted that any transmission connected storage units and large distribution storage assets[6] are required to become Balancing Mechanism Units (BMUs) and participate in the BM. These assets will regularly receive bids and offers to manage energy imbalances and for system reasons. For storage assets, there is a direct relationship between a bid acceptance and the asset's remaining capacity. This is because every MWh of bid acceptance in one settlement period will lead to an additional MWh being available for the unit to deliver in a subsequent settlement period. As a result, a bid acceptance will normally lead to a further period of export where wholesale prices are high (and vice versa for offers where wholesale prices remain low). This contrasts to the situation for other generation units such as wind or gas, for which a bid acceptance will not typically affect the unit's ability to generate in a subsequent settlement period.

2.11 In addition to optimising in the wholesale market and responding to instructions in the BM, storage assets can also provide ancillary services to NESO such as Dynamic Response and Reserve.[7] As a result, storage operators will also need to consider these contracts with NESO to ensure that the asset stays within the correct state of charge to deliver these services when called upon by NESO. As a result – irrespective of wholesale prices – this can result in providers having a strong incentive / requirement to export or import power to bring their state of charge to the desired level and so ensure they do not face any non-delivery penalties from NESO on failure to deliver these services.

[6] Above 100MW in England and Wales, 30MW in South Scotland and 10MW in North Scotland.
[7] Dynamic Response and Reserve provide NESO with fast acting services which ensure frequency remains within statutory limits pre- and post-fault.

2.12 Pumped storage and hydro assets also face constraints that impact how they operate. In particular, they may be subject to environmental constraints, where the upper reservoir could be close to full given heavy rain fall or snow melting. This will create a strong incentive / requirement to export power so as to free up space in the upper reservoir to reduce the risk of spilling and causing a flood.

Repetitive Re-Trading (RRT)

2.13 RRT occurs where an asset repeatedly re-sells power behind constraints while having bids accepted in the BM. This can be explained via a stylised example of a 50MW/100MWh two-hour battery situated in a constrained part of the network which has no ancillary service contracts (although the equivalent pattern can equally be observed for longer duration batteries or other storage technologies).

Stage 1 – In deciding on its intended schedule for the day, the asset chooses to cycle twice, by charging when the wholesale price is low and then discharging when the wholesale price is high.

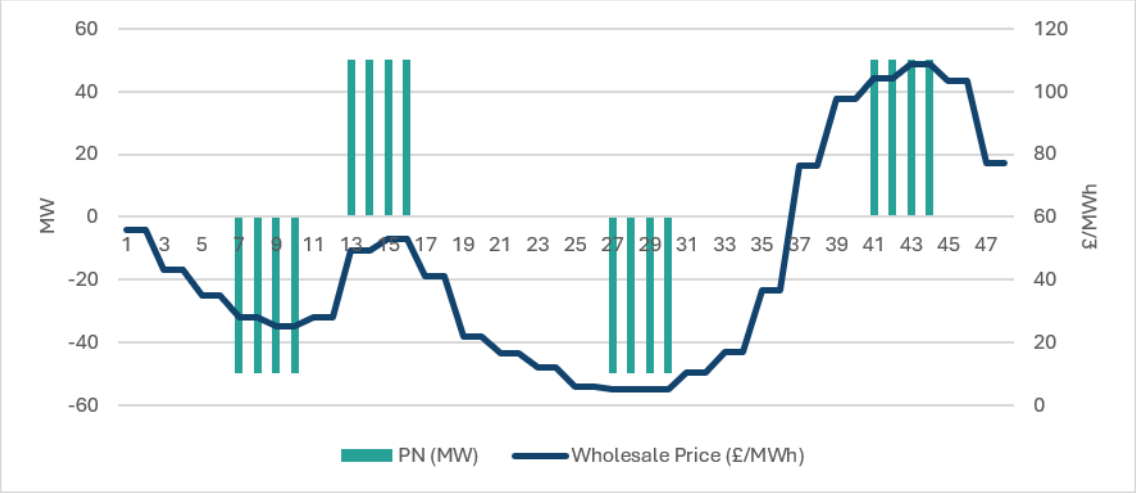

Figure 1 - 50MW/100MWh battery asset with two scheduled cycles

Stage 2 – Due to wind conditions leading to a surplus of generation and the asset's location on the transmission network, NESO accepts a bid to stop the asset from discharging during settlement period 13 (SP13). As a result, due to the additional generation capacity arising from being curtailed, the battery can either chose to a) discharge in an additional settlement period or b) negate the need for a charge during its next charging cycle ie SP27. In this example, the optimiser decides to re-sell the energy for SP17. This generates additional wholesale revenues (which the battery provider will take into account when setting its bid prices). Where there is a significant benefit associated with being able to re-sell the power or avoiding a charge, bid prices may be positive (indicating that the battery is willing to pay NESO in order to be curtailed).

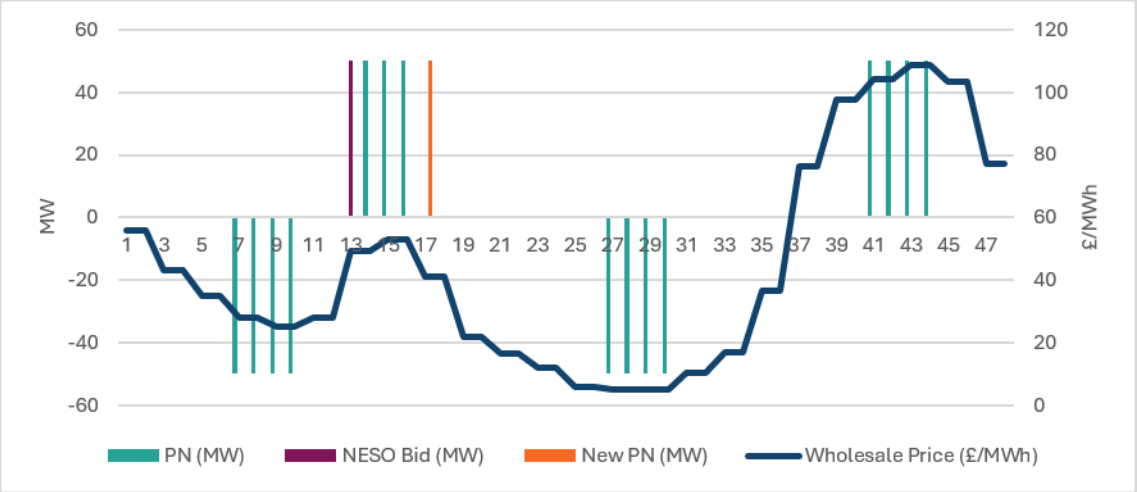

Figure 2 - Bid acceptance at SP13 and new PN at SP17

Stage 3 – Subsequently, NESO accepts another bid to stop the asset exporting in SP14 as the constraint is still active. The asset then again decides to schedule a further export during SP18 following this bid acceptance.

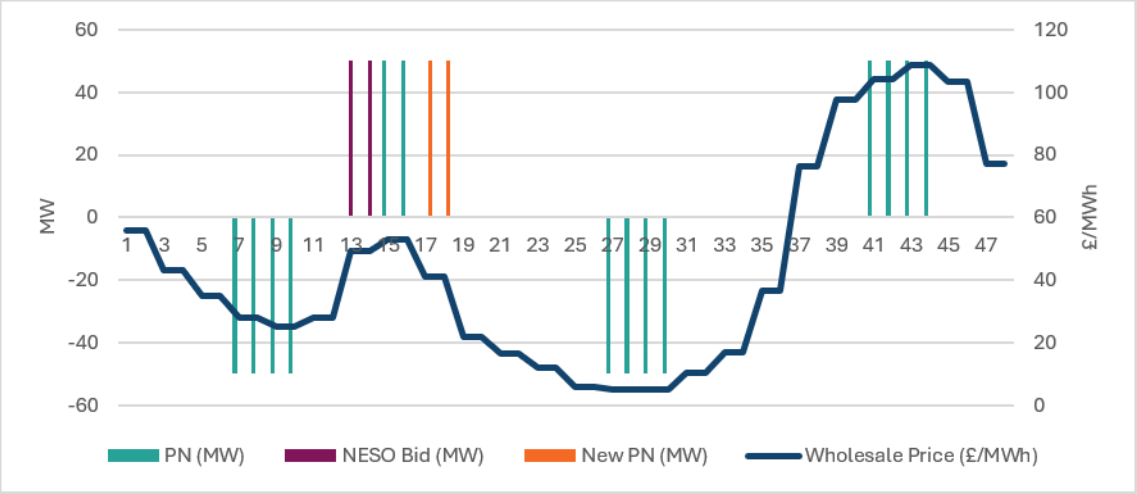

Figure 3 - Bid acceptance at SP14 and new PN at SP18

Stage 4 – The constraint remains active and NESO again accepts a bid to stop the asset exporting in SP15. This time the asset decides that instead of dispatching in SP19, it removes the charge at SP30 due to its forecast of market prices for SP19-26.

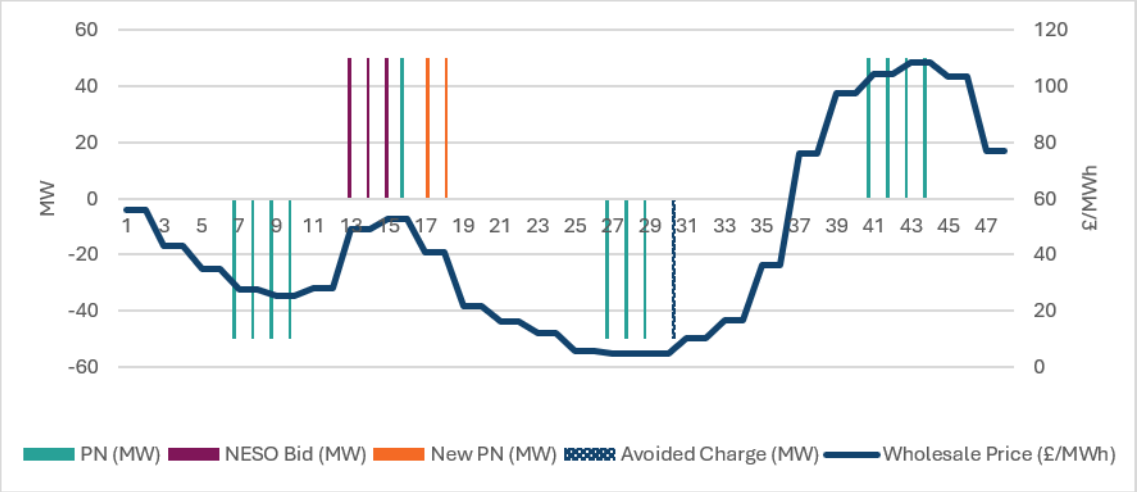

Figure 4 - Bid acceptance SP15 and avoided charge at SP30

Stage 5 – This pattern of the NESO bidding the unit down, and the asset either re-selling the power or removing planned charges continues throughout the day as long as the constraint period stays active and NESO accepts bids on the asset. The state of charge of the asset remains unchanged for long periods as the unit is repeatedly prevented from exporting.

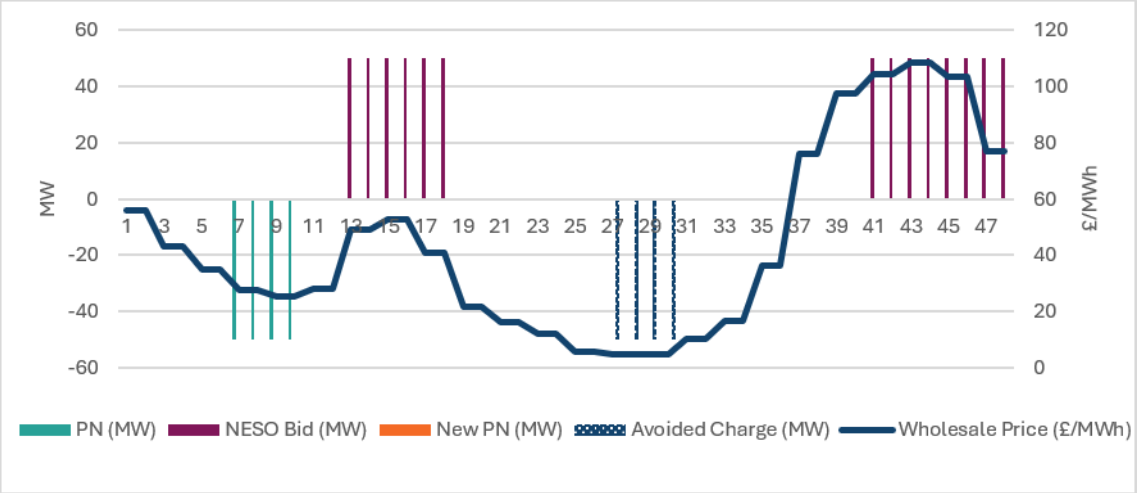

Figure 5 - Schedule of a battery which has Repetitively Re-Traded and had several bid acceptances

2.14 RRT is a consequence of the existing market design, under which storage providers are expected to optimise their schedules in response to national wholesale prices (which may be positive - and so reward market participants for exporting power - even where there is an excess of local generation). As mentioned above it arises from the direct relationship between a bid acceptance and a storage unit's remaining capacity, with every MWh of bid acceptance in one settlement period leading to an additional MWh available for the unit to deliver later in the day.

2.15 It should also be noted that the above example is simplistic and only considers optimisation based on wholesale price signals. In practice, various additional considerations will exist which providers will need to take into account. This

includes the requirements of NESO ancillary service contracts (which – irrespective of any considerations relating to wholesale prices – may require the unit to discharge to meet the required state of charge) and environmental considerations (eg to prevent spilling of an upper reservoir) – see paragraph 2.11 and 2.12.

3. Impact of RRT on Balancing Costs

3.1 RRT results in storage providers repeatedly re-selling the same power while attempting to export behind the transmission constraint, thereby exacerbating the constraint rather than helping to resolve it. As a result, NESO must continue to accept bids so long as the constraint persists, while replacing the energy it expected from the storage asset on the other side of the constraint so as to meet demand needs nationally.

3.2 The effect of RRT is to increase balancing costs. This is primarily due to the cost of replacing the output of the curtailed storage providers. Replacement energy is usually sourced from Combined Cycle Gas Turbine (CCGT) generators in England and Wales, and as a result these costs are driven heavily by the gas price. In contrast, in light of the benefits to storage providers of being able to re-trade power following curtailment, the cost associated with storage providers' bid acceptances will often be negative (ie providers will often pay NESO to be curtailed) or close to zero, such that this element may not contribute substantively to the balancing cost impact of RRT.

3.3 So as to estimate the balancing cost impact of RRT, NESO has conducted analysis using data on revisions to Physical Notifications (PNs) submitted following a system flagged bid acceptance from storage units behind transmission constraints.

3.4 For each storage provider included in the analysis, NESO's methodology[8] identifies settlement periods as representing possible instances of RRT on the basis of the following criteria:

- **Positive FPN** – only periods in which a unit was due to export (as indicated via a positive FPN) are included as potential cases of RRT.
- **System flagged bid accepted** – only periods in which a unit had a system flagged bid accepted are included as potential cases of RRT.
- **PN increased within a given time horizon of a previous bid acceptance** – only periods in relation to which NESO observes the PN being increased following an earlier system flagged bid acceptance in an export period are included as potential cases of RRT. Time horizons of 3, 6 and 12 hours are used in determining the window used to identify PN revisions. To give an example, under

[8] If you have any questions about the NESO methodology, please contact - marketmonitoring@neso.energy

a 3-hour time horizon, a settlement period will only be classified as relating to RRT where one or more system flagged bid acceptance was accepted in the 3 hours prior to that settlement period, and the PN for the settlement period was revised upwards during the 3 hour period following the time of the system flagged bid acceptance. In instances where more than one revision to the PN for a settlement period has been made, it is the net value of any PN changes following the timestamp of the previous system flagged bid acceptance which is considered – ie the sum of any increases or reduction in PN prior to the PN becoming final. If the net value of PN change is negative, then this settlement period is not identified as a possible instance of RRT.

3.5 Where a period is classified as relating to RRT, the relevant RRT volume is then calculated based on the lower of either the bid acceptance volume for that settlement period, or the net volume by which the unit's PN was increased. That volume is then used to calculate the associated balancing cost by multiplying it by the bid price (to reflect the cost to NESO associated with the additional BOA, which may be negative) and an estimate of the weighted average offer price for the settlement period (to reflect an estimate of the cost of replacing the curtailed energy in the BM). The vast majority of the balancing costs in the figures below are as a result of the cost to replace the curtailed energy.

3.6 There are various limitations to the approach used. Most notably, under the analysis, it is assumed that storage assets' schedule will be fixed (and notified via a PN submission) 3, 6 or 12 hours prior to the settlement period – and that any increases to PNs within these periods happen specifically as a result of the previous bid acceptance. It is therefore possible that where upwards revisions to PNs are made for reasons unrelated to an earlier bid acceptance, these will incorrectly be classified as instances of RRT. At the same time, the methodology will not capture instances where RRT results in additional export beyond a 12-hour window, nor instances of RRT arising as a result of units being instructed to pump or charge.

3.7 Furthermore, because of the variation in the offer prices accepted by NESO in any given period, the replacement energy cost that is assumed (based on the weighted average offer price) could be higher or lower than the true cost of replacing the curtailed generation. NESO's methodology also does not account for any second-order effects in wholesale markets arising from the increase in supply (and so potential reduction in prices) as a result of further sell trades in the wholesale market by storage assets.

3.8 Notwithstanding these limitations, we consider the NESO methodology to provide a useful basis for understanding the likely order of magnitude of the potential balancing impact of RRT.

3.9 Based on the 12-hour search window, NESO estimates that the balancing cost impact of RRT from storage assets was approximately £99m in FY 2025/26,

increasing from approximately £64m in FY 2024/25. This increase can be seen below in Figure 6, which shows that the monthly balancing costs that NESO are attributing to RRT has trended upwards over the past two years.

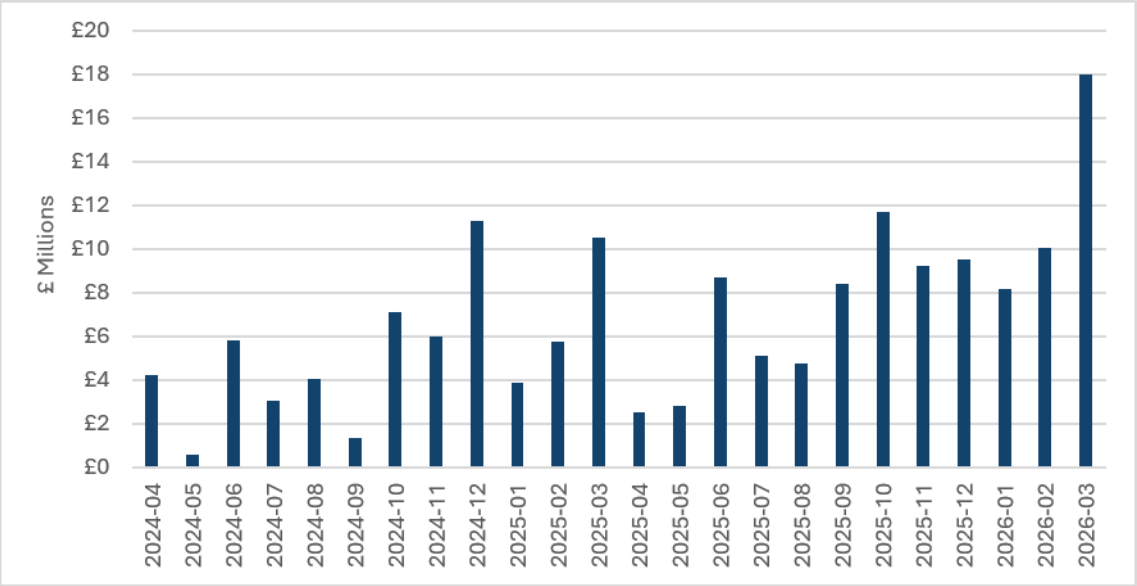

Figure 6 - Monthly balancing cost impact of RRT for storage BMUs in 12-hour search window

3.10 We can also see in Figure 7 that pumped storage make up the majority of balancing costs associated with RRT behaviour (around 80% over the two-year period). However, we are also starting to see a steady increase in the balancing costs associated with RRT relating to battery assets, rising from £0.09m in April 2024 to £3.9m in March 2026. This is due to the increase in volume and size of battery storage that are behind constraints.

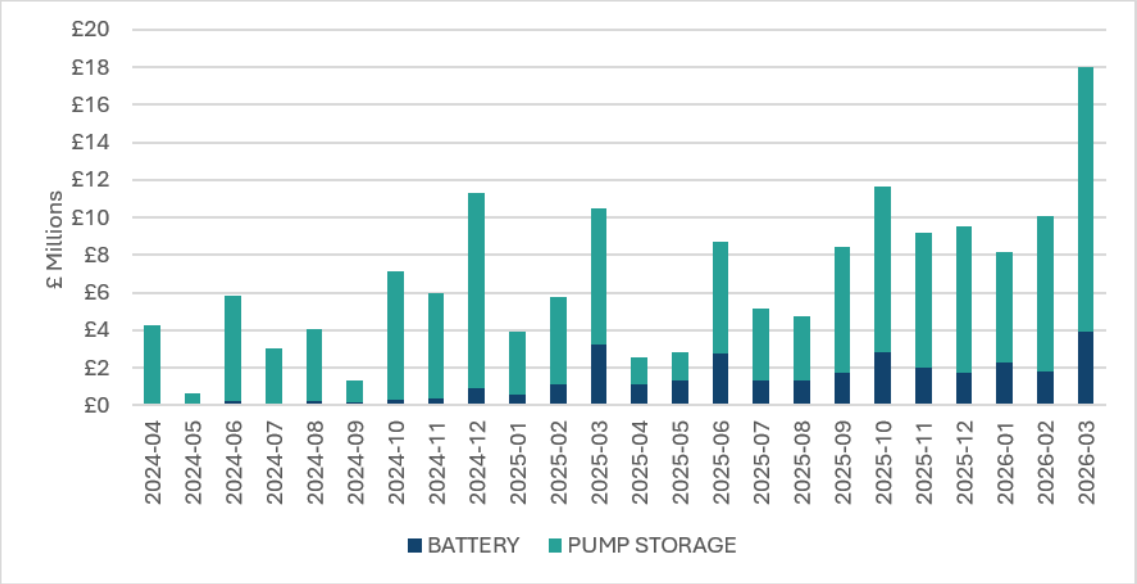

Figure 7 - Monthly balancing cost impact of RRT for pumped storage and battery BMUs using 12-hour search window

3.11 We are also aware that it is not only market signals that drive the battery storage assets to RRT. Some battery storage assets will hold ancillary service contracts with NESO such as Dynamic Containment, Dynamic Moderation, Dynamic Regulation and Quick Reserve and the service terms of these contracts will impact a battery as they must stay within an acceptable range of state of charge or they face non-delivery charges. Therefore, they submit export PNs to NESO repetitively in order to remain within these limits. Estimates from NESO show that the majority balancing cost from battery storage assets associated with RRT are by assets who do hold Ancillary Service contracts (77%).

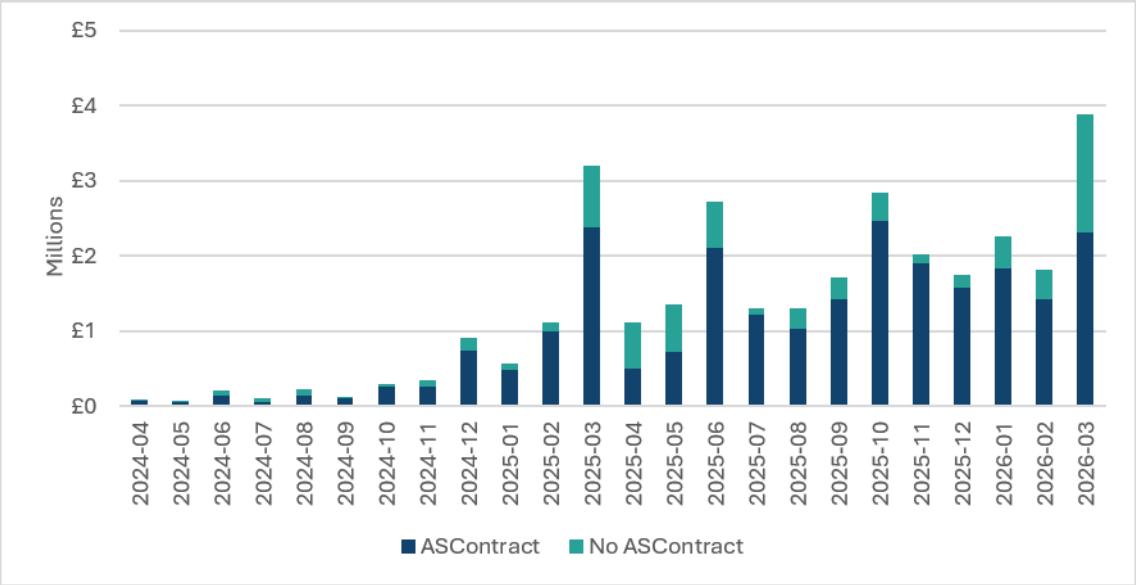

Figure 8 - Monthly balancing cost impact of RRT for battery BMUs with and without ancillary service contracts using 12-hour search window

4. RRT interaction with TCLC and other Market Rules

4.1 As described above, the re-selling and thus re-dispatching behaviour seen in RRT is not prohibited by existing market arrangements, according to which it is the responsibility of storage providers to choose how best to dispatch their assets where additional capacity becomes available following a bid acceptance, in light of the relevant technical constraints and the price signals they observe. However, there are various market rules which govern different aspects of how they must approach the exercise of submitting their PNs and setting their bid prices.

4.2 In this section we set out the rules determining the PN submissions that providers can make under the Grid Code[9] and Regulation on Wholesale Energy Market Integrity and Transparency, as incorporated into UK law (REMIT)[10], and rules around

[9] Grid Code (GC) | National Energy System Operator

[10] Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency (Text with EEA relevance)

bid pricing in constraint periods under the Transmission Constraint Licence Condition (TCLC).

Rules around PN submissions under the Grid Code and REMIT

4.3 The Grid Code is a technical document that sets out the operating procedures and principles governing the relationship between NESO and the users of the National Electricity Transmission System (NETS). It aims to ensure that the NETS is developed, maintained and operated in an efficient, coordinated and economical way. Whilst facilitating competition in the generation and supply of electricity and promoting security and efficiency of the electricity generation, transmission and distribution systems.

4.4 Of particular relevance in the context of RRT is the requirement under the Grid Code BC1.4 that participants (including electricity storage providers) must submit PNs that reflect their best estimate of each of their units' expected input or output of active power.[11] Among other things, this means that it would not be permitted for a storage provider behind a transmission constraint to inform NESO that it expected to export in a subsequent period where it did not in fact intend to do so (or indeed, did not have the capacity to do so) in the event it were not ultimately curtailed. In this scenario, the provider's PN would not reflect their best estimate of expected input or output.

4.5 As well as breaching the Grid Code, were a provider to submit a false or misleading PN this would also be likely to breach the prohibition on market manipulation under REMIT. REMIT protects against market abuse in wholesale gas and electricity markets, including the BM. Any evidence of a market participant engaging in market manipulation will be taken extremely seriously.

4.6 As well as having an obligation to ensure that PNs reflect their best estimate of expected output, providers are also prohibited from dispatching in periods in which it would not otherwise have been economic to do so, with the intent of exacerbating a constraint and benefiting from the subsequent bid payments. In particular, such conduct is also likely to amount to market manipulation or attempted market manipulation under REMIT.

4.7 It is crucial that electricity storage providers (like all generators) have processes in place to ensure that they are compliant with these rules governing how a unit is dispatched, including where employing algorithms to assist with dispatch decisions. For example, protections should be in place to ensure that any algorithms that are used as part of optimisation do not attempt to shift export to periods in which curtailment is considered more likely in light of an anticipated

[11] Physical Notification - Data that describes the **BM Participant**'s best estimate of the expected input or output of **Active Power** of a **BM Unit** and/or (where relevant) **Generating Unit**, except in the instance of a Stage 2 or higher **Network Gas Supply Emergency**, with the accuracy of the **Physical Notification** being commensurate with **Good Industry Practice**.

transmission constraint, to take advantage of the perceived benefit of being bid down in those periods.

Rules around bid pricing under the TCLC

4.8 Separately, although not regulating how units are dispatched, standard condition 20A of the generation licence (the TCLC) does regulate the bid prices that storage providers with an electricity generation license are permitted to submit in transmission constraint periods. In particular, it prohibits generators from obtaining an excessive benefit in relation to a reduction in generation in a constraint period. This means that we expect generation licensees to consider in their bid prices in constraint periods in which they are due to export both the costs and benefits of having a bid accepted - including any benefit associated with its ability to re-trade power (or avoiding payments to charge an asset) in a subsequent settlement period.

4.9 In June 2024 we updated the TCLC guidance[12] to provide generators with a greater level of detail in relation to our expectations regarding compliance with the TCLC. It is the licence condition together with this guidance document that provides the definitive guide to the requirements of the TCLC and the approach that we will take to interpreting and enforcing it, and we do not seek to replicate it here. Instead, in what follows we provide some commentary on how we would normally expect to apply different parts of the guidance to the specific case of a storage asset in a constraint period, including in the context of RRT.

4.10 As the guidance describes, a primary consideration in our assessment of whether a bid price is excessive will be the costs and benefits incurred (or expected) by the generator as a result of having a bid accepted,[13] and we would expect storage providers to set their bid prices in transmission constraint periods with reference to an assessment of these expected costs and benefits. The guidance sets out some non-exhaustive examples of different types of costs and benefits which may be relevant for storage assets:[14]

- The revenues associated with greater potential to generate in future periods, or the benefit associated with an avoided pump / charge.
- Any opportunity cost associated with reduced potential to pump/charge in future periods.
- When storage assets are close to full capacity, costs associated with spill for pumped storage / hydro assets and non-delivery of NESO ancillary services.

[12] Transmission Constraint Licence Condition (TCLC) Guidance
[13] 2024 TCLC Guidance, para 2.31
[14] 2024 TCLC Guidance, Table 1

- Cost of potential imbalance where timing of the bid means that the contracted position (as reflected in the FPN) for a subsequent period can't be delivered.
- Risk premium associated with movement in intraday or imbalance prices compared to forecasts.

4.11 In some cases, these costs and benefits may be subject to uncertainty. For example, at the time of setting bid prices, a storage provider may need to estimate the opportunity cost of foregone pumping / charging revenue or the opportunity benefit of additional generation revenue based on price forecasts – which may turn out to be inaccurate. As the guidance makes clear, in such circumstances, it is important that any assumptions made to estimate the costs or benefits associated with a bid acceptance are based on a robust methodology and are well-documented. Licensees should use realistic rather than 'worst-case' assumptions.

4.12 Applying the guidance to the specific context of storage providers and RRT, we would normally expect that:

- Bid prices should reflect the expected (or mean) value of any additional generation revenue resulting from a bid acceptance in a constraint period given price forecasts at the time – which may depend on whether the bid is expected to result in extra discharge/generation or to result in the avoidance of a charge/pump. A conservative method to calculating the value of this benefit that used only a "lower bound" based on, eg the minimum forecast intraday price over a set time horizon, may result in a provider underestimating the true expected benefit of a bid acceptance.
- Any risk premium that is included in bid prices should properly reflect the extent of the risk that is faced. For example, where the risk relates to errors in forecast prices, the premium chosen should reflect that prices may outturn higher or lower than forecast – and so the provider may ultimately benefit as well as lose out from an inaccuracy.
- Where bid prices are being set to reflect the costs associated with non-delivery of ancillary services due to the state-of-charge impact of a bid acceptance, the bid price should accurately reflect the expected cost of non-delivery, and should not be set at an inflated level with the intent of discouraging bid instructions (as on occasion NESO may have no choice but to bid the unit down, even where prices are set at an elevated level).

4.13 In addition to the cost and benefits of being bid down, the guidance also explains that generators may choose to seek to recover a reasonable level of profit and/or contribution to indirect costs via their bid prices.

4.14 The guidance makes clear that what constitutes a reasonable profit on bid acceptances in constraint periods is contingent upon the specific circumstances

of each case. No explicit limit exists regarding the acceptable profit allowance in £/MWh or percentage terms. The key requirement is that any profit margin in £/MWh that is included in bid prices should be such that the overall profit on bids in £ that is obtained by the licensee in constraint periods is not significantly greater than that which would have been expected absent a constraint. It is this requirement that we expect licensees to focus on when considering their compliance (and which would be the subject of any investigation).

4.15 Again, applying the guidance on reasonable profit in the context of storage providers in constrained areas of the transmission system, we would normally expect that:

- In general, due to their flexibility and likely position in the merit order, storage providers would be likely to be successful in having material volumes of bids accepted – thereby generating a profit on bids in the BM – even absent a constraint. Given this, it is likely to be reasonable for storage providers to include within their bid prices in constraint periods a profit margin above direct costs.
- The level of profit that would be expected absent a constraint is likely to be subject to uncertainty, such that it may be difficult to reach a firm view on the relevant benchmark. However, this uncertainty does not mean that licensees should not take steps to form a view on the profit which would be expected absent a constraint with reference to the different comparators available – particularly where the volume of bid acceptances is significant.
- It is important to emphasise that the relevant comparator is not the level of profit required to meet the developer's expectations or a stated rate of return, nor the level of profit required to keep the unit financially viable. While profits at this level may be reasonable, the use of such comparators without consideration of the counterfactual set out in the guidance (ie the profit which would be expected absent a constraint) could result in a benefit being obtained due to the constraint that is significantly greater than would otherwise be expected, causing assets in constrained areas to be advantaged compared to those in other areas.
- Similarly, given the wording of the licence condition and the guidance, it is the profits earned directly from bids which are relevant in assessing compliance with the TCLC. When determining what constitutes a reasonable profit absent the constraint, we would therefore not normally expect to take into account any perceived lost profits from offers that a generator might consider to have been available if the constraint did not exist.
- Absent a constraint, we would not expect to see significant patterns of RRT – as NESO would not in such circumstances have a need to repeatedly bid a unit down wherever it intends to export. Given this, it is important that licensees take

the expected volume of bid acceptances into account in their bid prices, to avoid a scenario where – even if profit margins in £/MWh are relatively low – they nevertheless obtain substantially higher profits compared to what would be expected absent a constraint as a result of large volumes of bid acceptances. This may mean, for example, that to ensure compliance where RRT occurs, storage providers may take steps to ensure that the profit margin included in any given settlement period is very low (reflecting the high volume of expected bids), or alternatively, decide to – following an initial bid acceptance at a higher profit margin – set subsequent bid prices very close to the expected re-trade price, with little or no profit margin included.

- In general, where there is evidence of licenced storage assets in constrained areas obtaining profits on bids in the BM that are significantly and persistently greater than those of assets in non-constrained areas, that may (in the absence of any other factors driving the difference in apparent profitability) raise concerns and could suggest that those assets are not being priced in a way that properly reflects the volume of bid acceptances.

4.16 We recognise that even with the level of detail provided in the existing TCLC guidance and the commentary included in this note; there are areas where storage providers may desire more certainty as to the approach they should take when setting bid prices in the context of RRT. A trade off exists between providing further specific guidance, and overly prescriptive guidance resulting in flexibility being lost in terms of providers (and Ofgem) being able to assess whether a bid price is excessive in light of the specific facts of each case. If there are any particular areas in relation to which licensees consider further formal guidance would be beneficial, we would be happy to consider these and remain willing to consult on updated guidance if necessary.

5. Interventions to address RRT

5.1 It is important that market arrangements work effectively and incentivise behaviours which are in line with system needs and do not create additional costs to consumers. As a result, we are working with both NESO and Department for Energy Security and Net Zero (DESNZ) on several options which look to incentivise storage assets to charge and discharge in an effective manner and hence mitigate the negative system impacts associated with RRT. We expect that some of this work will deliver short-term benefits, whereas other options may involve more material changes to market and dispatch arrangements which are likely to be more long-term pieces of work.

5.2 As described above, the TCLC stipulates that generation licence holders must not secure excessive benefits from bids during constraint periods. However, its role is to protect against the exercise of market power by generators situated behind transmission constraints, and it does not regulate dispatch behaviour of assets nor

the replacement of energy following a unit being curtailed. RRT by storage assets would be expected even where those assets are fully compliant with the TCLC, as the incentive to re-dispatch following a bid acceptance where wholesale prices are positive will exist even when the benefit that providers are obtaining on bids in these periods is sufficiently low that it could not be considered excessive. Given this we do not consider that the TCLC (or an expansion to it) can itself solve the negative system impact of RRT.

5.3 Through DESNZ's Reformed National Pricing (RNP) Delivery Plan, there is a programme of work aimed at improving the utilisation of storage.[15] As part of this, NESO has recently initiated a project called "Storage behind Constraints" which involves an operational review of how NESO dispatches storage positioned behind constraints. The purpose is to fulfil NESO's licensing obligation to balance the system in an economic and efficient manner. This review will assess various approaches to optimising operational practices within NESO's control room, aiming to lower constraint costs attributable to storage assets under the current market structure and regulatory environment. Options being considered include changes to storage behaviour in the BM, changes to decision making in NESO's control room, new markets to change storage behaviour and options that reduce the need to redispatch storage assets.

5.4 While the project does not focus exclusively on RRT, resolving the inefficiencies and system cost arising as a result of RRT are a key consideration. We expect the project to result in an enhanced dispatch process for storage behind constraints, ensuring that the way that storage units are being dispatched helps to resolve rather than exacerbates constraints, and so in this way helping to reduce related balancing costs.

5.5 In addition, NESO's RNP Call for Input[16] has also highlighted the challenge created by RRT in terms of efficient locational optimisation of flexible assets. As part of this longer-term work, NESO, Ofgem, and DESNZ will continue to examine a range of balancing and dispatch arrangements with the objective of improving system operability and reducing consumer costs. We would expect any deeper reform to dispatch arrangements that does take place to address the inefficiencies created by RRT. For example, unit schedules could be set for extended periods in a manner consistent with system constraints, as opposed to the present incremental half-hourly bid and offer acceptances in the BM. Such changes would have implications for RRT without necessitating explicit restrictions on re-trading. Accordingly, we expect that any impact assessment conducted regarding potential changes to dispatch arrangements should explicitly consider their implications for RRT.

[15] Reformed National Pricing (RNP): delivery plan

[16] Reformed National Pricing Call for Input (CfI) | National Energy System Operator

5.6 There are also several projects ongoing outside of RNP which may indirectly have an impact on RRT, such as the introduction of GC0166[17] parameters which will give the control room greater visibility of the available capacity storage assets have. Thus, enabling NESO to better understand the impact balancing actions will have on redispatch behaviour from storage assets. Also, NESO are reviewing locational procurement of response and reserve services.[18] This looks to ensure that NESO are not procuring response and reserve in areas where delivery is restricted by thermal or stability constraints. As a result, this may impact the number of storage assets behind a constraint with response and reserve contracts thus impacting one of the incentives of RRT.

5.7 Given the programme of work set out above, Ofgem considers that there is sufficient work underway that looks to reduce the negative system impacts caused by RRT, such that additional, separate, policy development by Ofgem would be duplicative, and is not required at this time. In parallel with these ongoing projects, Ofgem will continue to monitor market participants' conduct in the Balancing Mechanism with regards to the TCLC and other market rules. We are conscious that – were storage providers to set bid prices in a way that resulted in them obtaining an excessive benefit in constraint periods – that is likely to increase the incentive to redispatch behind transmission constraints and so could in this way reinforce existing market signals. We will not hesitate to act if we see excessive pricing in constraint periods, or other signs of non-compliance and may consider further regulatory intervention to ensure consumers are protected in the event that the system costs arising from RRT remain unaddressed.

[17] GC0166: Introducing new Balancing Mechanism Parameters for Limited Duration Assets | National Energy System Operator

[18] NESO: Locational Procurement