Access and Forward-looking charges

Report 2: Option Variants of Access Choices

SCR Access Subgroup

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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

Access SCR Delivery Group **Access SCR Challenge Group**

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1 Executive summary

1.1 This Report aims to outline the range of potential options which may form part of a user's access choice in the future. It follows on from Report 1[1] which set out the arrangements as they are today, however this report does not limit its thinking to the existing planning or commercial arrangements. It highlights all the relevant design options which could be considered as part of access if we had a "blank sheet of paper" for arrangements. Considering access arrangements is important for supporting efficient use and design of the networks in light of the changing energy landscape including uptake of various technologies and new business models.

1.2 Options have been grouped under six different areas:

- **Firmness:** This section considers users' physical connection to the system, how curtailment could be defined and how users may be reimbursed if access is lost. It notes the interdependencies between the different elements of firmness for example, if a user chooses to be physically connected to the system below planning standards, it is unlikely that they would be paid if their access to the system was lost.

- **Time-profiled and time-limited:** This section considers when a user could have access to the system, options range from; a 24/7 basis, or specific half hours in the year, or for a time-limited access for example only 1 year. A specific time profile could have value to users that do not need 24/7 access, for example a solar farm would only require access during daylight hours.

- **Shared access:** This section considers whether new connectees could more easily connect via shared access. With existing users sharing access with the new connectee by having an agreed capacity between a number of users, who could split this access in a way that best suits them.

- **Standardisation:** This section considers how standardised access could be implemented, via the other access options, for users connecting across distribution or transmission. It also considers where it might be more suitable for bespoke access arrangements to be made available through options and user choices.

- **Monitoring, enforcement and overrun conditions:** This section considers how a user's access could be monitored and the enforcement actions to be taken if access is exceeded (either use outside of agreed timeframes or volume of use).

- **Cross-system access:** This section considers the extent to which users have or could have explicit or implicit access rights on both their local and wider networks (e.g. if IDNO connected and have access to transmission etc.).

- **Other cross-cutting aspects:** This section considers any other aspects which may impact users across boundaries.

[1] Report 1: Current approach to the Design and Operation of the Electricity Transmission and Distribution Systems and User Characteristics

1.3 The next stage, following completion of this Report, will be for each of these options to be assessed in more detail, to identify which options could be taken forward to make up access products in the future for users to choose from.

2 Introduction

Significant Code Review

2.1 This report will inform the Ofgem led Electricity Network Access and Forward-looking Charging Significant Code Review ('the Access SCR') and is one of a suite of reports produced by the Access SCR Delivery Group (see paragraph 2.6).

2.2 Ofgem launched the Access SCR on 18 December 2018. The overarching objective of the Access SCR is to ensure 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. The outputs of the Access SCR will inform decisions on future changes to the industry codes that govern the way in which different users can connect to and utilise our electricity networks.

Drivers for the SCR - the changing energy system

2.3 Decarbonisation and new technologies are driving rapid change in the way in which energy is produced, with growth in distributed and locally connected energy resources. These changes could create demand and generation constraints on some parts of the electricity network. Network reinforcement to address constraints can be costly, time consuming and disruptive, and could therefore present a barrier to the take-up of new technologies and changing patterns of usage.

2.4 The pace of change can be expected to hasten over the next decade and beyond, bringing unprecedented challenges in the way in which electricity networks are designed, operated and managed. By extension this also points to the need for change in the commercial, regulatory and technical arrangements that govern the way in which different users (for example, domestic households including vulnerable users; large and small generators; and large and small commercial demand users) connect to and utilise the electricity networks.

2.5 Following engagement with industry, Ofgem believes that the current electricity network access arrangements and forward-looking charges will not efficiently facilitate these changes in our energy system. The Access SCR therefore identifies a number of key issues with the current arrangements and priority options for change. Consistent with this, the Access SCR includes:

- a review of the definition and choice of access rights for transmission and distribution users;
- a wide-ranging review of distribution network charges (ie Distribution Use of System (DUoS) charges);
- a review of the distribution connection charging boundary; and
- a focused review of transmission network charges (ie Transmission Use of System (TNUoS) charges).

The Delivery Group

2.6 To deliver the Access SCR, a Delivery Group has been established to provide input to Ofgem for its consideration in developing its SCR conclusions. The group is chaired by Ofgem, with members including the Electricity System Operator (ESO), distribution and onshore transmission, network owners, the Energy Networks Association (ENA), relevant code administrators (e.g. DCUSA and CUSC), and a representative for IDNOs. The purpose of the Delivery Group is to provide knowledge and experience of how the networks are planned and operated, to help develop and assess options. The Delivery Group has set up and tasked specific 'working groups' to consider and report on each of the aspects of the Access SCR listed above.

The Challenge Group

2.7 To provide ongoing wider stakeholder input into the Access SCR, a Challenge Group has been established. The Challenge Group provide a challenge function to the work of the Delivery Group (and that of any working groups it commissions), ensuring policy development takes into account a wide range of perspectives and is sufficiently ambitious in considering the potential for innovation and new technologies to offer new solutions. The Challenge Group's feedback has informed the development of this report.

Scope of the report

2.8 The Access Working Group is one of the three working groups currently established under the SCR. The Access Working Group has been tasked with reviewing the definition and choice of access rights for transmission and distribution users. This review currently comprises of two reports, an overview of these is provided below and the full product description is in Annex 1.

2.9 Access Report 1 set out how access and planning work currently from both a distribution and transmission perspective. This is useful context for understanding some of the practicalities of implementing the options set out in this report. However, to ensure that this report has not limited access options, we have assumed a "blank sheet of paper" with regards to current arrangements in identifying the options.

2.10 This report, Report 2, aims to outline all the potential options which may form part of a user's access rights and choices in the future. Access is being considered for both generation and demand. Users' access rights are particularly important to consider due to the changing energy landscape and uptake of technologies such as electric vehicles and heat pumps. This report highlights all the relevant design options which could be considered as part of access which we have classified under four different broad areas:

- **Firmness** – physical and financial,
- **Time profiled** – time profiled and time limited,
- **Shared access** – whether access rights could be shared between multiple users, and
- **Cross cutting aspects** – considerations across distribution / transmission of:
    - **Standardisation** – the extent to which options are bespoke or standardised.
    - **Monitoring, enforcement and overrun conditions** – how a user's access could be monitored and the enforcement actions to be taken if access is exceeded.
    - **Cross-system access**: This section considers the extent to which users have or could have explicit or implicit access rights on both their local and wider networks.

2.11 The Report then sets out an assessment of each option against the SCR guiding principles.

Out of Scope

2.12 This Report does not recommend which options should be taken forward or highlight actual access products which users could choose from in the future. This will be covered in following papers.

2.13 The industry led access work as set out in Ofgem's Access and Forward-Looking charges launch statement is also covered separately.

Guiding principles

2.14 As part of Ofgem's Access SCR launch statement, three guiding principles were set out. These are outlines below, and better-defined access rights should support these:

1. Arrangements support efficient use and development of the energy system;
2. Arrangements reflect the needs of consumers as appropriate for an essential service; and
3. Any changes are practical and proportionate.

2.15 Throughout this Report, different options for access are considered, with a high-level assessment against these principles.

Key terms

2.16 The following key terms are used throughout this report:

- **Access:** the nature of users' access to the electricity networks (for example, when users can import/export electricity and how much) and how these rights are allocated;

- **Firmness:** ongoing certainty of network capacity being available for a particular connection arrangement. This could be "physical" regarding the actual connection to the network, or "financial" when users are reimbursed when they are unable to use the system; and

- **User:** anyone who may "use" the electricity system; both generation and demand. This report calls out where something may only be relevant for certain types of user for example generation only, small domestic demand or active (for example participation in the energy market) / passive users (for example with little interest in energy).

Dependencies

2.17 This Report has been developed in parallel with the other SCR working groups, such as Cost Drivers.

3 Options for choice of access – Firmness

<u>Introduction</u>

3.1 This section explores the ways in which a user’s access to the system could be defined in terms of the probability of full access being available. There are certain network conditions that will mean that a user’s access to the network will have to be curtailed either partially or in full. The probability of this occurring is often referred to as the “firmness” of the network access. If there is a very low probability of a user being curtailed, they are said to have a firm connection. If a user has accepted a higher probability of curtailment at the time of connecting, they are said to be on a “non-firm” or “flexible” connection. It is important to keep in mind the distinction between an interruption due to an unforeseeable fault on the network and foreseeable curtailment due to expected network conditions.

3.2 Current arrangements for connections to the network are explained in more detail in Access Report 1. Broadly speaking, connections were traditionally made to the network on a firm basis which is defined by the applicable planning standards. More recently network companies and the ESO have introduced arrangements that facilitate quicker more efficient connections where the customer accepts a certain degree of flexibility in their access to the system.

3.3 These arrangements have been introduced relatively recently and there will often be differences in how they are implemented between network companies and also between distribution and transmission systems. Better defining customers’ level of firmness will help customers understand what level of curtailment and / or under what circumstances they can expect and therefore make better informed investment decisions. It will also help to ensure a consistent approach across distribution and transmission.

3.4 This section looks at three ways to define the level of firmness and the various options for definition in each of these areas:

- Firmness defined by physical drivers;
- Firmness defined by customer outcomes; and
- Firmness defined by financial security.

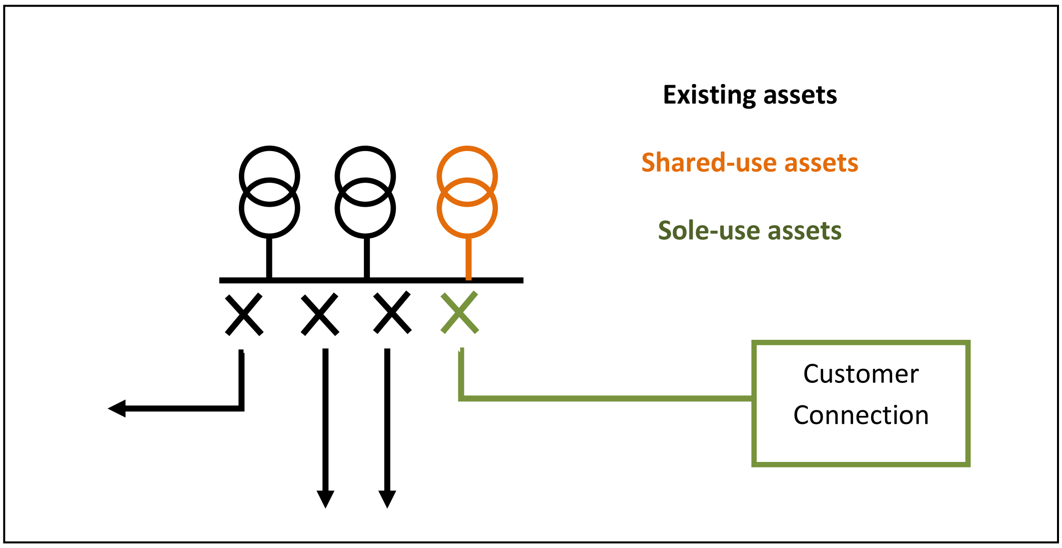
<u>Initial assessment of firmness of access defined by physical drivers</u>

Description of firmness defined by physical drivers

3.5 The access that customers have to the network will, to some extent, be defined by the physical assets that connect them to the wider system and the design of the network at the point they are connected. The capacity of these assets will set physical limits to the power that can be provided to the customer and the network design will determine the ability to continue to provide access (and to what extent) in the event of abnormal network running conditions such as after a fault. The way in which networks companies currently apply these standards is explored in more detail in Access Report 1.

3.6 Figure 1 below is a simplified diagram showing an example of existing, sole-use and shared-use assets for the purposes of a new connection. In this example, a new transformer is needed to provide the required capacity which is shared between multiple customers. A new circuit breaker and line are installed to supply only the new customer’s connection.

Figure 1: Diagram showing example of existing, sole-use and shared-use assets



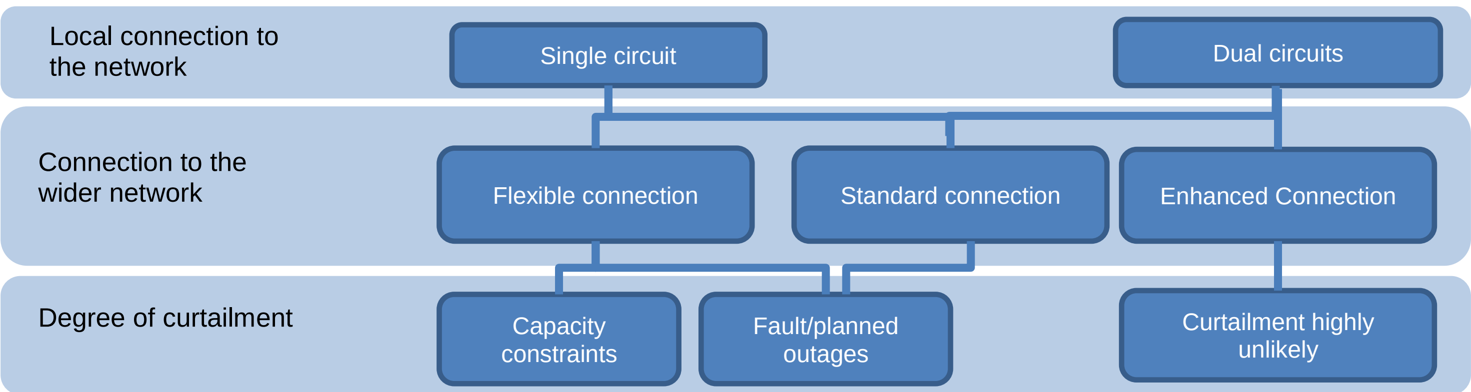
3.7 Types of physical driver that can affect access:

- Faults on the network
- Post-fault running conditions
- Planned outages
- Capacity constraints, and
- Voltage constraints.

Key design choices and variants

3.8 The option map in Figure 2 below shows the key choices a network user could have when making decisions around the physical connection they have to the network. It should be noted that the options presented below have many interactions with the options explored in Section 2 regarding the user outcomes. For example, if a network user makes a decision to have a connection to the wider system via a single circuit (sole-use assets), they will inevitably be exposed to a loss of Network Access in the event of a fault on that circuit. Therefore, options under both of these sections must be considered in parallel to ensure choices are compatible. Additionally, some of the options in section 2 offer alternative ways to define the physical firmness of customer connections e.g. rules-based options.

Figure 2: Option map for physical drivers of firmness



3.9 In terms of the user's connection to the wider system, the customer could choose whether to connect via a single circuit which is capable, in most circumstances, of delivering the capacity required for the connection or whether to be connected via dual circuits. If connected via a single circuit, the customer will experience an outage when that circuit is not in service due to a fault, maintenance etc. If supplied via dual circuits, in the event of one circuit being out of service, the remaining circuit will be able to continue provide either the full capacity or partial capacity depending on the design.

3.10 The wider system that supplies the customer's connection will be subject to planning design standards as described in more detail in Access Report 1. As a default, a new connection to the system would be designed to these standards but the customer may choose to have a connection which provides greater security of supply than these standards provide. Alternatively, in some circumstances, if the customer is willing to accept some flexibility in their access to the network, they may choose to connect to the network knowing that their Access may be limited under certain network conditions. Currently customers opting for a flexible or restricted connection agree to some curtailment; while estimates may be provided this can be open-ended. At transmission, curtailment for wider constraints or system reasons is managed and compensated via the Balancing Mechanism. In future, there could be options to better define the curtailment customers could expect in terms of the physical drivers as described below. At transmission, users may also provide commercial intertrip services to the system operator. Intertrip service are required as an automatic control arrangement where generation may be reduced or disconnected following a system fault event. The payment terms for the commercial intertrip service are determined bilaterally between the ESO and the generator.[2]

3.11 The options described above will influence how a user's network access is affected by various network events. For example, by choosing a flexible connection, users are implicitly exposing themselves to a capacity constraint whereas a user connected under a standard connection is only exposed to unplanned events such as faults. There may be options for customers to choose their level of access based on the physical drivers of curtailment they are willing to be exposed to. This could be particularly applicable where there are multiple constraints affecting an area of the network (for example both transmission and distribution). Some users may be willing to be exposed to a subset of the apparent constraints. In network terms, this will have an influence on the standards the connection will need to be designed to as described above.

Other factors affecting possible options

3.12 The connection charging boundary will have an influence on how customers pay for the options described in this section. It may also influence which choices are available to customers. The connection boundary at distribution and transmission is different. A shallow[3] connection boundary operates at transmission and a shallow-ish[4] connection boundary operates at distribution. If the distribution connection boundary becomes shallower, then the value of access choices would need to be reflected in the use of system charging methodology.

3.13 The impact of physical drivers on a specific customer's access to the system will be influenced by other customers connected to the same area of the network. This will have to be factored into the design of potential future access options along with any flexibility arrangements in place with these customers.

Summary of initial assessment of physical drivers of Network Access

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[2] Payments are made up of (a) Arming payment (£/settlement period) – paid for each settlement period where the generator allows signals to pass from the intertripping scheme to the relevant circuit breaker, and (b) a tripping fee (£/unit/trip) paid when a signal is sent to the relevant circuit breaker of a generator causing the generator to cease output to the transmission system.

3.14 A more detailed assessment of each variant of the options described in this section has been carried out by exploring the pros and cons of each variant against the three Guiding Principles of the Significant Code Review. This assessment also considered the required enablers and whether each variant might be particularly suitable or unsuitable for certain types of customer. This detailed assessment is shown in Annex 2 and the key insights drawn from it are described in Table 1 below.

Table 1: Initial assessment of physical drivers of Network Access

	Guiding Principle 1 – Efficient use of the network	**Guiding Principle 3 – Practicality**
Users	Having the option of a flexible connection to the network allows users to get much quicker, cheaper connections where it is suitable. This may apply more directly to larger users who can make such decisions at the time of connection rather than smaller users who often buy properties with a connection already established. However, being exposed to the physical drivers of curtailment means customers take on the risk of these constraints materialising and potentially also exposed to other users' behaviours which increases uncertainty for users.	Depending on the nature of the customers' connection and how heavily they rely on their network access, being exposed to physical drivers of curtailment could require customers to factor in assessments of likely curtailment for their investment plans. They will also need to manage the ongoing risk. If subject to curtailment, the notice periods of any curtailment will be important to customers.
Networks / ESO	Defining curtailment and connection standards in terms of physical drivers provides a direct comparison with planning and delivering efficient networks. This can keep costs as low as possible for the general customer population.	This option is relatively practical for networks to implement as it is a close reflection of the physical network conditions. However, it may require planning standards to be evaluated to ensure they give customers as much certainty as possible if they will be defining levels curtailment.

Key insights

3.15 The following insights are drawn from the results of the initial assessment of the firmness defined by the physical drivers option:

- Decisions made regarding the sole-use assets used to connect the user to the system are very closely linked to cost and easily attributable;
- There is an interaction between the standard chosen by the customer for the sole-use assets and the security of supply of the wider network, they must be equivalent to deliver the desired outcome;

[3] Under a shallow connection boundary, the connection customer will not contribute towards any wider network reinforcement required.
[4] Under a shallow-ish connection boundary, the connection customer will pay for their own sole-use connection assets and will contribute towards any wider network reinforcement required.

- When making decisions for the wider network, these will inherently affect other users. Future arrangements would need to include mechanisms to accommodate the interaction between multiple customers and any flexibility arrangements in place;
- All decisions are closely linked to the level of risk a customer is willing to accept and therefore is likely to be very different for different types of user;
- Broadly speaking, the higher the standard of connection/wider system, the better for customers (especially if essential) but could be have a negative impact on efficient investment;
- Defining customers' network access in terms of physical drivers of constraints helps in the development of efficient networks but passes on the risk to customers in terms of levels of curtailment;
- If customer choice is defined by physical constraints, this will rely on a good understanding of likely outages/curtailment to help inform customers' decisions; and
- Defining curtailment by physical drivers could lead to unlimited curtailment which may not be a suitable arrangement for all customers.

Combinations and interdependencies

3.16 Potential combinations:

- Defining network access by physical drivers could be combined with options set out in the section below to provide a limit on the customer's exposure (for example, by defining curtailment limits or financial reimbursement);
- Options here could be combined with time-profiled access as described in Section 5 to give greater certainty around when customers are exposed to curtailment;
- When defined by physical drivers, customers' access to the network will often be inherently shared among multiple users. Option for shared access as detailed in Section 5 could be used to formalise these arrangements; and
- Non-firm access defined by physical drivers could be combined with a certain level of firm access. This would essentially create a level of firm access which meets the user's essential needs and a level of non-firm access for which the user is happy to accept a level of flexibility when network conditions require it.

3.17 Interdependencies

- There are clear dependencies between the level of service that is achievable through options for both the sole-use assets and wider system. i.e. an enhanced level of service from the wider system may not be achievable through a single circuit connection

Standardisation

3.18 Standardisation in the physical drivers option could be by way of a selection of connection design 'products' with a defined level of network access. Setting these out at a national level through codes, methodologies or engineering standards could give users transparency and consistency in the impact of the options available, as well as giving network operators consistent principles for the design and growth of their networks.

3.19 The restriction to standard design 'products' could limit the ability to cater for users which require differing access requirements and the ability for network operators to enhance network efficiency without the ability to agree access arrangements outside of those prescribed by the standardisation. Limiting the design of access products could also stifle innovation and could benefit incumbent users by restricting the scope of access options.

3.20 Providing fully bespoke choices in the physical drivers would enable customers and network operators to fine-tune the connection design to the specific requirements and appetite for risk of both the customer's connection requirements and the network operator's network characteristics. However, this level of choice comes with a significant burden on both users and network operators if extended to all user- and connection-types, due to the volume of interactions, agreements and factors to take into consideration when assessing and implementing the bespoke arrangements.

3.21 Providing access arrangements with standardised parameters of physical drivers setting out the bands in which bespoke requirements can be accommodated, could provide a combination of the benefits to users and network operators of standardisation with an ability to still tailor to specific requirements.

3.22 Standardisation may also provide an option for users to have certainty over the level of network access they can expect as a minimum which is important to those who may have little or no ability to benefit from bespoke access arrangements.

Initial assessment of firmness of access defined by customer outcomes

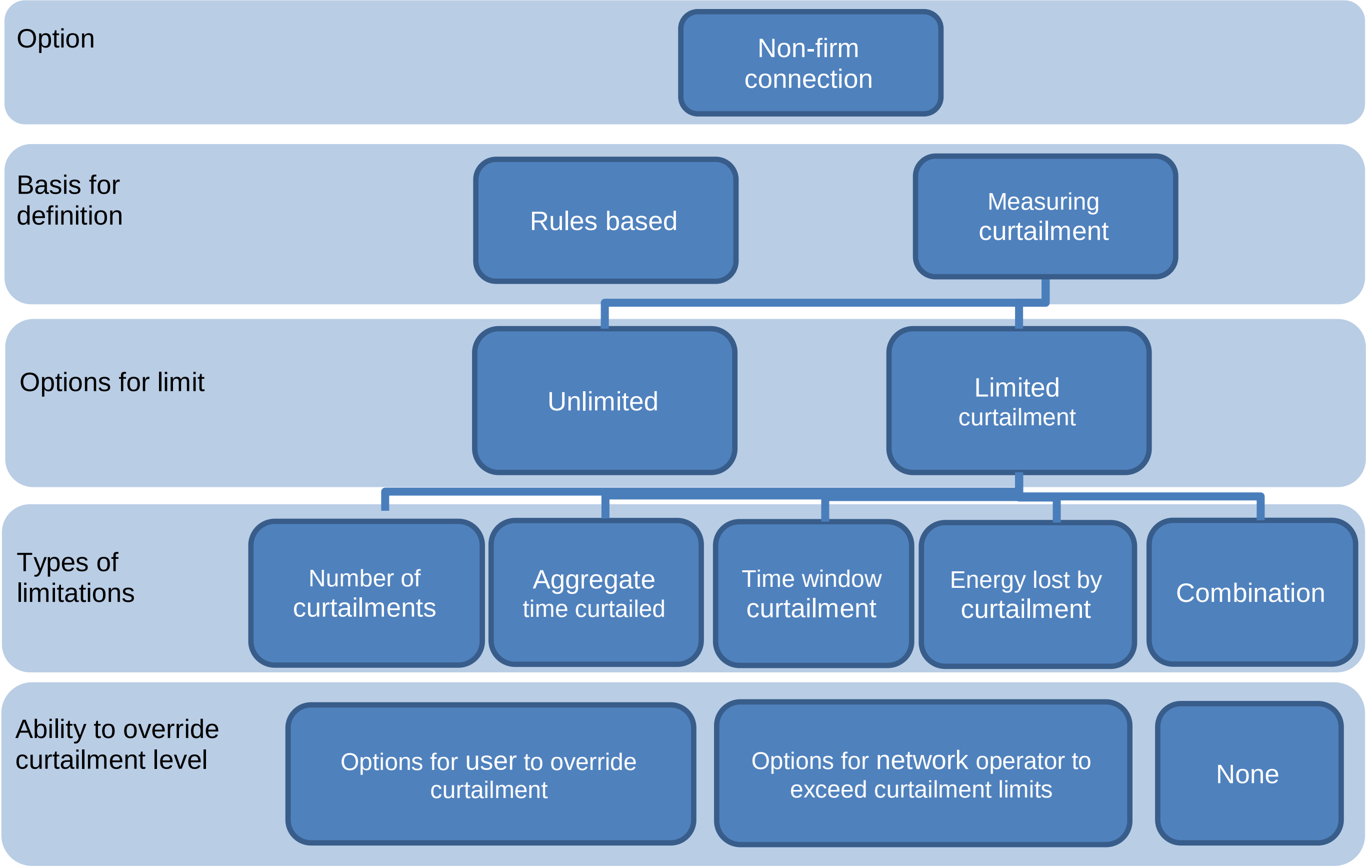
Description of firmness defined by customer outcomes

The previous section explored the various physical drivers that will impact the firmness of a customer's connection. The level of firmness, although driven by physical characteristics, can be defined in terms of the continuity of network access experienced by the connected customer. In circumstances where the network is not able to provide the full capacity of a connection (for example network faults or capacity constraints), this will lead to either a complete interruption to the supply (outage) or the need to curtail the import/export of the customer. This section explores parameters that can be used to define the level of continuity the customer experiences. These parameters could be used to set limits or potentially value/monetise the level of continuity.

Key design choices and variants

3.23 The option map below in Figure 3 below show the key areas for choice regarding how firmness is defined by customer outcomes. As mentioned in the previous section, many of the underlying factors driving curtailment will be linked to the physical network characteristics so there will be interactions between these two sets of options. Levels of curtailment will also need to be defined/assessed taking into account all relevant customers' behaviour on the network, they will rarely be able to be assessed in isolation for one customer. There are also links between how curtailment is defined and how it might be compensated which is explored in the section below on financial firmness (paragraph 4.34).

Figure 3: Option map for definition of firmness based on customer outcomes



3.24 Where a customer has chosen a flexible connection, they will be exposed to some foreseeable curtailment. The level of curtailment could either be defined by using rules which describe how curtailment is applied to each customer or by measuring the level of curtailment each customer experiences. It should be noted that using rules to apply curtailment sits somewhere between defining firmness by physical characteristics and by customer outcomes. Therefore, any options identified in this area need to be considered in parallel to the options being considered for exposing customers to network constraints.

3.25 If a customer chooses their firmness to be defined by measuring their curtailment, there are multiple options for the basis of this measurement:

- Defined by number of curtailments;
- Aggregate time of curtailment;
- Timed using windows - more static;
- Through a curtailment index; and
- Energy lost through curtailment (potentially defined by access).

Broadly speaking, the lower the option is in this list, the better it reflects the impact on the customer. There may be combinations or more complex arrangements, potentially defined as bespoke arrangements, based on customer requirements for example a minimum time between curtailments to allow recharging of back-up energy systems.

3.26 If curtailment is measured and potentially limited by the options above, users could be given the option to override curtailment assuming there were systems in place to ensure network security. Similarly, network operators may have the option to exceed curtailment limits if arrangements were in place to ensure the impact on the customer is considered. If future arrangements include provisions for override, consideration would have to be given to what mechanisms would need to be in place to support this. For example, from a network's perspective, remedial action would have to be taken either by designing more resilient networks or by calling on other sources of flexibility.

Summary of initial assessment of firmness defined by customer outcomes

3.27 A more detailed assessment of the key design choices against the three Guiding Principles of the Significant Code Review has been carried out and is shown in Annex 2.

Table 2: Initial assessment of firmness defined by customer outcomes

	Guiding Principle 1 – Efficient use of the network	**Guiding Principle 3 – Practicality**
Users	• Defining network access in terms of the customer outcomes will better reflect the impact of curtailment to customers. This impact will be better reflected by options that define and measure curtailment based on the energy curtailed rather than instances of curtailment. • Rules based curtailment may not always increase certainty for customers which could affect investment plans.	• This option may be more practical for customers than being exposed to physical drivers as it will allow them to account for curtailment on their own terms. This could simplify investment assessments. • Non-firm connections will need clear governance to ensure impact of curtailment is well-managed. There will also be interactions with trading that will need to be accounted for. • If subject to curtailment, the notice periods of any curtailment will be important to customers.
Networks / ESO	• Network access defined by customer outcomes will require flexible connections to be designed and provided to meet external requirements. This will involve networks taking on more of the risk associated with flexible connections and therefore may require more remedial action in terms of network resilience or greater use of other sources of flexibility. • While this may lead to higher overall costs, this will mean that network investment and operational decisions around flexible connections will take more account of customer outcomes.	• By taking on more of the risk associated with flexible connections, network companies will have to factor this in to decision-making processes. Network companies may have more options available to them to manage levels of curtailment. • If options that measure network access by value to customers are used, this will require the network company to have access to more data regarding customers' expected output.

		• Options that allow overrun by either the customer or network companies could potentially require inefficient mitigation arrangements to be put in place.

Key insights

3.28 The following insights are drawn from the results of the initial assessment of the firmness defined by customer outcome option:

- The overall option to define firmness in terms of customer outcomes rather than exposing customers to network drivers essentially shifts the risk of curtailment from the customer the network operator. This is then reflected in the assessment against the principles showing more benefit to customers but also being slightly harder to implement from a network perspective.
- Regarding the options for quantifying the level of curtailment when using various metrics, as the options progress from simply counting events to measuring energy curtailed, these show greater benefits for both customers and efficient network design. However, they also become harder to implement.
- Options to override show benefits for the party with the option to override but at the expense of the party being overridden. This will also require "backstop" systems to be put in place.
- Consideration for how and when users will be notified of intended curtailment as this could influence the impact of curtailment to the customer and also have an impact on their options to trade curtailment obligations.

Combinations and interdependencies

3.29 Potential combinations

- Options for network access defined by customer outcomes could be combined with options for time-profiled access as described in the section below on time-profiled access (paragraph 5.4).

3.30 Interdependencies

- If using definitions and measurement of network access based on customer outcomes to set limits for curtailment, these will need to take account of the physical drivers of curtailment as explored in the previous section.

Standardisation

3.31 Consideration of standardisation in firmness defined by customer outcomes builds on the options for standardisation in physical firmness described above (paragraph 3.18). Enabling flexible connections requires some degree of bespoke access arrangements; however, elements of standardisation can provide some certainty and protection for users and network operators in the extent of the outcomes and their effects on either the users or network security.

3.32 Implementing standardisation in network design for the aspects such as maximum levels of curtailment could provide users with greater certainty and transparency in understanding and quantifying, the impact of their choice of a flexible connection as opposed to fully bespoke arrangements where curtailment / or access could be reduced to zero in certain scenarios.

Initial Assessment of financial firmness

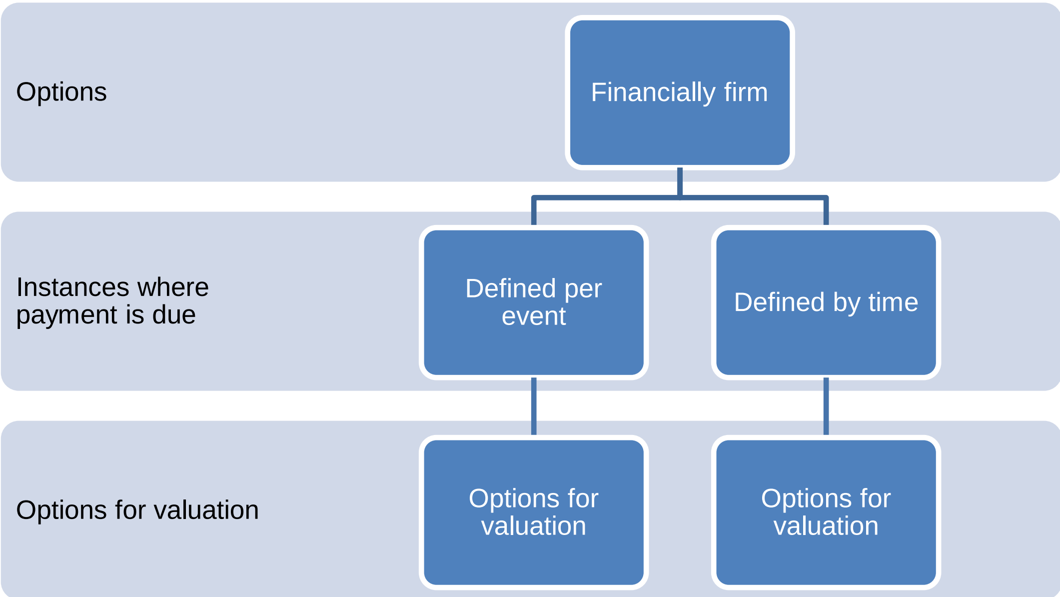
Description of financial firmness

3.33 Where customers have paid for a certain type of Access and there is the potential for curtailment, they may have an option to be compensated for this loss of Access. This section looks at options that would value that level of curtailment of compensate the customer with the intention of providing the customer with a financially firm arrangement. This involves financially reimbursing customers when their access to the system is limited or unavailable. When considering the options in this section, it should be noted that they could be applied in a layered fashion with other options, such as financial firmness beyond a defined level of curtailment.

Key design variants

3.34 The option map below shows the key options for implementing financial firmness. Financial firmness will only be compatible with certain other design choices so these options must be considered with this in mind.

Figure 4: Option map for financial firmness



3.35 If a customer is to be considered financially firm, first it must be decided how the trigger for compensation is defined. Here there are two options, either based on each curtailment event or based on the aggregate time curtailed.

3.36 To calculate payments to customers, the curtailment must be given a monetary value. There are multiple options for this:

- Value of avoided network cost (e.g. deferred network reinforcement / other e.g. based on charging model);
- Value of lost energy (e.g. wholesale market, spot price etc);
- Value of lost market value (beyond energy cost);
- Value of Lost Load (VoLL) similar to outage incentives;
- Value of lost production (demand).

3.37 Broadly speaking, the options presented in the list above get progressively closer to valuing the full impact to the customer. Ultimately these payments will have to be funded so there will be a balance between reflecting the impact and willingness to pay.

Summary of initial assessment of financial firmness

3.38 A more complete assessment of the options for financial firmness against the three Guiding Principles of the Significant Code Review has been completed and is presented in Annex 2. Below is a summary of the key insights that can be drawn from this assessment.

Table 3: Initial assessment of financial firmness

	Guiding Principle 1 – Efficient use of the network	**Guiding Principle 3 – Practicality**
Users	• Financial firmness could be valuable to many customers who rely on network access to justify investments. • For some users, the compensation valuation may not reflect their dependency on network access and would therefore favour a physically firm connection. • Careful consideration will have to be given to the funding arrangements for the compensation payments to ensure the customers that see the benefit are subject to the cost of providing these arrangements.	• For customers with a close link between network access and their revenue, financial firmness could be a practical way to connect to the network.
Networks / ESO	• Providing financial rather than physical firmness may be the most efficient outcome in some circumstances and could therefore be a useful option to have available. • The cost of financial reimbursement would provide a signal to network companies of the value of the curtailment to customers which could be used to evaluate when investment to reduce it is justified. • Depending on how customers connect to and use the network, financial reimbursement may not provide the right signals to users about efficient use of the existing network which may lead to inefficient use of the network.	• Depending on how widely this concept is adopted, this could involve complex valuations across a large volume of customers. • These valuations could have impacts on how investment projects are assessed for efficiency and therefore a consequential impact on planning standards. • At transmission level, there is already a mechanism to support options for reimbursement (Balancing Mechanism).

Key insights

3.39 The following insights are drawn from the results of the initial assessment of the financial firmness option:

- There will be clear links between decisions made regarding financial firmness and physical firmness. The arrangements and calculations behind the financial firmness must be clearly defined upfront for customers to make informed decisions,
- Funding arrangements for the compensation payments will need to be designed in such a way that ensures customers who benefit from financial firmness are subject to the efficient cost of providing it,
- Evaluation of the payments being made under financial firmness provide a signal to network companies to allow efficient investment decisions,
- Calculations that factor in the users' value of the curtailment are a better reflection of the impact but will be much less practical to implement particularly if a large volume of users are involved,
- If curtailment is valued based on the users' valuation and forecast of the value of access, network companies will essentially be guaranteeing the users' business plans and take on the associated risks, and
- Consideration will have to be given to the arrangements for traditionally firm customers to ensure that financially firmness does not create a distortion by being more favourable.

Combinations and interdependencies

3.40 Potential combinations

- Financial firmness could be combined with other definitions of firmness to provide, for example:
  - Financial firmness up to or beyond a defined limit, and
  - Financial firmness for certain types of physical driver (for example capacity constraints but not faults);
- Financial firmness could be combined with time-profiled network access;
- Financial firmness could be combined with time-limited access to cover periods while network capacity is being created etc.

Standardisation

3.41 Standardisation will likely be important in providing certainty and transparency for all parties involved in these arrangements. Having the calculation of payments in charging methodologies could provide users and network operators better information in order to assess the impacts and risks of access choices. This standardisation is likely to be attractive to the majority of users, giving a degree of predictability, auditability and an understanding of how the levels financial firmness and compensation rates have been arrived at.

3.42 There could be opportunity for bespoke arrangements outside of standard arrangements such as compensation arrangements agreed outside of Use of System arrangements through separate commercial agreements. However, these are likely to work alongside standardised arrangements in a combination to facilitate the most efficient outcome in certain network situations and provide appropriate cost signals when the alternative could be a very large cost of traditional network reinforcement. These bespoke arrangements would be important in facilitating flexibility and would likely suit large users with and ability to flex their demand or export capabilities. Whilst the bespoke arrangements could ensure the most efficient outcomes and enable flexibility to be market led, some level of standardisation could aid consistency across GB and the development of these markets.

3.43 Whilst standardisation across transmission and distribution may provide benefits (eg consistency for and simplicity to users) the financial impact of loss of income or avoided curtailment may differ significantly across networks. Funding arrangements for the compensation payments will also need to be designed in such a way that ensures customers who benefit from financial firmness are subject to the efficient cost of providing it.

4 Options for choice of access – Time-profiled and time-limited access

Introduction

4.1 The aim of this section is to define the access options for the two areas of:

- Time-profiled access (the degree to which time determines access); and
- Time-limited access (the degree to which a period of time-profiled access is determined).

4.2 There are no explicit network access options defined in electricity distribution, but network users when connecting to and using the distributed network are bound by the parameters agreed with the network owner and in the case of larger network users, these are encapsulated in their connection agreement. Whereas generation users of transmission networks do have explicit access choices; similar arrangements do not exist for demand network users, including other network owners connected to the transmission network.

4.3 In most instances the choices of network users implicitly define their network access and, in this section, we will openly describe the choices for time-profiled and time-limited access so that network users have a clear understanding of the network access options available to them. This approach of describing options is part of the policy development activities to ultimately create a common access framework and a set of access products for network users.

Initial assessment of time-profiled access option

Current arrangements

4.4 There are no explicit arrangements of time-profiled access in distribution or transmission networks, but there are examples of Time of Use tariffs in distribution and transmission. But distribution network operators have started to define time-profiled capacity rights and obligations; for example, WPD defines in its connection agreement with solar generation network users that the export capacity is time-profiled, in that export capacity is only available during daylight hours.

4.5 The National Terms of Connection (NTC) is part of live version of the Distribution Connection and Use of System Agreement (DCUSA) and is contained in Schedule 2B. Distribution network operators rely upon / use these terms and conditions to form their connection agreement or alternatively use the model form of connection agreement contained in Schedule 13 of DCSUA with network users. In the case of the time-profiled capacity arrangement example highlighted above these would be contained in the annex/schedule to the model form of connection agreement. At transmission, there is not currently the concept of time/season limited Transmission Export Capacity (TEC) in the Connection and Use of System Code (CUSC), as TEC allows 24-hour access and traditionally the market influences when generators export.

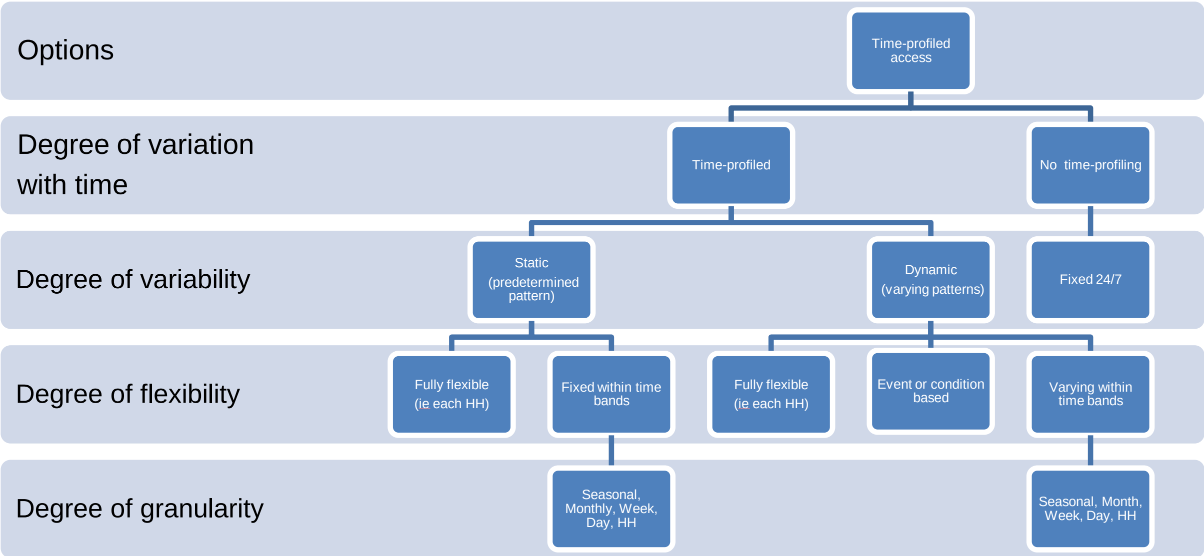
Description of the time-profile access option

4.6 Network users could be able to choose whether their access to the network is either constant or variable in time. When classed as constant this means that there is no variation over the defined time period. Whereas, when defined as variable this means that network operator and the user must agree the variability with time that satisfies the requirements of the user but within the capability of the network. For example, a network user may want certainty of access at all times of the day and year, or options such as ‘seasonal’ or ‘off-peak’ access to the network i.e. a solar farm (without a battery) would only need access during daylight hours.

Key design choices and variants

4.7 The option map shown in Figure 5 below describes the time-profiled access choices which a network user could face when connecting to (and remaining connected to) the network. In practice this option map cannot be completed in isolation from other access options. For example, a network capacity constraint, occurring at a defined time (or a set of conditions, defined in time) may limit network access at that time.

Figure 5: Option map for time-profiled access



4.8 Initially a network user would need to choose the ***degree of variation with time*** i.e. continuous or time-profiled access.

4.9 If the network user has chosen time-profiled access under ***degree of variation with time*** the next step is to agree the acceptable ***degree of variability*** i.e. will the network user wish a defined (static) pattern of access in time or a varying (dynamic) pattern of access in time or access based on an event or conditions, which although not defined in time correlates with time. Event or condition based access is included in this section primarily to ensure that it is captured and not overlooked as it may be a clearly definable arrangement linked to other access options, for example physical firmness. There are numerous examples of network operators defining the conditions when curtailment will be employed. These conditions are generally described by network operator in terms of capacity (kVA) or current (Amps); for example capacity constraints on overhead lines in summer where the ambient conditions affect the current carrying capacity of the overhead lines and techniques such as dynamic line rating allow network operators to maximise the current carrying capacity of the overhead throughout the year. But alternatively, conditions could be described in terms of climatic conditions for ease of understanding by the network user i.e. wind speed above a certain knots value.

4.10 Once the network user has chosen static or dynamic variability the next stage is to choose the ***degrees of flexibility and granularity*** i.e. from the lowest common denominator of one Half Hour (HH) to deciding in time bands the seasonal, monthly, day and within day granularity (i.e. down to HH). It is noted that Time of Use tariffs (both Retail and DUoS) are defined in the same way. Smart equipment may be able to vary load with much finer granularity i.e. sub-HH so further work will be required in implementation to consider the optimal level of granularity.

Summary of initial assessment of time-profiled access

4.11 An initial assessment of the key design choices has been completed by highlighting the pros and cons against the three guiding principles for this Significant Code Review and describing the enablers and whether the design choices are more or less suitable for different types of network user. The table below summarises in tabular form the key benefits and value (defined within the first guiding principle) and the practicality (defined within the third guiding principle) for both network users and networks operators, including the ESO.

4.12 The template containing the full initial assessment for the time-profiled access options are available to review in Annex 2.

Table 4: Initial assessment of time-profiled access

	Guiding Principle 1: Efficient development and use of the network	**Guiding Principle 3: Practicality**
Users	• No time-profiled access is ideal as a core service for all customers, whereas time-profiling is valuable for all active network users as a potential top-up service (above core requirements).	• No time-profiled access is easy to understand with minimal effort to manage simplified record keeping and manually check billing invoices.
Networks / ESO	• No time-profiled access limits efficient use and development of the network. • Facilitating time-profiled access enables greater network utilisation and can mitigate the need for diversity assumptions in planning. • Helps network operators know when capacity in parts of the network are needed, and at which points in the year.	• No time-profiled access is easy to implement and manage with simplified record keeping and billing systems with limited capability. • Time-profiled access is more difficult to implement due to more complex record keeping and greater required capability of billing systems. • Modelling the networks and knowing who is available to curtail at different points of the day could add to operability complexities.

Key insights

4.13 The following insights are drawn from the results of the initial assessment of the time-profiling access options:

- Continuous, non-time varying access is more appropriate for an essential or core service arrangement, likely to be valued highly, predominantly by domestic and small users. Time varying access is more appropriate for top up arrangements for most customers or where a network user has the ability to manage their consumption and/or generation. Additionally, time-profiled access could be applicable for those types of customers confined in time by other factors i.e. solar generation where no access is required outside daylight hours.
- Time-profiling can support the efficient use of the network and network congestion will signal that further development of the network is required. Users who understand the options for securing access and associated costs are better placed to make access requests that will make efficient use of the network.
- Time-profiling is a long-standing feature of electricity tariffs and common feature of some current retail and DUoS tariffs but is not yet an accepted approach to network access; so

most connected customers will believe that they have no time-profile access i.e. they have continuous, non-time varying access. Any change to new time-profiled access arrangements will need to be clearly explained and well in advance of the implementation of new arrangements.
- A network user's choice of time-profiled access will be influenced by its ability to operate in other markets.
- Time-profiling is practically possible and proportionate for all customers, with the widespread rollout of smart (i.e. Half Hourly functional) metering.
- Clearly defined rights and responsibilities for time-profiling are required to ensure that network users operate within the time parameters agreed; this should include clear rules for breaching time-profiled patterns.
- Dynamic time-profiling may create uncertainty for users and network operators and additional complexity for system operation. On the flip side this may also create opportunities for network users who are flexible to optimise revenue streams.

4.14 Further consideration is required around the practicality, enablers and dependencies around the time-profiling access options before it is possible to create access products that could be implemented. In particular the following areas would benefit from further thought:

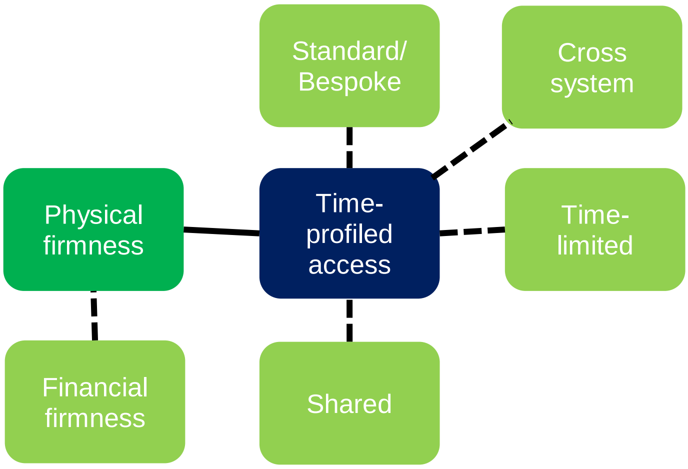
- Consider the 'different notice periods for change' within the dynamic variant of the ***degree of variability*** i.e. how frequently and within what notification time/ notice periods.
- For the dynamic variant under the ***degree of variability*** option to consider the granularity of the time bands as there are possible differing outcomes; especially across the spectrum as seasonal access options could have very different outcomes to HH access options. Noting that it might be very challenging for small users to have a dynamic HH access arrangement depending on the notice periods they have, at least without technical enablers or provided as a managed market solution.
- Evaluate whether time-profiling access is generic for users or if there are specific access arrangements for generation users compared with demand users.
- Alignment of arrangements across transmission and distribution networks as there is a need to avoid the unintended consequence of creating distortions between users connected to the transmission network compared with the distribution network.
- Time-profiled access should be structured to avoid providing operational dispatch incentives.

Combinations and interdependencies

4.15 Time-profiling cannot be decided in isolation of other access arrangements. For example, the decisions on degree of flexibility, variability and granularity are contingent on the access decisions of other access options like physical firmness etc.

4.16 Time-profiled access is linked either directly or indirectly with all the other access options considered in this document. The key interdependencies are shown below in Figure 6 below, with the direct and indirect linkages shown with solid and dashed lines respectively. At this initial assessment stage there appears to be no identifiable reasons why there should not be an access product linked to time-profile, but further work is required to define the scope of time-profiled options and whether time-profiling is an access product in itself or one characteristic of an access product.

Figure 6: Interdependencies map for time-profiled access



4.17 As an illustration a time-profiled access choice is linked directly to the physical firmness access arrangements and an iterative optioneering process is followed to deliver an outcome that is acceptable to the customer within the confines of the capability of the network. The final outcome will balance the requirements of the network user, the user's willingness to fund connection and reinforcement charges and the level of time-profiling acceptable to the network user. There appears to be no need to amend current planning standards as time-profiled access is currently available to network users.

4.18 As previously noted in paragraph 4.10 there might be similarities in the patterns of time-profiled access and Time of Use tariffs (both Retail and DUoS); but each provide different benefits to network users and network operators. For example, time-profiled access rights give greater certainty to network operators about when users will access the network reducing the need for diversity assumptions in planning standards, whereas Time of Use tariffs provide a pre-determined pricing signal to network users for using of the network across different time periods.

4.19 It is quite possible that network users who have time-specific access could have lower charges than those with constant 'round the clock' access, but this would need to be considered further and in conjunction with the charging design work.

Standardisation

4.20 A level of standardisation will likely be required in order to implement time-profiled access arrangements on a business-as-usual basis. It would likely be necessary to provide a standardised framework, defined and agreed nationally in order to enable network operators to offer and apply these options consistently. This could provide the level of consistency and understanding required by all parties participating in the arrangements and ensures network users can understand them and have a degree of predictability on the impact on them. Network operators would benefit from the standardisation in design parameters when assessing the impacts of these arrangements on the network for new and existing connections.

4.21 This standardisation could be combined with a level of bespoke arrangements such as on the degree to which curtailment may occur within a standardised time profile (as opposed to the time profile giving a binary 'on' or 'off' outcome).

4.22 Bespoke arrangements are likely to be beneficial for large users interacting with specific network conditions or constraints, where time-profiled access could facilitate connection to the network and operation without costly network reinforcement or reconfiguration. These bespoke user or local network-arrangements may also be implemented to facilitate earlier connections on an interim basis.

Initial assessments of time-limited access options

Current Arrangements

4.23 There a no examples in distribution networks of time-limited access options; whereas in transmission a network user can ask for and receive a short-term TEC product.

4.24 The live version of the Distribution Connection and Use of System Agreement (DCUSA) contains no explicit clauses associated with access arrangements. Clause 12 (Limitation of Capacity) in Schedule 2B of DCUSA defines with the ongoing management of network capacity (both import and export capacity), applicable to those network users that have a defined maximum import or export capacity (i.e. MIC or MEC); and clause 12.13 restricts a reduction MIC/MEC for a further a twelve months following a change.

4.25 Connection and Use of System Code (CUSC) currently offers two time limited forms of TEC; Limited Time Transmission Entry Capacity (LDTEC) and Short term Transmission Entry Capacity (STTEC). Neither offer time limited access within a day. Both offer time limited access measured in days or weeks. STTEC is described in CUSC Section 6 Para 6.31 and LDTEC is described in CUSC Section 6 Para 6.32.

Description of the time-limited option

4.26 Network users could opt for time-limited access arrangements i.e. short-term access. Standard access arrangements will be valid for an annual period (i.e. aligned to calendar year or financial year or a variable start date), but users will be able to choose, if meeting specific conditions, whether to apply for short term access arrangements.

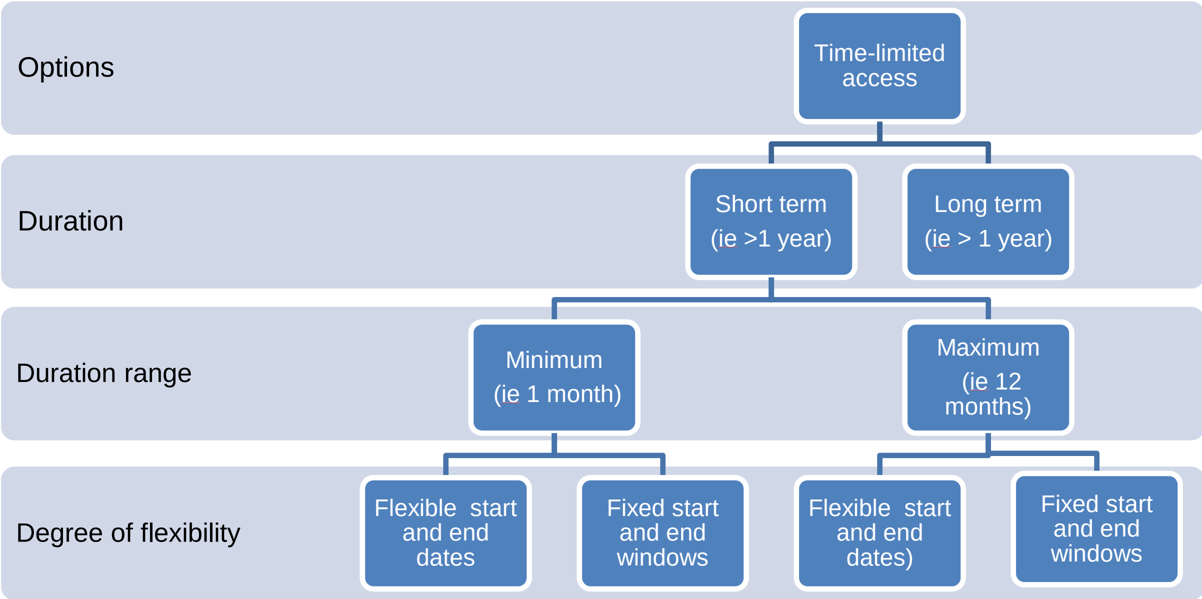
Key design choices and variants

4.27 The option map shown in Figure 7 describes the time-limited access choices faced by a network user connected to the network.

4.28 Standard access arrangements could be valid for an annual period, but users could be able to choose, if meeting specific conditions, whether to opt for short term access arrangements of ***duration range*** for example between 1 months and 12 months. Within those defined time periods a network user in conjunction with the network/system operator will select the ***degree of flexibility*** (i.e. the flexible or fixed) for the start and end windows. It is noted that within the ***degree of flexibility*** the windows could be divided into time bands, but this is not considered here; if considered appropriate further work is required.

4.29 It is envisaged that there would be eligibility criteria applied before a network user would be granted time-limited access arrangements. For example, time-limited access could be granted by a network operator to enable a user to utilise network capacity made available whilst another network user has temporarily mothballed their operations.

Figure 7: Option map for time-limited access



Summary of initial assessment of time-limited access

4.30 An initial assessment of the key design choices has been completed by highlighting the pros and cons against the three guiding principles for the Significant Code Review and describing the enablers and whether the design choices are more or less suitable for different types of network user. The table below summarises in tabular form the key benefits and value (defined within the first guiding principle) and the practicality (defined within the third guiding principle) for both network users and networks operators, including the ESO.

4.31 The template containing the full initial assessment for the time-limited access options are available to review in Annex 2.

Table 5: Initial assessment of time-limited access

	Guiding Principle 1: Efficient development and use of the network	**Guiding Principle 3: Practicality**
Users	• Useful for customers seeking fixed terms connections e.g. for construction projects. • Could be useful for customers seeking a temporary increase in import or export capacity.	• Time-limited access is easy to understand and reality simple to implement but uncertain whether is valued by users. • Users would undertake the same access process as they would with an unlimited access application, therefore may not provide a quicker access alternative.

Networks / ESO	• Could be usefully combined with time-profiled access to enable utilisation of networks prior to reinforcement. • Enables network access only for the required period and therefore "frees" this back up quickly for other users.	• Time-limited access arrangements in a distribution network's ANM area may be difficult to implement. • This already is a feature today in transmission networks and therefore should be quite simple to implement.

Key insights

4.32 The following insights are drawn from the results of the initial assessment of the time-limited access options:

- Time-limited access may encourage greater utilisation of network capacity but granting of time-limited access should be based on defined conditions to ensure compliance with non-discrimination licence obligations.
- Time-limited access arrangements are likely to be appropriate for active network users (i.e. those customers that are able to manage their consumption and/or generation) to benefit from short term availability of network capacity; although this doesn't rule out passive customer who are seeking increased capacity for a short time period. This could include all sizes of customers from domestic through to large industrial users.
- Time-limited access is unlikely to be appropriate for an essential service but could be used for top-up access arrangements.
- Time limited access is practical and proportionate if it enables greater network utilisation, with such utilisation possible if the network/system operator facilitates a fully flexible start and end window approach,
- Network users' choice of time-limited access will be influenced by their ability to operate in other markets, and
- Clearly defined rights and responsibilities for time-limited access are required to ensure that network users operate within the parameters agreed; this should include clear rules for breaching time-limited rules.

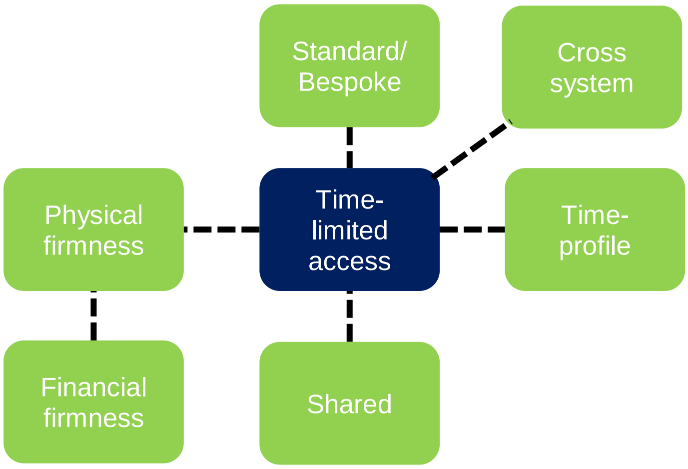
4.33 Further consideration is required around the practicality, enablers and dependencies aspects for the time-limited access options before it is possible to create access products that could be implemented. In particular the following areas would benefit from further thought:

- the flexible options could be developed further by considering the granularity of the different time bands and the notice periods, and
- under duration range has the perspective of the customer been explored in enough depth as a large user that is connecting in a year may wish a short-term access arrangement in the interim period until their operations are fully functional; or a network user only needs access in order to provide a flexible service to relieve a constraint in the near term; or the network user wants a non-firm access which they would intend to update to full form access once some reinforcement had been completed.

Combinations and interdependencies

4.34 Time-limited access is linked indirectly with all the other access options considered in this document. These interdependencies are shown in Figure 8, with the indirect linkages shown with dashed lines.

Figure 8: Interdependencies map for time-limited access



4.35 At this initial assessment stage there appears to be no identifiable reasons why there should not be a time-limited access product, but further work is required to define the scope of time-limited options and whether time-limited is an access product or a one characteristic of an access product.

4.36 Although available short-term TEC is available in transmission network anecdotally is used infrequently by network users and there is little understanding of whether this is something that is valued by distribution connected network users. There appears to be no need to amend planning standards as time-limited access can be accommodated with the current arrangements.

Standardisation

4.37 Time-limited access options are more likely to be successful as bespoke arrangements to facilitate individual users' requirements or assist network operators with time-bound network constraints whereby time-limited access could facilitate flexibility services on an interim basis whilst reinforcement works are undertaken. Implementation of these access options in this way may also benefit from a certain amount of standardisation in the way that the bespoke arrangements are offered and agreed. This could give parties consistent contractual arrangements across network operators as well as the ESO having line-of-sight to the terms of these arrangements. Implementing standardised terms via the DCUSA National Terms of Connection is an example of how this could be done.

4.38 For users who require time-limited firm access, for example temporary construction connections, standardisation of contractual arrangements and the length of terms for the access could provide the users with clearer understand of their access and network operators with better understanding on how their network utilisation will develop.

5 Options for choice of access – Shared

Introduction

5.1 The aim of this section is to define the access options for shared access (i.e. the extent to which access can be shared between users). There are no existing facilities for explicit sharing of access on licenced networks. In most instances the choices of network users implicitly define their network access and in this section, we will openly describe the choices for shared access so that network users have a clear understanding of the network access options available to them.

5.2 Some stakeholders have highlighted potential similarities between shared and traded access, however they are envisaged as distinctly different. While trading of access is outside the scope of the SCR and is instead being considered under network-led activities, we highlight the differences in the two concepts within this section to aid stakeholder consideration as the concepts are developed further.

Description of the shared access option

5.3 Shared access is potential additional solution to provide connections to new customers on to locally constrained networks or for applications from existing customers that wish to amend their existing access rights. There needs to be clear network and customer benefits or there would be risks of gaming e.g. by customers trading within groups and allocating capacity behind a constraint, or a reduction in the benefits of diversity to the detriment of customers in general.

5.4 Network operator’s experience of trying to form groups and consortia to share connection costs suggests that users’ requirements would need to closely align or be sufficiently complementary to achieve sufficient shared benefits for group sharing to work.

5.5 Shared access could allow users across multiple sites in the same broad location, behind the same network constraint, to share access up to a jointly agreed level. Network users would be able to join a sharing arrangement with a group of new customers connecting at around the same time or a group of existing customers. Connecting customers should benefit e.g. through quicker connections, however this does not in isolation provide wider customer benefits. Each connection would have its own agreed capacity with each user operating within its own agreed level and also operating collectively below the agreed shared access level. Contractual arrangements would be multiparty. Collective management of usage against the maximum level would increase significantly in complexity with the number of users in the sharing arrangement.

5.6 A parallel can be drawn with existing examples of large non-domestic customers sharing access in the context of traditional private networks, for example where multiple industrial customers are co-located on a large site behind one exit point on to the licenced network. There will be an agreed maximum capacity value at the boundary between the two networks (typically with boundary meters) so customers on the site need to agree and balance their requirements up to that maximum. The site owner or private network owner is likely to be the coordinating body to monitor the site’s total maximum demand in line with the agreed maximum capacity.

5.7 There needs to be a tangible benefit driving the need for and value of a sharing arrangement e.g. to defer or avoid reinforcement for a network constraint. Initial sharing and ongoing monitoring could be facilitated by the DNO, by the customers collectively or potentially by a third party. Initial assessment suggests there needs to be a 'coordinating hand', for instance a DSO, to monitor compliance and be responsible for taking action for any breach.

5.8 Shared access, like other access options, has the joint aims of giving users more access choice and increasing the efficiency of network utilisation. Better defining access for a particular user or group of users should provide more clarity for users and leads to more efficient use of the network. Network operators would be able to incorporate the agreed access ceiling for a group of customers in to system planning in the same way that capacity commitments to large individual users are factored in now.

5.9 Well-defined access rights for a sufficiently large population of users, that provides more detail than just individual user's agreed capacities, should give network operators increased certainty about when users will access the network. This should also reduce the number of customers with non-defined access whose individual requirements need to be factored in to assumptions about usage diversity and the resulting total requirement on a particular network. However, given the large size of the population of customers with non-shared access rights, if commercial pricing signals encourage users with non-shared access rights to increase their usage at periods that are utilised by customers with shared access rights, then at a local level the combination of the firm rights for both customer groups could trigger reinforcement due to overloading in the shared access period.

5.10 If well defined access rights for specific users increased network utilisation, it should be noted that this could lead to less incidental spare capacity through diversity, including capacity to meet the requirements of smaller users with non-defined access. The generality of customers should derive benefits from better network utilisation through a reduction in drivers for network reinforcement. However network operators would still need sufficient capacity headroom for risk management, anticipated general growth and for when the network was operating abnormally. Increasing the utilisation of the network may therefore ultimately result in more demand remaining disconnected during fault repairs due to the lack of spare capacity on alternative circuits. For larger sharing options it will be important to establish that the benefits of shared access exceed the benefits already assumed via diversity of load.

5.11 Monitoring compliance is likely to involve monitoring each customer's usage data against the collective maximum level. Close bilateral coordination by two customers may be possible, perhaps with each seeing the other's usage data alongside their own. However, it is unclear how this could be done by a collective group of customers without a controlling hand. The licenced network operator would be well placed to fulfil this coordination role as it should be able to have timely visibility of usage data and would maintain records of each customer's agreed operating parameters. Other arrangements involving collective coordination e.g. by portfolio managers, or third part coordination would need data sharing facilities, timely data access and agreements for sharing information.

5.12 For large groups of customers across wider areas the role of the coordinator becomes much more complex to the point of impracticability. Potential issues include the risk of breach of pre-arranged sharing by an individual user(s), potentially driving the need for much more bilateral discussion between the coordinator and individual users to the point of being disproportionate. Trying to achieve sharing across a very large group of customers would necessitate arrangements that move closer to a current licenced network operator role where general diversity is a consideration in system planning.

5.13 Sharing could work with some other access options including time-profiled and time-limited. The shared access ceiling would not need to be flat 24/7 and time-limited access could be suitable for a period leading up to completion of reinforcement, until the new customer's usage record enabled it to join a trading arrangement or until flexibility service contracts were in place.

5.14 Where a larger number of existing customers are behind a developing constraint bilateral provision of flexibility services to the network operator is likely to be more appropriate that shared access.

Comparison of Shared and Traded access

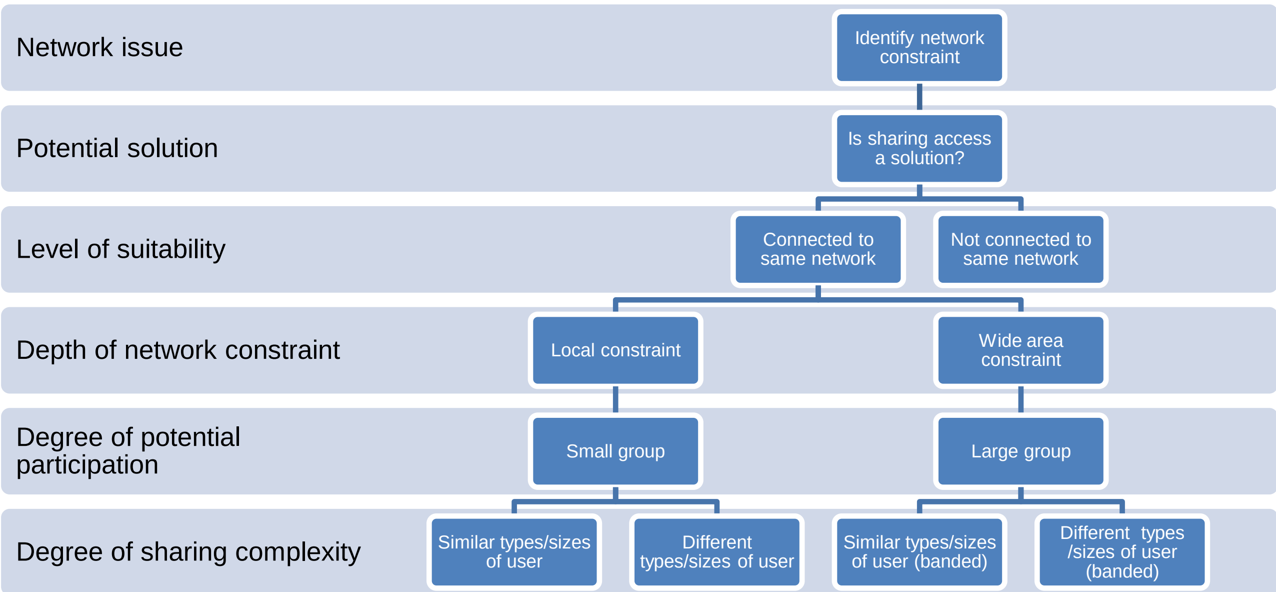
5.15 Stakeholders have raised points about the differences or similarities between shared access and access trading. While both concepts provide potential benefits for more efficient access allocation the objectives for users are different. Fundamentally, shared assess is a potential additional way of connecting new customers in constrained locations, whereas trading is envisaged as an option for existing customers to share access on a more commercial basis. To highlight the differences in the concepts for shared and traded access a comparison table has been included in Annex 3.

5.16 Sharing access where one or more group members are connected to a DNO's network and one or more are connected to and IDNO network may work if they are in the same broad location behind the same network constraint. Sharing across distribution and transmission networks does not work as the customers are unlikely to be participants sufficiently similarly located behind the same local constraint.

Key decisions and variants

5.17 The decision tree shown in Figure 6 below describes the process for facilitating sharing access amongst network users connected to the network.

Figure 6: Option map for allowing shared access



Summary of initial assessment of shared access

5.18 An initial assessment of the key decisions has been completed by highlighting the pros and cons against the three guiding principles for the Significant Code Review and describing the enablers and whether the design choices are more or less suitable for different types of network user. The table below summarises in tabular form the key benefits and value (defined within the first guiding principle) and the practicality (defined within the third guiding principle) for both users and networks (including the ESO).

5.19 The template containing the full initial assessment for the shared access options are available to review in Annex 2.

Table 6: Initial assessment of shared access

	Guiding Principle 1: Efficient development and use of the network	**Guiding Principle 3: Practicality**
Users	• Provides potential benefits and value to a group of newly connecting customers or customers seeking more capacity behind a constraint. • Potentially useful for a smaller group of customers who can cooperate with each other and be coordinated.	• Potentially practical for smaller groups of customers. • Impractical for larger groups of customers unless data sharing and coordination can be achieved by a controlling hand alongside mechanisms for breach. • The provision on flexibility services may be more appropriate for larger groups (bilaterally between the customer and the network operator).
Networks / ESO	• Could efficiently utilise network capacity e.g. behind a local constraint.	• May not be practical to introduce the concept, if other areas of access are taken forward for example if time profiled access negates the need for shared access, then it would not be practical to add additional access options which could be complex. • Could be difficult to operate the system, by knowing who to curtail when if different users could change their” share” of access at any point in time.

Key insights

5.20 The following insights are drawn from the results of the initial assessment of the time-limited access options:

- Sharing access would need to provide distinct network utilisation benefits that can be valued in order to have merit e.g. to defer or remove the need for reinforcement;
- Shared access is a concept focussed on connecting new customers;
- Increasing the number of parties in the sharing arrangement increases the benefit of usage diversity, but it also increases complexity and the risk of individual customer breach significantly, towards the point of being impractical and disproportionate;
- Sharing access can be across the same type of network users (i.e. demand customers) as well as across different types of customer (i.e. demand and generation network users);

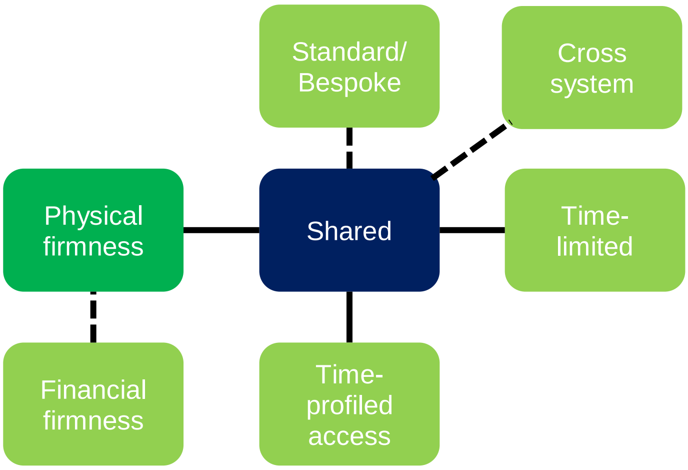
- Assumes that each participating customer has half hourly metering and HH data collection as a minimum (as granularity of data is important);
- Sharing access is likely to be more appropriate for larger informed customers who fully understand and can accommodate any contractual consequences for breach of the collective capacity ceiling;
- The assessment suggests there needs to be a ‘coordinating hand’ to monitor individual contributions to the collective access ceiling and identify any parties in breach;
- Where there was customer appetite for sharing (as of yet this is not proven) then standard contractual options or operating rules could, in principles, be captured in codes;
- Further consideration is required around the practicality and enablers/ dependencies aspects for shared access before it is possible to develop this from a concept to a practical option for access. Further consideration of whether sharing access could work “cross system” i.e. whether a DNO-connected user could share with IDNO/TO connected user;
- Whether the Electricity Act currently provides for sharing a given maximum power requirement across multiple premises when maximum power requirement is defined in law at an individual premises level; and

Combinations and interdependencies

5.21 Shared access is linked either directly or indirectly with all the other access options considered in this document.

5.22 The key interdependencies are shown below in Figure 7 below, with the direct and indirect linkages shown with solid and dashed lines respectively.

Figure 7: Interdependencies map for shared access



5.23 Any combinations / interdependencies that you must consider i.e. you cannot do x without y

Standardisation

5.24 Similar to time-limited access, shared access options are likely to be attractive to users as predominately bespoke arrangements, with elements which are standardised. Due to the overlaps required with other access options, such as physically firm and time profiled, shared access options are likely to derive aspects of standardisation as a consequence of these other access options.

5.25 The specifics of the sharing arrangements may require an ability to agree bespoke arrangements due to the variety of users and their individual requirements together with the conditions on the network which they are accessing.

5.26 Standardised contractual arrangements which would form the bespoke shared access options could make implementation and ongoing operation of these options simple and more consistent for the parties involved.

6 Standardisation

Introduction

6.1 This option examines the extent to which an access arrangement's parameters can be standardised or set on a bespoke basis and the potential benefits or disadvantages of these approaches.

6.2 Standardisation of access can be considered as 'off-the-peg' design choices and parameters, with a range of set choices or 'sizes' which fit broad groups of users' or network requirements.

6.3 This standardisation in options for access could be established in the design of a connection to the system as well as for the ongoing characteristics of a user's connection and how their access is defined and operated.

6.4 Bespoke arrangements can be considered to provide design choices which can be more tailored to fit the requirements of a user or network condition.

6.5 These bespoke arrangements in options for access could be developed to provide specific parameters selected by either the user or network operator in the design of a new connection or the ongoing characteristics of a new or existing connection.

6.6 This option also considers that combinations of standard and bespoke access arrangements may be developed such that, the standard 'off-the-peg' design choices can also be have alterations to better facilitate certain users' or networks' requirements. These design choices could co-exist as separate choices of either type, or as a combination where bespoke options are available within standardised bands or thresholds.

6.7 Currently, users do have some degree of both standardisation and an ability to agree bespoke arrangements for their access. Through arrangements such as the Common Connection Charging Methodology, engineering recommendations (e.g. EREC P2 and SQSS) and DCUSA users have standardised access in aspects such as physical firmness and charging arrangements. An ability to agree to arrangements such as alternative connections (e.g. Active Network Management and time constrained) gives users bespoke access choice and for large users, the Extra-high-voltage Distribution Charging Methodology gives a specific use-of-system charge for their connections and capacity access.

6.8 As part of this option assessment there is also a consideration of whether all options are available to all users or types of user and what the potential impacts are of widespread as well as restricted availability.

6.9 Providing further access options and user choices may better facilitate users' access requirements and network operators' ability to more efficiently utilise the network. Having definition of which aspects of design choices are standardised and which elements can be more bespoke will provide a framework to ensure consistency and transparency to users and network operators.

Key design choices and variants

6.10 The option map in Figure 8 below describes the parameters which the design choices can be characterised as either standardised, bespoke or a combination of these. It also describes the extent to which these design choices can be implemented as variants.

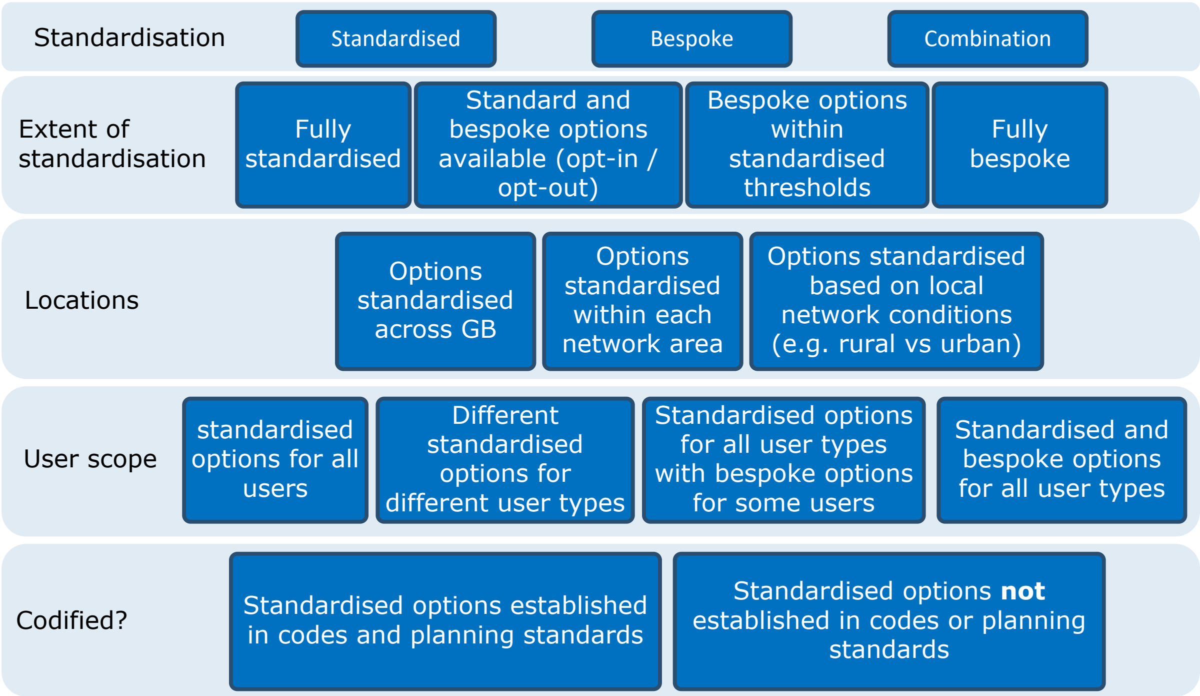


Figure 8: Option map of standardisation and bespoke access

6.11 When considering the other design choices described in this report, the options for standardisation of their parameters can be overlaid to provide the path to the implementation of these design choices. Defining the extent and types of standardisation or options for bespoke parameters, will be required in terms of the how other design choices are implemented and what choices the users may or may not have.

6.12 Whether standardised, bespoke or a combination of these, the design choices can be implemented locationally and across defined user-types. These options could be made available to all users / user-types or limited by certain criteria.

6.13 Standardisation by location could be implemented via standards on a national level or on varying degrees of increasing localisation down to specific sections of a network where bespoke arrangements could be implemented to cater for specific network conditions or user requirements.

6.14 The question of where the degree of standardisation is set can be within national industry documentation such as in codes, planning standards and common charging methodologies or in more user- or DNO-specific arrangements such as individual contractual arrangements

<u>**Summary of initial assessment of standardisation vs bespoke option**</u>

6.15 A more detailed assessment of each variant of the options described in this section has been carried out by exploring the pros and cons of each variant against the three Guiding Principles of the Significant Code Review. This assessment also considered the required enablers and whether each variant might be particularly suitable or unsuitable for certain types of customer. This detailed assessment is show in Annex 2 and the key insights drawn from it are described below.

Table 7: Initial assessment of standardisation vs bespoke

Fully Standardised	**Guiding Principle 1 – Efficient use of the network**	**Guiding Principle 3 – Practicality**
Users	• Can provide simplified choice which is potentially more accessible for a wider range of customers, providing consistency and transparency in defined access rights. • This might be attractive for small users which may not have an ability to, or desire to engage with variable access arrangements • Broad approach restricts opportunities for some users which does not sit neatly into standardised access arrangements, preventing tailored arrangements – risk these might not meet the access requirements users have. • Limiting option availability could avoid inappropriate choices being made but needs to balance with an ability to make new service offerings available to customers as new requirements emerge. Limiting option availability could stifle innovation and provide a competitive advantage to incumbents by restricting the scope of access options.	• It may be easier for users to understand and compare standardised options. • Standardised choices may limit the need for specific contractual arrangements and user-DNO interactions which may be more attractive to small users. • Access options and choices may not meet individual users' requirements and become impractical for some users. • Option availability may lead to simplification through symmetric processes for all connection types but may add in excess bureaucracy where choice is irrelevant or even spurious. This could lead to confusion and require unnecessary assessment of choices by users.
Networks / ESO	Value of options for networks • Fully standardised arrangements could provide simpler forecasting due to better defined user access types, which may facilitate improved planning. • Could limit / restrict the ability to innovate or improve network utilisation by restricting ability to tailor requirements of specific network conditions and matching access with available capacity. • Connections which have selected inappropriate choices may lead to under or over provisioning of access capacity.	• Standardisation can aid speed and efficiency of system design and forecasting by providing set assumptions or 'building blocks' of user access when determining impacts on the network • More efficient to administer than many bespoke arrangements • Does not require large volume of complex site-specific charging arrangements • May require increased granularity of charging models
Fully Bespoke	**Guiding Principle 1 – Efficient use of the network**	**Guiding Principle 3 – Practicality**
Users	• Tailored to customers' individual requirements, fine-tuned to maximise	• Very large users are likely to be able to manage the increased need for interactions and

	opportunities for customers to benefit from specific access rights • Likely most attractive to very large users (demand and generation) which are able to manage their access characteristics and be flexible preferring tailored access.	bespoke contractual arrangements along with the technical requirements needed. • Smaller users are likely to find it prohibitive to undertake the additional burden of assessing bespoke options, additional contractual arrangements interactions and technical requirements needed for bespoke arrangements.
Networks / ESO	• Detailed user requirements can facilitate more fine-tuning of network requirements, flexibility options, network forecasts and investment requirements, which could provide for more efficient network development and utilisation. • Could help facilitate innovation by enabling increased flexibility in commercial arrangements and design enabling further increases in network efficiency	• High burden of administration, data capture/retention/management and requirement to draft and enter into bespoke commercial arrangements • Increased bespoke arrangements would require increased and more granular chagrining arrangements leading to more complexity, with additional risk of opportunity to "game". • increased volume of individual access rights across customers and network operators requires increase in the matching network operator-Supplier-customer arrangements and interactions. Requiring increased resource for all parties involved. • Users may view networks / NGESO as not being transparent as they will not know what other users access arrangements are
Combination of standard & bespoke	**Guiding Principle 1 – Efficient use of the network**	**Guiding Principle 3 – Practicality**
Users	• Provides an element of tailoring to users' requirements to existing network conditions or to manage specific issues • Increases choice for consumers where there is an option to opt-in or opt-out of standard arrangements or bespoke arrangements meaning that wider range of user types can be more effectively accommodated.	• Combination of standardisation with degrees of bespoke access can ensure that the practicality of these arrangements can be tailored to the wide range of users • Could facilitate protection for small users who may not be able to benefit from bespoke arrangements whilst enabling larger users to select tailored choices

	• Could provide for a range of standard options tailored to customer types with a degree of bespoke arrangements within thresholds which could give users better defined access, suiting their requirement but enable network operators to take a standardised approach.	• Bespoke arrangement within standard thresholds / bands provide users with tailored requirements whilst also providing assurance / certainty of the extent to which an element may vary. (e.g. bespoke firmness options, within standardised curtailment limits, effectively 'capping' level of curtailment offered). • Standardisation of certain aspects of bespoke arrangements may be beneficial for large users working across different networks.
Networks / ESO	• Provides ability to fine-tune connection and network requirements to improve network efficiency / utilisation, w here bespoke arrangements are available within defined standard bands / thresholds • Facilitates the ability to innovate whilst maintaining standards	• Combination of arrangements can facilitate standardisation where bespoke arrangements may be impractical providing balance between the easier-to-facilitate standard arrangements and more administration-intensive bespoke arrangements • Requires increased complexity of systems and processes • May require increased resources to facilitate the range of design choices. • Increases complexity of design by having to consider an increased number of individual user access arrangements' when assessing impact on network. However, the increased flexibility in design may provide a balance compared to restriction of fully standardised approach.

Key insights

6.16 The key factors determining the attractiveness of either standardisation or bespoke options are driven primarily by the balance between efficiency and complexity. Whilst bespoke arrangements can provide greater efficiency of network utilisation, through fine-tuning user and network requirements, the efforts required to implement this across wide-ranging sizes and types of user and network areas can create an inefficient solution due to the increased volume of design parameters to analyse and user interactions to facilitate. Users may benefit individually from bespoke arrangements tailored to their access requirement, but their ability to engage with the associated systems, process and interactions required may outweigh the perceived benefits or inhibit their ability to participate in them. The task of tackling this complexity may provide opportunities for new intermediaries to emerge to facilitate some aspects of the processes and interactions required. The degrees to which access options have bespoke parameters therefore has a direct relationship with the level of complexity in charging arrangements, volume of and detail required in commercial arrangements and in the complexity of network assessment and design.

6.17 The extent to which this balance between efficiency and complexity is a restricting factor on whether standardisation or bespoke arrangements are attractive also differs for different types of users. Whereas for large volume, small users, individual bespoke arrangements might be impractical, for larger users able to adjust their access requirements, it may be more attractive to have bespoke arrangements to provide more efficient network outcomes

6.18 When assessing how other access options are standardised or have bespoke arrangements, there will need to be consideration of how flexible these options will be in order to 'future proof' them for changes in network requirements or different user types. Rigid standardisation could restrict future changes or limit the agility of what access options to quickly accommodate future changes. There may therefore need to be a change process designed and implemented alongside the initial standardisation which would be able to facilitate the access options evolving over time. Over-standardisation could also limit the ability to harness efficiencies and the development of new markets which bespoke arrangements might otherwise provide.

Bespoke access options

6.19 This impact of bespoke design choices on complexity and the efficiency of their implementation will vary when considering different types of user and the boundaries in which they operate. Large uses connected at EHV already have a degree of bespoke access (via EDCM / Central Volume Allocation (CVA) charging, MIC/MEC, identified constraints, alternative connections, NGESO operating conditions) and this, together with the relatively low volumes of these users, make the potential for fine-tuning access requirements to the users' and / or the networks' efficiency needs a more practical undertaking. These users are likely to find bespoke arrangements attractive but may have concerns over open-ended parameters where, for example the level of their curtailment does not have a defined cap or protected limit.

6.20 For the much higher volume of smaller users connected at lower voltages, the practicality of agreeing and enabling bespoke access arrangements is a more significant consideration. The changes to systems, process and interactions required to implement the arrangements are more substantial. For these user types, it is likely to be more attractive that bespoke arrangements are on an opt-in basis within set bands or thresholds, to provide consistency and transparency, whilst maintaining a degree of choice. It is important that users which are not able to or have no desire to take advantage of bespoke access option, are protected from being unduly disadvantaged; some degree of standardisation is likely to provide some protection in this regard.

Standardised access options

6.21 Standardisation of access options can provide efficiencies in terms of simplification of design and of the interactions required with users, however the consequence may be to reduce the efficiency to which the network can be utilised, or an individual user's requirements can be accommodated.

6.22 Where standardisation is implemented there can be an increased transparency and understanding for the involved parties, particularly where the standardisation is across regions or at a national level. By having prescribed options with defined parameters, both users and network operators can have clarity on the requirements for these options and their consequences.

6.23 For smaller users this can be a benefit in terms of limiting the level of understanding required to engage with access arrangements as well reducing the level of interactions required with their network operator or supplier and the limiting the need for specific contractual arrangements.

6.24 For larger users this may not be attractive since it could reduce their existing abilities to agree bespoke access arrangements as well as limit future requirements for tailored access; larger users may be less likely to align within standardised bands particularly where their connection requirements have a significant impact on the existing network.

6.25 Implementing standardisation through industry codes, common methodologies and other common standards provides opportunity for collaboration both at their creation and implementation as well as through ongoing common approaches. Having standardised arrangements can aid the speed and efficiency of system design and forecasting by the provision of larger 'building blocks' of access arrangements to be used when determining users' impact on the network, compared to the need to assess a higher number of smaller 'building blocks' where more bespoke arrangements are available.

6.26 By having standard access options set out in planning standards for aspects such as physical firmness or extents to which curtailment can be undertaken, would give users transparency on the choices of access available to them and how they will impact on their power requirements. It can also give network operators an ability to make better informed decisions on forecasted network reinforcement requirements or where flexibility can be deployed as an interim / alternative measure.

6.27 A consequence of standardisation is in the reduction in ability to innovate and develop alternatives which can be tailored to a particular parameter, user or network requirement. Where standardisation is set with a limited number of broad categories or across a wide range of parameters the result could be to limit the ability to tailor access to user requirements, make more efficient use of the network, or hinder the uptake of certain arrangements. However, increasing the number of standardised options with more granular parameters could limit this impact

6.28 These impacts would be widespread where access options were fully standardised without options for bespoke arrangements. However, stepping back from this extreme, other ways in which this could be implemented could be via the following:

- Default standardisation with options to opt out and undertake bespoke options - this could provide consistency and transparency for the majority of uses and a 'baseline' with which to assess the impact of any bespoke option. However, there would need to be consideration of whether bespoke arrangements where not offered to the detriment of 'standard';

- Standardised options with ability to determine bespoke arrangements within set limits (caps and collars) – this would provide the parties involved an ability to agree bespoke arrangements with a protected minimum and maximum extent enabling more efficient impact assessment and network design;
- Standardised options defined by user types – providing an ability to tailor to groups of users whilst maintaining the benefits of standardisation;
- Standardised options limited to certain usage characteristics – providing defined access options only where certain requirements were met and therefore not available to all users.

6.29 These methods could be applied across all access options or separately as required, and their extent could change over time as future user / network requirements change.

Hybrid access options

6.30 Combinations of standardised access options with an ability to have levels of bespoke access may prove to provide a desirable balance between individual user requirements and practicality. The availability of bespoke arrangements which can be tailored to a user / group of users or for example to a particular network issue, on an opt-in / opt-out basis, can provide the necessary flexibility required for issues such as the development of smart networks. This is particularly suited to larger users where an ability to manage and control their access requirements enables them to tailor their requirements with the requirements of the network and vice versa.

6.31 Hybrid combinations of standard options with thresholds which limit the bespoke extent an option could provide the framework necessary to give users and network operators, practical limits to the otherwise impractical volume and range of differing bespoke arrangements. Incorporating these standardised bands or thresholds to the bespoke extent of an access option, could provide transparency for users on the impact and consequences of a particular arrangement as well as certainty on the upper and lower limits of a particular parameter. This may make the option and bespoke arrangement more attractive and practical to the user by providing improved certainty.

6.32 For the network operator these types of hybrid would help to limit the requirement to assess individual impacts of bespoke arrangements by using the bands or thresholds in assessing network impacts.

6.33 Having defined standardised arrangements with an option to opt-out can give smaller users, which may not have the capability or desire to benefit from bespoke arrangements, certainty on their access arrangements along with not needing to enter into specific contractual arrangements or needing specific equipment to manage their access.

6.34 There may also be a benefit in having access options defined by user-type or another characteristic, meaning that some access options would not be available to all users. The benefits of this could be in maintaining more simplistic arrangements for high-volume small users, who may not be able to take advantage of a more dynamic access option. It would also streamline requirements for network operators in keeping these users on standardised arrangements helping to avoid inefficiencies in planning standards, charging arrangements and other similar aspects.

Combinations and interdependencies

6.35 The degree to which design choices are standardised or not is a consistent factor in each of the key design choices reviewed in this report.

6.36 However, in each case where standardisation is defined the following cross-cutting issues need to be considered:

- Overrun and override: where there are defined bands / thresholds or agreed bespoke arrangements, the consequences of the user or network operator breaching these needs to be considered and defined; and
- Default options: where standardised choices are available and particularly where bespoke arrangements are required, the consequences of the user not making a choice or agreeing bespoke arrangements needs to be considered. This can be via default arrangements forming a backstop via implicit or explicit access choices. This also overlaps with the overrun and override issues above.

7 Monitoring, breach and enforcement

Introduction

7.1 The access compliance regime is important for all users. This section considers the monitoring, breach and enforcement conditions that should apply to users' access rights and options for overrun conditions.

7.2 **Monitoring and enforcement**: to what extent should a connection's compliance with an access right be monitored:

- reliance on contractual arrangements without formal monitoring – for example a customer could accept certain access conditions and would take appropriate measure to maintain compliance with these conditions without continuous monitoring by the network operator. For example, under present arrangements customers undertake to keep their connections within defined power quality limits, compliance with these limits is not routinely monitored unless as concern is raised.
- technical monitoring without direct control – for example a customer could accept certain access conditions, would take appropriate measure to maintain compliance with these conditions and would have their compliance monitored by the network operator. The network operator would not take immediate measures in response to non-compliance but would apply enforcement or overrun conditions after the event.
- technical monitoring with direct control – for example a customer could accept certain access conditions, would take appropriate measure to maintain compliance with these conditions, and would have their compliance monitored by the network operator who would take immediate enforcement actions to maintain compliance – for example by sending a demand/generation management signal or operating an inter-trip scheme.

7.3 **Enforcement and overrun conditions:** What should be the consequence of exceeding an access right be:

a) are these temporary or permanent? – i.e. applied for the billing period from that point forward

b) what are the consequences?: financial (i.e. excess charge) physical (curtailment, de-energisation) or contractual (i.e. forfeit of specific arrangements?);

c) does this result in an automatic requirement for upgrade requiring contribution? – e.g. move from a lower band to a higher band);

d) should a connection be able to exceed access rights under certain circumstances? – (i.e. to provide network flexibility; or routinely at all times except when the network operator requires reduction back to a pre-agreed 'guaranteed capacity').

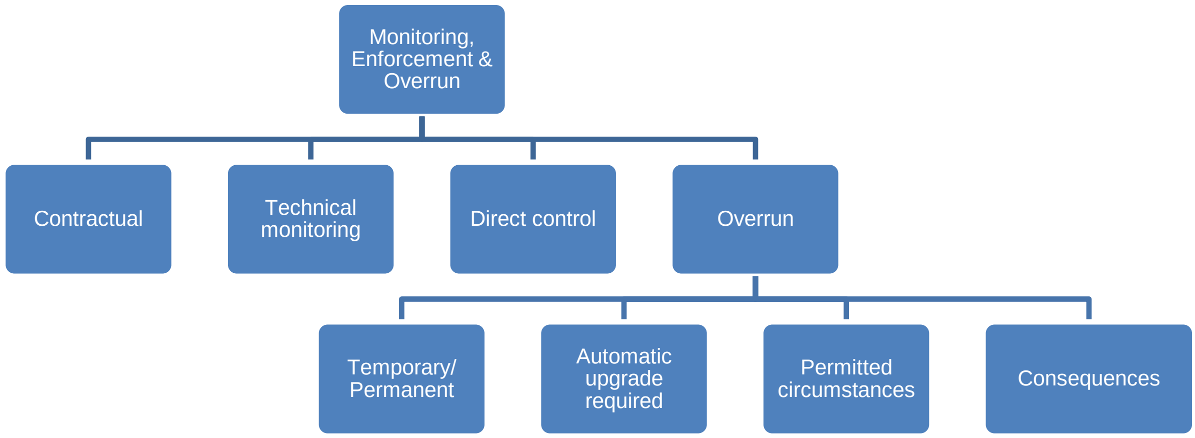
7.4 Current monitoring and enforcement of access rights varies depending on the size, location, metering type and voltage/point of connection. For example, a high-voltage connected factory would have half-hourly metering and will incur an excess capacity charge should usage go beyond an agreed limit but will not attract any immediate action, aside from automatic safety measures such as circuit breakers or fuses. Whereas a typical domestic customer is presently not half-hourly metered and has no definition, monitoring or associated charges for use beyond an agreed capacity, aside from the automatic safety measures such as a fuse in the connecting service-head. (Note: the roll-out of smart metering is anticipated to increase the number of domestic properties with access to half-hourly meter readings).

7.5 There are no explicit requirements to return underutilised capacity however all sites energised with a registered capacity will be charged at the published rate.

Key design choices and variants

7.6 The option map shown in Figure 9 describes the options considered.

Figure 9: Option map for monitoring, enforcement and overrun conditions



Summary of initial assessment of 'Monitoring and Enforcement'

Table 8: Initial assessment of 'monitoring and enforcement'

	Guiding Principle 1 – Efficient use of the network	**Guiding Principle 3 – Practicality**
Users	• Simpler arrangements (i.e. contractual only) require the customer to implement controls to keep within access rights. • Complex arrangements (i.e. increasing degrees of monitoring or direct control) add additional equipment at the point of connection and/or onto the wider network. • The risk of de-energisation may be too severe and represent a user investment risk, leading to inefficient over-provision but could also encourage users to 'book' their requirements with greater accuracy	• Simpler arrangements trade-off lower immediate costs against higher overall costs if networks must overprovision to manage risk. Also, as with principle 1, simpler arrangements require the customer to implement controls to keep within access rights. • There needs to be a balance of complexity, visibility and severity of action reflective of user type. Small users may require different treatment
Networks / ESO	• Simpler arrangements rely on customers' ability to manage access and/or natural diversity between usage across a network. • Where there is a risk of overall rights being exceeded, a network may need to overprovision.	• Arrangements may require complex billing systems. • Arrangements may require additional equipment at the point of connection and/or the wider network.

	• Monitoring and enforcement may require immediate 'real time' action to maintain safe and sustainable operation. • Monitoring may need to be at a smaller interval than half—hourly to capture granular network effects	

Summary of initial assessment of 'Overrun Conditions'

Table 9: Initial assessment of overrun conditions

	Guiding Principle 1 – Efficient use of the network	**Guiding Principle 3 – Practicality**
Users	• Temporary or permanent arrangements balance the risks of exceeding access rights against the action required to mitigate. • Financial measures ensure access decisions are given enough rigour but must be cost reflective to avoid access rights being requested unnecessarily. • There is potential for a market in overrun requirements to request and offer capacity from other users and/or the network. • Automatic arrangement captures changing requirements without delay but may force undesired increase to requirement. • A guaranteed minimum level of capacity would allow users to signal their minimum or contingency requirements and permit usage beyond this whenever the network can accommodate.	• Financial arrangements may be complex to anticipate and respond to. • Financial enforcement could/should be viewed as an investment cost • Automatic arrangements minimise need for engagement but require a system to monitor and detect. • There needs to be a balance of complexity, visibility and severity of action reflective of user type. Small users may require different treatment with curtailment, perhaps, 'unthinkable' for core domestic use but may be acceptable for other use such as storage heating or EV charging. User choice may depend on who the user is.
Networks / ESO	• Temporary arrangements may lead to ambiguity when designing network requirements. May require measures to detect and protect against 'gaming' or other unintended consequences. • If excess actions are not cost reflective, there is a risk that access definitions do not match physical actions (i.e. excessively prohibitive or lenient).	• Financial arrangements may be complex to implement. • Temporary or permanent arrangements must balance issues of materiality and legitimacy. • May not be possible to identify or set a guaranteed level of capacity which is meaningful or relevant to user populations which have high levels of diversity.

	• Permitted exceptions may add further richness in the description of capacity requirements and how these may change when providing a service. This may increase complexity without aiding understanding. • Consequences should be considered in context to drive the right behaviours and reflect network capability. • Consequences may be considered in sequence with financial arrangements applied up until physical limit causes direct action. • There may be parallels with 'Ratchet Charges' in gas.	

Key insights

7.7 Monitoring, enforcement and overrun arrangements may need to vary between users with the choice of measures designed to balance complexity, visibility, severity and costs proportionate to the user. If consequences are too severe, they may cause some customers to inefficiently over invest; for other users, particularly those with domestic core/essential needs, it is unlikely that curtailment will be appropriate. More commercial mechanisms may be best suited to customers whose reason for connection is related to the import and export of energy as opposed to an being an end user of energy.

7.8 Monitoring arrangements may need to operate at intervals smaller than half-hourly to capture 'true' network effects. It may be more appropriate to use staged enforcement actions so as to not penalise occasional actions which do not cause physical limits to be exceeded.

7.9 There is potential for a market in overrun requirements to request and offer capacity from other users and/or the network. Arrangements may require measures to detect and protect against 'gaming' or other unintended consequences.

Combinations and interdependencies

7.10 Arrangements may require systems for users to express their choice and change their choices; as well as a capability and desire to do so. Arrangements may also require the infrastructure to monitor and control access rights.

7.11 Arrangements are dependent on user type and the access options open to these user – for example the options related to core/non-core use; and or options for trading/sharing of rights.

8 Cross-system access

Introduction

8.1 Cross System access explores the extent to which users connected to any area of the network (e.g. IDNO / DNO / Tx) have or could have access rights to other networks. For example, if connected at an IDNO, does that user have rights to use the transmission network. These rights could be explicit (written into agreements) or implicit (not written into agreements).

8.2 Today, as set out in report 1, explicit access to different networks is available through different contract arrangements, for example an embedded generator could have a BEGA which provides them with transmission entry capacity (TEC) and therefore can use the transmission system. However other contractual arrangements would result in only explicit access to the distribution system or transmission system depending on where you are connected.

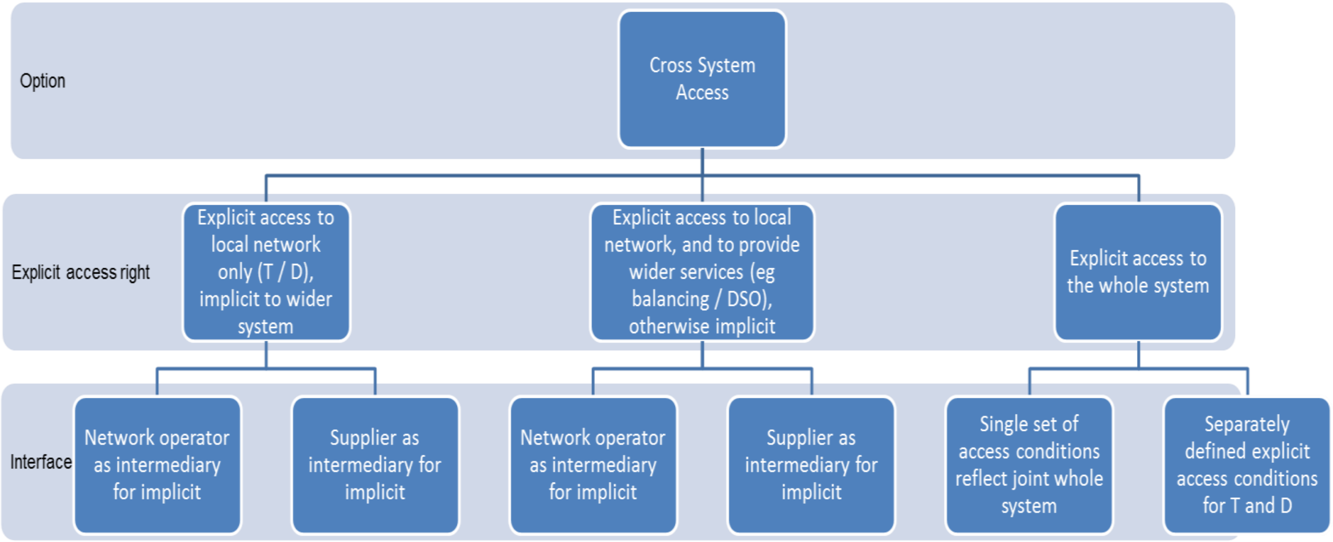
8.3 As the energy industry evolves, the traditional flow of energy from transmission to distribution is no longer the case, as seen in the Cost Drivers Report which highlights a number of grid supply points which are now exporting to the transmission system.

8.4 This section of the paper considers different options for explicit or implicit access in the future.

Key design choices and variants

8.5 The option map shown in Figure 10 below describes the permutations applicable to cross system issues for Users.

Figure 10: Option map for cross system access option



8.6 Access to the local network with implicit access to wider system is similar to contractual arrangements today (outside of BEGAs) which provide either transmission or distribution access.

8.7 Explicit access to the local network and to provide wider services, is similar to the BEGA option as noted in the introduction.

8.8 Explicit access to the whole system is a new concept which would essentially result in any access product having the ability to use the whole system and therefore different contractual arrangements for where a user has access would not be required.

8.9 There is also a secondary consideration of which parties would be involved. This could either be directly through a user's network operator, more than likely with their connection agreement, or through a supplier such as a smaller embedded generator who may use an aggregator to have system access.

Summary of initial assessment of cross system access

Table 10: Initial assessment of cross system access

	Guiding Principle 1 – Efficient use of the network	Guiding Principle 3 – Practicality
Users	• Providing clear access either to the local network only or to the whole system may help users plan their business cases e.g. which markets they can also participate in. • For smaller users e.g. domestic non-half hourly metered customer, it is unlikely that specific access rights will be a main concern, though their aggregated trading position as managed through a Supplier may drive network benefits that can be transacted by Suppliers.	• It has been noted in the two charging SCRs that embedded generators may start paying balancing service use of system charges (BSUoS) and transmission network use of system charges (TNUoS). If this is the case, it is also fair that users can have explicit access to the whole network. • Contract arrangements should be simpler for users if they have access to the whole system rather than requiring any additional contracts. • Consideration would be required about how "whole system" access would be reflected in DCUSA and CUSC
Networks / ESO	• Having whole system access for everyone connected to the network should allow better network planning as flows of energy across the network may be more realistic (a generator connected to an IDNO's network cannot stop its electricity flowing past the IDNO boundary within interaction with DNO and transmission systems).	• The exact mix of rights at any point in time will be complex, particularly if agreeing time specific access rights across networks. • Determining equivalence of access to upstream networks, given the increasing diversity of embedded users impact on upstream networks, will add complexity. • Contractual arrangements however should be simpler if access = access and therefore no additional contracts are required for additional access, such as a BEGA today.

Key insights

8.10 The way that the networks are used today is very different than in the past when electricity flowed from transmission to distribution. We are now looking more "whole system" across transmission and distribution and therefore access rights should support this. Different users do however have different requirements for example domestic to larger users, which is why providing different access routes e.g. through a supplier or network operator could be important. It may also not be appropriate for all users to have the same approach for access rights, for example it may be disproportionate to explicitly identify a small user's (e.g. domestic property) use to the transmission system. This would need to be considered further through the access work and the Small Users sub group.

8.11 Further work would be required to understand the charging arrangements required to support whole system access, how this aligns with work on the connection boundary and other charging elements of this SCR alongside the TCR.

8.12 It would also be useful to understand whether whole system access may require more alignment between planning specifications at transmission and distribution or if any other changes are required.

8.13 Roles and responsibilities associated with any whole system access would need to be defined, for example who enforces the access a user has and who could curtail users if this access is breached.

8.14 Ofgem directed the networks and the ESO to consider how access rights / curtailment obligations could be traded, these two streams of work will need to consider the interactions between them for example, if whole system access was available to users, what this would mean for trading.

Combinations and interdependencies

8.15 Cross system access could be used in combination with any of the other access options, as it is an additional layer of how access products work. For example, if you had a time profiled access, this could either be for your local network or for the whole system.

9 Cross-cutting - other

Introduction

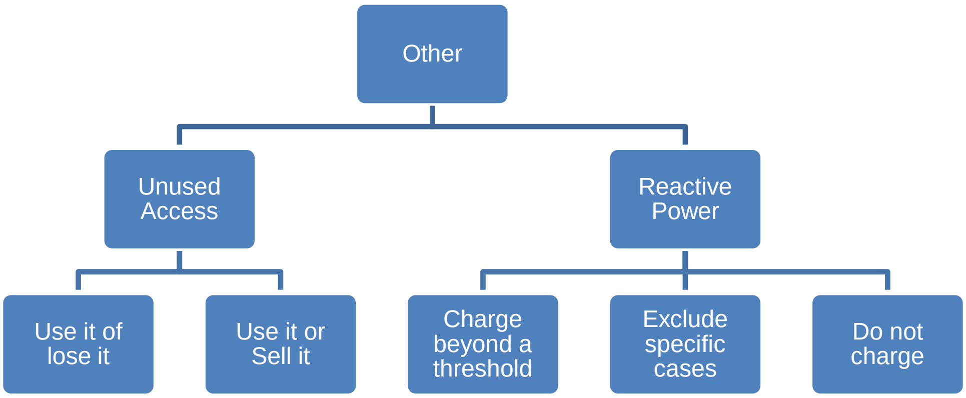
9.1 Other cross-cutting options include: 1) conditions related to the ongoing provision of access where this is unused 2) the extent to which reactive power is an explicitly defined component of access beyond the apparent power (kVA) capacity requirements.

9.2 Under present arrangements, most sites have a de-facto access right to a power of 0.95 i.e. reactive up to 25% (approx.) of the apparent power (kVA). Where reactive power requirements are greater than this and the user is current transformer (CT) metered, a reactive power (p/kVAr) charge is applied. Where sites which have been connected under agreements which specifically require the connection to operate at power factors outside of this window for, say, voltage support reasons etc, then the de-facto access rights permit this, and no reactive power charge is applied.

9.3 There are no existing mechanisms for allocated capacity to be withdrawn on a use-it-or-loose-it or use-it-or-sell-it basis.

Key design choices

Figure 11: Option map for un-used and reactive power conditions[5]



Summary of initial assessment of un-used and reactive power conditions

Table 11: Initial assessment of un-used and reactive power conditions

	Guiding Principle 1 – Efficient use of the network	Guiding Principle 3 – Practicality
Users	• Arrangements may encourage clearer definition of requirements at outset but may prevent customers from signalling a growing or future requirement. • Further definition is required on what 'use' means and how this applies to occasional or back up capacity.	• Legitimacy may be questioned should a paid for service/product be withdrawn. • Unclear how a mandated sale can be enforced – to whom, at what price etc.

[5] Reactive power and un-used access are distinct issues rather than substitutes for each other

	• Could disproportionately transfer the risks associated with specification of access requirement on to the customer. • Where power factor is a relevant driver of cost/benefit arrangements specific charges could allow this to be signalled. • Under a shallow-connection boundary use-it-or-lose/sell-it may cease to be relevant - as users would pay an ongoing cost-reflective charge for their access and could signal their need to retain it even if not regularly used (e.g. the access required for an occasionally 'peaking' powerplant or a back -up supply)	• To what extent can the time-varying nature of power factor cost/benefit be identified?
Networks / ESO	• Arrangements could ensure capacity is allocated to 'active' use • Use-it-or-lose/sell-it provisions may require network operators to make subjective decisions over access use – how would the access required for an occasionally 'peaking' powerplant or a back -up supply be assessed.	• Voltage related power-factor considerations are variable from site-to-site and from time-to-time. • Not clear if PF is a driver of cost/benefit aside from the raw capacity (kVA) requirements

Key insights

9.4 There is a balance to be stuck between encouraging users to specify their access requirements up-front and steps taken to disincentives any over-specification. Aside from the raw impact on apparent power (kVA) capacity requirements, it is important to consider when/if wider reactive power usage is a cost or benefit.

Combinations and interdependencies

9.5 Time profiled access definitions could include elements of reactive power requirements

10 Conclusions and Next Steps

10.1 There are many different elements of access which could be taken forward into packages for users to choose from in the future. This report has focussed on trying to identify key design options for each access choice.

10.2 As highlighted throughout the report, there are opportunities to improve the definition and choice of access. These may vary in benefits to users and network operators, as well as in complexity to implement.

Key insights

10.3 For some customers, we consider that a non-firm connection could prove to be a very cost-effective way for customers to gain access to the electricity system in exchange for accepting some uncertainty around the continuity of their access. There are different ways in which this uncertainty can be defined, managed and valued to build access products that meet varying customer requirements. Further work is required to assess these different approaches.

10.4 Most network users generally have continuous (i.e. not time-profiled) use of networks. Some recently connected distribution network users have time-profiled flexible connections and there may be benefits in making this access choice available for all customers. Our initial evaluation suggests that defining time-profiling would benefit both network users and operators, as it removes the need to make assumptions on diversity, potentially increasing the utilisation of the existing network and reducing the need to reinforce the network. But this requires network users to operate within their agreed time-profile, which is likely to require a clear monitoring and enforcement policy. Some standardisation of access choices may help ensure a level of consistency and understanding across all network users, but bespoke options could also be available to meet individual users' needs. Time-limited access is currently only available for transmission-connected generation users through short term Transmission Export Capacity arrangements. Further work is necessary to understand whether time-limited access is valued by transmission and distribution network users.

10.5 Shared access may be a useful additional way to connect new customers to networks with local constraints. Like other access options, there are practical details to be resolved. These details include determining who identifies the users to share access with (the customer or the network operator), who monitor compliance and who is responsible if users exceed their agreed access rights. Some stakeholders have highlighted potential similarities between sharing access and trading access. A headline comparison of shared access and traded access is included in Annex 3, but further work is required to better understand the interactions.

10.6 When considering any access options, it will be important to consider whether options are standardised, bespoke or a combination of both. Bespoke arrangements can provide for greater network utilisation efficiencies and accommodation of individual user requirements, however there are advantages for users and network operators in standardisation providing transparency and certainty. Therefore, it is likely that a combination of these will provide an optimum balance giving the required flexibility which will accommodate future network requirements.

10.7 The benefits of improved definition of access choices can only be achieved if we have the right controls in place to support it (for example through clear roles and responsibilities, as well as an effective compliance regime to monitor and enforce access rights). Monitoring, enforcement and overrun arrangements may need to vary between users, with the choice of measures designed to balance complexity, visibility, severity and costs proportionate to the user. If consequences are too severe, this may cause some customers to inefficiently over invest. For other users, particularly those with domestic core/essential needs, it is unlikely that curtailment will be appropriate. It may be more appropriate to use staged enforcement actions, so as to not penalise occasional actions which do not cause physical limits to be exceeded. This could help ensure that the impact of non-compliance for the user is proportionate to the network impact of non-compliance. Any monitoring and enforcement arrangements will also need to take into new access choices (more granular monitoring of access may be required in the future to support new access choices). We also need to further understand the practicality and value of allowing users or network operators to “overrun” their normal agreed access limits, subject to certain conditions.

Further work

10.8 Further work is required to develop and assess the potential options for change. In particular we recommend;

- Developing our understanding of the links and between access arrangements and charging. This is important as access choices and charging combined will influence user behaviour and therefore need to be considered alongside one another to ensure the right signals are given, and that signals are given through the most effective means (which may not be formal access conditions). For example, if the connection boundary becomes shallower, then the value of access choices would need to be reflected in the use of system charging methodology.
- Developing our understanding of the links between the specific access choices and the creation of combined access “products”.
- Undertaking more customer research to identify which options provide the most value to customers and best meet their needs. This could also help us understand which access choices can be combined to produce future access products.
- Further assessment of the options against the three guiding principles. In particular assessing the practicality of offering these access options (e.g. do any require changes to legislation or planning standards), the value that these options may provide to network users and the value that these options may provide to network operators.

Annex 1 – Product Description

Title	Access arrangements
Objective	To better understand how access rights and user characteristics are currently taken into account when planning the system, to understand the value of improved access choice and definition. To better understand the access choice design options, so that we can better analyse the value of these options. This includes considering the extent to which access choices are standardised and the extent to which they provide clarity about whole system access.
Acceptance criteria	**A publishable report formed of two key parts:** **2a) Access choice design that outlines the range of possible access choices and the key design choices for each, applicable to all network users (generation and demand) at every level of the system; including:** • Develops a working definition of "access" (Based on the definition used by Ofgem in their SCR launch document) and other key terms to ensure consistency. • Provides an overview of the possible combinations of access choices (e.g. time-profiled, shared, non-firm access). This should be based on the access choices identified as a priority by the Ofgem SCR launch document. • Outlines the key design options for each access choices (ego how firmness is defined and capped, the range of potential time-profiled options to consider, the options once a user exceeds their level of access) • Assess the key design options for each access choice. This should be based on the guiding principles outlined in our December 2018 document. • An initial view of how thresholds for access for small users (those users without a defined capacity as the basis for DUoS charging – with a focus on domestic and small non-domestic users) could be defined, and their pros and cons from a system perspective. (engaging Citizens Advice and charging subgroup **2b) Cross-cutting issues for new access choices: (a) The extent to which access choices are standardised or bespoke and (b) How cross-system access is defined.** • Based on the key design choices, what are the options for standardised and bespoke access choices (T&D), or combinations of these, (e.g. whether they might vary across the system, or by user type/market segments)? Are there any barriers that would hinder network operators from offering bespoke arrangements or standardised options? • What are the pros and cons of these options, considering network benefits, users' perspectives, and links with charging arrangements? (link with charging subgroup). The assessment should be based on the guiding principles outlined in our December 2018 document. <u>Whole system access:</u> • What are the options for defining access rights on a whole system basis? • What are the pros and cons of these options, considering network benefits, users' perspectives, and links with charging arrangements? (link with charging subgroup). This assessment should be based on the guiding principles outlined in our December 2018 document. • How could this differ based on the key design choices? Are there any barriers that would hinder access from being defined across the system? How would these approaches be implemented (e.g. through codes)?

High-level timescales (Secretariat to develop detailed project plan).	• 21 Jan - Launch sub-group • 25 Jan - Finalise sub-group members and product description • 13 Feb - Initial drafts of two draft deliverable documents • 26 Feb - Present two draft deliverable documents to Challenge Group • 01 Apr – Final draft of Report 1 and a draft of Report 2 shared with Delivery Group • Apr 19 - Final reports circulated to Ofgem
Dependencies - takes input from	Uses data from the information request.
Dependencies - provides input to	Informs the development of all the other access products.
Which DG members should be involved?	All network companies and ESO.
Ofgem Lead	Amy/Stephen
Internal or external	External
Any comments on methodology used	The assessment should be against the guiding principles and should be in a format that we can update as we get further information.
Other comments	Initial thinking on design options: **Firmness** • How curtailment level is defined (e.g. a numerical cap (e.g. instances, kWh, frequency, duration) or a limit on cause of curtailment)? • What happens when curtailment level exceeded? (e.g. trigger for investment, payment to customer). • Whether firmness is based on a planning standard or not? And if so how (e.g. derogations as per SQSS, or alternatives embedded in the standard, changes to the nature of what the standard prescribes)? • Any associated conditions of access. **Time profiled** • Granularity of time profiled access rights • What happens if access level is exceeded? • Any associated conditions of access. **Shared access** • Any thresholds on the extent to which access can be shared (e.g. capacity, geographical region). • What access rights could be shared? • What happens if access level is exceeded? • The process for finding users to share access with. • Any associated conditions of access. **Access thresholds for small users** • Options for how thresholds could be set (e.g. capacity threshold, volume threshold, minimum number of instances above a threshold at peak)

	• Initial view on pros and cons, considering system impacts or conditions where they would apply **Other basic parameters** • how import / export rights are defined (e.g. separately / together, implicit / explicit, dependent on primary purpose?) • power factor • how implicitly / explicitly access is defined • interactions with access allocation processes – e.g. queue vs notification procedure. • other conditions **If time/resource allows, then the report would also cover options for short-term duration:** • Circumstance when short term access is made available (e.g. anytime or only short-term release of additional capacity). • What happens if access level is exceeded? • Duration of access right (E.g. within year, a year, or several years).

Annex 2 – Detailed initial assessments of access arrangements options

This annex is appended as a separate document.

Annex 3 – Shared and Traded Access comparison table

Comparison of Shared and Traded access

Highlighted here are the differences in the concepts for shared and traded access. While both concepts provide potential benefits for more efficient access allocation the objectives for users are different.

	Sharing access	Trading access	Comments
Description	This would allow network users across multiple sites to share access.	This would allow network users to bilaterally trade or exchange access.	
Core purpose	To connect new network users behind a constraint, to ensure that electricity networks are used efficiently and flexibly.	To trade spare access to ensure that electricity networks are used efficiently and flexibly.	Different core purpose.
Network user relationship	Two or more network users.	Limited to network users trading bilaterally with each other.	
Desired outcome	New network user connected within collective capacity/access ceiling thereby avoiding reinforcement.	Existing network users buy and sell access from each other thereby avoiding reinforcement.	
Network conditions	A network constraint exists; may be most valuable behind a local constraint.	A network constraint exists; may be most valuable behind a local constraint.	Needs a constraint to create a value for the options.
Potential participating network user categories	New network users working together. A new network user (new network users) joining with an existing network user (existing network users). Existing network users agree to amend their access rights to share access with each other.	Existing network users.	Network users need usage history to show they have spare access to trade. Users will need to be 'informed' network users. Potentially larger users.
Timing	The extent to which access rights can be reallocated <u>is agreed and fixed upfront</u> with the network operator and	The extent to which access rights can be reallocated is <u>not agreed upfront</u> and can change on an ongoing	

	included as part of connection agreement.	basis via trading arrangements. Some stakeholders have suggested that this may lead to more efficient allocation and use of network capacity.	
Contractual relationship	Bilateral contract between parties. Connection agreement with network operator. This may provide more certainty to network operators about where new network capacity is justified, but limits what access rights can be re-allocated and who they can be reallocated to.	Bilateral commercial trades. This provides more ongoing flexibility to users about what access rights can be reallocated and who they can be reallocated to. May provide less certainty to network operator about where new network capacity is justified.	
Coordination	May require a “coordinator” or platform to: • Identify parties to share access with, and • Manage the sharing of access on an ongoing basis. Likely to require technical approval by network operator.	Requires a platform to identify parties to trade access with and oversee the process of trading access. Likely to require technical approval by network operator.	
Network Operator role	Requires network operator assessment upfront to understand the extent to which access at one site is equivalent to access at another site (e.g. exchange rate).	Requires network operator assessment on an ongoing basis to understand the extent to which access at one site is equivalent to access at another site (e.g. exchange rate).	
Contract length	Short, medium or long-term.	Short, medium or long-term.	Shared access could be temporary solution until the new connectee is able to trade.
Legislative change	Need to consider whether access rights can be allocated to more than one user under current legislative framework.	No legislative challenges currently identified.	