Charging Futures

Reforming electricity charging, together

ena energynetworks association

Access and Forward-looking charges

Non-firm Access to Distribution Networks

Access Subgroup

Document Control

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Related Documents

Reference 1	Electricity Industry Access and Forward-Looking Charging Review - Significant Code Review launch statement and decision on the wider review – Ofgem publication
Reference 2	

Distribution

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1 Executive summary

1.1 Non-firm Access gives users access to the electricity system with the understanding that the access may be curtailed under certain network conditions. This arrangement has the benefit of making efficient use of system capacity where access cannot be guaranteed under all network conditions. The benefits of this efficient use of capacity can be reflected in the charges made to customers opting for this type of Access.

1.2 This paper explores options for implementing Non-firm Access for distribution network users. The options considered cover how curtailment is defined, how it is measured and what actions can be taken when curtailment is considered to have exceeded agreed levels.

1.3 These options are then assessed against the guiding principles of the Access SCR in Annex 1 and a summary of this assessment provided in section 7.

2 Background and Purpose

2.1 On 9th March 2020 Ofgem published the shortlisted policy options it plans to take forward for further assessment as part of the whole Access and Forward-Looking Charges Significant Code Review (SCR).

2.2 This paper focuses on the options for implementing the shortlisted Access choice of Non-firm Access to the electricity distribution system.

2.3 The paper first explores current arrangements for what is considered "firm" or traditional Access with the intention of defining a baseline beyond which Access would be considered Non-firm and the options explored here would apply.

2.4 The paper then explores various options that could be applied in combination to define the arrangements for Non-firm Access as a result of this SCR.

2.5 Appended to this paper is a table which assesses these options against the guiding principles of the Access SCR. These two documents should be considered together.

3 The baseline – what is currently considered "firm" or a traditional connection

3.1 This paper explores options for defining Access where a user's requirements cannot be met in all foreseeable network conditions and therefore must be curtailed in part or in full to protect the network and avoid negative impacts on other users. This is distinct from unforeseeable outages due to network faults which leave the point of connection de-energised. This latter scenario is considered an outage and is subject to separate price control arrangements.

3.2 It is important to make a distinction between the "firmness" of a customer's sole-use assets and that of the wider network to which they are connected. As discussed below, there will be local factors that influence when a Firm connection can be offered to a particular part of the network. It will be important to be transparent and clear with connecting customers what factors are leading to their connection requiring a decision between reinforcement or curtailment.

Sole use

3.3 The extension to the network that is provided to service only the connecting customer is termed the sole-use element of the connection. Due to the fact that these assets will only be supplying one customer, a wider assessment of impact to other customers is less important. This means the connecting customer can have more influence on this element of their connection in terms of the security of supply the assets will be specified to deliver.

3.4 Given that the security of supply of this element is a decision made by individual customers (within the limits of asset standards etc.), it is not proposed that arrangements for Non-firm Access apply to any restrictions or outages arising from this element of a customer's connection.

Wider system

3.5 The ability of the wider network to which the customer is connecting to support their needs will be a factor of the impact of all customers connected to that part of the network. The import/export of one customer has the potential to affect all customers so the network must be designed, built and operated to ensure all users' needs are met simultaneously.

3.6 Therefore, if a customer wishes to connect to a part of the wider network that cannot currently support their needs, this will require an intervention from the network operator on their behalf to ensure other users are not impacted. Alternatively the connecting customer could accept arrangements where their Access to the wider network can be limited to ensure their use does not impact other customers.

3.7 How the wider network is assessed to determine the impact on other customers depends on the type of connection as described in the sections below. Where a customer's connection would have the potential to affect the service provided to existing customers but they do not wish to trigger an intervention, they would need to be subject to curtailment. This curtailment would ensure other users are not impacted by the new connection. This curtailment driven by the need to ensure the security of the wider system is the subject of the options as described in section 4 and the basis for the initial definition of Non-firm Access.

Demand

3.8 Arrangements for traditional demand connections are mature and well understood. Therefore, determining the boundary for where arrangements for Non-firm Access will apply will be better defined. The application of Non-firm Access for demand users may need to be more reflective of the customers' use of energy for example some element may need protecting from curtailment.

3.9 There is a well-established standard for security of supply for meeting the requirements of group demand. This standard is applied to the wider network to ensure it is able to support the requirements of the customers connected to it to a suitable level of security.

3.10 If a customer wishes to accept being connected to a part of the network that will not be to this standard (and therefore not requiring the reinforcement to achieve the standard) their Access would be considered Non-firm.

Generation

3.11 The standards that apply to group demand do not explicitly set out arrangements for meeting the requirements of generation customers connected to the network. Generation is factored into the arrangements but only to the extent that it can support the security of group demand.

3.12 Traditional (non-flexible) generation connections are assessed on a case-by-case basis taking into account credible outage and fault scenarios to determine if reinforcement is required to reliably support the connection. The process for this assessment may be defined in network operator's individual internal policies but there is no common national standard for this.

3.13 These assessments often differ to assessments for demand connections and they are more likely to require more detailed voltage, fault level and reverse power flow studies. In addition the coincidence of peak generation output and minimum local network demand will need to be assessed. The assessment will also take into account any mitigations that are achievable given local network configuration and conditions which can support meeting customer requirements.

3.14 If a network operator assesses that the network cannot reliably support the generation connection or that it would adversely impact other users, reinforcement or another intervention may be required to support the connection. If the customer wishes to connect without this reinforcement being carried out, their Access would be on a curtailable basis.

Storage

3.15 Unless mitigating arrangements can be put in place, storage is typically assessed as both a demand and generation connection as described above to reflect the impact it could have on the network in each mode of operation.

4 Options for defining Non-firm Access

4.1 This section sets out the areas that would need to be considered to implement Non-firm Access and the options in each area that would need to be adopted in combination. Non-firm Access could apply to a portion of a user's overall access i.e. they could have firm access for a set capacity with a non-firm portion overlaid in addition. This approach could be particularly useful for demand customers.

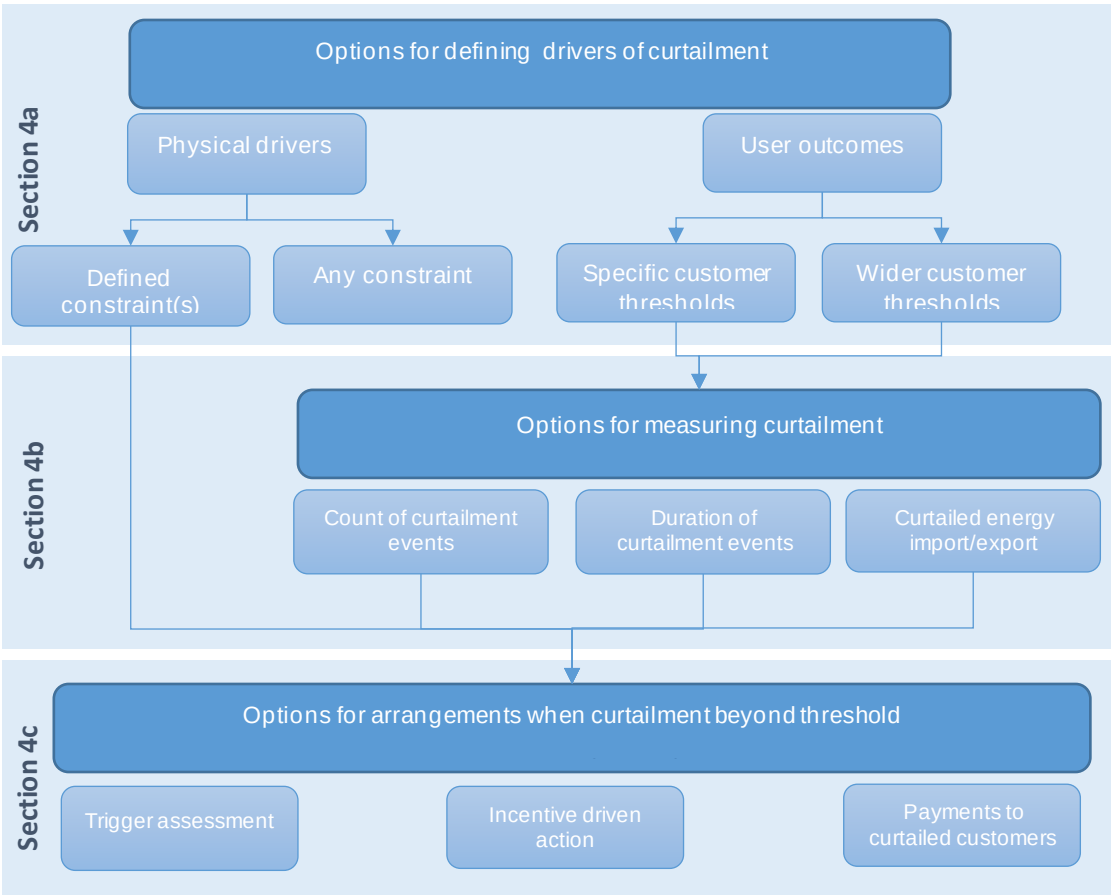

Figure 1: Options Map for Non-firm Access

Options for defining levels of curtailment for Non-firm Access

4.2 The options below represent way in which the curtailment resulting from Non-Firm Access could be defined. Common to all the options below is a decision that would need to be made on whether these definitions are to include curtailment arising due to constraints on the transmission network including at the transmission substation that provides the connection to the Distribution System. This decision has interaction with options being explored regarding the interface between transmission and distribution in the SCR Access Subgroup report titled Defining Distributed Generation (DG) Users' Access to the Transmission System[1] .

[1] http://www.chargingfutures.com/charging-reforms/access-forward-looking-charges/resources-2/scr-working-group-publications/

Physical drivers

Option 1.1 Widest view of network conditions and constraints

4.3 Under this option, the curtailment seen by a customer would be defined by any source of a need for curtailment with the exception of direct faults as explained in section 3. This would mean that customers accepting non-firm access under these arrangements would be subject to curtailment from all network sources of curtailment relative to their connection without being subject to additional arrangements.

Option 1.2 Defined by specific, identified constraints

4.4 Alternatively, non-firm access offers made to customers could define specific drivers for curtailment linked to specific network constraints. Curtailment driven by any other source would be subject to additional arrangements.

Consumer outcomes

4.5 Under this option, levels of curtailment would be defined by customer outcomes. This effectively means that levels of curtailment would be quantified by the customers' experience of the curtailment rather than the network conditions that are driving them. There are various options for how this can be quantified and these are explored below.

4.6 Using this definition would mean thresholds could be set for curtailment beyond which additional arrangements would apply. Options for what these arrangements could be are explored in below.

Option 1.3 Curtailment threshold set by a specific assessment of local network

4.7 An initial assessment could be made of the expected levels of curtailment on a specific area of the network where the customer is connecting. This could then form an element of the access agreement with the customer. Each customer would have a specific expected curtailment level above which additional arrangements would apply.

Option 1.4 Curtailment threshold set universally

4.8 The curtailment threshold could be defined universally, either across GB or on a licence area level. This could either be based on

- An expected level of curtailment from assessment of networks and efficiency of other interventions; or
- A level of curtailment that is assumed to meet customer requirements.
- Options for how curtailment is measured under consumer outcomes

4.9 In either of the options above, the way in which curtailment is defined and measured would have to be decided. This definition could be based on:

Options for measuring curtailment

4.10 The options below could be used to measure curtailment levels if curtailment is defined by user outcomes. These options could be used in isolation or potentially be combined for example a level defined by overall time of curtailment but also with a further measure of how many individual curtailment events are experienced.

Option 2.1 Number of events

4.11 A count of the number of times a user is subject to a curtailment event.

Option 2.2 Time (i.e. Half hours or more granular)

4.12 The amount of time over a given period that a user is subject to curtailment. This could be measured in half hourly periods or on a more granular basis achievable through system logs. This could then be converted to a percentage for ease of communication and integration with any other arrangements.

Option 2.3 Energy using forecast export/import

4.13 Using an estimate or forecast of the users' expected export or import over the duration of curtailment events in a given period. This could then be converted to a percentage for ease of communication and integration with any other arrangements.

Options for arrangements when curtailment goes beyond threshold

4.14 If thresholds for curtailment are set by either specific constraints or by one of the options under consumer outcomes, arrangements will need to be defined for what happens when curtailment goes beyond this threshold.

4.15 In addition to the options below for arrangements when curtailment goes beyond agreed thresholds, consideration needs to be given to the strength of the action required. This could be arranged such that users are guaranteed security of their connection beyond the threshold in a similar way to users with firm access. This would provide greater certainty to customers with non-firm access. However, such a prescriptive approach could reduce the benefit of the flexibility provided by the users and may lead to less overall efficient outcomes. For example the curtailment of the user beyond the threshold could require reinforcement action to reduce to within the threshold which may not be economically justified.

Option 3.1 Trigger assessment of options

4.16 Curtailment beyond threshold could trigger a process under which the network operator assesses various options for addressing curtailment levels and makes an intervention decision which achieves the most efficient outcome.

4.17 Clear principles would be needed for this process to ensure decisions are transparent and achieve the right balance between outcomes for the users subject to curtailment and wider system users. Having clear guidelines would also help to achieve greater levels of certainty for network users and network operators. This assessment process could potentially be designed to implement concepts such as least regrets planning and whole-system options assessment. It could also be designed to optimise the national market position.

4.18 This assessment would ensure that the most efficient solution to address the constraint is deployed. This could be traditional options such as reinforcement or, where shown to be more efficient, solutions such as procured flexibility or payments to customers (see option 3.3 below) could be used.

Option 3.2 Incentive driven action

4.19 If sufficient and appropriate incentives are developed and implemented for the RIIO-ED2 price control, the signals provided to network operators and customers could drive the right behaviour in terms of managing curtailment levels.

4.20 For example, incentive reward/penalty revenue could be determined by reduced/increased levels of curtailment respectively. If associated incentive rates are set to be reflective of network impact, network operators could factor this into their assessment of options therefore leading to the overall most optimal decisions being made.

Option 3.3 Payments to customers curtailed beyond threshold

4.21 Customers who experience curtailment beyond a threshold, either on an individual or a group basis, could receive payments to reflect this. These payments could be a more efficient way to handle curtailment than traditional methods of intervention to reduce curtailment such as reinforcement. An important factor within this option is how the payments to customers would be valued. There are several options for this for example:

- Based on value of avoided network costs (E.g. deferred network reinforcement or forecast value of procuring flex)
- Value of lost energy (wholesale market) or wider market value (i.e. beyond just energy costs)
- Value of Lost Load

4.22 These options will vary in the degree to which they reflect the impact of curtailment to customers. However consideration will have to be given to the practicalities of implementing these options, interaction with the benefits already seen by the curtailed customer (through reduced connection charges or UoS charges) and whether they offer the best value for all customers.

4.23 Practically, this concept could be delivered through the established flexibility procurement process currently in place – this would be particularly practical where payments are valued to reflect the benefit to the network (i.e. deferred reinforcement). This option could also be a sub-option to options 3.1 or 3.2 where it is one of the solution in the “toolkit” to address curtailment beyond a threshold. This would have the added benefit of widening the set of customers able to respond with flexibility and receive payment – any customer behind the same constraint could provide this which would help with liquidity.

5 Interaction with ED2 arrangements and mechanisms

5.1 Decisions made by customers at the time of connection will have an impact on how they operate on an enduring basis. This will be particularly true where network companies are making investment decisions that will be factoring in levels of curtailment for customers with Non-firm Access. This means arrangements in the wider RIIO-ED2 framework will need to factor in reforms made under this SCR particularly in the areas of:

- Procurement of flexibility – as explored in more detail above
- A potential Curtailment Index – strong interaction with section [ref] of this paper
- Volume drivers or Capacity Mechanisms relating to funding for releasing capacity on the network

5.2 In addition, thought will have to be given to how price control arrangements associated with Non-firm Access will endure into future price controls. If the arrangements resulting from this SCR rely on price control mechanisms, certainty around these arrangements in future price controls will be important to customers and network operators.

5.3 The specific options and decisions which could be impacted by RIIO-ED2 arrangements are explored in the summary of the assessment against guiding principles in section 7 of this paper. The main factors within RIIO-ED2 arrangements are whether any mechanisms:

- Act broadly across larger groups of customers, for example an incentive driven by a curtailment index measured across an entire licence area
- Provide customer-specific arrangements such as payments similar to guaranteed standards

5.4 How these factors may influence or interact with options explored in this paper is explored further in section 7.

6 Interaction of Non-firm Access with other activities

Other Access options and Adaptations

6.1 Consideration will have to be given to how arrangements for Non-firm Access interacts with other options for Access choices. This is covered in the SCR Access subgroup document entitled Hybrid Access Options[2].

[2] http://www.chargingfutures.com/charging-reforms/access-forward-looking-charges/resources-2/scr-working-group-publications/

How non-firm access at distribution could affect Access at transmission

6.2 The impact of Non-firm Access arrangements on users' access to transmission is explored in the SCR Access Subgroup note entitled Non-firm Access at Transmission[3].

Connection charging boundary

6.3 The current connection charging boundary provides a direct signal of the benefits of Non-firm Access to customers at the time they are making the decision regarding their connection arrangements. This provides a route for the network benefits to be passed on to customers through reduced connection charges.

6.4 If the connection boundary is reformed under this SCR, a replacement for this signal and route for the transfer of benefits will need to be developed. This would need to be explored and implemented through the design of Use of System charges under this SCR. Without this signal and flow of benefits, customer decisions may be based on incomplete information of the impact on the electricity network and may result in overall inefficient development of the system.

6.5 The current equivalent of Non-form Access rights are offered to users with reduced connections charges which reflect the reduced requirement for reinforcement work to facilitate their connection. This means customers can make individual decisions based on the reduction in connection charge and the forecast level of curtailment. This naturally leads to an efficient overall outcome for all users which reflects the value each customer places on their Access and the cost associated with providing it.

6.6 If the benefits of Non-firm Access have to be signalled through UoS charges due to a shallower connection charging boundary, arrangements would have to ensure this benefit is only conveyed where there is genuine network benefit (i.e. it is being used to manage a constraint). There may also be challenges with reflecting the savings associated with each specific area of the network and associated constraints. This may hinder the ability to achieve the most efficient overall outcome due to price signals being less accurate.

Procurement of flexibility

6.7 Flexibility has the potential to achieve efficiency in the investment required to meet existing and future customers' needs. Non-firm Access naturally makes use of users' ability to provide flexibility to the system. An alternative way for users to provide flexibility for the benefit of the electricity system is through direct procurement of flexibility where specific network needs arise in response to constraints.

6.8 There will be clear overlap between these two approaches to realising the benefits of flexibility. The two approaches are likely to be suited to similar but distinct circumstances which will be driven by the timing of both network needs and customer requirements.

6.9 To ensure these two mechanisms can work in parallel and deliver maximum benefits, the arrangements for both will have to be considered together to ensure interactions are addressed and customers are able to make informed decisions regarding their options under both.

[3] http://www.chargingfutures.com/charging-reforms/access-forward-looking-charges/resources-2/scr-working-group-publications/

Current price control arrangements (e.g. IIS)

6.10 As mentioned in section [ref], there is a close association between curtailment and interruptions and the boundary between the two will need to be clearly defined and communicated to the relevant users of the system.

6.11 In addition, the arrangements developed under this SCR and the wider ED2 arrangements will need to be assessed in parallel to ensure combined arrangements result in the most beneficial outcome to all consumers

7 Summary of assessment against guiding principles

7.1 An assessment of the options outlined above is provided in Appendix to this paper. This can be summarised:

Options for defining levels of curtailment for Non-firm Access

7.2 Defining curtailment by consumer outcomes is a better reflection of the impact of curtailment, so if supported by customer engagement is likely to be the preferred option.

7.3 Whether this is defined on a network-wide or more local basis would need to be aligned with RIIO-ED2 arrangements i.e. incentives are most compatible with a network-wide definition.

Options for how curtailment is measured under consumer outcomes

7.4 Measuring curtailment by energy is the best reflection of impact on customers but is complex and will rely on counterfactuals. These could be achieved through archetype profiles but this would be a compromise against the true reflection of customer impact. Therefore a more practical option may be to define and measure curtailment percentages by hours of curtailment with customers being able to calculate the associated impact on their energy import/export. Either of the above options could be expressed as a percentage to ensure clarity of engagement and communications with users.

Options for arrangements when curtailment goes beyond threshold

7.5 Arrangements for intervention beyond a threshold will also need to be compatible with ED2 arrangements. If incentives are not used the assessment approach (option 3.1) will deliver the most efficient outcome. If such an assessment is run transparently using a clear set of principles, it could achieve a good balance between providing certainty to customers and discovering the most efficient overall outcome.

7.6 Payments paid more directly to customers who experience or are willing to accept curtailment beyond a threshold could be considered as part of an assessment of interventions (i.e. include option 3.1 as a tool in the assessments made under option 3.1). This could be achieved through use of procured flexibility or direct payments to customers valued by the impact to the individual customer.

7.7 While payments made directly to the customer based on the value of the impact of the curtailment to them (option 3.3 in isolation) could provide greater certainty to customers, this option could be complex to implement due to the requirement for forecasting of counterfactual production/consumption and the systems required to process these payments. This would also likely require a new funding mechanism and has the risk that overall network costs relating to the specific area may increase. The value of benefits already conveyed to the customer through reduced connection charges or UoS charges would have to be factored in to avoid double-counting i.e. if a customer is considered "financially firm" they should face the same connection and use of system charges as physically firm customers.

Annex 1: Assessment of options against SCR Guiding Principles

Access SCR Guiding Principles

1. Arrangements support efficient use and development of system capacity
    - Access arrangements support network capacity being allocated in accordance to users' needs and the value they ascribe to network usage
    - Arrangements provide signals that reflect the costs and benefits of using the network at different times and places, to support efficient use of capacity, and ensure no undue cross-subsidisation between users
    - They provide effective signals for where new network capacity is justified
    - Arrangements reduce barriers to entry and enable new business models where these can bring value for the system.

2. Arrangements reflects the needs of consumers as appropriate for an essential service
    - Electricity provides an essential service, and for small users in particular we need to ensure that arrangements do not lead to inappropriate outcomes or unacceptable impacts, particularly for those in vulnerable situations.
    - Users, or suppliers/intermediaries on their behalf, are able to understand arrangements and have sufficient information to be able to reasonably predict their future access and charges.

3. Any changes are practical and proportionate
    - Data collection, processing and analysis requirements considering whether the option requires changes to the way in which data is currently collected, processed or analysed, and whether new data may need to be collected.
    - Existing systems, assets and equipment considering whether new IT/operational systems (e.g. billing systems) may be required to implement the option and the degree to which new metering and monitoring equipment requires to be installed and the practicality of doing so.
    - Charge calculation and settlement considerations, where the option requires parties who calculate charges to update their charging methodology or models and the extent to which this is required.
    - Engineering and planning standards, assessing whether a particular option would require changes to engineering or planning standards, the scale of change required and the expected implementation timescales.
    - Customer engagement or commercial agreements, considering any changes that would be required to how customers are engaged and managed and any impact on existing commercial arrangements.
    - The ease with which the options can be implemented, considering the need for any legislative changes as part of the implementation requirements, and whether transitional arrangements are required.

Option	Options for defining levels of curtailment for Non-firm Access			
	Option 1.1 Widest view of network conditions and constraints	Option 1.2 Defined by specific, identified constraints	Option 1.3 Curtailment threshold set by a specific assessment of local network	Option 1.4 Curtailment threshold set universally
1. Arrangements support efficient use and development of system capacity				
Access arrangements support network capacity being allocated in accordance to users' needs and the value they ascribe to network usage	This options allows individual users to make decisions based on the levels of curtailment they are likely to see based on network conditions at the time of connection. Indicative curtailment under this option may not be specific enough for users to determine if the Access fits their needs.	As per option 1.1 but a closer representation of user requirements that is not so influenced by wider network factors.	Closer alignment to a user's risk appetite but potentially less reflective of the cost associated with it.	Averaging over a wider scope will allow a better reflection of cost associated with reducing curtailment. Setting thresholds universally may not reflect specific customer needs and therefore the value they ascribe to the Access in a specific location.
Arrangements provide signals that reflect the costs and benefits of using the network at different times and places, to support efficient use of capacity, and ensure no undue cross-subsidisation between users	This option most closely reflects the overall cost of use of the network. However these costs may not best reflect the cost being driven by the individual user.	A more specific definition will result in the costs being signalled more closely reflecting the impact of the individual user.	Specifying curtailment by consumer outcomes means it will be less reflective of network impact, however more bespoke assessments will allow a better reflection of network costs.	A more generic definition of curtailment will result in a less specific signal of network impact and therefore costs.
They provide effective signals for where new network capacity is justified	Under these options, users will make individual decisions as to whether the likely curtailment is acceptable given the reduction in connection or use of system charge. The point at which customers stop accepting offers is an indication that the reduced charge no longer outweighs the curtailment and intervention should be considered.			Defining curtailment universally limits the ability for customers to make individual choices which limits the ability for their decisions to send an effective signal.
Arrangements reduce barriers to entry and enable new business models where these can bring value for the system.	Defining curtailment in network terms means users naturally take on more risk. This allows users to develop new business models around this risk in return for reduced charges reflecting the value this brings to the system. For example users could trade-off individual curtailment risk appetite with the reduction in charge.		Defining curtailment by consumer outcomes limits the ability for individual customers to take on risk. This may limit new business models where customers are willing to take on higher risk to deliver value to the system.	

Option	Options for defining levels of curtailment for Non-firm Access			
	Option 1.1 Widest view of network conditions and constraints	Option 1.2 Defined by specific, identified constraints	Option 1.3 Curtailment threshold set by a specific assessment of local network	Option 1.4 Curtailment threshold set universally
2. Arrangements reflects the needs of consumers as appropriate for an essential service				
Electricity provides an essential service, and for small users in particular we need to ensure that arrangements do not lead to inappropriate outcomes or unacceptable impacts, particularly for those in vulnerable situations.	By exposing users to all potential sources of curtailment, this reduces predictability and could therefore result in inappropriate outcomes if network conditions change after the connection is made.	Definition of the constraints that users are exposed to will increase predictability and allow informed decisions. However, they are still accepting some risk and would have to do this in an informed way.	This option provides certainty at the time of connection but may vary between customers both in terms of location and sequence of connection. This may lead to variability in consumer experience.	This option would provide consistency in general terms but may result in variability between customers if curtailment is also assessed at a universal level.
Users, or suppliers/intermediaries on their behalf, are able to understand arrangements and have sufficient information to be able to reasonably predict their future access and charges.	Basing the definition of curtailment on physical/network drivers could reduce the ability for customers to understand expectations. However, work could be done to provide customers with estimates to help with predictability.	This option improves on 1.1 in terms of predictability but may not improve the ability for customers to understand the basis of curtailment.	Defining curtailment by consumer outcomes will naturally help customers understand the impact. Individual assessments may be harder to understand than a universal definition as under 1.4.	Defining curtailment universally is likely the simplest for users to understand. However if their individual experience differs significantly from the universal assessment, this may cause confusion.
3. Any changes are practical and proportionate				
Data collection, processing and analysis requirements considering whether the option requires changes to the way in which data is currently collected, processed or analysed, and whether new data may need to be collected.	Defining by physical parameters will require a relatively low amount of data processing and analysis as customers will be more directly exposed to network conditions. However, to provide customers with indications of curtailment levels will require some level of analysis. There will also be a burden on customers to carry out analysis of the impact of curtailment on their business model.		Both options for defining curtailment by consumer outcomes will require collection, processing and analysis of data both to set targets and measure performance. The difference between the two will be the level of aggregation. This would require configuration of Active Network Management systems to capture the curtailment events in a consistent way. Depending on the option chosen for measurement of curtailment, analysis of the customers' underlying import/export may be required.	

Option	Options for defining levels of curtailment for Non-firm Access			
	Option 1.1 Widest view of network conditions and constraints	Option 1.2 Defined by specific, identified constraints	Option 1.3 Curtailment threshold set by a specific assessment of local network	Option 1.4 Curtailment threshold set universally
Existing systems, assets and equipment considering whether new IT/operational systems (e.g. billing systems) may be required to implement the option and the degree to which new metering and monitoring equipment requires to be installed and the practicality of doing so.	No requirements beyond the equipment and systems required to implement curtailment based on network conditions.	Monitoring systems will need to be capable of distinguishing between sources of curtailment to be able to report and implement these arrangements. This would likely require further development of current systems/reporting. Constraint due to capacity limits of Connection assets at GSP would considered a DNO-driven constraint and not a constraint of DNO customer use as directed by the ESO.	To implement either of these options systems will be required to be able to measure levels of curtailment to each customer on the basis defined by the options for measurement below. The difference between the two would only be the level of aggregation. If optimisation is to be implemented under either of these options, systems and processes would be needed to implement this.	
Charge calculation and settlement considerations, where the option requires parties who calculate charges to update their charging methodology or models and the extent to which this is required.	Since these options are not looking to achieve financial firmness, the charge will not be reflective of levels of curtailment and therefore no specific charging system will be needed under any option. However, the general charging arrangements for non-firm access may require updates to charging arrangements and will be heavily influenced by any changes to the connection charging boundary. If a change is made to the connection boundary, then it would require these signals to be sent via use of system charges. It may be more difficult to send these signals via use of system charges. E.g. sending value of specific, local constraints via administratively set charges is difficult. Links with the work on how to value to access via use of system charges product.			
Engineering and planning standards, assessing whether a particular option would require changes to engineering or planning standards, the scale of change required and the expected implementation timescales.	No proposed changes to planning standards under any option.			

Option	Options for defining levels of curtailment for Non-firm Access			
	Option 1.1 Widest view of network conditions and constraints	Option 1.2 Defined by specific, identified constraints	Option 1.3 Curtailment threshold set by a specific assessment of local network	Option 1.4 Curtailment threshold set universally
Customer engagement or commercial agreements, considering any changes that would be required to how customers are engaged and managed and any impact on existing commercial arrangements.	Customer engagement requirements are likely to be higher if defining curtailment by physical drivers to ensure customers are well-informed when making decisions on their Access. This option would be reasonably easy to implement via a connection agreement.	Customer engagement requirements are likely to be higher if defining curtailment by physical drivers to ensure customers are well-informed when making decisions on their Access. This option may be very administration-heavy as the definition of constraints is likely to change frequently with network development and reconfiguration.	Although a lower requirement, some engagement will still be required to ensure all customers are aware of the impacts of non-firm access even if defined by consumer outcomes. These options would be relatively easy to implement via connection agreements assuming regular updates are not required.	
The ease with which the options can be implemented, considering the need for any legislative changes as part of the implementation requirements, and whether transitional arrangements are required.	No legislative change requirements anticipated. No transitional arrangements anticipated.	No legislative change requirements anticipated. Transitional arrangements may be required to limit definition of curtailment to specific constraints.	No legislative change requirements anticipated. Transitional arrangements may be required for customers currently subject to physical drivers.	No legislative change requirements anticipated. Transitional arrangements may be required for customers currently subject to physical drivers or individual curtailment metrics.

Option	Options for how curtailment is measured under consumer outcomes		
	Option 2.1 Number of events	Option 2.2 Time (i.e. Half hours or more granular)	Option 2.3 Energy using forecast export/import
1. Arrangements support efficient use and development of system capacity			
Access arrangements support network capacity being allocated in accordance to users' needs and the value they ascribe to network usage	A count of events is likely to be an ineffective way of reflecting users' needs and therefore allocating capacity.	A measure of the time will better reflect the impact of curtailment on users.	This option is the best reflection of the impact of curtailment on users and therefore facilitates the best way to capture the value users ascribe to their Access.
Arrangements provide signals that reflect the costs and benefits of using the network at different times and places, to support efficient use of capacity, and ensure no undue cross-subsidisation between users	This option would provide a poor signal.	This option may most closely reflect the costs/benefits of the use of the network.	This option does not materially improve on option 2.2 from a networks perspective.
They provide effective signals for where new network capacity is justified	This option would provide a poor signal.	This option would provide a better signal than 2.1.	This option would provide the best signal as it better captures the full impact to users.
Arrangements reduce barriers to entry and enable new business models where these can bring value for the system.	This option would not best support new business models as it is an inaccurate measure of customer impact.	This option would better support new business models and provide better certainty to parties looking to develop new business models.	This option may best support new business models as it is the most accurate way to capture user impact. However, the uncertainty that comes with use of forecasts etc. may add to complexity for parties trying to develop new models.

Option	Options for how curtailment is measured under consumer outcomes		
	Option 2.1 Number of events	Option 2.2 Time (i.e. Half hours or more granular)	Option 2.3 Energy using forecast export/import
2. Arrangements reflects the needs of consumers as appropriate for an essential service			
Electricity provides an essential service, and for small users in particular we need to ensure that arrangements do not lead to inappropriate outcomes or unacceptable impacts, particularly for those in vulnerable situations.	Since this measure will be a poor reflection of customers' experience, it is not well suited to avoiding inappropriate outcomes.	This option will provide a fair reflection of users' experience leaving some risk with the customer regarding the overall impact of curtailment.	This option will best reflect the users' experience and therefore is least likely to lead to inappropriate outcomes.
Users, or suppliers/intermediaries on their behalf, are able to understand arrangements and have sufficient information to be able to reasonably predict their future access and charges.	This option would result in poor predictability.	This option is easier to understand and would allow the impact on customers to be assessed from their side.	This option would allow the best predictability but the complexity involved may require some in-depth knowledge.
3. Any changes are practical and proportionate			
Data collection, processing and analysis requirements considering whether the option requires changes to the way in which data is currently collected, processed or analysed, and whether new data may need to be collected.	These options would have similar requirements in terms of data collection and processing. This would require configuration of ANM systems to collect this data in the required format consistently.		This option would need to factor in customer counterfactual/forecast data. This could potentially be achieved using archetypes but this would reduce accuracy.
Existing systems, assets and equipment considering whether new IT/operational systems (e.g. billing systems) may be required to implement the option and the degree to which new metering and monitoring equipment requires to be installed and the practicality of doing so.	These options would require systems/processes to store/analyse the data on top of the functionality within ANM systems to capture it.		This option would likely require new systems or significant upgrades to allow the counterfactual to be layered onto curtailment data.

Option	Options for how curtailment is measured under consumer outcomes		
	Option 2.1 Number of events	Option 2.2 Time (i.e. Half hours or more granular)	Option 2.3 Energy using forecast export/import
Charge calculation and settlement considerations, where the option requires parties who calculate charges to update their charging methodology or models and the extent to which this is required.	There is unlikely to be a difference in charge calculation between these options.		
Engineering and planning standards, assessing whether a particular option would require changes to engineering or planning standards, the scale of change required and the expected implementation timescales.	No additional planning standards or additional standards are proposed under any of these options.		
Customer engagement or commercial agreements, considering any changes that would be required to how customers are engaged and managed and any impact on existing commercial arrangements.	No material difference in engagement across these options. However, option 2.3 may be the most complex to explain to customers.		
The ease with which the options can be implemented, considering the need for any legislative changes as part of the implementation requirements, and whether transitional arrangements are required.	No legislative changes required under any of these options. Transitional arrangements may be needed for customers on existing flexible connections as this could change the way in which their flexibility is defined.		

Option	Options for arrangements when curtailment goes beyond threshold		
	Option 3.1 Trigger assessment of options	**Option 3.2 Incentive driven action**	**Option 3.3 Payments to customers curtailed beyond threshold**
1. Arrangements support efficient use and development of system capacity			
Access arrangements support network capacity being allocated in accordance to users' needs and the value they ascribe to network usage	This option would have the potential to make an accurate assessment of all users' needs against costs but would not necessarily provide certainty in terms of the solution that is adopted.	This option would deliver a broadly optimal outcome if the incentives used are calibrated and reflective of the underlying costs and benefits.	This will be dependent on how the value of any payments are set. If they are set through procurement process this will allow good reflection of user value.
Arrangements provide signals that reflect the costs and benefits of using the network at different times and places, to support efficient use of capacity, and ensure no undue cross-subsidisation between users	This option would reflect the value of the network balanced against users' needs within the scope of the options being assessed. However, the results may be very different in different areas which may create complexity. The assessment under his option could include payment options as under option 3.3 which would bring across the benefits of these approaches where adopted.	This would provide good signals if the incentives are well calibrated. It will also create an amount of certainty as incentive parameters will be well-known.	Again, if set through a procurement process, this option would allow a good reflection of both user value and the value to the network against other options. However, if valued based on user impact, there is a risk that overall network costs increase.
They provide effective signals for where new network capacity is justified	If the assessment is comprehensive and well-informed, this option will provide a very effective signal.	The effectiveness of this option would rely on the calibration of incentive parameters and how well incentives drive local behaviour.	This option could generate a good signal for where increasing capacity is a more economic action than increased curtailment.
Arrangements reduce barriers to entry and enable new business models where these can bring value for the system.	New business models could be included in this assessment and therefore be considered for deployment.	With incentive parameters being well-known and consistent, new business models could be assessed against them.	Depending on the arrangements adopted, this option could support innovative business models in response to tenders etc.

Option	Options for arrangements when curtailment goes beyond threshold		
	Option 3.1 Trigger assessment of options	**Option 3.2 Incentive driven action**	**Option 3.3 Payments to customers curtailed beyond threshold**
2. Arrangements reflects the needs of consumers as appropriate for an essential service			
Electricity provides an essential service, and for small users in particular we need to ensure that arrangements do not lead to inappropriate outcomes or unacceptable impacts, particularly for those in vulnerable situations.	Users' needs will be well-represented in this assessment but the case-by-case basis of the outcome may lead to some uncertainty. For example, the solution adopted under each assessment may be different in nature while still addressing the underlying issue.	Well-known incentive parameters will provide a level of certainty but individual responses may be less certain. Changes in UoS charges relating to incentive rewards/penalties may not be directly targeted at the users affected however the behaviour they drive should target solutions for those customers where it is in the interest of all users.	A procurement process could be a good mechanism for users to signal the value they ascribe to their use and how essential it is. Putting it alongside other options such as increasing capacity will allow the chosen action to best reflect users' needs.
Users, or suppliers/intermediaries on their behalf, are able to understand arrangements and have sufficient information to be able to reasonably predict their future access and charges.			Procured flexibility is a relatively established process and could be on behalf of customers through aggregation etc.
3. Any changes are practical and proportionate			
Data collection, processing and analysis requirements considering whether the option requires changes to the way in which data is currently collected, processed or analysed, and whether new data may need to be collected.	To make an effective assessment, this option would require sufficient data to determine the impact of curtailment to customers.	This option would require consistent data in a format suitable for reporting requirements. In addition to this, additional data may be required to make informed decisions on the impact of specific interventions.	This approach could make use of established processes for procurement of flexibility. If payments are valued by impact to the customer, data would be required to be collected and processed to inform this calculation. If combined with another option, the respective requirements would also apply.

Option	Options for arrangements when curtailment goes beyond threshold		
	Option 3.1 Trigger assessment of options	**Option 3.2 Incentive driven action**	**Option 3.3 Payments to customers curtailed beyond threshold**
Existing systems, assets and equipment considering whether new IT/operational systems (e.g. billing systems) may be required to implement the option and the degree to which new metering and monitoring equipment requires to be installed and the practicality of doing so.	These options may require further systems to store and process data to facilitate effective, transparent and consistent decision making.		This would depend on the mechanism adopted. Procurement is well established but any other mechanism may require new systems/processes. For example, calculating payments based on user impact will likely require new systems to generate payments based on forecasts and process these payments to customers.
Charge calculation and settlement considerations, where the option requires parties who calculate charges to update their charging methodology or models and the extent to which this is required.	These options would not directly impact individual users' charges.		This options would not directly impact users' UoS charges assuming any payments made are through a separate process. However, the funding, calculation and administration process would need to be defined if payments are made based on user impact.
Engineering and planning standards, assessing whether a particular option would require changes to engineering or planning standards, the scale of change required and the expected implementation timescales.	All options considered here can be implemented without the need for material changes to engineering and planning standards.		
Customer engagement or commercial agreements, considering any changes that would be required to how customers are engaged and managed and any impact on existing commercial arrangements.	This option would require clear communication and transparency of decision making process and the resulting decisions.	If incentive parameters are well known and well-communicated, this option would require minimal engagement.	Making sure users understand the process adopted and its interaction with other arrangements would be important. Commercial agreements would need to be put in place to give effect to the process of making direct payments to customers.

Option	Options for arrangements when curtailment goes beyond threshold		
	Option 3.1 Trigger assessment of options	**Option 3.2 Incentive driven action**	**Option 3.3 Payments to customers curtailed beyond threshold**
The ease with which the options can be implemented, considering the need for any legislative changes as part of the implementation requirements, and whether transitional arrangements are required.	No legislative changes required under any of these options. Transitional arrangements may be needed for customers on existing flexible connections as this could change the way in which their flexibility is defined.		