

The Voice of the Networks



Energy Networks Association

Industry-led Access Rights Allocation Group 2019

**Combined report for ‘The Trading of
Non-firm distributed generation
curtailment obligations’, and
‘The Exchange of Access Rights
between Users’**

Product 1 and 2

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Restriction: Public

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1 Introduction

Background

- 1.1 In December 2018 Ofgem launched a Significant Code Review¹ of Electricity Network Access and Forward-Looking Charges, with the objective of ensuring that electricity networks are used efficiently and flexibly, reflecting users' needs and allowing consumers to benefit from new technologies and services while avoiding unnecessary costs on energy bills in general.
- 1.2 In its launch statement Ofgem sets out those areas that it expected to lead and those areas that it expected industry to take forward. Through the ENA the electricity system operator and network operators formed a working group under the governance of the Open Networks² project to progress those issues identified by the SCR launch statement.
- 1.3 A Project Initiation Document (PID) developed by the Industry led Access Working Group formed to progress the four issues raised by Ofgem was approved by the Open Networks Steering Group in April 2019. The PID identifies the Products 1 to 4 as:
 - Product 1: Trading of Non-firm distributed generation curtailment obligations
 - Product 2: The Exchange of Access Rights between users
 - Product 3: Queue Management
 - Product 4: ANM Charging.
- 1.4 This report only looks at Products 1 and 2, and the sections of PID that relate to these Products are shown in Annex 1. Other work on trading concepts is taking place in a product under the Access SCR sub-group (differences between shared access and traded access) and the potential for trials of Products 1 and 2 are being considered for work under Open Networks for 2020.

Purpose of this document

- 1.5 This report provides an update to our stakeholders on the progress made in delivering **Product 1** (Trading of Non-firm distributed generation curtailment obligations) and **Product 2** (The Exchange of Access Rights between users).
- 1.6 The purpose of this report is to:
 - develop thinking on the trading of non-firm distributed generation curtailment obligations and the exchange of access rights between users, seeking input and views from wider industry participants; and
 - provide the foundations for further work to be taken forward by the ENA's Open Networks project in 2020 to:
 - Test principles/ rules against planned market simulations
 - Identify trial opportunities
 - Validate pre and post-transaction datasets utilising trials.
- 1.7 An early draft of this report was shared with the TRANSITION and LEO³ project teams and was used to provide direction in the development and implementation of Market Simulations with industry participants. Guidance was based around the Principles and Rules outlined in Sections 3 and 4. Further details of these projects and their outputs are contained in Section 5 of this report.

¹ https://www.ofgem.gov.uk/system/files/docs/2018/12/scr_launch_statement.pdf

² <http://www.energynetworks.org/electricity/futures/open-networks-project/>

³ <https://ssen-transition.com/dso/leo/>

2 Overview of current connection arrangements

Introduction

- 2.1 A significant proportion of generation connected to the distribution system in the last five years has done so because of flexible connection arrangements. The expected flexibility of the generator will be defined within the connection agreement with the DNO/IDNO to which they connect, i.e. the conditions and/or events that require the output of the generator to be curtailed. In addition, the network constraint will generally be identified and described in the connection agreement, e.g. the demand on asset A exceeds its capacity.

Current flexible arrangements

- 2.2 Figure 1 below details the types of flexible connection arrangements offered by DNOs to potential customers wishing to connect to distribution networks.

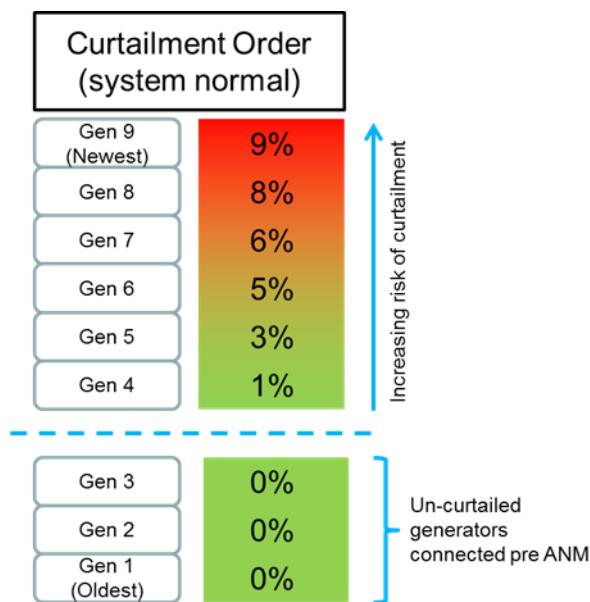
Figure 1: Examples of flexible connection arrangements currently being offered by DNOs

Timed Capacity Connections	This solution offers a connection with a fixed level of curtailment. The customer manages their import/export level within a prescribed operating schedule agreed within their Connection Agreement.
Export Limiting Devices	Automated equipment at the customer's substation controls the customer's demand / generation to ensure that the customer's Agreed Export Capacity is not exceeded.
Local Management Schemes	Network feeder monitoring is taken from the protection panels located at the customer's site. Capacity is temporarily reduced for prescribed feeder outages or monitored voltages / currents exceeding the limits prescribed in the Connection Agreement.
Remote Intertrip Schemes	Capacity is temporarily reduced to a pre-defined level (which may be zero) for prescribed system abnormal network conditions. These may be distant from the customer's site and are monitored in real-time.
Active Network Management (ANM)	In areas where there are multiple or complex constraints affecting one or more customers, full ANM systems will be implemented. These distributed control systems continually monitor the limits on the network and then allocate the maximum amount of capacity to customers in that area.

- 2.3 In areas where there are multiple or complex constraints affecting one or more customers, Active Network Management systems (ANM) will be implemented. These distributed control systems operate in real-time and monitor inputs, outputs, network flows and voltages at key points within the controlled zone. If the network is approaching limits, the ANM controller instructs actions to be taken. These could be changes in network topology or changes in the power into or out of the network, depending upon the characteristics of the particular system. Examples include:
- **ANM Circuit Schemes** which manage a limited number of customers and are managed at an HV circuit or Secondary Substation level;
 - **ANM Customer Substations** which use an ANM controller to send Curtailment signals based only on the voltage and current measurements at a single substation; and
 - **ANM Zones** which are more complex ANM systems which manage areas of network supplied at Primary or Grid substation level and may encompass multiple substations.

- 2.4 Where multiple generators are connected to the same network assets and face the same constraints, there have been a range of approaches in managing the generators within the parameters of the constraints. The two common types are:
- Last In First Off (LIFO): the network user that connects last gets curtailed first (and so on in order) until the constraint is alleviated; and
 - Capacity sharing: all network users are curtailed by an agreed amount (absolute or percentage) to alleviate the constraint.
- 2.5 This report focuses on LIFO arrangements as they are much more prevalent on existing ANM schemes than capacity sharing arrangements⁴. Figure 2 gives a pictorial representation of a LIFO stack.

Figure 2: Example of a LIFO 'stack'



- 2.6 Generators 1-3 are assumed to have connected first before a network constraint arose, and so have no curtailment obligations. Generator 4 was the first to have to make a choice between triggering network reinforcement (which it would be required to partially fund under the connection charging apportionment rules) and having its output managed by an ANM system. Generators 5-9 faced a similar choice, with all of the generators having opted to have their output managed by the ANM scheme rather than trigger network reinforcement. Generator 9 has the highest likelihood of curtailment as it will be curtailed first to alleviate the constraint (i.e. last in, first off).
- 2.7 The following key information must be known for the DNO/IDNO to manage a constraint:
- An expected constraint will happen which can be described in terms of MW (or MWh) in time or by a defined set of conditions i.e. an event such as system abnormal.
 - A list of network users whose behaviour influences the constraint is known along with their scope of flexibility. That list must include those that have contractual arrangements to be curtailed and those that do not.
 - A curtailment order is known that is rules based.

⁴ Note, no assumptions have been made on the IT hardware, software, communications or electrical infrastructure required to ensure LIFO or Capacity Sharing or another approach can be delivered in practice.

Application of LIFO - Constraints under System Intact Conditions

- 2.8 Where a flexible connection is used to constrain capacity under System Intact conditions, the level of capacity is allocated to each customer based on the date when the customer's connection was accepted. The LIFO hierarchy prioritises the oldest connections when issuing capacity. LIFO aims to offer developers increased certainty in their investment decision making processes.

Application of LIFO - Constraints under First Circuit Outage

- 2.9 Where a flexible connection is used to constrain capacity under First Circuit Outage (FCO) conditions, the ANM scheme will, where efficient and technically practicable, use LIFO principles in conjunction with 'Sensitivity Factors'. This approach seeks to make efficient use of the network whilst having due regard of the LIFO stack. In complex interconnected networks, a wide variety of factors can affect a network constraint. The amount of influence a customer connected to an ANM scheme can have on a particular constraint is sensitive to both the topology and the characteristics of the network. Sensitivity Factors represent the degree to which a given customer is able to influence a particular network constraint under a particular network outage. These factors can be used to optimise the available real-time network capacity by minimising the overall level of curtailment required to resolve a network constraint. The principles of access under FCO conditions are based on a hybrid of LIFO and Sensitivity Factors. It applies LIFO amongst only those ANM customers assessed to influence the critical network parameters.
- 2.10 In networks with radial topologies that do not have alternative supplies, the need for Sensitivity Factors is reduced as all generators are more likely to have a similar influence on the critical upstream network parameters, meaning there may be little difference in efficiency between LIFO and minimum curtailment based on Sensitivity Factors.

Curtailment Index

- 2.11 In December 2017 Electricity North West introduced its Curtailment Index approach. All Distributed Generation connection offers greater than 200kW, and non-firm demand connections greater than 200kW are provided with a curtailment index within their quotation. The aim of the curtailment index is to provide assurance to network users that on average the network will be available for use for an average time per year.
- 2.12 Electricity North West publishes a curtailment index per voltage level which is presented as the percentage of time that the network is unavailable. To determine the curtailment index Electricity North West considers all the scenarios when the system is abnormal and unavailable, for instance during faults, and construction and maintenance outages.
- 2.13 When a customer connects the company monitors the actual curtailment experienced by the customer, and if this level approaches or exceeds the index value it will investigate and potentially seek to intervene.
- 2.14 Network users with a curtailment index will receive an annual review letter, which will provide the curtailment experienced, looking back over the year. The 'actual' curtailment is calculated based on a six year rolling average.

Transmission Arrangements

- 2.15 **Firm versus non-firm** - At transmission, a user's connection may be "firm" if it meets the applicable standards within the SQSS or "non-firm" where doesn't meet those applicable standards (and is designated as a design variation), or generally where it relates to an offshore transmission system. The scope of the 'non-firm' arrangements will then be set out within their connection agreement to show where restrictions on availability apply to certain

circuits and outage conditions (i.e. with no compensation payable) as a result of the non-firm arrangements. There may in some cases be a second stage of reinforcement works contracted which removes some or all of those non-firm arrangements in future.

- 2.16 **TEC Exchange** - This is available when a connected user offers some of their Transmission Entry Capacity (TEC) and it is agreed via the ESO that another user will use this TEC instead (but only up to their Connection Entry Capacity (CEC)) over a limited duration.
- 2.17 TEC Exchange, however, has had limited uptake, which could be due to various reasons, including the fact that it only applies to connected projects with TEC and where there is already headroom below their CEC contracted. In addition, the majority of parties who currently enquire about TEC exchange, either want one of the products outlined below instead or want to become more "firm" and this is not facilitated by a TEC exchange.
- 2.18 **Short duration TEC** - A connected user can apply for additional TEC (but only up to their CEC) over a four (and potentially five or six depending on the short-term application type) week block in a given financial year.
- 2.19 **Limited duration TEC** - A connected user can apply for additional TEC (but only up to their CEC) for a minimum of seven weeks in a given financial year (in weekly increments) with potential to choose between a semi-fixed or a variable increase.

3 Framework for enabling curtailment obligation trades, under Product 1

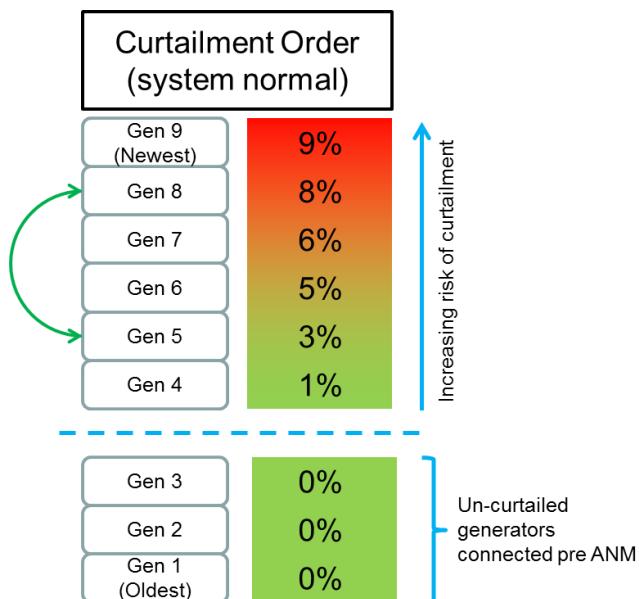
Introduction

- 3.1 The aim of this section is to give simple examples of how trades between parties with curtailment obligations could take place, in theory, behind a common constraint. The examples illustrate simple bilateral trades of one generator with one other generator, but it may be possible for multiple trades to be in place at the same time e.g. in order to trade away its entire curtailment obligation, one large generator may trade parts of its curtailment obligation with several other smaller generators. A pre-requisite is that all the customers are in the same stack behind the same constraint. In theory some of the generators could be connected to a DNO network and some connected to IDNO networks, but controlled by the same ANM scheme, however this would require ownership and control arrangements to be put in place for the network and customer management equipment.
- 3.2 Further, this section describes the principles which could underpin the trading of curtailment obligations between generators in a LIFO stack and the potential trading rules which could support those principles.

Trading between two generators that are at risk of being curtailed

- 3.3 This example considers a trade between two generators, both of whom have a curtailment obligation, as shown in Figure 3 below.

Figure 3: Trading between two generators that are at risk of being curtailed

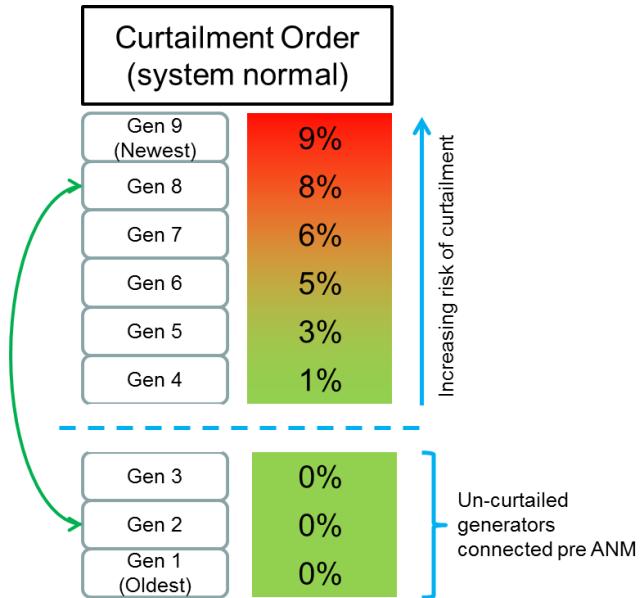


- 3.4 In this example, generator 8 (i.e. 'Gen 8') has sought to reduce the likelihood that it will be curtailed by trading with generator 5 (i.e. 'Gen 5'). As a result, the new curtailment 'stack' will go in the sequence generator 9, 5, 7, 6, 8 then 4. Depending on the extent of the constraint, there may now be circumstances in which generator 5 is curtailed but generator 8 is not (for example if only three generators are required to curtail output in order to alleviate the constraint).

Trading between a generator that is at risk of being curtailed and a non-curtaileable generator

- 3.5 This example considers a trade between two generators, one of whom has a curtailment obligation and one which does not, as shown in Figure 4 below.
- 3.6 In this example, generator 8 (i.e. 'Gen 8') has traded away its curtailment obligation entirely by trading with generator 2 (i.e. 'Gen 2'). As a result, the new curtailment 'stack' will go in the sequence generator 9, 2, 7, 6, 5 then 4.

Figure 4: Trading between a generator at risk of being curtailed and a non-curtaileable generator



Trading principles

- 3.7 Four principles for trading have been identified:

- Transparent information sharing;
- Ability to maintain network continuity;
- Visibility of other potential trading parties; and
- Transparent trading arrangements.

These are described in further detail below.

PRINCIPLE 1: Transparent information sharing

Principle definition: Sufficient information must be made available to enable generators to undertake trades, and to enable network operators to determine the new 'stack' post-trading.

Considerations

- 3.8 In order for trades to take place, generators must be able to value a change in their level of curtailment obligation. To do so, they will need information about the constraint, including the scenarios which would lead to their existing and prospective curtailment obligations being required, and the likelihood of those scenarios occurring.

- 3.9 Network operators must be able to give effect to the new curtailment order post-trade, and so needs to know that trades have taken place.
- 3.10 At this stage it is unclear whether there is value in the network operator knowing the conditions of the curtailment trade, as the value of the trade may reveal information on the necessity for removing the constraint through network reinforcement. The rules specified below do not include a requirement for information on the price of the trade to be shared – this is left open for consideration at this stage.

Potential rules

- 3.11 A set of rules is necessary for the trades to take place practically – our initial view is that these are, at least:
 - The network operator must make information available about a constraint to the network users impacted by that constraint. This information should include the possible extent of the constraint (in MW or MWh) and times or network conditions at which curtailment will be necessary to alleviate the constraint;
 - The network operator must publish the process it will follow to determine which generators to curtail to alleviate the constraint under each plausible scenario; and
 - Parties who have traded must provide the network operator with details of the trade, including which parties have traded, the magnitude of the trade and the time periods for which the trade will be applicable. This sharing of information may be facilitated through a trading platform where applicable.

PRINCIPLE 2: Ability to maintain network continuity

Principle definition: *Trading of curtailment obligations must not undermine the ability of the network operator to maintain the continuity of its network in the constrained area.*

Considerations

- 3.12 The network operator can only ensure network stability if the generator taking on the curtailment obligation is able to comply with its new obligations post-trade. This will require any generator taking on a curtailment obligation to have an ANM local system monitoring unit on their connection. This could be confirmed by 'pre-authorisation' for trading from the network operator. Generator connection agreements may require to be modified to reflect post-trade changes to LIFO positions and curtailment order.
- 3.13 A trade can only take place if the generator taking on the curtailment obligation has an equivalent impact on the constraint as the generator reducing its curtailment obligation. This may require the generator taking on the curtailment obligation to commit to a different MW reduction than the generator reducing its curtailment obligation because a given network constraint may have different sensitivity to the MW output of different generators (see Appendix 2 for an example relating to voltage rise).
- 3.14 Sensitivity factors (defined between zero and one) can be used to encode the extent to which a MW reduction of each generator relieves the constraint. A substitution factor can then be determined as the ratio of the sensitivity factors of two generators to give the MW reduction required from the generator taking on the curtailment obligation in order to have an equivalent impact on the constraint to the generator with the curtailment obligation.
- 3.15 By going through a relatively straightforward pre-authorisation (which simply checks that appropriate assets are in place at the connection) and then applying substitution factors, it may not be necessary for the network operator to approve trades. However it is not yet clear

that this can apply in all circumstances, so an additional rule requiring trades to be technically approved by the network operator may be necessary.

Potential rules

- 3.16 A set of rules is necessary for the trades to take place practically – our initial view is that these are, at least:
- The network operator must pre-authorise any generator wishing to trade, by confirming that generator has the ability to comply should it become liable for a curtailment obligation; and
 - The MW reduction agreed by the generator taking on the curtailment obligation must have an equivalent impact on the constraint as the MW reduction already required by the generator with the curtailment obligation, as determined by substitution factors.

PRINCIPLE 3: Visibility of potential trading opportunities

Principle definition: *Those generators which have 'opted in' to trading must be aware of potential trading opportunities and understand other trading parties' capability for flexibility.*

Considerations

- 3.17 In order for a market for curtailment trading to exist, potential participants will need to be able to determine what opportunities for trading are available from other parties under the same constraint. But in order to comply with data privacy and confidentiality rules, generators will need to 'opt in' to potential trading.
- 3.18 The rules supporting this principle are dependent on the mechanism by which trades are delivered. Trading could be:
- 'paper based', in which case trading parties would likely need to make themselves known to the network operator which would then publish a (potentially anonymised) list of potential trading parties; or
 - via an 'electronic platform', in which case trading parties would opt in by registering for use of the platform.

Potential rules

- 3.19 A set of rules is necessary for the trades to take place practically – our initial view is that these are, at least:
- Generators wishing to trade must opt in to potential trading.
 - A register (or platform) must exist for visibility of potential trading opportunities. This could either be:
 - In the case of bilateral trading, a list of generators connected to the network that have the potential to alleviate the constraint and which have opted in to trading must be made available, including:
 - their current curtailment obligation (if applicable);
 - their flexibility or curtailment granularity; and
 - their effectiveness in alleviating the constraint (i.e. their sensitivity factor).
 - In the case of platform facilitated trading, a list of all potential trades offered by the parties behind the constraint including:
 - whether they are offering to increase or bidding to decrease a curtailment obligation;

- the parameters of their potential trade i.e. level of curtailment and time period;
- their effectiveness in alleviating the constraint (i.e. their sensitivity factor); and
- their bid/offer price for making the trade.

PRINCIPLE 4: Transparent trading arrangements:

Principle definition: *The parameters within which trading can take place must be well-defined and available to all trading parties.*

Considerations

- 3.20 To facilitate curtailment trading it is necessary to define and publish the parameters within which parties can trade. The detail of these parameters is yet to be defined, but options are included for consideration.
- 3.21 Firstly, the time period for which trades can take place must be defined and could range from short duration to a permanent arrangement. With established settlement arrangements, the most granular time periods for which trades could take place would be in blocks of half hourly settlement periods. But ANM schemes manage networks in real time, so there may be options for trading to take place within a settlement period. Conversely, the need for network operators to reconfigure ANM systems may mean that only longer-term trades are viable, and so trades may, for example, be required to be applicable for at least a 24 hour period.
- 3.22 Secondly, a clearly defined end to the trading window is required (often referred to as 'gate closure'). This will need to be set a time which enables the network operator to reconfigure its ANM system to take into account the traded position before the time period in which the trade takes effect. The time period required will also depend on whether the network operator is required to approve trades – if so, the trading window will need to close sooner (i.e. further away from real time) to enable approval to take place. It may also be useful to identify a defined starting point at which trades can take place before the time at which they will take effect.
- 3.23 In addition, trading parties will need to comply with competition law and procurement rules as applicable and non-trading parties should not be adversely affected as a result of a trade.

Potential rules

- 3.24 A set of rules is necessary for the trades to take place practically – our initial view is that these are, at least:
 - Trades must be defined in time periods of [minimum trade duration]; and
 - Trades can take place at any point between [time period] and [time period] before the time at which the trade will take effect.

4 Proposed principles and rules for exchange of non-curtailable maximum import and/or export capacity and the equivalents at transmission, under Product 2

Introduction

- 4.1 The aim of this section is to describe the principles which could underpin the exchange of capacity rights between users with non-curtailable capacity. In this section exchange means a user reducing their maximum capacity rights and another user increasing their maximum capacity rights. Such exchanges or trades do not take place at the moment in distribution, however, the facility for Transmission Entry Capacity (TEC) exchange exists in transmission. In theory such exchanges could take place across network boundaries, for example a DNO connected user could exchange capacity with an IDNO connected user. A pre-requisite for such trades would be however that both users were connected behind the same constraint and therefore located in the same geographical vicinity.

Exchange principles

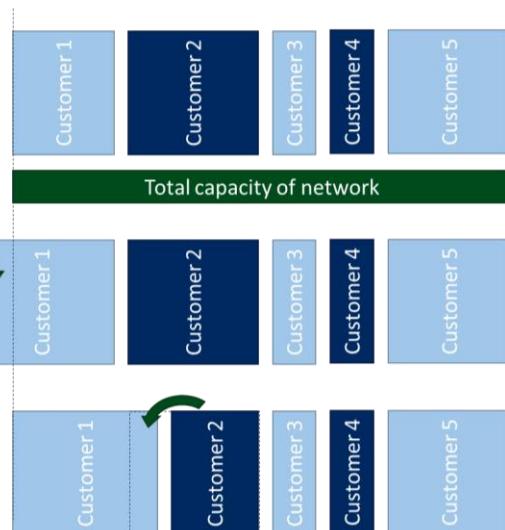
- 4.2 Figure 5 below illustrates the options open to a customer wishing to increase their capacity rights in a constrained network.

Figure 5: An example of the option of exchanging capacity rights between users

An existing network is built to meet the capacity requirements of five customers. Customer 1 wishes to increase their allocated capacity.

Option 1

Reinforcement is completed to enable Customer 1 to increase their allocated capacity.



Option 2

Customer 2 releases some of their allocated capacity to enable customer 1 to increase their allocation.

(Product 2A identifies principles and rules to support this)

- 4.3 Four principles for exchanging capacity rights have been identified:

- Transparent information sharing;
- Ability to maintain network continuity;
- Visibility of other potential parties; and
- Transparent exchange arrangements.

These are described in further detail below.

PRINCIPLE 1: Transparent information sharing

Principle definition: Sufficient information must be made available to enable users to undertake the exchange of rights.

Considerations

- 4.4 In order for exchanges to take place, users must be able to value a change in their level of maximum capacity. To do so, they will need information about where capacity is available either via their system or network operator (hereafter referred to as the network operator) or another user who is willing to exchange.
- 4.5 Network operators must approve the new capacities⁵, and so need to know what exchanges have occurred.
- 4.6 At this stage it is unclear whether there is value in the network operator knowing the conditions of the capacity exchange, as the value of the exchange may reveal information on the necessity for network reinforcement. The rules specified below do not include a requirement for information on the price of the exchange to be shared – this is left open for consideration at this stage.

Potential rules

- 4.7 A set of rules is necessary for the exchanges to take place practically – our initial view is that these are, at least:
 - The network operator must make information available about head room capacity to the network users impacted by a potential constraint; and
 - Parties who have agreed to exchange capacity must provide the network operator with details of the exchange, including which parties have exchanged, the magnitude of the exchange and the time periods for which the exchange will be applicable to ensure connection agreements can be updated. This sharing of information may be facilitated through a platform where applicable.

PRINCIPLE 2: Ability to maintain network continuity

Principle definition: Exchange of capacities must not undermine the ability of the network operator to maintain the continuity of its network.

Considerations

- 4.8 The network operator must be able to ensure network stability after an exchange of capacities. It is likely that the network operator may need to undertake studies to understand the network impact of an exchange before it takes place which may result in conditionality for the exchange.
- 4.9 An exchange can only take place if the user taking on additional capacity has an equivalent or lesser impact on the potential constraint as the user reducing its maximum capacity. This may result in the actual increase in maximum capacity for the user taking on capacity being lower than the actual maximum capacity released by the user giving up capacity if there are network operability concerns, for example voltage increases, (see Appendix 2 for an example relating to voltage rise).
- 4.10 Connection agreements will require to be modified to reflect the parties' respective maximum capacity rights, post-exchange.

Potential rules

⁵ Pursuant to s16 of the Electricity Act in respect of premises level Maximum Power Requirements to record the new legal level of use by a given premises.

- 4.11 A set of rules is necessary for the exchanges to take place practically – our initial view is that these are, at least:
- The exchange of maximum capacity will be assessed on a case by case basis to ensure it is technically feasible; and
 - The cumulative impact of the exchange on the network must have the same or less impact on the potential constraint.

PRINCIPLE 3: Visibility of other potential trading parties

Principle definition: *Those users which have 'opted in' to exchanging capacity must be aware of other potential parties with whom they can exchange.*

Considerations

- 4.12 In order for a market for capacity exchange to exist, potential participants will need to be able to determine with which other users they can exchange. But in order to comply with data privacy and confidentiality rules, users will need to 'opt in' to potential exchanges.
- 4.13 The rules supporting this principle are dependent on the mechanism by which exchanges are delivered. Exchanges could be:
- 'paper based', in which case parties would likely need to make themselves known to the network operator which would then publish a (potentially anonymised) list of potential parties; or
 - via an 'electronic platform', in which case parties would opt in by registering for use of the platform.

Potential rules

- 4.14 A set of rules is necessary for the exchanges to take place practically – our initial view is that these are, at least:
- Users wishing to exchange capacity must opt in; and
 - A list of users connected to the network behind the potential capacity restriction that have the potential to exchange capacity and which have opted in to potential exchange must be made available.

PRINCIPLE 4: Transparent exchange arrangements:

Principle definition: *The parameters within which exchanges can take place must be well-defined and available to all parties.*

Considerations

- 4.15 To facilitate maximum capacity exchanges it is necessary to define and publish the parameters within which parties can exchange. The detail of these parameters is yet to be defined, but options are included for consideration.
- 4.16 Firstly, the time period for which exchanges can take place must be defined and could range from short duration to a permanent arrangement. Any short duration must take into consideration the need for contractual changes to reflect the exchange.
- 4.17 Secondly, a clearly defined end to the exchange window is required (often referred to as 'gate closure'). This will need to be set a time which enables the network operator to ensure

contractual changes and any operational changes e.g. on intertrips are made before the exchange comes into effect.

- 4.18 In addition, parties will need to comply with competition law and procurement rules as applicable and other Users must not be adversely affected as a result of an exchange.

Potential rules

- 4.19 A set of rules is necessary for the exchanges to take place practically – our initial view is that these are, at least:

- Exchanges must be defined in time periods of [minimum exchange duration];
- Exchanges can take place at any point, however [time period] is required before the time at which the exchange will take effect; and
- Exchanges must be approved with the network company before they come into effect with updating the connection agreements.

5 Feedback from Market Simulations

Introduction

- 5.1 To gain early feedback and assess interest in the principles supporting Products 1 and 2, the working group engaged with Scottish and Southern Electricity (SSEN)'s innovation projects TRANSITION and Local Energy Oxfordshire (LEO)⁶ and their 2019 programme of Market Simulations.
- 5.2 TRANSITION and LEO are centred around the Oxfordshire area and have been established to trial and develop core aspects of the Distribution System Operator (DSO) models being explored by industry, government and the energy regulator. These projects are engaged with a wide variety of participants including distributed energy resources (DER) and other emerging market actors such as grid services platform developers and flexibility providers.
- 5.3 TRANSITION /LEO had prepared a summer 2019 programme of market simulations to test and progress the wider project design. These simulations presented an ideal opportunity to test the principles developed for Product 1 and 2.
- 5.4 The methodology adopted followed an established pattern of: orientating workshop participants to general related concepts by using role play simulation of a TRANSITION /LEO use case; allowing a period of time to explore concepts and debrief; and then separately exploring the Principles proposed under Products 1 and 2 using a whole-room workshop/feedback approach.

Thematic Analysis of Initial Stakeholder Feedback

- 5.5 Thematic analysis of the comments received, revealed the following insights:
 - i. Equivalence of trades
 - Information is needed on the current level of curtailment for each trading party;
 - Equivalence needs to consider the difference in load factors;
 - Trades could potentially be established by MW block, to limit the effects on non-participating customers in stack; and
 - Trades could consider value in carbon terms to avoid giving an advantage to diesel over renewables.
 - ii. Fairness
 - Customers who do not opt in should not be negatively impacted;
 - There may be a real risk that parties could 'corner the market' if market is illiquid;
 - There may be a need for separate oversight of trades (potentially a central role) to avoid the risk of gaming; and
 - Ofgem was seen as the ultimate arbiter should disputes with licensed parties not be resolved.
 - iii. Customer Insight
 - Giving the DNO sight of the values of trades could reveal a requirement/support the case for additional network capacity – i.e. if the sum of trades is more expensive than reinforcement, then reinforcing could lead to a more efficient system.

⁶ <https://ssen-transition.com/dso/leo/>

iv. Dynamics

- For the unaware, LIFO (last in first out) stack was not an immediately understood concept and takes some time to explore;
- Ambiguity over price, value, costs and trade-offs led to cautious trades (and/or 'heroic' assumptions);
- The duty to confirm acceptable performance/capability should sit with the seller;
- Responsibility to coordinate services and/or revenue stacks should sit with the seller; and
- DNOs (and others) should confirm if they consider different services to be exclusive or complimentary.

v. Process

- Approvals need to allow sufficient time to update ANM systems etc;
- The requirement for technical assessment of network, could be a condition of the contract – this may lead to limits on the number of exchanges agreed during a period;
- Need to specify window ahead of closure, data exchanges and visibility of technical viability;
- Rules to deal with delivery need to be clear about the acceptable technical requirements and performance characteristics; and
- Non-performance should not be penalised if it is caused by the buyer (in this specific case explored during Market Simulation it was a DNO outage that was considered but similar effects could be caused by different parties in a LIFO stack by potentially changing their behaviour to the disadvantage of the trading party).

5.6 These insights have been considered and used to refine the principles present in the report. They will also form a basis for further development and implementation via the Open Networks project in 2020.

5.7 TRANSITION and LEO shall publish a learning report for the Market Rules Simulations in early 2020, with a series of further simulation events proposed for 2020 and 2021. SSEN are integrating such event plans into the Open Networks event plan to facilitate further opportunities to test working group concepts through the core GB demonstrator projects.

6 Feedback from other Stakeholder Engagement

Introduction

- 6.1 In addition to the TRANSITION and LEO innovation projects, the working group engaged with the following in the development of this report:
- Ofgem's Access SCR Challenge Group⁷;
 - The Charging Futures Forum⁸; and
 - The Association for Renewable Energy & Clean Technology (REA)⁹.
- 6.2 Under Charging Futures, the working group held a webinar with a range of industry stakeholders. Responses to the following questions were sought via Menti:
- Q1: Do you agree with the four principles presented for trading curtailment?
 - Q2: Are there any additional principles for trading curtailment that we have missed?
 - Q3: Do you agree with the four principles for trading capacity?
 - Q4: Are there any additional principles for trading capacity that we have missed?
 - Q5: Do you agree that in locations where there is ample spare capacity there is little or no economic value in capacity trading?
 - Q6: Would you be interested in utilising any of these trading options?
 - Q7: Which products do you anticipate you may use?
 - Q8: What additional information would you need prior to making a decision of the suitability of a product for you?
 - Q9: Are you aware of any unintended consequences resultant from this work?

Analysis of Initial Stakeholder Feedback

- 6.3 Analysis of the comments received, revealed the following insights:
- i. Trading curtailment – agreement with principles?
 - 69% of respondents agreed with the principles presented; and
 - No disagreement, rather further clarification sought.
 - ii. Trading curtailment – additional principles?
 - Consideration of trades with more than one party and opportunities of storage; and
 - Arrangements should maintain or improve overall/whole system efficiency.
 - iii. Trading non-curtailable capacity – agreement with principles?
 - 40% of respondents agreed with the principles presented; and
 - Whilst there was no categorical disagreement, greater clarification was sought on details.
 - iv. Trading non-curtailable capacity – additional principles?
 - Greater detail on timescales for trades and transparency; and
 - Consideration of access rights.

⁷ <https://www.ofgem.gov.uk/electricity/transmission-networks/charging/reform-network-access-and-forward-looking-charges>

⁸ <http://www.chargingfutures.com/about-charging-futures/charging-futures-overview/>

⁹ <https://www.r-e-a.net/>

- v. Value of capacity trading where there is ample spare capacity:
 - 45% of respondents agreed, although situation may change post introduction of Access SCR;
 - Support that market would determine the value; and
 - Value of capacity trading may be increased if quicker route to market than via DNO.
 - vi. Interest in utilising either product:
 - 71% of respondents expressed an interest in utilising these products; and
 - 29% of respondents were unlikely to utilise these products.
 - vii. Additional information needed:
 - Price, Location and Duration;
 - Liquidity of market and range of potential trades;
 - Policy continuity;
 - Contractual terms & references, potential penalisation, forecast on utilisation per day/month/year; and
 - Plans for a flexibility market in that area.
 - viii. Unintended consequences:
 - Impact on parties unable to trade e.g. vulnerable customers?;
 - Non-engaged parties may find themselves "shut-out";
 - New build may be reliant on trading curtailment when there is no certainty trade will be available;
 - if "too successful" trading could cause a new constraint, e.g. at a different voltage level;
 - If not managed carefully, could result in others being affected detrimentally;
 - Potential trips/faults due to non-compliance, putting the network at risk;
 - Trading behind an HV constraint that causes a constraint elsewhere; and
 - Danger that parties aim to secure capacity now it has a monetary value, regardless of need.
- 6.4 As stated above, additional input was provided by the REA on behalf of its members. This followed a separate presentation of the working group's report on the 10th December 2019.
- 6.5 The REA provided the ENA with a written response to the questions listed above and this is included within Appendix 3 to this report. The following are key points from this:
- The principles outlined for trading curtailment look sound;
 - No additional principles were considered to have been missed by the working group in respect of the trading of curtailment obligations;
 - The REA proposed a slight modification to the principles for trading non-curtailable capacity to accommodate potential generators, i.e. those seeking to connect;
 - The REA considered it desirable therefore that the availability of the option also be made known to parties not presently connected;
 - Whilst in agreement that it was a reasonable assumption that there is little or no economic value in capacity trading where there is ample capacity, this should not be ruled out where parties expressed a desire to trade;
 - The REA suggested that its landfill gas generator members may have an interest in utilising these trading options, particularly Product 2 trading of non-curtailable capacity (as the gas production at many sites is decreasing and trading their non-curtailable

generation capacity, if this were an option, may prove more interesting than alternative means of utilising the capacity); and

- No potential unintended consequences were expressed.

6.6 Finally, the REA expressed a strong interest in participating in future trials on this work.

Appendix 1: Glossary of terms / definitions:

Curtailment	Curtailment refers to a user's ability to import or export from the network being restricted i.e. the user's access to the network is said to be curtailed. The term is usually applicable to generator export but it can also be applied to demand from large industrial sites. Typically, Curtailment is a temporary reduction in the allowed exports from a generator, below a customer's agreed export capacity. Curtailment is activated in response to a notification or signal that the generator is required to curtail its output.
MIC	Maximum Import Capacity which equals Non-Curtailable Import Capacity + Curtailable Import Capacity
MEC	Maximum Export Capacity which equals Non-Curtailable Export Capacity + Curtailable Export Capacity
Stack	Stack refers to a group of users connected behind a given network constraint (or constraints), where each user is allocated a Stack Position. The lower a user's Stack Position the lower its risk of curtailment.

For the avoidance of doubt, in the context of Distribution Maximum Import Capacity (MIC) and Maximum Export Capacity (MEC) are both the Maximum Power Requirement as agreed by the distributor pursuant to s16 of the Electricity Act. Any changes to MIC and MEC therefore need to be agreed by the distributor prior to any revised access level taking effect.

The Maximum Power Requirement for both Import and Export Capacities can comprise both Non-Curtailable and Curtailable elements of access.

- Maximum Export Capacity = Non-Curtailable Export Capacity + Curtailable Export Capacity
- Maximum Import Capacity = Non-Curtailable Import Capacity + Curtailable Import Capacity

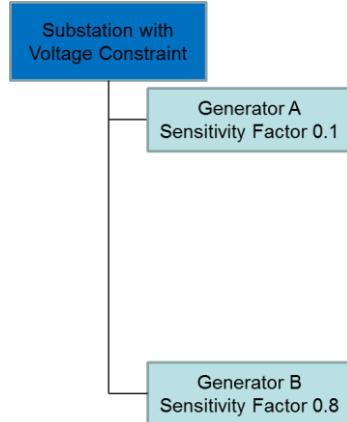
Any reallocation of Maximum Capacity between parties must therefore explicitly define the type of capacity access being reallocated in addition to the magnitude of that capacity access. The arrangements considered in Product 2 considers only users with only non-curtailable capacity (i.e. in the equations above, curtailable capacity is zero).

A more comprehensive list of terms and definitions is provided by the ENA Open Networks project. This reference document¹⁰ provides definitions for terms that are used in the Open Networks project and related activities, including terms identified and used in Ofgem's ongoing Significant Code Review (SCR) into access arrangements and forward-looking charges.

¹⁰ <http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-workstream-products.html/ws2-customer-experience.html>

Appendix 2: Sensitivity Factors Example

As referenced in Principle 2, a MW reduction from different generators may not have the same impact on a constraint. This appendix gives a worked example based on a voltage constraint at a given substation with generator A connected close to the substation and generator B connected a significant distance away from the substation.



The output of generator A will not have a material impact on the voltage at the substation but the voltage rise on the long line feeding generator B means that the output of generator B will have a material impact. Generator B reducing a given MW of output will have a greater effect on relieving the constraint than the same MW reduction from generator A. So generator B will have a high sensitivity factor (e.g. 0.8) and generator A will have a low sensitivity factor (e.g. 0.1).

Now assume generator B has a curtailment obligation which it wishes to trade away to generator A. The substitution factor for generator B to 'offload' its curtailment obligation to generator A is given by the sensitivity factor of customer A divided by the sensitivity factor of customer B, i.e.:

$$\text{Substitution Factor (B to A)} = \frac{\text{Sensitivity Factor (B)}}{\text{Sensitivity Factor (A)}} = \frac{0.8}{0.1} = 8$$

Generator A is required to reduce MW output by eight times the reduction from generator B in order to have the same impact on the constraint, and so must take on eight times the MW curtailment obligation.

Appendix 3: REA Response

1. Do you agree with the 4 principles for trading curtailment?

Whilst LFG generators would fall into the category of curtailed generators, their primary interest is likely to be in product 2. Having said that, the principles outlined for trading curtailment look sound.

2. Are there any additional principles for trading curtailment that we have missed?

Not that we can think of.

3. Do you agree with the 4 principles for trading capacity?

We would propose a slight modification to the proposal for trading capacity – which is to extend the product to potential generators, i.e. those seeking to connect.

This could be illustrated graphically on slide 10, on option 2, by Customer 2 (e.g. a LFG generator) releasing capacity not to customer 1, but by a newly-connected “Customer 6”. Given that non-curtaileable capacity would be expected to attract a premium, a new generator would obviously want to realise that benefit. We are not sure how a new generator connecting under G99 could achieve this, given that curtailment / clauses relating to active network management are built into the standard. This would have to be addressed.

The ability to purchase firm capacity could also be of interest to existing generators who have curtailments.

Within the rules very little would need to change to accommodate this suggestion.

4. Are think any additional principles for trading capacity that we have missed?

Obviously if potential connectees were to be incorporated in product 2, then it would be desirable for the availability of the option to also be made known to parties not presently in the connection queue. The most likely candidates would be those who had previously made enquiries about connecting to the relevant part of the network but had not progressed their projects due to the prohibitively high costs of network reinforcement. DNOs should have information on these parties. Ofgem and trade associations could also help make this more widely-known.

5. Do you agree that in locations where there is ample spare capacity there is little or no economic value in capacity trading?

This seems a reasonable assumption, and assuming that this observation justifies not developing trading mechanisms in those areas, we have no problem with that. However, if two parties were to approach a DNO with a proposal in an area where there is spare capacity, it should not be ruled out on principle. (Similarly, if two parties were to approach a DNO with a proposal prior to the development of a trading mechanism, it should not be ruled out on principle – provided it has no impact on other network users).

6. Would you be interested in utilising any of these trading options?

According to the UK Digest of Energy Statistics, there is 1060 MW of existing landfill gas power generation capacity, but output in terms of GWh production per year is falling fairly rapidly. At the present rate of decline of landfill gas production, it would suggest that by 2023 only around half of the peak power production would be being generated from landfill gas. By this time LFG generators may be utilising much of this capacity for other generation sources, e.g. natural gas, solar generation, storage etc. At present some companies are actively working on diversification

options, or are seriously considering it. They do not know that trading their capacity might be an option, and if it does become an option, they will then be able to judge if it is more attractive than their own plans for utilising it.

We have not had time to investigate this fully, but it is possible that trading spare capacity on operational generation schemes could potentially jeopardise generators' accreditations under the Renewables Obligation. This needs to be communicated with Ofgem, as administrator to the scheme, and a clear process would need to put in place to ensure accreditations are protected.

7. Which of the products would you anticipate you might use?

Trading of non-curtailable capacity, i.e. (a slight variation of) product 2.

8. What additional information would you need prior to making a decision on the suitability of these products to you?

These answers are being put forward by the REA, on behalf of its LFG members. Given the time constraints (turning around this response in a matter of days, before Christmas) we haven't been able to give this question much thought.

9. Are you aware of any potential unintended consequences resultant from this work?

We can only envisage positive consequences resulting from this work.

Appendix 4: Further notes on trading curtailable access rights and commercial services

Introduction

This has been drafted following the experience gained developing and testing the principles and rules for Products 1 (Trading of Curtailment Obligations) and 2 (Exchanging Capacity Rights) so that it is not lost. This section aims to provide further information on the potential rules for facilitating trading of curtailable access and facilitating commercial services. Again these arrangements are illustrated using the LIFO approach due to its simplicity.

Range of prospective trading or commercial service parties

Although Product 1 explicitly defines the scope of the review to the trading of curtailable access rights amongst distributed generators there are a number of different categories of user situated behind a constraint that can alleviate a user's curtailment by commercial actions other than trading of access. These user categories are:

- For all constraints, storage may be able to charge or discharge;
- For a generation constraint, another generator may be able to turn down; and
- For a generator constraint, a demand user may be able to turn up.
- For a demand constraint, a generator user may be able to turn up; and
- For a demand constraint, another demand user may be able to turn down.

The above bulleted categories of action are not the trading of access or curtailment but the engagement in commercial services to achieve an action by another party to prevent a constraint or the impact of constraint/curtailment from occurring.

Range of conditions that provide curtailable access trading opportunities

There are a number of situations that currently exist that offer the opportunity for parties to trade their curtailment obligations or commercially procure third party services to avoid being impacted by a constraint:

- Constrained generation already on ANM scheme;
- Unconstrained generation not on ANM scheme;
- Contracted constrained generation not yet connected;
- DER providers already on ANM scheme;
- DER providers contracted, but not connected; and
- Demand users.

Conditions precedent for Users to trade curtailable access or engage in commercial services

Practically there are a number of checks required to ensure that users are able to participate in trading or engage in commercial services:

1. A customer who can demonstrate the ability to deliver curtailment e.g. for generation the ability to turn down automatically for a generation constraint or for demand the ability to turn down at the times of demand constraints are likely to be there.
2. A customer who can demonstrate the ability to deliver commercial services e.g. for generation/storage the ability to turn up automatically for demand/storage constraint or for demand the ability to turn up at the times of generation constraints are likely to be there.
3. The ability to do the action automatically e.g. connected to ANM. Or for demand it might be a pre agreement to maintain demand above normal levels for a defined period.
4. The ability for any action to be verifiable e.g. confirm generation reduction, or demand turned up.

Outline steps for Users to trade curtailable access rights or engage in commercial services

Practically there are a number of steps before and after trading that facilitate Users being able to trade or engage in commercial services:

- i. Publication
 - Network Operator invites expression of interest for parts of the networks with ANM (this could be done annually, or when new customers connect to an ANM network). Network Operator also publishes timetable for trading or commercial services.
 - Network Operator publishes information relevant for DER providers to trade or procure commercial services:
 - Define time for publication; and
 - Define period being traded e.g. day/week/ month/year/ outage etc. Also set 'gate closure' time in accordance with published timetable.
- ii. Qualification
 - DER providers express interest in trading curtailable access or offering commercial services on an ANM network (define response time e.g. 28 days). At the same time DER providers provide information to allow pre-authorisation e.g. can they demonstrate they have the systems in place to apply any changes to stack position and also for the Network Operator to implement/verify it; and
 - Network Operator confirms pre-authorisation of interested parties (or works with them to remedy any gaps).
- iii. Commercial Services
 - DER parties arrange commercial services with each other (bilaterally with no Network operator involvement).
- iv. Authorisation
 - DER parties confirm to Network Operator trades and/or commercial services have taken place; and
 - Network Operator confirms validity of trade or commercial service. To be valid a trade or commercial service must be confirmed by both parties and conform with any rules laid out by the DNO as above.
- v. Delivery/enactment
 - Network Operator/DER apply changes to ANM system; and
 - At the end of a curtailable access trading or commercial services period the Network Operator reverts the ANM system to 'standard' unless another trading or commercial services period has commenced.

Appendix 5: Scope of Products

Extract from Project Initiation Document approved by Open Networks Steering Group
Product 1: Trading of Non-firm distributed generation curtailment obligations

This product will identify and assess options for the trading of curtailment obligations by non-firm generation with other relevant parties (including demand and/or generation). The output of this product is expected to feed into Open Networks WS1A (Flexibility Services), Product 6: "Consider how to facilitate other markets that DSOs might be able to enable or support in the future".

Curtailment instructions to Users connected on a non-firm basis to the Distribution [and Transmission] network(s) are generally issued on a LIFO (Last In First Off) basis. This product will consider the appropriateness of the LIFO approach under a range of different scenarios, proposing alternative arrangements, where appropriate. Note: This product will also consider 100% curtailment (or de-energisation) instructions issued to customers.

Product Scope

Inclusions	<ul style="list-style-type: none"> • Describe current arrangements (baseline) • Identification of range of users' actions that can alleviate a user's curtailment below a constraint • Trades with parties with more favourable or no curtailment obligations e.g. LIFO within ANM schemes • Consider feasibility of trades across network boundaries, including IDNOs • Definition/visibility of constraints and when this is made available to users • Consideration of timeframe for trade (short-term or permanent and when trades happen) • Consideration of network companies' and ESO role in facilitation of trades • Rules and compliance obligations (including provisions for default) and changes to contracts • Reference to work being conducted elsewhere • Consideration of use of trials to assess outcomes
Exclusions	<ul style="list-style-type: none"> • System operator procurement of services
Assumptions	<ul style="list-style-type: none"> • Assumes user charges from network companies are not affected by the trade • Assumes current network charging and access arrangements (i.e. not considering changes proposed under the SCR)
Constraints	

Product Activities & Timeline

Product Activities	Timeline	Deliverable	Stakeholder Engagement	Approval
a Describe current arrangements (baseline) in order to define the types and range of information required to manage network constraints through curtailment	May 19	Report section	n/a	

Energy Networks Association

b	Define the principles to facilitate trading curtailment, including but not limited to: <ul style="list-style-type: none"> • Visibility and frequency of information sharing, • Curtailment rules, • Substitution rules, • Trading rules, • Pricing and competition guidelines, • Others (as yet undefined) 	May 19	Report section	n/a	
c	Develop hypothetical use cases for testing principles	May 19	Solution development	n/a	
d	Test principles and rules against hypothetical use cases and revise principles, where appropriate	May 19	Solution development	n/a	
e	Define requirements for project TRANSITION and project LEO ¹¹	May 19	Solution development	n/a	
f	Evaluation of principles (e.g. through 'war gaming') based on TRANSITION/LEO	Summer 19	Solution Evaluation	Possible inclusion of stakeholders in projects	
g	Consider potential refinements following project TRANSITION/LEO, in particular to clarify: <ul style="list-style-type: none"> • Trades across network boundaries (including IDNOs) • Role of network companies • Rules and compliance obligations (including provisions for default) and changes to contracts 	Autumn 19	Report section	n/a	
h	Report/consultation complete and shared with Stakeholders	End 19	Publishable report / consultation	Report shared as widely as possible	

Dependencies

Body of work	Input/output Required	When
Project TRANSITION/LEO	Meaningful output from project TRANSITION and project LEO required to enable full development of solution.	Summer 19
Stakeholders' engagement	Development and usefulness of solution is reliant on engagement from well-informed stakeholders, whose time and expertise is already in demand for other areas.	Autumn 19
Market based curtailment	Maintain alignment between UKPN project team and this group. Live trials of UKPN project will run through to Autumn 2020 so will not directly inform this product, but their design	Throughout 2019

¹¹ <https://ssen-transition.com/>

trading (UKPN NIA project)	will and this product can influence the way in which UKPN's trials are conducted.	
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Delivery against Guiding Principles

Guiding Principles	How this product is delivering against them
Arrangements support efficient use and development of network capacity	Exchange of curtailment rights should enable the most economically efficient generation mix to be realised.
Arrangements reflect the needs of consumers as appropriate for an essential service	No direct impact on smaller users, but an efficient generation mix should reduce overall costs.
Any changes are practical and proportionate	To be assessed as product develops – dependent on implementation costs.

Product 2: Exchange of capacity between users with non-curtailable capacity

Inclusions	<ul style="list-style-type: none"> Describe current arrangements (baseline) Investigate reasons for low utilisation of TEC exchange – can lessons be learnt for the definition of this product Consideration of the applicability of principles established under Product 1 Establish principles for exchange of capacity based on principles from Product 1 where possible Consider feasibility of exchanges across network boundaries, including IDNOs Definition/visibility of constraints and when this is made available to users Consideration of timeframe for exchanges (short-term or permanent and when exchanges can happen) Consideration of network companies' and ESO role in facilitation of exchanges Consideration of risks and potential unintended consequences of capacity exchanges, including possibilities for gaming Reference to work being conducted elsewhere Consideration of use of trials to assess outcomes
Exclusions	<ul style="list-style-type: none"> Exchange of curtailable access rights
Assumptions	<ul style="list-style-type: none"> Assumes current network charging and access arrangements (i.e. not considering changes proposed under the SCR)
Constraints	

Product Activities & Timeline

Product Activities		Timeline	Deliverable	Stakeholder Engagement	Approval
A	Describe current arrangements including the options available to customers for exchange of capacity	Jun 19	Report section	n/a	
B	Investigate possible reasons for low uptake of TEC exchange. Identify issues with current arrangements to be addressed under this product.	Jun 19	Report section	Engage with users who have used TEC exchange	

Product Activities		Timeline	Deliverable	Stakeholder Engagement	Approval
C	Consider the applicability to this product of the principles and rules established for trading of curtailment obligations under Product 1.	Jun 19	Report section	n/a	
D	Define the principles to facilitate the exchange of capacity, building on Product 1 where possible. To include, but not limited to: <ul style="list-style-type: none"> • Visibility and frequency of information sharing, • Exchange rules, • Pricing and competition guidelines, • Others (as yet undefined) 	Jul 19	Report section	n/a	
E	Provide early view of principles for capacity exchange to TRANSITION and project LEO ¹² for inclusion in 'war gaming'	Jun 19	Solution development	n/a	
F	Develop hypothetical use cases for testing principles	Jul 19	Solution development	n/a	
G	Test principles and rules against hypothetical use cases and revise principles, where appropriate	Jul 19	Solution development	n/a	
H	Evaluation of principles (e.g. through 'war gaming') based on TRANSITION/LEO	Summer 19	Solution Evaluation	Possible inclusion of stakeholders in projects	
I	Consider potential refinements following project TRANSITION/LEO, in particular to clarify: <ul style="list-style-type: none"> • Exchange across network boundaries (including IDNOs and TEC exchange for distribution connected customers with TEC) • Role of network companies • Rules and compliance obligations and changes to contracts • Risks of unintended consequences 	Autumn 19	Report section	n/a	
J	Report/consultation complete and shared with Stakeholders	End 19	Publishable report / consultation	Report shared as widely as possible	

Dependencies

Body of work	Input/output Required	When
Project TRANSITION/LEO	Meaningful output from project TRANSITION and project LEO required to enable full development of solution.	Summer 19
Stakeholders' engagement	Development and usefulness of solution is reliant on engagement from well-informed stakeholders, whose time and expertise is already in demand for other areas.	Autumn 19

¹² <https://ssen-transition.com/>

Delivery against Guiding Principles

Guiding Principles	How this product is delivering against them
Arrangements support efficient use and development of network capacity	Exchange of capacity may enable access to be allocated to those users who value it most, and may create incentives for users to give up unused capacity. However there is a risk of users being incentivised to hold onto unused capacity in anticipation of future exchange value – this and other possible unintended consequences need careful consideration.
Arrangements reflect the needs of consumers as appropriate for an essential service	Capacity exchange will only be enabled between larger distribution connected users (those with an explicit capacity defined in a connection agreement) and transmission connected users, and so will not directly impact smaller users.
Any changes are practical and proportionate	To be assessed as product develops – dependent on implementation costs.