

Common Methodology for Providing Curtailment Estimates

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Introduction

About ENA

Energy Networks Association represents the companies which operate the electricity wires, gas pipes and energy system in the UK and Ireland.

We help our members meet the challenge of delivering electricity and gas to communities across the UK and Ireland safely, sustainably and reliably.

Our members include every major electricity and gas network operator in the UK and Ireland, independent operators, National Grid ESO which operates the electricity system in Great Britain and National Grid which operates the gas system in Great Britain. Our affiliate membership also includes companies with an interest in energy, including Heathrow Airport and Network Rail.

We help our members to:

- Create smart grids, ensuring our networks are prepared for more renewable generation than ever before, decentralised sources of energy, more electric vehicles and heat pumps. Learn more about our [Open Networks programme](#).
- Create the world's first zero-carbon gas grid, by speeding up the switch from natural gas to hydrogen. Learn more about our [Gas Goes Green programme](#).
- Innovate. We're supporting over £450m of [innovation investment](#) to support customers, connections and more.
- Be safe. We bring our industry together to [improve safety](#) and reduce workforce and public injury.
- Manage our networks. We support our members manage, create and maintain a vast array of electricity codes, standards and regulations which supports the day-to-day operation of our energy networks.

Together, the energy networks are [keeping your energy flowing](#), supporting our economy through [jobs](#) and investment and [preparing for a net zero future](#).

About Open Networks

Britain's energy landscape is changing, and new smart technologies are changing the way we interact with the energy system. Our Open Networks programme is transforming the way our energy networks operate. New smart technologies are challenging the traditional way we generate, consume and manage electricity, and the energy networks are making sure that these changes benefit everyone.

ENA's Open Networks programme is key to enabling the delivery of Net Zero by:

- opening local flexibility markets to demand response, renewable energy and new low-carbon technology and removing barriers to participation
- providing opportunities for these flexible resources to connect to our networks faster
- opening data to allow these flexible resources to identify the best locations to invest
- delivering efficiencies between the network companies to plan and operate secure efficient networks

We're helping transition to a smart, flexible system that connects large-scale energy generation right down to the solar panels and electric vehicles installed in homes, businesses and communities right across the country. This is often referred to as the smart grid.

The Open Networks programme has brought together the nine electricity grid operators in the UK and Ireland to work together to standardise customer experiences and align processes to make connecting to the networks as easy as possible and bring record amounts of renewable distributed energy resources, like wind and solar panels, to the local electricity grid.

The pace of change Open Networks is delivering is unprecedented in the industry, and to make sure the transformation of the networks becomes a reality, we have created six workstreams under Open Networks to progress the delivery of the smart grid.

2022 Open Networks programme Workstreams

- WS1A: Flexibility Services
- WS1B: Whole Electricity System Planning and T/D Data Exchange
- WS2: Customer Information Provision and Connections
- WS3: DSO Transition
- WS4: Whole Energy Systems
- WS5: Communications and Stakeholder Engagement

Our members and associates

Membership of Energy Networks Association is open to all owners and operators of energy networks in the UK.

- ▶ Companies which operate smaller networks or are licence holders in the islands around the UK and Ireland can be associates of ENA too. This gives them access to the expertise and knowledge available through ENA.
- ▶ Companies and organisations with an interest in the UK transmission and distribution market are now able to directly benefit from the work of ENA through associate status.

ENA members



ENA associates

- [Chubu](#)
- [EEA](#)
- [Guernsey Electricity Ltd](#)
- [Heathrow Airport](#)
- [Jersey Electricity](#)
- [Manx Electricity Authority](#)
- [Network Rail](#)
- [TEPCO](#)

Executive Summary

The focus of Energy Networks Association (ENA) Open Networks WS1A Product 8 – Curtailment Information is to improve the availability and useability of pre-application curtailment estimates provided to customers. A phased delivery of improved curtailment information will be implemented throughout the remainder of ED1 and into ED2.

Stakeholder feedback has suggested that the availability of improved curtailment information that is more granular, accurate, and frequently provided would improve opportunities in flexible services and revenue stacking for customers with Active Network Management (ANM) enabled Flexible Connections assets. It can also create additional services for Flexibility Service Providers (FSPs) who can replace the curtailment needs with flexibility products.

The aim of this report is to establish a common methodology across all GB DNOs for providing indicative pre-application curtailment estimates, based on technology type and location. This information can help the customers avoid making connection applications in areas with high curtailment and focus on areas with lower curtailment, therefore achieve better utilisation of network capacity.

As an initial step, it is recommended that:

- Curtailment estimates, based on curtailment studies, should be available at the Grid Supply Point (GSP) and/or Bulk Supply Point (BSP) level.
- Models, parameters, and assumptions used for curtailment studies should be consistent with existing practice, which are adopted by each DNO.
- Curtailment estimates should be available for solar, wind, non-variable (e.g., gas), energy storage (only required if a variable profile is used and/or import curtailment is applied) and other technologies.
- The results should be published on a Geographic Information System (GIS) platform. To avoid duplication, existing capacity maps/heat maps should be considered as the first option for showing pre-application curtailment information.
- Curtailment estimation data used to populate the map should be made available for download.

Based on feedbacks from customers after adoption, this proposed methodology will be reviewed and will be subject to future improvement.

The product team intends to keep this document live adopting the feedback from stakeholders and also future requirements emerging from the outcomes of the Ofgem Final Decision on Access and Forward-Looking Charges Significant Code Review (SCR). The product team are cognisant of the difference between the curtailment limits set by the SCR and the curtailment estimate provided during connection, which are at system normal conditions, excluding (N-1) and transmission related curtailment.

The product team are working closely with the SCR implementation groups to ensure the recommendation in this report are adapted or updated to suitability reflect the outcomes of the SCR working group. In addition, the product team will continue to engage with asset owners and wider industry via the Focus Group and Flex consultation on whether we need to make any changes to our plans for sharing the curtailment estimates in light of Ofgem Final Decision on Access and Forward-Looking Charges Significant Code Review.

WS1A Product 8

Stakeholder feedback has suggested that the availability of improved curtailment information that is more granular, accurate, and frequently provided would improve opportunities in flexible services and revenue stacking for assets with FC. It can also create additional services for FSPs who can replace the curtailment needs with flexibility products. The focus of WS1A Product 8 – Curtailment Information was to work with stakeholders to develop a strategy for improving the availability of curtailment information with a phased delivery of improved curtailment information throughout the remainder of ED1.

Deliverables for 2022

This report is the outcome for deliverable C - common methodology for providing curtailment estimates. The aim is to establish a common methodology for providing indicative curtailment estimates based on technology/location.

Ref	Product Element	Deliverables	Scope/description	Expected Completion
A	Improvements to pre-application information	Recommendations (slides)	Recommendations for DNOs to agree consistent timeframe for updating constraint information on heat maps.	Feb-22
B	Implementation stage 1	Publish profiles	DNOs to publish - Generation and battery storage standard profiles. - Curtailment estimates on heat maps.	Mar-22
C	Improvements to pre-application information	Common methodology for providing curtailment estimates	Report describing common methodology for providing indicative curtailment estimates based on technology/location.	Jul-22
D	Consistency of data	Common approach to sharing information	The report will include: - Agreed common template for curtailment report with consistent level of granularity. - A set of aggregated ANM actions/curtailment and publish in consistent format.	Oct-22
E	Improvements to flexible connection offer information	Best practice for providing connection offer information Publish LIFO stack information	Paper to establish best practice for providing LIFO stack information. Publish best practice LIFO stack information in connection offers.	Nov-22
		Guidance document on	Prepare and publish guidance document on standard assumptions used in curtailment assessments.	

		standard assumptions		
F	Implementation stage 2	Flexible connection curtailment report	DNOs to publish agreed flexible connection curtailment report in line with agreed template.	Dec-22 and beyond

Scope of this report

The aim of this report is to establish a common methodology across all GB DNOs for providing indicative pre-application curtailment estimates, based on technology type and location. The intention is to provide curtailment estimation for long term flexible connections. Curtailment estimates for customers connected under active network management (ANM) or distributed energy resource management systems (DERMS) before reinforcement work is completed are not covered this report.

Curtailment studies

The models, parameters, and assumptions used for the curtailment studies should be consistent with each DNO’s existing design standard and/or code of practice. This is to ensure the estimation will be in line with the curtailment report to be received by prospective customers. Such models, parameters, and assumptions may include, but not be limited to:

- Queue management methodology (e.g., Last in first out (LIFO), or Curtailment Index)
- Demand profiles.
- Generation profiles for connected, accepted and on-going (quoted or pre-quotation) connections.
- Ratings and control criteria applied such as:
 - If pre-fault curtailment is required
 - If cyclic/distribution rating or short-term rating is used

Standard profiles

It is recommended that the curtailment studies are carried out with the standard profiles that are currently adopted by each DNO.

For solar and wind, DNO -specific standard profiles will capture the varying geographical characteristics of generation profiles between DNO areas, therefore producing more meaningful and accurate curtailment estimates to prospective connections in the area.

It is recognised that DNOs are currently using different profiles for energy storage. However, it is beyond the scope of this product to harmonise the energy storage profiles used for curtailment studies between DNOs.

Curtailment locations

Curtailment studies should be carried out for each GSP and/or BSP at a voltage level below 72kV (e.g., 33kV or 66kV), as a minimum. If ANM is not required at the GSP and/or BSP, this area should be shown either as

uncurtailed or be given a curtailment of 0%. A typical size of 10MW of connection can be used for the study at the supply point.

Curtailment estimates at the higher voltage level of the same GSP and/or BSP may be provided, if feasible. Curtailment at higher voltage level of the same supply point may be lower, as there are potentially fewer constraints such as protection settings or a transformer's tap changer ratings. However, providing curtailment figures at a lower voltage is likely to cover a larger number of prospective connections. Meanwhile, a larger connection is more likely to attract site specific discussions between the customer and DNO, so curtailment can be discussed. Finally, providing multiple curtailment figures at different voltage level may be difficult to implement on GIS platforms due to overlapping layers, though curtailment at various voltage levels can be provided by providing a separate sheet for downloading.

Curtailment estimates can be provided at a higher geographical resolution, at primary substations or congested areas, if this curtailment is significantly higher than the associated BSP. As illustrated in figure 1 below, consider two locations for prospective generators: a new generator at higher voltage, prospective generator (PG) 1, and at lower voltage, prospective generator 2. If constraints 3 and 4 are active, PG2 is likely to have a much higher curtailment compared to PG1. In this case, curtailment figures should be shown for the 11kV primary substation. On the other hand, if constraints 3 and 4 are inactive therefore there is no additional constraints for PG2, there is no need to show the curtailment figure for the 11kV primary substation.

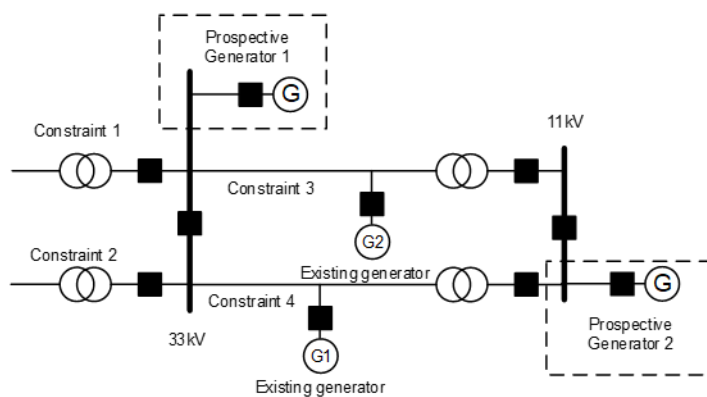


Figure 1

Curtailment estimations

Technologies

Curtailment estimation information should show specific results for the following technologies:

- Solar.
- Non-variable (e.g., gas).
- Wind.

- Energy storage. This will only be required if a variable profile is used and/or if ANM is used for controlling the import of energy storage.
- Other technologies if applicable such as hydro and tidal generation

Levels of curtailment

Energy reduction-based curtailment

DNOs currently show the level of curtailment based on percentage reduction in energy (MWh), by comparing the curtailed profiles to the standard profiles (uncurtailed). Curtailment estimation, given in energy export reduction, can be shown in four bands:

- <5% annual energy curtailment
- 5-10% annual energy curtailment
- 10-20% annual energy curtailment
- >20% annual energy curtailment

Time-based curtailment

In “Access and Forward-Looking Charges Significant Code Review: Final Decision” published by Ofgem, curtailment is defined as the maximum number of hours that the FCs are curtailed. If the curtailment studies have been carried out with one or two years of data, the curtailment hours can be derived by comparing the curtailed and uncurtailed profiles. Curtailment estimation, given in curtailment hours, can be shown in four bands:

- <438 hours annually (<5%)
- 438-876 hours annually (5-10%)
- 876- 1752 hours annually (10-20%)
- >1752 hours annually (>20%)

Publishing curtailment estimates

Platform for publication

The curtailment figures should be published on a GIS platform that is able to show indicative curtailment level for each BSP. The curtailment figures can be provided either in graphic format or text format. The most suitable format should be considered so that this information can be integrated with existing heat maps/capacity maps.

An example is given below to show one possible solution for implementation.

Data download

Curtailment estimates can be made available for download. Data should be provided in the most suitable formats (csv or shape file) that can be integrated with existing capacity maps. If this data is provided, it should include the following information:

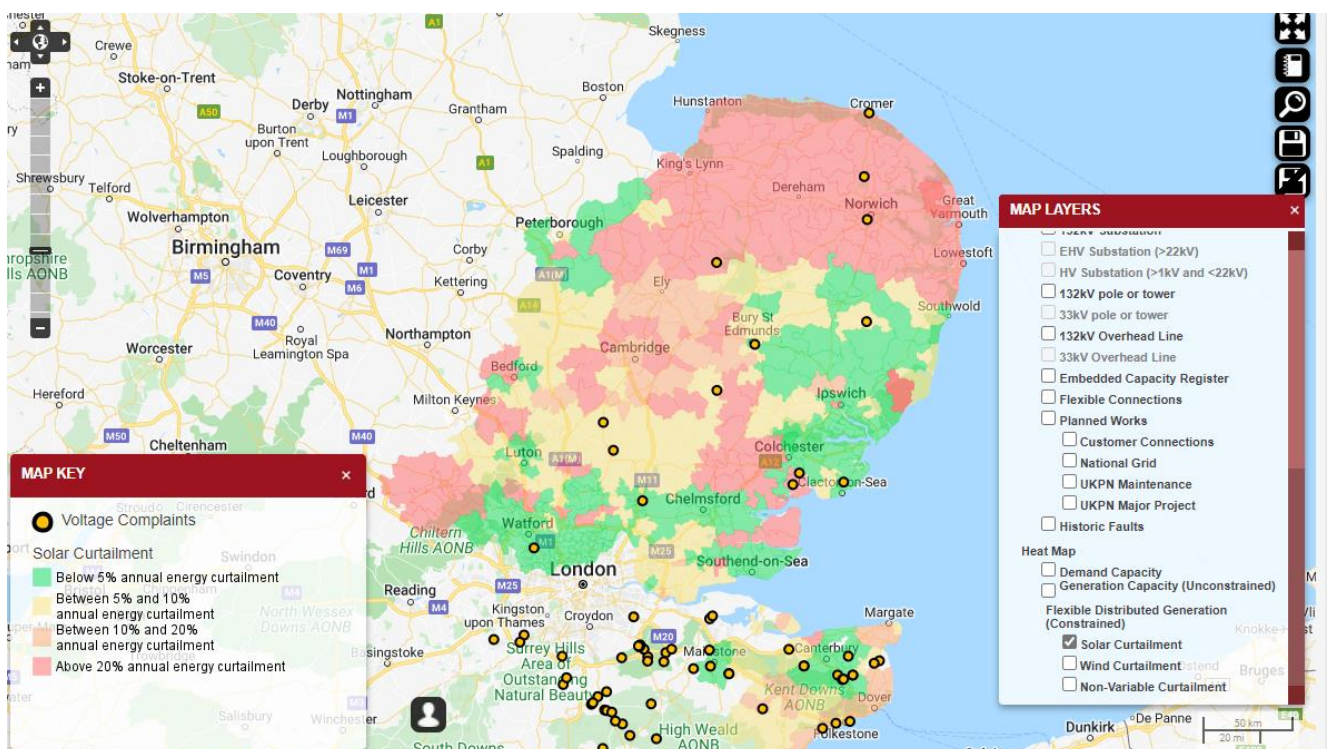
- Substation name,
- Substation location,
- Technology type and curtailment estimates for each.

Example

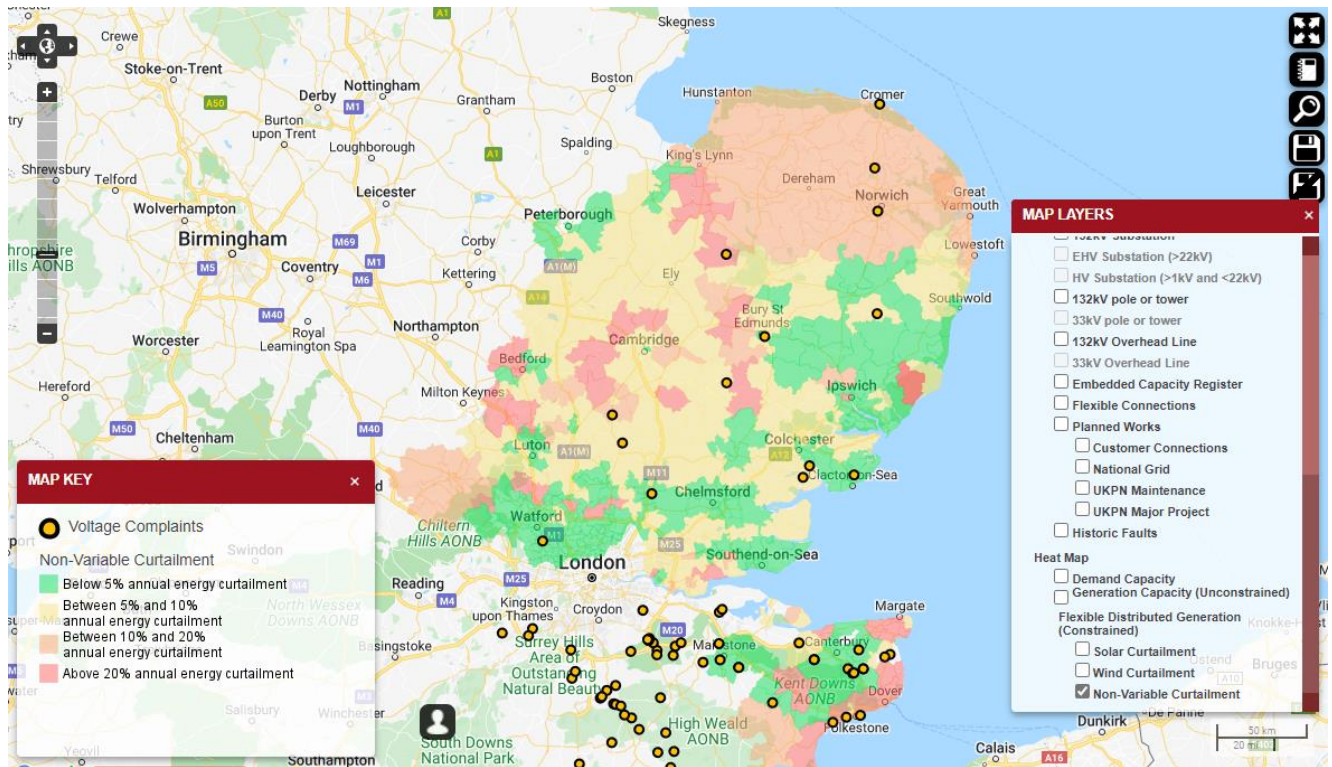
An example is given below, which shows the indicative level of curtailment for solar and non-variable generation within UK Power Networks’ area.

Different levels of curtailment are shown in different colours. Areas currently supplied by a BSP will be covered with a polygon. The colour of the polygon represents the level of curtailment of a certain technology. Assuming curtailment at substation A is over 20% for solar and less than 5% for non-variable.

When the user selects solar curtailment, geographical areas with demand customers supplied by substation A will be covered with a red polygon to indicate high curtailment.



When technology type is changed to non-variable, the same area is covered with a green polygon to indicate a curtailment level of <5%



It is assumed that a proposed connection will be connected to the same supply point for load, either to local circuits, or a direct connection back to the supply point. However, it is recognised that such connections are not always feasible or the minimum cost solution. It is possible for a proposed connection, located in area supplied by one supply point, to be connected to another supply point, which does not currently supply demand in the area. As shown in figure 2 below, the proposed connection is in area supplied from Substation A. based on the heap map, the proposed connection will be subject to a high curtailment. However, if the minimum cost solution is to connect to substation B, the proposed connection will not be supplied for Substation A and will be subject to a lower curtailment

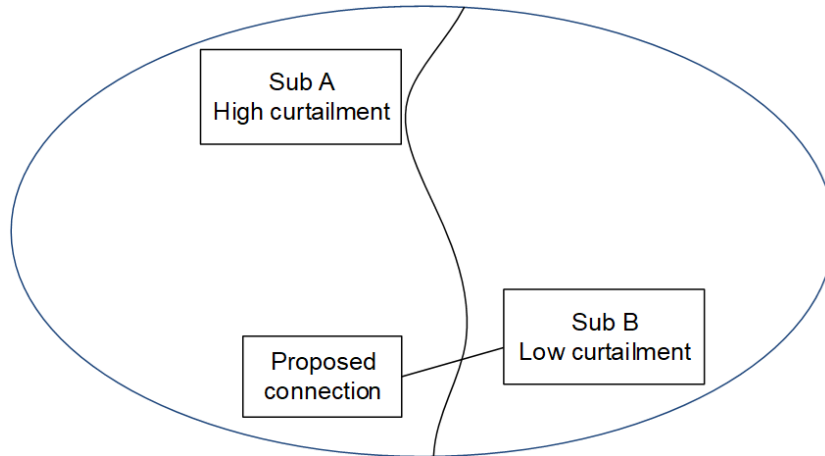
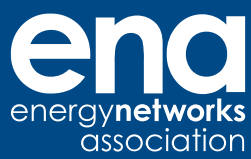


Figure 2

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