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Curtailment under Technical Limits

Stakeholder Consultation

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Sites with “Technical Limits” (Part 4 Connections)

Current arrangements

As part of the accelerated connections program in collaboration with the National Energy System Operator (NESO), the industry is looking to identify and address the main challenges currently facing our connection customers and speed up connections. One of the main barriers to customer applying to connect to the distribution network is the dependency on transmission system reinforcement. Conventionally, these customers could not be connected until transmission network reinforcements had been completed. Distributed Energy Resources (DER) customers wishing to connect to the distribution network at a Grid Supply Point (GSP) (i.e. the boundary between transmission and distribution networks) which cannot connect until transmission network works are completed, are currently categorised by the NESO as Part 4 customers.

The industry is addressing this by establishing ‘Technical Limits’ at GSPs.

What are Technical Limits?

Technical Limits (TLs) are operational limits agreed between the DNO, TO and NESO at each GSP, to allow the DNO to manage the power flows at the GSPs and connect qualifying Part 4 distribution customers at these GSPs ahead of transmission reinforcement works, on a flexible basis. That means that the connection would be non-firm and uncompensated in case of a curtailment.

Expressed in Real Power (MW) value, Technical Limits represent the minimum and maximum acceptable power flow at each GSP where wider Transmission system constraints could be active.

Those limits may vary depending on month/time of day, for example summer minimum and winter peak.

Technical limits will apply even under System normal conditions. If the limit is breached during system normal conditions (N-0), the DNO will be required to take appropriate action to curtail Part 4 Distributed Energy Resources (DERs) as necessary.

Sites with “Technical Limits” (Part 4 Connections)

Implementation of Technical Limits

Technical Limits are set through an industry-agreed methodology that can be applied across GSPs and are then controlled by the respective DNO using an Active Network Management (ANM) solution.

- ►We will begin to commission Technical Limits as part of our Active Network Management (ANM) commissioning.
- ►Ahead of commissioning of the Technical Limits, we will work with the NESO and National Grid Electricity Transmission (NGET) to ensure that our ANM solution meets all their requirements.

Inter-control room communications protocol (ICCP) is a digital link between Electricity North West and the NESO and provides ‘control and visibility’ between the two control rooms. The NESO has made control and visibility a requirement of TLs.

- ►ENWL is in the process of establishing an ICCP link with the NESO.

What is Active Network Management (ANM)?

ANM is a system used by grid companies to manage network constraints by utilising flexible assets, services and connections. The ANM system continually monitors all the constraints in real time and dispatches flexible services or varies the import and/or export of flexible connections associated with the constraint.

See more details about our ANM system in our Operational Decision Making Framework (Section 4.2.1 Active Network Management)

Managing Technical Limits

ENWL will manage Technical Limits through our ***Technical Limits Active Network Management (ANM TL) scheme.*** The ANM TL software will curtail Part 4 Distributed Energy Resources (DERs) and prevent Technical Limits being breached.

This means that DERs at Sites with Technical Limits (Part 4 Connections) will be entered into our Active Network Management (ANM) system, for *Transmission constraints only*, in a curtailment order or stack. This curtailment stack will be calculated separately to the stack used to manage the constraints which are within the distribution network.

- In the event that the Technical Limit is going to be breached, the ANM TL will curtail Part 4 Connections *ahead* of all other DNO negotiated Flexible Connections and Services.
- If the limit breach is not associated with a "Technical Limit" point on the network, then the ANM will utilise the standard Electricity North West curtailment list instead.

ENWL's obligations to NESO under Technical Limits

The NESO mandates that the DNO has to manage the Part 4 DER such that the TLs are not breached. However, should the TL be breached, the DNO would curtail/interrupt the relevant DER.

Should a Part 4 DER customer fail to respond to a signal from ENWL requiring them to curtail their output, this may result in us having commercial discussions about the customer's ongoing connection to the network under TLs.

As such DNOs will need to set curtailment limits in a manner that will allow for the pre-curtailment of DERs ahead of a breach of the Technical Limit.

Curtailment Options for TLs

In this consultation, we are looking for customer feedback on three options of curtailment methodologies for Part 4 DER Customers.

Below is an overview of each of the proposed options:

1. **Curtailment Index (CI).** This method shares the required curtailment equally and proportionately over the period of a year across all the connected Part 4 DERs at a GSP, regardless of the connection application, connection offer or connection date.
2. **Last In First Out (LIFO).** This method provides the lowest (most favourable) curtailment to the Part 4 DER with the earliest offer acceptance. The level of curtailment exposure increases (deteriorates) in line with the DER position in the connection offer acceptance queue.
3. **Curtailment Index Batching (CIB).** This method is identical to CI until the estimated[1] curtailment level for the first Part 4 DER(s) reaches a certain threshold X%. The incumbent DER(s) will then be nominated as 'Batch 1', whereas any new DER joining[2] the GSP will form a new 'Batch 2' and will receive greater curtailment than the first batch (up to a higher threshold Y%). All new DERs from this point onwards will be added to 'Batch 2' and can expect curtailment levels up to Y%. This reduces the impact of newcomer DERs on the curtailment level of existing DERs at a GSP, in a more equitable manner than LIFO.

[1] If a customer applies for a formal quote for a Part 4 connection, the DNO will also provide a Curtailment Assessment report that gives customers an estimate of how often their connection may be curtailed over the course of one year.

[2] The timing that the new DER joins the group is based on the acceptance date of the Part 4 connection offer, *not* on the actual connection date.

Curtailment methodologies

The following examples explain how DER assets that contribute to the same Part 4 constraint get curtailed when that constraint materialises, under each of the proposed methodologies.

Curtailment Index

The Curtailment Index (CI) methodology provides an equal allocation of curtailment across all connected DERs.

With the CI methodology, Part 4 DERs will be assigned a Curtailment Index, to allow them to be incorporated into the ANM system, and an estimated value of curtailment they should expect to see during the course of a year.

A Curtailment Index is presented as the ratio of the total curtailment already experienced within the year compared to the estimated maximum curtailment allowance for the year.

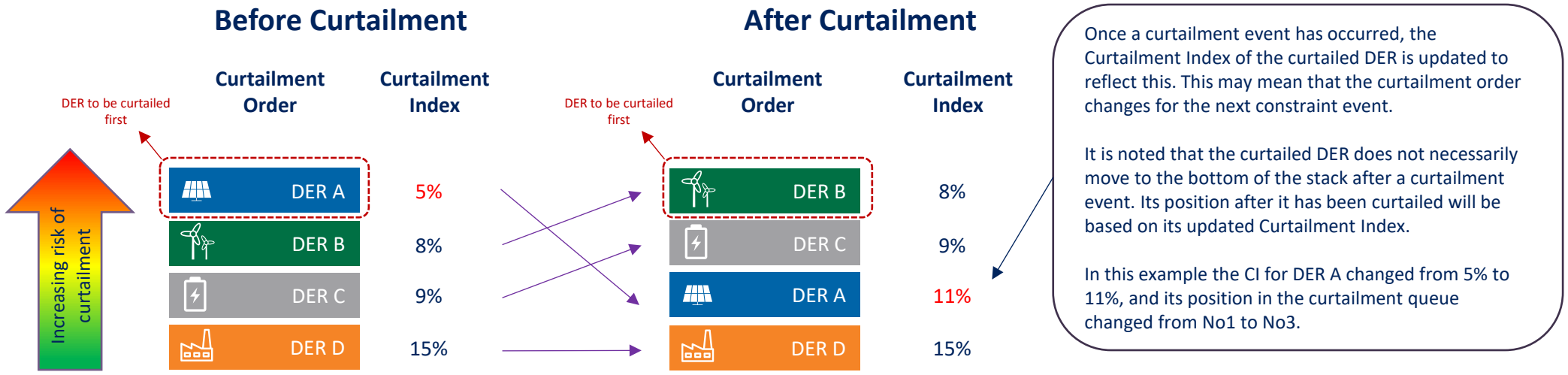
$$Curtailment\ Index = \frac{Actual\ Curtailment\ throughout\ the\ year\ (MWh)}{Estimated\ curtailment\ for\ the\ year\ (MWh)}$$

Curtailment Index

The DER with the lowest Curtailment Index is placed at the top of the stack and is more likely to be curtailed. Every time a DER is curtailed by the DNO to help resolve a constraint, its CI is recalculated to reflect this and subsequently its position within the curtailment stack may change.

Curtailment is (proportionate to the size of the DER) equitably shared over the period of a year across all the DERs held within the stack. In other words, all DERs have the same maximum estimated Curtailment Index (%), which is presented as the percentage of time that the network is unavailable per site over a year.

Under the CI methodology, the ANM system will hold the curtailment order of Part 4 connected customers for each GSP, their actual CI and an estimated curtailment value, in terms of total MWh curtailed per year.



Once a curtailment event has occurred, the Curtailment Index of the curtailed DER is updated to reflect this. This may mean that the curtailment order changes for the next constraint event.

It is noted that the curtailed DER does not necessarily move to the bottom of the stack after a curtailment event. Its position after it has been curtailed will be based on its updated Curtailment Index.

In this example the CI for DER A changed from 5% to 11%, and its position in the curtailment queue changed from No1 to No3.

Last In First Out (LIFO)

With the LIFO methodology, a Part 4 constraint at a GSP is resolved by curtailing Part 4 DERs in reverse order of their connection offer acceptance date.

Under LIFO, each DER is assigned a position within a curtailment stack based on their offer acceptance date. When new DERs accept a connection offer for the same GSP, they are given a position at the top of the curtailment queue i.e. these assets will be curtailed first when a constraint is binding.

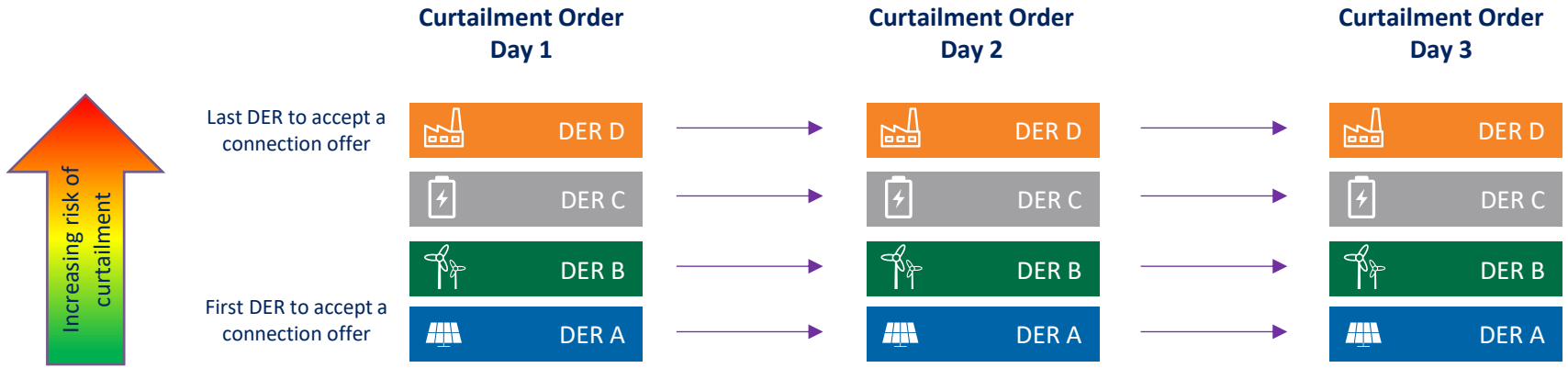
In the example below, the first DER that secured a connection offer is DER A, which is at the bottom of the curtailment order stack. DER D was the last DER to accept a connection offer and is at the top of the curtailment stack.

Last In First Out (LIFO)

During a constraint event, DER D at the top of the curtailment stack will be curtailed first. This means that a DER at the top of the stack will always be fully curtailed before the DER one position lower in the curtailment stack is curtailed.

DER A would ***always*** be the last one selected to be curtailed and would only be curtailed if the impact of curtailing other DERs (DEB C, DER C, DER D) further up on the curtailment stack did not resolve the potential Technical Limit breach.

LIFO ensures that the curtailment risk for a given DER will not be impacted by DERs that accepted a connection offer for the same GSP at a later stage.



Curtailment Index Batching

Curtailment Index Batching (CIB) provides an equal allocation of curtailment within each batch of DERs.

→ In this example, it is assumed that the maximum estimated curtailment threshold for Batch 1 and Batch 2 is 30% and 100%, respectively.

In CIB, when the addition of a new DER causes the estimated curtailment level of the existing connected DERs to reach 30%, the existing DERs are placed into ‘Batch 1’. Any future DER goes into Batch 2 and receives greater curtailment, up to 100%. All new DERs from this point onwards will be added to ‘Batch 2‘ and can expect curtailment levels from 30% up to 100%.

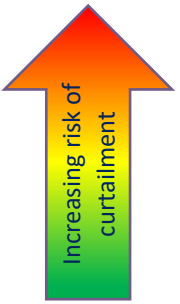
The DERs still change their position in the curtailment stack as in the standard CI model, i.e. based on their current CI value. However, ‘Batch 1’ spends less time at the top of the curtailment stack (“red zone” below) than ‘Batch 2’, because its estimated curtailment level is lower than ‘Batch 2’ (in this example it started from 20% and increased to 25% and then to 30%).

Once DERs in ‘Batch 1’ reach 30% (maximum threshold), this does not guarantee that they will stop being curtailed.

‘Batch 2’ starts with a higher estimated curtailment (42% in this example) therefore will proportionally be curtailed more during a year than Batch 1.

Curtailment Index Batching

It is noted that, once the initial reinforcement is complete and subject to conversation with National Grid Transmission Operator (NGTO), these % for the estimated curtailment thresholds may be adjusted to reflect the new Technical Limits at the GSP. These % are also subject to other factors, such as demand in the distribution network (i.e. if demand drops, Part 4 DERs will need to export more power to the transmission network, increasing congestion at GSP level.)



Only DER A on the stack

Curtailment Order	Curtailment Index	Estimated Curtailment
DER A	5%	20% (up to 30% max)

DER B added to the GSP

Curtailment Order	Curtailment Index	Estimated Curtailment
DER B	0%	25% (up to 30% max)
DER A	5%	25% (up to 30% max)

- The estimated curtailment for DER A increased due to the impact of newcomer DER B on power flows at the GSP.
- The estimated curtailment level for both DER A and DER B is under 30%, therefore there is not need for the creation of Batch 2.
- DER B moved to the top of the stack because its CI is lower that that of DER A.

DER C added to the GSP

	Curtailment Order	Curtailment Index	Estimated Curtailment
Batch 2	DER C	0%	42% (up to 100% max)
Batch 1	DER B	0%	30%
	DER A	5%	30%

- Due to the impact of newcomer DER C on power flows at the GSP, the estimated curtailment level for DER A and DER B reached 30% and they were placed into Batch 1 and this group is closed.
- When the new DER C is added, it forms Batch 2 which has a great curtailment level of up to 100%.
- Any new DERs will be added to 'Batch 2'.
- Any DER could be used as long as their CI has not reached their estimated curtailment. The order in which they will be used depends on the actual CI value, i.e. the DER with the lowest actual CI will be curtailed first, and after curtailment its actual CI will be updated. This means its position in the queue might change. If all DERs in Batch 1 reach 30% curtailment, then ONLY Batch 2 will be used (but this is not guaranteed).

Curtailment Options for TLs – Comparison Table

Comparison of the proposed Part 4 curtailment methodologies

	Curtailment Index	Last In First Out (LIFO)	Curtailment Index Batching
How order of curtailment is defined	The order of curtailment for each Part 4 DER is defined in the curtailment order list for transmission constraints only, based on its *current* level of curtailment index. This ensures shared utilisation of flexibility resources across the network.	The curtailment order is based on the DER's position in the offer acceptance queue. The Part 4 DER which was the chronologically last to accept the connection offer under TLs would *always* be the first to be fully curtailed in the event of a network constraint.	The order of curtailment for each Part 4 DER is based on its *current* level of Curtailment Index; this ensures shared utilisation of flexibility resources across the network. Subject to current curtailment levels, Part 4 DERs that join the GSP group later will be added to a new batch and will receive greater curtailment than the previous (existing) batch(es).
Static vs dynamic curtailment order	Curtailment index for each Part 4 DER is *dynamic*; every time a Part 4 DER is curtailed their Curtailment Index value is recalculated.	The Part 4 Connection DER's *order* within the curtailment list is *static*; it changes (improves) when new Part 4 connections are added. However, the *likelihood* of curtailment for each DER remains *consistent*.	Curtailment index for each Part 4 DER within a batch is *dynamic*; every time a Part 4 DER is curtailed their Curtailment Index value is recalculated. Furthermore, when all the DERs within the first batch have reached an estimated curtailment threshold of 30%, the next Part 4 DER that will join the same GSP group will form a second batch with higher estimated curtailment threshold (e.g. 80%).
Transparency in curtailment	Ensures fairness through equal use of DERs connected via Part 4 connection arrangements over a period of a year. Customers with Part 4 Connections are not negatively impacted by being the last chronologically to accept a Part 4 connection offer. Larger DERs will likely be impacted more.	The level of curtailment exposure increases in line with the DER's position in the Part 4 connection offer acceptance queue. This means that the DER with the earliest connection offer acceptance date will experience the lowest curtailment, whereas DERs with later connection offer acceptance date face *disproportionally* greater risk of curtailment. In this way, DERs are insulated against greater curtailment caused by other DERs who applied for connection after them.	This methodology provides an equal allocation of curtailment across Part 4 DERs within the same batch. It also reduces the impact of newcomer DERs on the curtailment risk for existing DERs, in a more equitable manner than LIFO.

Curtailment Options for TLs – Comparison Table

Advantages and disadvantages of the proposed Part 4 curtailment methodologies

	Advantages	Disadvantages
Curtailment Index	This methodology is consistent with the CI methodology adopted by our ANM system to manage constraints on the distribution system. This curtailment methodology was consulted upon in our DSO 2021 strategy, where our stakeholders were unanimous in their support of the use of the CI approach over other curtailment methodologies. Ensures fairness through equal curtailment of DERs connected via Part 4 connection arrangements at the same GSP over a period of a year. Protects Part 4 DERs who were the last chronologically to accept a Part 4 connection offer from being excessively curtailed compared to DERs with earliest connection offer acceptance date.	Larger Part 4 DERs will likely be impacted more by curtailments compared to smaller Part 4 DERs connected to the same GSP. More complex approach than LIFO.
Last In First Out (LIFO)	Simpler approach. Part 4 DERs with an earlier connection acceptance date are insulated against greater curtailment caused by other Part 4 DERs who applied for connection to the same GSP after them.	Unequal curtailment of DERs at a GSP. The Part 4 DER with the earliest connection offer acceptance date will experience the lowest curtailment, whereas DERs with later connection offer acceptance date face *disproportionally* greater risk of curtailment as it would *always* be the first to be curtailed in the event of a network constraint.
Curtailment Index Batching	This methodology provides an equal allocation of curtailment across Part 4 DERs within the same batch. Ensures shared utilisation of flexibility resources across the network. It also reduces the impact of newcomer DERs on the curtailment risk for existing DERs, in a more equitable manner than LIFO.	Part 4 DERs that join the GSP group later will be added to a new batch and will receive greater curtailment than the previous (existing) batch(es). More complex approach than LIFO and Curtailment Index.

Consultation survey

We are seeking your views on our proposed curtailment methodologies for Connections to ensure they are equitable, transparent, and effectively meet the needs of our stakeholders. This consultation outlines three potential approaches, and your feedback will help shape our final methodology. We want to ensure that the level of detail provided allows you to make an informed assessment and that our approach to curtailment is clearly explained.

Your insights will be invaluable in helping us refine key aspects, including the most appropriate methodology, the batching structure within the Curtailment Index approach, and how we communicate updates on our curtailment processes. By participating, you can directly influence how we manage curtailment fairly and efficiently. We encourage you to share your views and help us develop a solution that works for all.

Please complete the survey **HERE**.

If you have any further feedback or any queries, please contact stakeholderengagement@enwl.co.uk

Thank you for your participation.