March 2026

NGED Curtailment Estimator Guidance

DSO

Curtailment team

nationalgrid DSO

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1. Overview

1.1. Executive Summary

National Grid Electricity Distribution (NGED) are focused on operating the network openly and transparently so that our stakeholders can make informed decisions about their connection to our energy system.

Key to this is understanding how we arrive at decisions about curtailment, balancing security of supply with network capability and access.

We publish significant data through our website. To facilitate our stakeholders' use of this data and issued curtailment reports, the following inputs and assumptions used have been detailed within this document. These include:

1.1.1. The published input data required to carry out curtailment analysis.

1.1.2. The functionality of the Active Network Management (ANM) systems licenced by NGED which need to be considered when undertaking curtailment analysis.

1.1.3. NGED's methodology for carrying out the analysis that produces the curtailment reports that will be provided with a new Flexible connection offer.

1.1.4. For further information on how NGED's ANM system works please see NGED's published ANM guidance.

Our role in the energy transition supports the growth of cleaner, more affordable and locally generated power. By sharing data and insight, and helping our stakeholders to use it well, we're aiming to provide firm foundations for growing businesses, economies and skills throughout the licence areas that we serve.

1.2. Glossary

The table below lists acronyms used throughout this document, along with what each stand for.

Please see the appendix for a detailed explanation of each term.

Term	Definition
ADMS	Advanced Distribution Management System
ANM	Active Network Management
BESS	Battery Energy Storage Systems
BSP	Bulk Supply Point
CAFPL	Connection Assets Forward Power Limit
CARPL	Connection Assets Reverse Power Limit
CCP	Connection Control Panel
DANM	Distribution Active Network Management
DCP	DCUSA Change Proposal
DCUSA	Distribution Connection and Use of System Agreement
EHV	Extra High Voltage
GSP	Grid Supply Point
GT	Grid Transformer
HV	High Voltage
LTDS	Long Term Development Statement
LV	Low Voltage
NESO	National Energy System Operator
PEL	Pre-Event Limit
PS	Primary Substation
PT	Primary Transformer
SGT	Super Grid Transformers
TANM	Transmission Active Network Management

Table 1. Glossary of acronyms.

1.3. Revision History

Revision	Description	Date
1	First issue	04/03/2026

Table 2. Revision History

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Introduction

Context behind the publishing and utilisation of our data

2. Introduction

2.1. Background

2.1.1. NGED have been offering Flexible connections since 2016 and Curtailable connections since 2023 to enable customers to connect onto the electricity distribution network faster and at a lower cost. These connections are facilitated using NGED's ANM systems which monitor real-time thermal and voltage behaviour on our network and calculates the allowable output of Flexible and Curtailable Connections.

2.1.2. Understanding expected levels of curtailment is key for customers when deciding whether to connect to NGED's network. NGED have a team dedicated to producing curtailment reports and making the data available for external users. This document provides supporting information to help understand the content of the curtailment estimate provided by NGED.

2.1.3. The curtailment estimate process detailed here is to provide an indication of curtailment volumes rather than edge case analysis. Our curtailment estimation methodology takes a different approach to that specified in DCUSA Schedule 2D, which has specific requirements for Curtailable connections.

2.1.3.1. As a result, these estimations do not come with any contractual guarantee and when compared together the curtailment estimate of a site, may differ from a Curtailment Limit.

2.1.3.2. The Curtailment Limit (hours) is a contractual cap which calculates curtailment caused by the worst single constraint that a site contributes to. It must be calculated in line with the spreadsheet specified in DCP 404 and NGED will be liable to any curtailment beyond the limit, as defined in DCUSA Schedule 2D.

2.1.3.3. By contrast, a curtailment estimate (MWh) is an estimate of curtailment caused by any constraints a site might contribute to, taking into account the ANM system's method of operation.

2.2. Curtailment Report: Interpretation

2.2.1. The curtailment report is intended to provide customers with an estimate of the likely level of curtailment on their connection due to ANM system operation. The report should be read in conjunction with the methodology assumptions set out in sections 3.2 & 3.3.

2.2.2. The pre-curtailment volume (MWh) and un-curtailed capacity factor provide an estimated annual output without distribution or transmission curtailment. Where the MWh volume is based on typical profile data, it may differ from site-specific output forecasts.

2.2.3. The post-curtailment volume (MWh) and curtailed capacity factor provide an estimated annual output with potential distribution and transmission constraints. They indicate the potential reduction in generated energy – and therefore potential loss of revenue – that a connection may experience if an offer including ANM is accepted.

2.2.4. The heatmap visualises the half-hours throughout a typical day in each calendar month when curtailment may be expected. It is intended that this will enable an assessment of the impact the likely time periods of curtailment will have on the operation and viability of a scheme.

2.2.5. The Last In First Off (LIFO) queue provides the committed volumes and fuel types subject to distribution and transmission ANM. The queue is presented with distribution and transmission separately categorised to help understand the contribution to each constraint type and the commercial drivers behind each constraint type. While NGED can facilitate managing distribution reinforcement, mitigating transmission curtailment could involve significant timeframes and NGED receiving updated Technical Limits from NESO.

2.2.6. The curtailment per constraint shows which constraints are the cause of the curtailment that has been estimated. While not all scenarios are considered within the analysis and some constraints may be masked through the curtailment of the more severe constraints, this list provides insight on what network reinforcement may be required to avoid certain curtailment. The resolving of these constraints and any subsequently identified would be subject to a full review by NGED.

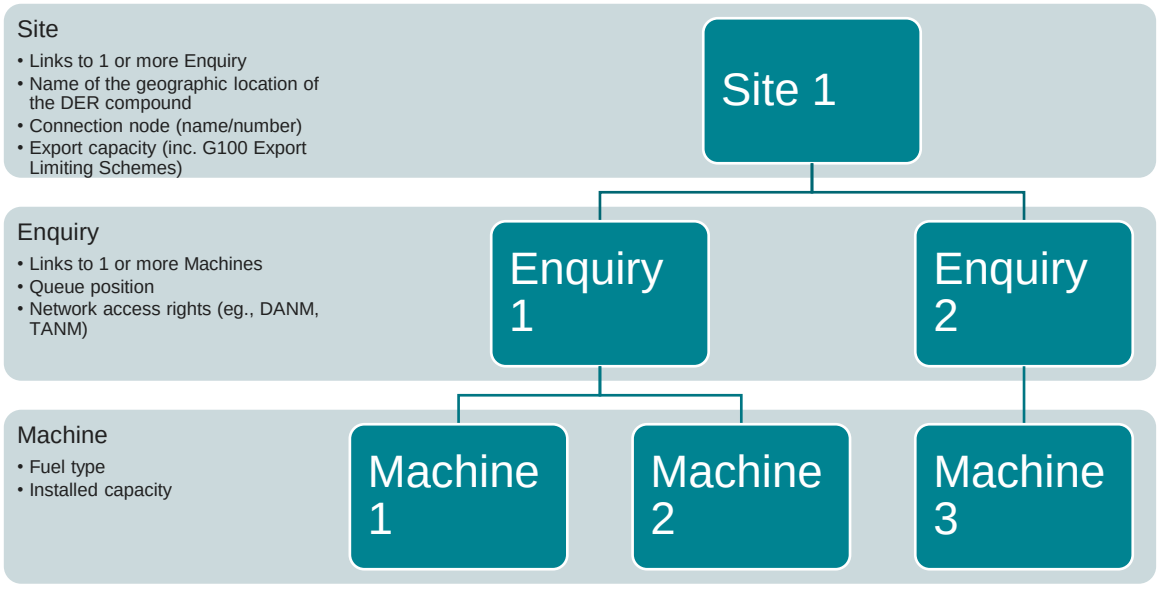
3. Central principles

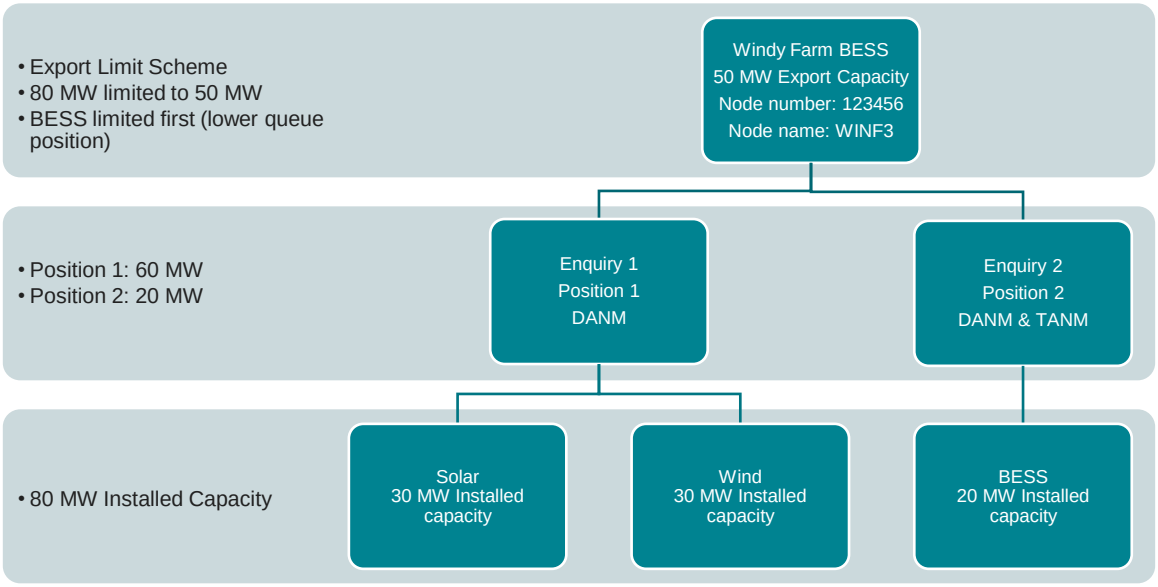
Core principles that contribute to the curtailment estimation process are detailed within the NGED DSO Curtailment Analysis Data Usage Guidance document. Please refer to this guidance in conjunction with this document.

3.1. Input data

To carry out curtailment analysis the following input data is used:

3.1.1. Historic loading: Branch load
3.1.2. Generic fuel type profiles
3.1.3. Site specific profiles: Instead of using one of the generic fuel type profiles a bespoke profile can be allocated to a specific machine to more accurately represent its operation.
3.1.4. Sensitivity factors
3.1.5. Asset ratings and Pre-event limits
3.1.6. Transmission Distribution boundary limits
3.1.7. Connection queue
Within the analysis the list of connections being assessed is categorised into Sites, Enquiries & Machines. This allows the analysis to handle multiple enquiries at each site or multiple fuel types (machines) within each enquiry. These three categories contain the following information
3.1.7.1. Site: site name, export capacity of a whole site & the node it is connected to
3.1.7.2. Enquiry: position in the queue, DANM/TANM status & associated dates
3.1.7.3. Machine: Fuel type & installed capacity





Note the actions of a G100 Export Limit Scheme are independent of the ANM system. NGED's analysis would use a maximum pre-curtailment output of 50MW for the case above.

Please see section 3 of the data guidance document for details of this input data.

3.2. System Functionality Assumptions

The curtailment analysis methodology is designed to replicate the ANM systems licenced to NGED as accurately as possible. The implementation of this has been streamlined to enable the provision of reports within the reasonable timeframes and operation as a web-based tool. The most significant assumptions within the methodology are the use of intact running arrangements only and the resolution of lower voltage constraints before higher voltage constraints, with transmission constraints resolved last.

Please see the section 4 of the guidance document for full details.

3.3. Indirect Curtailment

The curtailment estimates the limitation of access caused only by the ANM system. Curtailment from other systems is not included.

Please see the section 5 of the guidance document for details.

4. Curtailment Estimate Report Interpretation

4.1. Summary Table

A high-level overview of the results of the curtailment analysis are presented in a table along with information of the site being assessed. This contains:

Enquiry Reference	NGED's unique reference for this application. Where a site has two applications against it a different report will be provided if they have separate positions within the queue.
Site	The name of the scheme being assessed. Multiple applications (e.g. where an addition to installed capacity is made) are grouped by site.
Obtain Minimum Information Date	The date the application was made to NGED with all minimum information provided. This date determines the order of analysis at the application stage.
NESO Countersignature Date	The date the application (or collection thereof) was accepted by NESO. This date is used in combination with other information to determine the queue position.
Machines inc. Installed Capacity	The capacity of the installed machines. Where a scheme consists of multiple fuel types a breakdown of these capacities by fuel types is detailed. The half hourly profile used within the analysis is based on these installed capacities and limited by the export capacity.
Site Export Capacity	The contractual maximum export capacity (or import capacity) of the scheme. Where the installed capacity is greater than the site export capacity it will be capped at the export capacity for each half hour. If an application is for an extension to the existing site's export capacity, only the additional export capacity will be considered
ANM System	The GSP or group of GSPs managed as an ANM system
Pre-Curtailment Volume MWh	Sum of the site's maximum load, scaled based on a generic fuel specific profile, across the analysis time period.
Post-Curtailment Volume MWh	Sum of the site's load after any curtailment has been applied across the analysis time period.
Un-curtailed Capacity Factor	The ratio of pre-curtailment volume, divided by the site's capacity, against the analysis time period.
Curtailed Capacity Factor	The ratio of post-curtailment volume, divided by the site's capacity, against the analysis time period.
Annual Curtailment	The curtailed volume of load divided by the pre-curtailment volume, to give a ratio of how much a site is curtailed based on what they could have done.
Overall LIFO Position	Based on the number of sites ahead of the analysed site across the full ANM system (which is defined by a GSP or GSP group).

Table 3: Summary table definitions

Enquiry Reference	5******
Site	Windy Farm BESS
Obtain Info Date	01-01-2024
NESO Countersignature Date	01-09-2024
Machines inc. Installed Capacity	Wind: 16.8 MW, BESS: 10MW
Site Export Capacity	16.8 MW
ANM System	Chesterfield
Pre-Curtailment Volume MWh	147,563 MWh
Post-Curtailment Volume MWh	123,075 MWh
Uncurtailed Capacity Factor	100%
Curtailed Capacity Factor	83.4%
Annual Curtailment	16.6%
Overall LIFO Position	8

Table 4: Example Summary Table

4.2. Heatmap

4.2.1. The report includes a heatmap to provide a visual representation of the curtailment across the analysis time period. This details the aggregate of curtailment for each half hour (y-axis) for each month (x-axis). Periods of high curtailment are demonstrated in red and low curtailment in green. The mean per unit curtailment for each half hour combination is given in each cell. This is used to determine the colour scale.

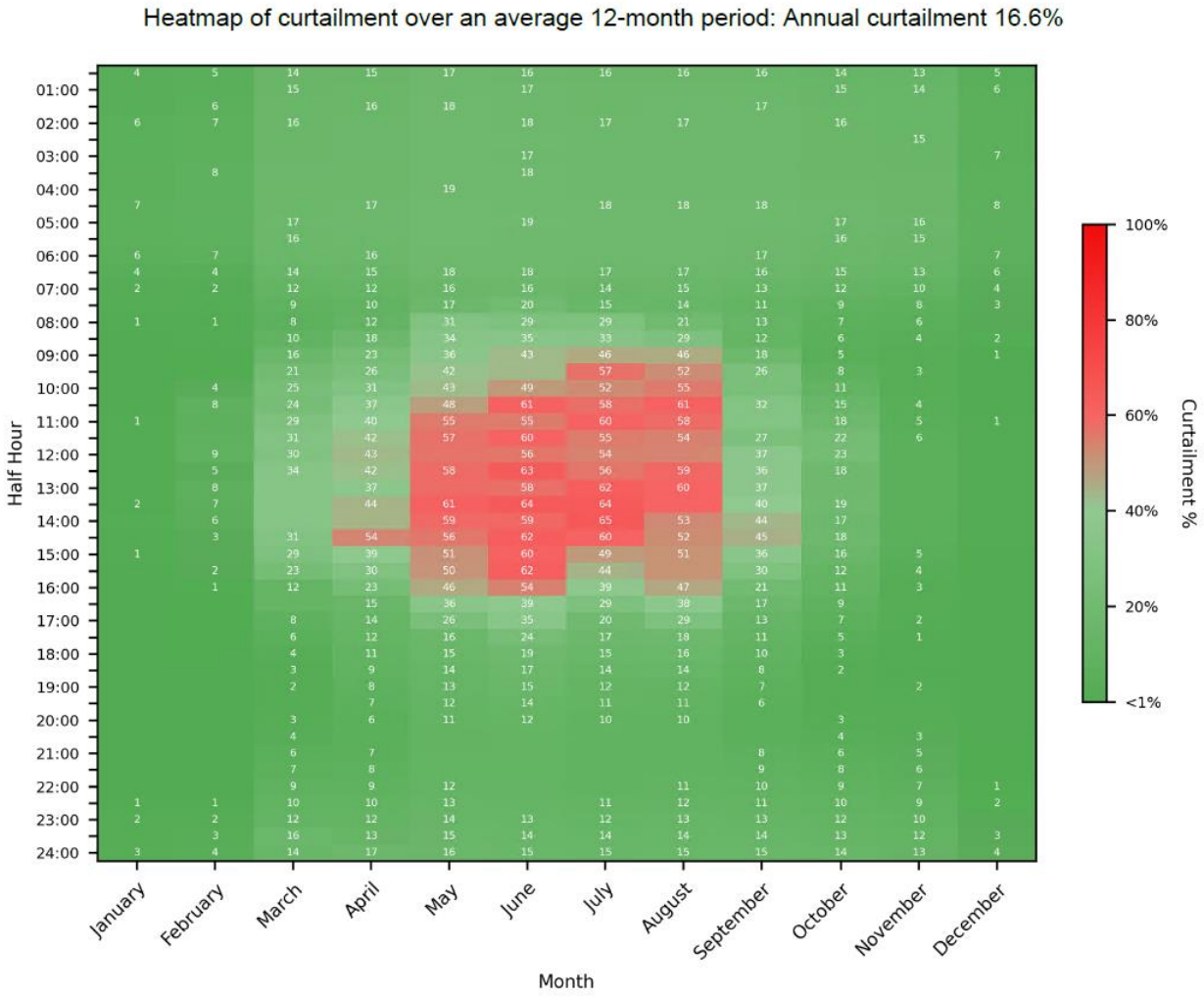
4.2.2. Where no number is shown on the heatmap this represents a half hour where no curtailment has been identified or the input profile showed the site was not operating, e.g. a solar site at night.

4.3. MW Graph

4.3.1. The impact of curtailment on the site is demonstrated with five separate curves:

- 4.3.1.1. Site export capacity: The export capacity of the site that the relevant enquiry is associated
- 4.3.1.2. Pre-Curtailment Mean: a curve of the average output, for each day, used within the analysis
- 4.3.1.3. Pre-Curtailment Max: a curve of the maximum output, for each day, used within the analysis
- 4.3.1.4. Post-Curtailment Mean: a curve of the average output, for each day, after curtailment has been applied
- 4.3.1.5. Post-Curtailment Max: a curve of the maximum output, for each day, after curtailment has been applied

4.3.2. The difference between each pair of curves demonstrates when and how much curtailment has occurred. Both curves are provided to indicate the maximum a site will have exported & the curtailment required at that time and the average output to indicate the capacity factor and associated curtailment for each day.



4.4. LIFO Queue

4.4.1. An aggregation of non-firm DER ahead of the site being assessed are shown within the LIFO Queue table. This is broken down into four categories of fuel type and whether these DER contribute to distribution and/or transmission constraints. As each DER may contribute to a Distribution or Transmission constraint the sum of “No. of DERs” will not necessarily add up to the Overall LIFO Position. Furthermore, any firm DER considered within the analysis will be counted within the Overall LIFO position but not included within the LIFO queue table.

4.4.2. A more detailed list of connections can be accessed via the DSO Curtailment Analysis website, however, depending on the date of publication there could be some misalignment of the queues.

	Distribution		Transmission	
DER Type	**Capacity (MW)**	**No. of DERs**	**Capacity (MW)**	**No. of DERs**
Wind	0	0	0	0
Solar	343.4	11	343.4	11
Synchronous/Other	16.4	4	16.4	4
BESS	30	2	30	2

Table 5: Example LIFO Queue

4.5. Constraint Summary

4.5.1. To give an indication of the cause of curtailment the top 5 constraints that have been identified are shown within the report.

4.5.2. A table and bar chart provide a breakdown of how the constraints contribute to the curtailment.

4.5.3. Distribution constraints are listed using the from and to bus name attributed to the branch. Transmission constraints are listed by the name of the GSP and corresponds to the CARPL/CAFPL or Technical Limit as applicable.

4.5.4. The Curtailment Percentage shows the proportion of the total estimate curtailment that is caused by each constraint. If there are more than 5 constraints this may not add up to 100%.

4.5.5. The constraints are broken down by Distribution and Transmission to indicate how the curtailment may change if one of these were resolved.

4.5.6. The curtailment methodology includes resolving lower voltage constraints first, then working up to higher voltage constraints. This reduces overall curtailment as resolving local lower voltage constraints reduces the loading on the higher voltage constraints, reducing the need for the same or other sites to be curtailed further. However, it is therefore possible that a constraint will not be shown within the report, which would cause curtailment if a lower voltage constraint was resolved. For example, within the report below, if the 33kV constraint were resolved through reinforcement, it is possible a 132kV constraint would become unmasked and still result in curtailment of the connection.

Curtailment Per Constraint

Worst five constraints:

Constraint	Constraint Type	Curtailment Volume (MWh)	Curtailment Percentage
GRSM3_1L3, BIWA3A, L1	Distribution	16060	95%
Chesterfield	Transmission	923	5%
-			
-			
-			

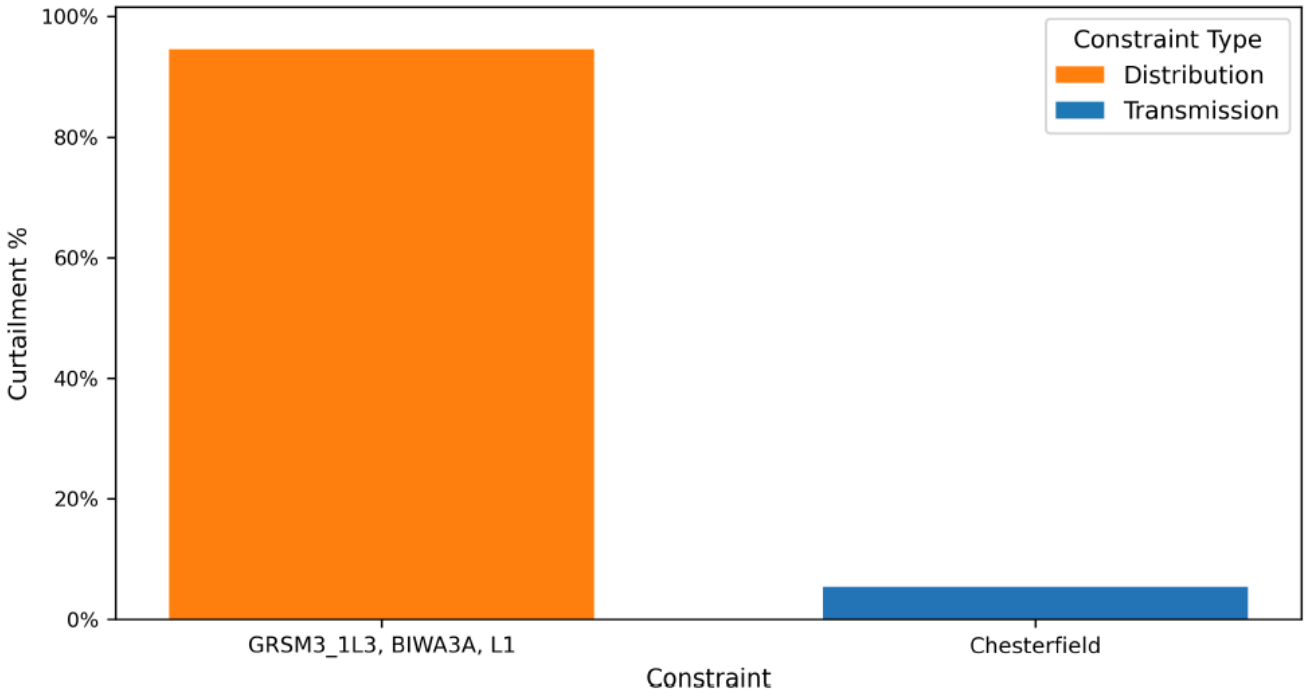


Table 6: Example constraint summary

5. Curtailment Analysis Methodology

5.1. Analysis Preparation

5.1.1. Branches identified:
The list of branches within the ANM system are filtered for those that have a sensitivity factor 5% or more to any site within the connection queue

5.1.2. Site per branch identified:
For each branch identified in 5.1.1, a list of sites that have a contribution of 2% or more is created

5.1.3. Machine profiles created:
The MW capacity of each machine is multiplied by the half hour pu for its respective fuel type to create MW half hourly profile.

5.1.4. Export capacity limitation:
For enquiries that have multiple machines the output of the machines is summed per half hour. If this sum breaches the export capacity it is limited to the export capacity. This is to mimic a G100 export limitation scheme.

5.1.5. Transmission Distribution boundary limit selection:
For schemes that may be subject to both CARPL/CAFPL & Technical Limits, the lowest of these two limits is selected for each season. If Technical Limits are not appliable this step is not used.

5.2. Constraint Exceedance Management

5.2.1. Baseline exceedances:
The initial loading (3.1.1) is compared against the forward and reverse limits (3.1.5) for each branch and boundary before the contribution of any additional enquiries has been added. This provides a list of baseline exceedances which the analysis will not be able to resolve.

5.2.2. Cumulative contribution:
The proportional output of all enquiries within the queue is added to each branch. This is determined using the sensitivity factor (3.1.4) for each enquiry's node to each branch and the profile scaled output of each enquiry. For each branch and each half hour this contribution is added to the initial branch loading.

5.2.3. Active exceedances:
The updated loading calculated in 5.2.2 is compared against each branch's limit, taking account for changes in seasonal limits to create a list of active exceedances that require addressing.

5.2.4. Constraint prioritisation:
The active exceedances identified in 5.2.3 are ordered based on voltage level and then proportional exceedance. E.g.

- 5.2.4.1. 150% loaded Primary transformer
- 5.2.4.2. 110% loaded primary transformer
- 5.2.4.3. 120% 33kV circuit
- 5.2.4.4. 140% 132kV circuit

5.2.5. LIFO queue per constraint
For each of the active exceedances a LIFO queue is formed using the output of 5.1.2

5.2.6. Curtailment calculation
Starting with the enquiry at the bottom of the LIFO stack (the most recent), for the lowest voltage constraint with the highest exceedance, the reduction in output of each enquiry is determined to resolve the exceedance.

5.2.7. Output adjustment:
The reduced output for each enquiry is updated for that half hour.

5.2.8. Review output:
Each constraint is reviewed to confirm if any further curtailment is needed to resolved any exceedances. If there is still an exceedance the analysis is repeated from 5.2.2 using the adjusted output of each enquiry.

5.2.9. Save output:
The result for that half hour is recorded against each enquiry and constraint for publishing within the report. The analysis then moves to the next half hour.

5.3. Result reporting

5.3.1. The results of the analysis detailed in 5.2 are used to determine the content of the curtailment report.

5.3.2. The MW output before and after curtailment is summed for every half hour across the analysis time period to give a MWh value.

5.3.3. The percentage Capacity Factors are calculated using the MWh values from 5.3.2.

5.3.4. The mean average for each half hour for each month is taken to populate the heatmap.

5.3.5. The list of constraints is used to populate the Curtailment Per Constraint section with the 5 worst constraints. The from and to bus name is used to identify each constraint. Constraints are grouped into distribution and transmission to distinguish the causes of curtailment.

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Appendix

Supporting information

7. Appendix

Term	Definition	Explanation
ADMS	Advanced Distribution Management System	The software used by NGED's control centre to monitor, control and optimized the performance of the electrical distribution network
ANM	Active Network Management	The Energy Networks Association Active Network Management Good Practice Guide summarises ANM as: Using flexible network customers autonomously and in real-time to increase the utilisation of network assets without breaching operational limits, thereby reducing the need for reinforcement, speeding up connections and reducing costs
BESS	Battery Energy Storage Systems	Connections that can import or export power
BSP	Bulk Supply Point	A substation comprising of one or more Grid Transformers and associated switchgear
CAFPL	Connection Assets Forward Power Limit	Constraints on SGTs regarding power flow from the transmission to distribution network
CARPL	Connection Assets Reverse Power Limit	Constraints on SGTs regarding power flow from the distribution to transmission network
CCP	Connection Control Panel	The grid edge device NGED use to send signals to connections to monitor their import or output of power and instigate curtailment
DANM	Distribution Active Network Management	ANM conducted due to constraints on the distribution network
DCP	DCUSA Change Proposal	Proposals for changes to the code that DNOs/DSOs are obliged to follow (the Distribution code), that are then approved by Ofgem. DCP404 specifically relates to non-firm connections at the distribution level and aims to streamline and standardise how such customers connect to the grid.
DCUSA	Distribution Connection and Use of System Agreement	An agreement between electricity distributors, supplies and generators that specifies the terms & conditions for connection to and use of distribution systems
EHV	Extra High Voltage	132kV, 66kV or 33kV networks
GSP	Grid Supply Point	A substation comprising of one or more Super Grid Transformers and associated switchgear

GT	Grid Transformer	The transformers used at a Bulk Supply Point. Typically used to step down from 132 or 66 kV to 11 or 33 kV.
HV	High Voltage	11kV or 6.6kV
LTDS	Long Term Development Statement	An annually published document that sets out the use and likely development of the distribution network and the DNO's plans for modifying the distribution system for the following two years.
LV	Low Voltage	400V or 230/240V
NESO	National Energy System Operator	The body that performs the roles of transmission system operator (operation of the transmission system) and electricity system operator (real-time balancing of supply and demand)
PEL	Pre-Event Limit	A restriction applied to each branch to ensure that any event on the network will not cause the assets rating to be exceeded
PS	Primary Substation	A substation comprising of one or more primary transformers and associated switchgear
PT	Primary Transformer	The transformers used at a Primary substation. Typically used to step down from 66 or 33 kV to 11 or 6.6 kV
SGT	Super Grid Transformers	The transformers used at a Grid Supply Point. Typically used to step down from 400 or 275 kV to 132 or 66kV.
TANM	Transmission Active Network Management	ANM conducted due to constraints on the transmission network. This can be determined by Technical Limits or CAFPL/CARPLs
-	Constraint	Any limit on the ability of the licensee's Distribution System, or any part of it, to transmit the power supplied onto the licensee's Distribution System to the location where the demand for that power is situated.
-	Curtailable	A Curtailable Connection may enable a customer to connect quicker by agreeing that the use of some or all of that Connection may be restricted by the DNO/IDNO at certain times. The amount of Curtailment that a customer can be subject to will be measured relative to a defined Curtailment Limit, and the ability for a DNO/IDNO to Curtail that Customer may cease after an agreed end date
-	Export Capacity Factor	The ratio of the volume of MW a connection exports against the maximum volume of export capacity MW across a year

-	Flexible	Connection arrangements whereby a customer's export or import of electricity is managed (often through real-time control) based upon contracted and agreed principles of available capacity. Flexible Connections typically allow quicker and cheaper connection to the Distribution System but are made on the basis that there is no limit on the extent to which a user's access can be interrupted.
-	Intact	With open points in their normal position and without any outages that are material to the condition being considered or studied
-	Load	The flow of electricity on our network in any direction
-	Network Model	Digital representation of the electrical network made up of components such as buses, branches, loads and generators