Steve McMahon
Ofgem, Deputy Director for Onshore Networks
10 South Colonnade,
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London, E14 4PU

12 May 2023

Dear Steve,

Re: Ofgem support for energy storage connections tactical response

Thank you for attending the Strategic Connections Group (SCG) meeting on 21 March 2023. In that meeting we discussed the challenges that the large volume of industrial-scale batteries is creating. Given the collective agreement for urgent action, the connections subgroup presented a range of 'tactical response' solutions that can be delivered quickly. The agreed next step was for us to put these to you in a letter along with supporting information, so Ofgem could then issue a letter of support for their implementation.

This summary cover letter and appendix provide that agreed information. The level of information we have provided is commensurate with the short timescales and the fact that we are not, at this stage, proposing any code modifications or seeking derogations.

The challenge

The volume of connected and contracted industrial-scale batteries on the transmission and distribution network has grown significantly over the last 12 months, and now totals over 120GW (including hybrid sites[1]). To provide context to this scale, this is double the GB electricity peak demand and six times the highest 2030 battery forecast from the 2022 NGESO GB Future Energy Scenarios (FES). This volume continues to increase.

The challenge primarily arises due to their access rights and operation. Under current arrangements, batteries almost universally request and have connections which provide 'firm' access[2] for their full import and full export, even though they rarely use it – our analysis shows average industrial-scale battery capacity utilisation is just 4.6%, and ~80% of their contracted capacity sits idle for ~95% of the time. Yet because their operation is often unpredictable[3] and because their firm access rights mean they have the right to use their capacity at any time, there are risks of DNOs using diversity factors[4] to enable better sharing of this under-utilised capacity with other customers. In summary, the combination of battery volume, firm access rights, low utilisation, and low operational predictability results in a large volume of network capacity that has little utilisation yet can't be used by other customers.

[1] For example, a site which includes storage and solar PV generation.
[2] Our understanding is that this is to enable participation in ESO frequency response markets, although these are currently fully served by around 1GW of existing connected storage.
[3] This is both a function of the system services they provide and limited DNO experience of battery operational behaviour.
[4] Diversity is explained on page 9.

The outcome is that, in many areas, there is little spare network capacity for the societal decarbonisation that is essential to achieving legislated Net Zero targets; over 70% of GB grid supply points (GSPs) are now contractually constrained due to transmission constraints and there are many distribution network constraints. These network constraints are a barrier to the connection of the EVs, heat pumps, and renewable generation we need to decarbonise.

This is a problem we face now. Without intervention this problem will continue to grow as the number of connected and contracted-to-connect batteries increases.[5]

Proposed response

Solving this challenge by creating significant additional network capacity is likely to be uneconomical: as batteries make little use of their contracted capacity, this would potentially create additional capacity that is paid for by all customers that is very underutilised – this is inefficient and increases customers' bills. We need solutions that reflect the role of batteries in the system and their operational profiles – we need solutions that make better use of this large volume of contracted but under-utilised battery capacity and avoid the triggering of unnecessary reinforcements.

To do this, we plan a two-phase response targeting industrial-scale energy storage customers seeking a connection to the distribution network.[6] First, an initial 'tactical response' consisting of four solutions we presented in the March SCG.[7] These are characterised by changes we can implement quickly by working within existing code and licence interpretations. These buy time, slow the rate at which the situation deteriorates further, and stop the immediate triggering of unnecessary reinforcement. This letter is about this tactical response. Second, in the medium-term and pending the outcome from the 'tactical response' phase, we may develop more far reaching solutions as well as code modifications to cement the interpretations from the tactical response phase. This second phase will be supported by appropriate levels of justification and stakeholder engagement.

The four proposed tactical response solutions are:

1. DNOs to adopt a common interpretation of 'firm' network access rights for new storage customers, which are much more in line with generation access rights. These proposed storage access rights are lower than what most DNOs would currently class as 'firm' for storage customers. This reduces the risk of having to create additional network capacity that is likely to be very lightly utilised and, combined with Solution 2, it enables better use of existing network capacity (meaning GB customers can decarbonise more quickly and at lower cost). Overall network investment is more efficient.
2. Greater commonality across DNOs in the application of diversity principles when establishing how much network capacity is needed to accommodate storage import requirements (under EREC P2/8), and the ability to curtail[8] new storage customers as mitigation against the risks of doing so. This greater use of diversity releases some of the existing contracted but underutilised capacity for use by other customers, and helps DNOs to only build new capacity if it's needed – both these are in GB customers' interests.

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[5] One DNO licence area recently contracted 750MW of new batteries in just one month.
[6] The solutions only target distribution storage as transmission storage is already being addressed through other routes.
[7] We presented a fifth potential solution which would require batteries to submit day/week-ahead profiles. We are not taking this forward as a tactical response but may develop this in the next phase of work.
[8] For the avoidance of confusion, this document only uses the capitalised terms "Curtail" and "Curtailment" where it is explicitly and solely referring to customers with Access SCR Curtailable Connections. For all other use cases, or where it does not matter if the customer has an Access SCR Curtailable Connection or another connection arrangement, the uncapitalised terms "curtail" and "curtailment" are used to describe the act of reducing a customer's import/export to a level below their contracted capacity.

3. Include Distribution Future Energy Scenario (DFES) forecast low voltage (LV) network demand and generation growth when assessing connection applications for all large customers, including storage. This safeguards some existing capacity for societal decarbonisation, meaning GB customers face fewer barriers transitioning to low carbon technologies (LCTs).
4. Ofgem to direct a different Access and Forward-Looking Charges Significant Code Review (Access SCR) Curtailment Limit methodology, to reduce the customer-funded expenditure necessary to keep storage customers within their Curtailment Limit. This protects GB customers from the increased network costs that could result from the higher volumes of non-firm storage connections resulting from the shortage of distribution network capacity.

The attached appendix explains these four solutions further. Between them, they are primarily about trying to get better use out of existing network capacity, avoiding investments to add capacity until we can be sure they're beneficial, and protecting the wider customer base from some of the network cost impacts of the extraordinarily high volumes of storage. Where appropriate, the solutions mirror changes that are already being progressed at transmission for the same reason.

Next steps

As discussed in the March SCG, we would welcome a letter of support from Ofgem for these four solutions so we can initiate their implementation. Given the scale and urgency of the problem, we request this letter by 9 June 2023 please, so we can start to deliver these solutions and their benefits over the summer.

These four tactical response solutions won't by themselves resolve the whole issue – they are immediate practical steps we can take to buy some time and avoid immediately triggering unnecessary reinforcement. Industry will need to go further as part of the next phase of work, potentially including retrospective changes to access arrangements for existing customers where these are in GB customers' interests. Failing to make these changes will result in inefficient network development that will cost customers more, and divert DNO and supply chain resource away from delivering the interventions GB customers need for a safe, efficient, reliable, and decarbonised supply of electricity.

We look forward to continuing to work with you on this. Should you have any queries please don't hesitate to contact me.

Yours sincerely,

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Appendix A – supporting information

The challenge

As of March 2023, there was 122GW of connected and contracted industrial-scale batteries in GB (82GW at transmission, 40GW at distribution)[9] – lefthand map in Figure 1. Largely because of this, over 70% of GB GSPs now have constraints – righthand map in Figure 1.

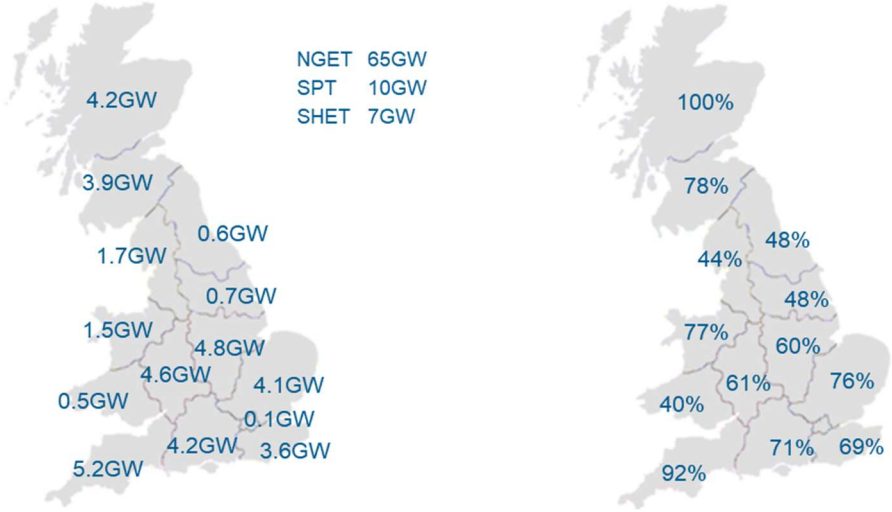

Figure 1: As of March 2023, connected and contracted industrial-scale batteries (left) and percentage of GSPs impacted by transmission constraints (right)

Such network constraints have a real adverse impact on customers. Not only do they inhibit general demand growth, but they are a major barrier to customer decarbonisation as EV chargers, heat pumps, and renewable generation all need network capacity. As an example, renewable generation projects of just 1MVA are being offered 2037 connection dates in some areas due to GSP constraints. Interim and 2050 Net Zero targets will likely not be achieved if such barriers remain.

To find the right solutions, it is important to understand that batteries contribute to these network constraints due to a combination of three factors:

1. **The volume** of connected and contracted batteries. The current figure of 122GW is double the GB peak demand, and six times higher than the highest 2030 forecast from the most recent NGESO GB FES. This figure continues to increase.
2. **Their firm access rights**. Most batteries have 'firm' access for their full import and export capacity, e.g. a 50MW battery has 50MW of firm export capacity and 50MW of firm import capacity. This usually means they can use this capacity anytime they choose.[10]
3. **Their operational profiles**. Batteries typically have very low duty levels and their capacity use has low predictability (DNOs can't predict when they're going to be importing or exporting or by how much).

The low predictability is primarily a function of the frequency, balancing, and other system support services batteries often provide (e.g. frequency deviations are not predictable) but in part also reflects limited DNO experience of battery operational behaviour. The low duty levels are illustrated in Figure 2, which shows duration curves for batteries and four other customer types. Duration curves represent how much of their

[9] These figures include hybrid sites.
[10] There is no single common definition of 'firm' – this is explained on page 6.

contracted import and/or export capacity a customer uses over a 12 month period (the 'average utilisation').[11] The area between the curve and the x-axis represents this average utilisation – the larger the area, the greater use they make of their contracted capacity. The customer type duration curves were produced by averaging several customers so that they are representative – 23 for the battery curve, 15 for solar PV, 10 for wind, 10 for industrial, and circa 50,000 for domestic. All curves are for distribution-connected customers.

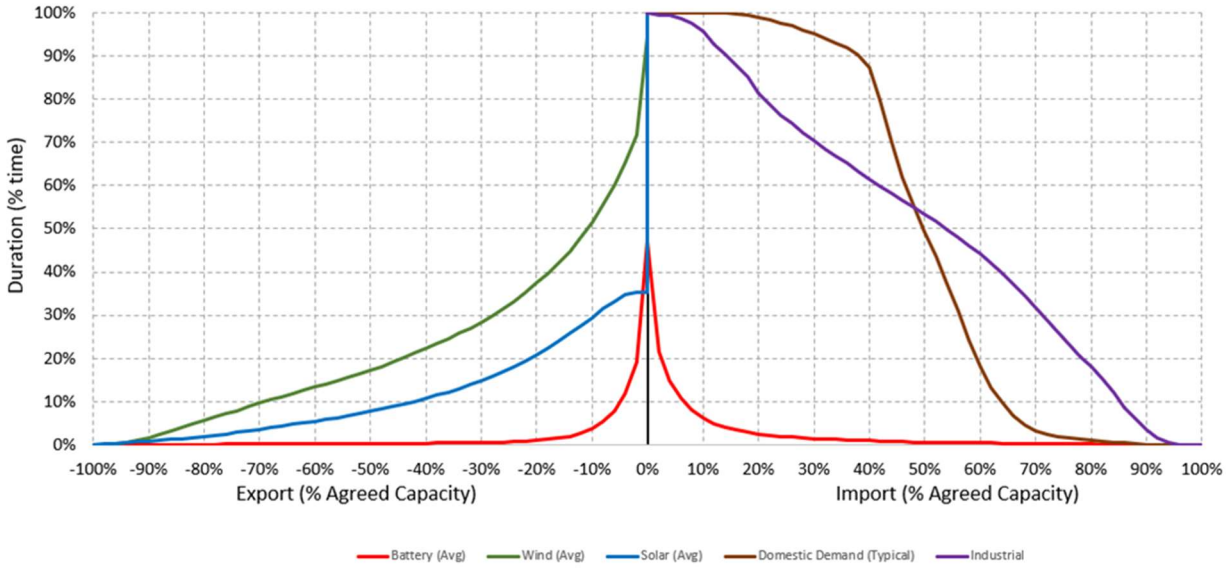

Figure 2: Distribution battery duration (utilisation) curves compared to other distribution customer types

Figure 2 shows that batteries make very limited use of their contracted capacity compared to other customer types: they have an average utilisation of just 4.6%, and **~80% of their contracted capacity is sitting idle for ~95% of the time**. Yet because their operation is unpredictable and they have firm access rights, it can be risky for DNOs to reallocate this under-utilised capacity to other customers when it's not being used.

In comparison, other customer types make greater use of their capacity – the average utilisation is 11% for solar PV, 22% for wind, 51% for industrial, and 51% for domestic. Whilst the average utilisation for solar PV sites is also low, it has less of an impact as their utilisation is far more predictable – e.g. DNOs know they won't use their contracted capacity at night, meaning they can safely allow other customers to use it during that period. It's much harder for DNOs to do this for batteries because their operation has much less predictability.

In summary and in the absence of solutions, the combination of battery volume, access rights, and operational behaviour creates the outcome where **there is little spare firm network capacity for other customers even though at any one moment in time there is likely ample available capacity**. This shortage of firm capacity is a barrier to general customer demand growth and decarbonisation. Without intervention this problem will continue to grow as the number of connected and contracted batteries increases (the Electricity Act 1989 compels DNOs/ESO to continue offering connections) and become more pressing as society tries to decarbonise.

The proposed tactical response solutions tackle both some of the underlying causes (such as access rights) and the problems that manifest (such as a lack of capacity being reserved for societal decarbonisation). Another subgroup is focusing on storage volume, primarily through better queue management. The solutions proposed in this letter target all storage rather than just batteries, as the problems are primarily due to the

[11] Individual domestic customers don't have contracted capacity in the same way that the other four customer types shown in Figure 2 do. So in order to do a like-for-like comparison for Figure 2, for the domestic customer trace, the 100% import capacity point on the x-axis equates to the maximum EREC P2/8 Group Demand of the 50,000 domestic customers.

unpredictable nature of many of the system services that storage technologies can provide rather than battery technology itself.

Our proposed solutions will help free up and make better use of existing network capacity, ensure DNOs are only creating additional network capacity where it is really needed, and protect the wider customer base from some of the network cost impacts of the extraordinarily high volumes of storage.

Prohibition of Discrimination

Solutions 1, 2, and 3 propose to treat new storage differently to how storage has been treated in the past. Solution 4 proposes to treat new storage differently to other customer types.

Distribution Standard Licence Condition (SLC) 19.1 prohibits DNOs from discriminating "between any person or class or classes of persons…in carrying out works for the purposes of connection to the licensee's Distribution System." Ofgem has recognised that "in practice this means a network operator cannot unduly discriminate between one type of customer and another."[12] We consider that the treatment we are proposing can be objectively justified due to the operational profiles of storage customers, as described above, and to ensure compliance with the licensee's overarching statutory duty in Section 9 of the Electricity Act 1989 to "develop and maintain an efficient, coordinated and economical system of electricity distribution." We would also note:

1. Solutions 1 and 2 will more closely align the treatment of new storage with other types of generation. This is appropriate as storage is licensed as generation, and the similarities have been recognised by Ofgem (and are described in footnotes 19 and 20). We are harmonising and converging the treatment of new storage with other types of generation – this is not discriminatory.
2. Solution 3 applies to all new customer types and so does not discriminate against storage.
3. Solution 4 does specifically target new storage, but we believe this is justified due to the characteristics of this group of customers and is proportionate to the impact that storage is having on the system.

For the reasons we have set out above and in the remainder of this letter, we consider that not making any changes to address the issues identified would result in a less efficient and coordinated system being developed that would ultimately cost GB customers more. We therefore consider that we are acting in furtherance of our statutory duties in making these proposals.

For these reasons, looking at the specific circumstances surrounding storage connections and the regulatory framework as a whole, we consider the proposed solutions are compliant with SLC 19.

Solution 1 – clarifying network access rights for new distribution storage connections

When a customer applies for a connection, the DNO must identify the Minimum Scheme to connect them to the network. The Minimum Scheme is defined in DCUSA[13], and is the lowest overall capital cost solution to connect the customer's required capacity.

A customer's Minimum Scheme is dependent on the network access rights[14] provided to the customer – the 'firmer' their network access rights, then the greater the security of supply, and so cost, of the network solution to connect the customer.

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[12] See A guide to electricity distribution connections policy (ofgem.gov.uk), para 3.3.
[13] Paragraph 1.1 of Schedule 22D of DCUSA V15.1.
[14] Network access rights are separate to and distinct from the security of a customer's sole-use extension assets.

Industry and Ofgem have traditionally used the terms 'firm' and 'non-firm' to describe network access rights. There is no single common definition as to what these terms mean. As a result of this and the desire to be accommodating of individual customer requirements, a range of interpretations and access right arrangements have naturally arisen. In some cases, DNOs have reasonably based their interpretation on the EREC P2 planning standard. This has resulted in affording individual storage customers a very high level of 'firmness' that was originally developed and economically justified for groups of customers (e.g. whole towns) or large industrial customers, for whom the value of supply security is much greater than storage (see footnote 19).

Continuing this approach risks affording inappropriately high levels of access right 'firmness' to storage customers. This would adversely impact GB customers in three ways:

1. Higher levels of firmness typically require greater levels of network investment, much of which is socialised across all customers (especially post-Access SCR) – i.e. customer bills will be higher.
2. Delivering this increased network investment will divert valuable DNO and supply chain resource away from delivering the interventions customers need to enable Net Zero.
3. A higher level of firmness increases the amount of network capacity a storage customer reserves. This is because it reduces the DNOs' ability to apply diversity assumptions[15] to share the large volume of underutilised network capacity reserved for storage with other customers.

In summary, continuing the current approach adversely impacts GB customers: they're picking up the bill for potentially uneconomical storage reinforcements whilst those same storage sites may block out the network capacity and resource that GB customers need to decarbonise.

Solution 1: DNOs to adopt a common interpretation of the network access rights that new storage customers have with a 'firm' connection, which are much more in line with existing firm generation access rights. These are: a firm storage customer's capacity can be curtailed during abnormal system conditions (e.g. n-1, n-2 etc), but shouldn't ordinarily be curtailed during system intact conditions. All such curtailment would be uncompensated. These access rights apply to both import and export capacity. This solution would apply to all storage connection applications and storage modification applications received from 31 August 2023[16], that meet the DCUSA definition of "Generation Connection"[17], and who are not one of the customer types listed in paragraph 1.3 of DCUSA (v15.1) Schedule 2D[18].

This solution benefits GB customers as these network access rights are lower than what most DNOs would currently class as 'firm' for storage customers. This means the Minimum Scheme and new network investment required to accommodate storage sites are reduced. This in turn reduces the risk of having to create additional capacity which is very lightly utilised. This solution also, when combined with Solution 2, enables better use of existing network capacity (meaning GB customers can decarbonise more quickly and at lower cost). In summary, customer-funded network investment is more efficient.

Justification and notes:

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[15] Diversity assumptions are explained on page 9.
[16] All proposed implementation dates depend on receiving Ofgem's letter of support on or soon after 9 June 2023.
[17] The definition of "Generation Connection" from DCUSA (v15.1) Schedule 22: "*means a connection to a Premises where the primary purpose of the Premises is wholly or mainly Electricity Generation and/or Electricity Storage. In determining such primary purpose we will consider: i. if the Maximum Capacity of the connection of the Premises to the Distribution System for export is greater than the Maximum Capacity for import; ii. if the Premises has a Generation Licence; iii. if the Premises has a Generation Licence Exemption; and/or iv. any other information we consider relevant.*"
[18] I.e. Solution 1 does not apply to *"(a) domestic and non-domestic Customers that are billed on an aggregated and non-site-specific basis or who are metered directly using whole current meters; or (b) Unmetered Supplies.*"

- This solution much more closely aligns the import and export access rights of storage with generation export rather than with demand. This is appropriate as storage, whether importing or exporting, is much more similar to generation (in that its purpose is to realise value from importing/exporting/trading energy) than to final demand (i.e. consumption). This can be evidenced by their relative VoLL values[19] and relative fungibility[20]. This similarity was recognised in Ofgem's Access SCR Final Decision in May 2022 (paragraphs 3.43 to 3.49); as a result DCUSA's Common Connection Charging Methodology now treats electricity storage as generation for reinforcement cost apportionment and the High-Cost Project Threshold. This similarity with generation is also reflected in the licencing regime, where storage is licensed as generation.
- Paragraph 1.1 of the Common Connection Charging Methodology (Schedule 22 of DCUSA) says that a customer's Minimum Scheme "shall be consistent with our [the DNO] statutory and licence obligations including the requirement to develop, maintain and operate an efficient, co-ordinated and economical electricity Distribution System." Solution 1 helps DNOs better meet this requirement by supporting more efficient network planning and reducing the development of network which is likely to be very lightly utilised. Network investment is more reflective of its socio-economic value.
- This solution ensures the same degree of access rights are provided to the import and the export of storage – as is not always the case now – this is logical considering the nature of storage.
- The Electricity Act 1989, Distribution Standard Licence Conditions, DCUSA, and Distribution Code do not detail what access rights a DNO should provide a customer, and therefore do not appear to prohibit Solution 1.
- Solution 1 causes minimal disruption to the established connections process – if there is insufficient existing network capacity to deliver a Solution 1 'firm' connection (as described above) then current arrangements will apply: the storage customer may be offered to connect on a 'non-firm'[21] basis (which could include curtailing the customer during system intact conditions) until the Minimum Scheme is complete. A customer can still request to connect 'non-firm' on an enduring basis if they are unwilling to accept the costs of a Solution 1 'firm' connection.
- As per current arrangements and in line with other customer types, the Minimum Scheme for a Solution 1 'firm' connection shall deliver single circuit extension assets. Storage customers are welcome to apply for higher security extension assets; any assets in addition to the Minimum Scheme would be classed as an Enhanced scheme. Doing this would not provide greater network access rights for the storage customer[22], and storage customers would not be permitted to request a higher level of 'firmness' than that provided by the Solution 1 definition of 'firm'.
- As per current practice, any curtailment of the storage customer would be to stop them creating a new, or exacerbating an existing, distribution network capacity issue.

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[19] Value of Lost Load (VoLL) is a good measure of the socio-economic value of access rights and supply security. The RIIO-ED2 VoLL for demand is £21,000/MWh. There is no official VoLL for generation, but it's likely to equate to the wholesale value of lost export - usually <£300/MWh (source: https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators). There is no official VoLL for storage, but it's likely to equate to lost service revenue or a less optimal arbitrage value – this is unlikely to be more than a few hundred pounds per MWh. This means the VoLL for storage is likely two orders of magnitude lower than that of final demand, and similar to that of generation. The socio-economic quantification of access rights for storage and generation are therefore similar, and thus the access rights of storage should align to those for generation.

[20] Storage, like generation, is broadly fungible, i.e. so long as sufficient storage with appropriate technical parameters is able to operate across the system, which particular units are operating is not critical. In contrast, final demand is broadly non-fungible: electricity used for societal or economic purposes such as heating, transport, or manufacturing would be hindered by insufficient access rights. Whilst some reduction or time-shifting of electricity consumption is possible for some final demand customers, this tends to be limited before it becomes unacceptable. Locational-shifting is rarely possible as it is with storage or generation.

[21] By 'non-firm', we mean a connection with lower network access rights than a 'firm' connection ('firm' as defined by the Solution 1 proposal).

[22] Network access rights are separate to and distinct from the security of a customer's sole-use extension assets.

- Solution 1 and Solution 2 are mutually supporting – Solution 1 enables the full benefits of Solution 2 by allowing DNOs to make greater use of diversity assumptions by reducing their potential impact, and Solution 2 enables the full benefits of Solution 1 by enabling DNOs to build less capacity by providing a less onerous route to EREC P2/8 compliance. The benefits of one solution cannot be fully realised without the other.
- If this proposed solution is acceptable to Ofgem, the next step after Ofgem's letter of support would be to communicate this to industry.

Solution 2 – EREC P2/8 distribution storage diversity assumptions

EREC P2/8 is the primary distribution planning standard that determines the capacity and security of supply of the distribution network to secure demand. This means it informs the network capacity and Minimum Scheme required to accommodate the import[23] capacity of a storage customer. DNOs are mandated to comply with EREC P2/8 as a licence obligation and by the Distribution Code.

A fundamental principle of EREC P2/8 and network planning is diversity. Diversity reflects that the total peak demand from a group of customers is less than the sum of the individual peak demands. This is because customers naturally use electricity at different times to each other, so their individual peak demands don't all occur at the same time. DNOs design their networks considering an appropriate level of diversity as it results in more efficient investment – networks are designed to meet the likely (diversified) peak demand rather than the higher theoretical maximum demand which will never occur.[24] Designing to diversity avoids unnecessary expenditure and is permitted by EREC P2/8.[25]

There is of course a risk of applying diversity – this is the risk that there is greater convergence in customer behaviour than the diversity assumptions assume. If this happens, power flows would be greater than predicted and network limits could be exceeded. As a result, DNOs can make greater use of diversity for customer groups for which they can confidently predict future behaviour. These are customer groups for which DNOs have lots of historical data and where past behaviour is a good indicator of future behaviour (domestic customers for example). In the case of storage, individual DNOs have little real operational data and, given the ability of storage to operate in multiple markets[26], past behaviour isn't necessarily a good indicator of future behaviour. As a result, there is a risk using diversity assumptions for storage and so some DNOs are naturally conservative with their use.

Continuing this conservative approach means DNOs will have to reinforce the network more than if greater diversity were assumed, and it limits how much of the existing underutilised storage capacity can be 'released' for the benefit of other customers. This would increase the likelihood and duration of delays for new customers seeking to connect, and increase the network costs recovered through all customers' bills. Solution 2 is about safely increasing the use of diversity factors for storage.

Solution 2: there are two parts to Solution 2. First, DNOs will develop and apply common principles around diversity factors for all new and existing storage sites. These will be based on historical utilisation data pooled by all DNOs, and potentially include a view on how storage sites may operate in the future. These will be applied from 31 August 2023. Second, Solution 2 will allow DNOs to manage any new storage site connected under Solution 1. This management (e.g. an intertrip or ANM arrangement) protects the network and supplies to distribution customers if the diversity assumptions prove in practice to be too ambitious, by curtailing new

[23] EREC P2/8 only covers network demand security of supply, it doesn't cover generation security of supply.
[24] The greater the diversity assumption, the lower the Group Demand that the network needs to accommodate and the lower the network investment required to maintain EREC P2/8 compliance.
[25] Paragraph 3.8 of EREC P2/8 allows DNOs to make "appropriate allowance for diversity".
[26] Also relevant is that service markets themselves can change in response to network and system operability challenges.

storage customers' import (insofar as allowed by their network access rights[27]). This management may be on an interim or enduring basis depending on network need and how the diversity principles are applied. This mitigation enables DNOs to make greater use of diversity.

This solution benefits customers generally as it enables better use of existing network capacity by other customers (meaning customers can decarbonise more quickly and at lower cost), and it reduces the amount of new network investment required to accommodate storage sites (it reduces the risk of having to create additional capacity which is very lightly utilised).

Justification and notes:

- EREC P2/8 allows DNOs to use diversity, and DNOs already apply diversity to other demand customer types.
- This solution does not change the access rights of existing storage customers. This solution instead means that DNOs don't have to build as much network capacity to accommodate storage, because the diversity assumptions about the operation of storage will be based on real historical data.
- Solution 2 is complementary to Solution 1, and is needed to realise the full benefits from Solution 1.
- If this proposed solution is acceptable to Ofgem, the next step after Ofgem's letter of support would be for DNOs to collectively agree the common diversity principles that should be used.

Solution 3 – including DFES decarbonisation forecasts when assessing connection applications

When DNOs receive a connection application they assess whether there is sufficient spare network capacity for that customer, or whether additional network capacity is required. This assessment incorporates existing ('background') customer demand and generation levels[28] as they are at the time of the application, but some DNOs don't include for any growth in this demand and generation. Demand growth has historically been 0-2% per year; generation growth is more varied and locational as it is more affected by larger schemes.

This rate of demand and generation growth is forecast to significantly increase. This is because GB decarbonisation is largely predicated on transitioning existing fossil fuel technologies (e.g. petrol/diesel cars, natural gas cooking and heating) to electricity, and building renewable generation to power these. Unlike most previous demand and generation growth, this LCT growth is driven by legislation – both absolute greenhouse gas emissions targets and sector-specific legislation such as banning new internal combustion engine vehicles.

Continuing the current approach of not accounting for such future societal growth when assessing large customer connection applications is likely to adversely impact GB customers – there is high confidence this demand and generation growth is coming, and not 'holding back' some network capacity for use by smaller customers to accommodate it could delay the transition to LCTs and inhibit legislated decarbonisation targets.

Solution 3: when DNOs assess connection applications, in addition to existing and contracted demand and generation, DNOs will be able to incorporate up to ten years of projected demand and generation growth on the LV[29] network. This would have the effect of 'reserving' sufficient existing spare capacity across the distribution network to cater for up to ten years of societal growth. The forecast for this LV demand and

[27] For example, new storage customers with a 'firm' connection (as defined by Solution 1) will not normally be curtailed in intact conditions. Any Solution 2 customer curtailment will be within and as allowed by the customer's network access rights.
[28] Including contracted but yet-to-connect customers.
[29] LV (low voltage) is all voltages up to and including 1kV; HV (high voltage) is all voltages above 1kV up to and including 22kV; EHV (extra high voltage) is all distribution voltages greater than 22kV.

generation growth shall be based on the DNO's lowest[30] DFES scenario that meets interim and 2050 Net Zero targets. This solution would apply to all connection applications and modification applications for all customer types (e.g. demand, generation, storage, and hybrid sites) received from 31 August 2023 and who are not one of the customer types listed in paragraph 1.3 of DCUSA Schedule 2D[31].

This solution benefits society as it helps safeguard sufficient capacity for near-term decarbonisation. It better enables LV customers (predominantly domestic and small business customers) to transition to LCTs and use them at full capacity, and it more broadly supports legislated decarbonisation.

Justification and notes:

- The principle of accounting for forecast future growth when network planning is not new – when DNOs make network interventions to provide capacity (e.g. reinforcements), they scale those interventions to include future demand and generation growth. This is a core principle of planning and network investment, and ensures efficient decision-making. Solution 3 is in line with this existing core principle.
- This solution more closely aligns with transmission, where forecast demand growth at the customer's date of connection is used in the connection offer assessment process.
- The Electricity Act 1989 and Distribution Standard Licence conditions do not detail how a DNO should assess connection applications or available network capacity, and therefore do not appear to prohibit Solution 3.
- Paragraph 1.1 of the Common Connection Charging Methodology (Schedule 22 of DCUSA) says that a customer's Minimum Scheme "shall be consistent with our [the DNO] statutory and licence obligations including the requirement to develop, maintain and operate an efficient, co-ordinated and economical electricity Distribution System." Solution 3 helps DNOs better meet this requirement – better accounting of demand and generation growth enables more efficient and coordinated network planning and so more economical system development.
- Paragraph 1.7 of the Common Connection Charging Methodology (Schedule 22 of DCUSA) says "the factors taken into account by us [DNOs] to calculate the connection charge will include, but are not limited to: available capacity of the existing Distribution System." However "available capacity" is not a defined term, and the CCCM does not specify how a DNO should assess available capacity or connection applications. We therefore consider that this paragraph is not a barrier to Solution 3. If Solution 3 is accepted, we may subsequently propose a DCUSA code modification to clarify the interpretation.
- We consider that using the lowest DFES forecast that meets interim and 2050 Net Zero targets strikes the right balance – it reserves capacity for the minimum decarbonisation needed to meet Net Zero legislation but no more; this avoids the risk of unnecessarily reserving capacity that isn't then used by societal growth and so could have been used by storage sites and other large customers.
- We consider reserving capacity for ten years of growth is appropriate as many of the existing GSP constraints are forecast to be resolved after 2030.

Solution 4 – storage Curtailment Limit setting under Access SCR

The volume of connected and contracted storage has reduced spare network capacity in many parts of the distribution network to the point where DNOs cannot offer firm connections (even under the Solution 1

[30] The 'lowest' DFES scenario is that which results in the lowest demand growth at licence area level. This is not always the scenario that results in the lowest demand or generation growth on a particular substation or circuit.
[31] i.e. Solution 3 applies to all customers who aren't *"(a) domestic and non-domestic Customers that are billed on an aggregated and non-site-specific basis or who are metered directly using whole current meters; or (b) Unmetered Supplies."*

definition) unless the network is first reinforced[32]. This means the number of storage customers that may connect on a non-firm basis, either as an interim or enduring measure, will likely increase. The reforms introduced by Access SCR mean DNOs may either need to procure flexibility services for, or pay compensation to, these non-firm storage customers who meet the Access SCR eligibility criteria.[33] Both these expenditures are customer-funded.

The combination of these Access SCR reforms, Solution 2, and the likely increasing volume of non-firm storage customers means GB customers will be increasingly funding large commercial storage customers, either via compensation bills or flexibility service bills.[34] This means GB customers are picking up the bill to compensate storage for problems that storage has largely created, whilst those same storage sites block out the network capacity and resource that GB customers need to decarbonise – this does not feel appropriate.

Solution 4 proposes to limit that GB customer exposure by calculating a higher Curtailment Limit for new non-firm storage customers.

Solution 4: Ofgem to use the allowance granted by paragraph 2.1 of DCP404 legal text[35] to direct DNOs to use an alternative method to calculate the Curtailment Limit for new storage. This Curtailment Limit would be higher than for other customer types, so reducing the likely requirement for customer-funded flexibility services or compensation. We consider that this new Curtailment Limit should at least incorporate up to 10 years of forecast LV demand and generation growth to align with Solution 3. This solution would apply to all storage connection applications and modification applications received from 31 August 2023 (to align with Solutions 1 and 2), who meet the DCUSA definition of "Generation Connection"[36] and who meet the Access SCR eligibility criteria to receive a Curtailable Connection.

This solution benefits the wider customer base as it reduces their financial risk from the storage challenge.

Justification and notes:

- We consider this proposed solution is permitted and can be implemented without any code changes, as paragraph 2.1 of Schedule 2D of DCUSA permits Ofgem to direct DNOs to use an alternative method to calculate the Curtailment Limit.
- We consider that the 'speculative development' carve out in Access SCR shows precedence for excluding certain customer types from some of the benefits of Access SCR where it is in the interests of the wider customer base.
- The DCP404 legal text which sets out the current Curtailment Limit methodology was developed in 2022 and approved by Ofgem on 15 December 2022 – this was before the extent of the battery challenge had become known. The DCP404 drafting and Ofgem's approval therefore did not have the

[32] By reinforce we mean any intervention to add capacity. This could include reinforcement, reconfiguration, or using innovative or smart solutions.
[33] The reforms introduced by Access SCR went live on 1 April 2023. They include a requirement to set a customer-specific Curtailment Limit for non-firm customers that meet the Access SCR eligibility criteria. DNOs must either procure flexibility services to remain within this limit or pay the customer compensation if the limit is exceeded. Both the flexibility service procurement and compensation payments are socialised. This requirement is enacted by the legal text in DCUSA Change Proposal 404 (DCP404), which was approved by Ofgem on 15 December 2022 and incorporated into DCUSA Version 15.1.
[34] Given that the volume of storage likely dwarfs the market of other types of flexibility providers, the money will likely go to the existing 122GW of batteries or new storage customers – i.e. the very customers that are largely causing the capacity shortage.
[35] Which is now paragraph 2.1 of DCUSA (v15.1) Schedule 2D: "*Unless otherwise directed by the Authority, the Import Curtailment Limit and Export Curtailment Limit will be determined by assessing the parts of the existing Distribution System that require reinforcement under the Minimum Scheme, in accordance with Paragraphs 2.3 to 2.8.*"
[36] See footnote 17 on page 7.

opportunity to consider its suitability for the challenge we face now. We therefore consider a change to the methodology is appropriate.

- This proposed solution more closely aligns with the two-step connection process at transmission, where customers are subject to uncompensated curtailment until their connection is made firm.
- For better alignment with Solution 1 (if accepted), the new methodology should only study Curtailment Limits for intact conditions.
- If this proposed solution is acceptable to Ofgem, the next step after Ofgem's letter of support would be to agree what the new common methodology to calculate the Curtailment Limits for storage should be. Ofgem will then need to issue DNOs a direction to use this new methodology. As Solution 4 would apply to all eligible storage applications received from 31 August, this new methodology will need to be finalised and directed no later than 28 September 2023 so DNOs know what methodology to use to calculate the Curtailment Limits (which are included in connection offers).

Metrics

The impact of the solutions could be tracked with three metrics. These are only targeted at storage customers to whom the solutions apply (e.g. they won't include domestic and other small scale storage as these are outside the scope of the solutions):

1. Solution 1 – DNOs to report annually to Ofgem the number and MW of new storage connection offers made and accepted (both 'firm' and 'non-firm').
2. Solution 2 – DNOs to report annually to Ofgem the total distribution storage capacity connected and contracted multiplied by the average diversity factor used. This gives a good indication of the amount of network capacity released by diversity factors.
3. Solution 4 – DNOs already have an obligation to record and report Curtailment hours for Access SCR Curtailable Connection customers. By comparing the default Curtailment Limit (calculated using the existing method)[37] with the new Solution 4 Curtailment Limit, DNOs can provide an annual estimate to Ofgem of the financial saving to GB customers of the new higher Curtailment Limit.

The counterfactual options

The primary counterfactual is to make no changes to the way in which storage is treated, and instead create additional network capacity as required for storage growth, societal decarbonisation, and other new customers. Given the volume of network capacity that would be needed, this would likely entail significant large-scale reinforcement across the distribution networks (and possibly extensive works at transmission). These would be customer-funded. These would take years to deliver, and such a spike in work would also have resource and supply chain implications. The counterfactual has not been proposed as a solution as it is unlikely to be the most efficient solution given the low utilisation of storage capacity. Some reinforcements now and large-scale reinforcements in the future may be the right answers; what we are rejecting is large-scale reinforcements now before the needs case has been proved.

Other solutions which we are not proposing include:

- Connecting other customers with lower access rights than currently, i.e. maintain storage access rights at their present level and reduce the access rights for other customer types if there is insufficient network capacity. This would mean that domestic EV chargers, other electrified transport schemes, heat pumps, renewable generation etc. could all face lower access rights and so be subject

[37] As set out in DCP404, which was approved by Ofgem on 15 December 2022 and incorporated into DCUSA Version 15.1.

to constraints. Not proposed as: we believe this would be unacceptable to customers and society; not technically feasible to implement and manage. It also doesn't reflect the much greater value of supply security for demand customers compared to storage (see footnote 19), and that most demand customers have no choice where they locate whereas "storage has more locational flexibility than most demand connections"[38].

- Pausing new storage connections for a time-limited period so the system need for further storage can been identified. Not proposed as: not a quick tactical solution as requires further stakeholder engagement and justification; doesn't reflect there may still be areas that would benefit from storage; would stifle further storage development in GB.

Summary

In summary, we propose four tactical response solutions. They are targeted at industrial-scale distribution storage sites (apart from Solution 3, which is targeted at all large customers). They will help free up and make better use of existing network capacity, ensure DNOs are only adding additional network capacity where it is really needed, and protect the wider customer base from some of the network cost impacts of the extraordinarily high volumes of storage. They help protect against DNO and supply chain resource being diverted away from delivering the interventions GB customers need for a safe, efficient, reliable, and decarbonised supply of electricity. They are mutually supporting and designed to work together.

Most importantly, we consider that these solutions are consistent with and complementary to our primary statutory obligations that put the customer at the heart of our decision making framework. Specifically, we consider that these solutions:

- are better than the counterfactual of reinforcement, primarily because of the cost, timescales, and risk that this would entail. These solutions support commitment to the Electricity Act 1989 in the development of an efficient, co-ordinated, and economical system. They ensure that customer money is invested prudently and reasonably, and unlock and enhance the time value of money component by quicker delivery of solutions by getting better use out of existing network capacity;
- align with DNOs' overarching Section 9 Electricity Act 1989 obligation to "develop and maintain an efficient, co-ordinated and economical system of electricity distribution";
- reflect the intention of Distribution SLC 19.1, as these solutions are bespoke to the network impact and characteristics of storage. Looking at the specific circumstances surrounding storage connections and the regulatory framework as a whole, we consider the proposed solutions are compliant with SLC 19;
- supplement and support the requirement under the Electricity Act 1989 to offer connection terms, in a manner that may advance connection dates and thereby support Scottish, Welsh, and UK legislated Net Zero targets by helping to enable decarbonisation;
- support Ofgem's principal objective "to protect the interests of existing and future consumers…. The interests of such consumers are their interests taken as a whole, including their interests in the reduction of greenhouse gases…"; and
- support Ofgem's strategic vision "for an energy system to be on tracked for Net Zero, including: rapid growth in the use of EVs [and] heat pumps…".

Failing to make these changes will result in less efficient network development that will cost GB customers more and inhibit decarbonisation (quite possibly to the extent that legislated Net Zero targets are missed).

[38] Source: paragraph 3.47 of Ofgem's 'Access and Forward-Looking Charges Significant Code Review: Final Decision'.