SCR Access and Forward-looking charges

Monitoring and enforcement note
Access subgroup

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Related Documents

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

Distribution

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1 Executive summary

1.1 The access project is considering how different access choices may benefit customers and network operators. In considering different access options the working group received feedback that where a particular access option was chosen, consideration should be given as to how a customer's adherence with the parameters of the option could be ensured. Failure to adhere to the parameters of an access option could cause dis-benefits for other network users.

1.2 To achieve arrangements to ensure that customers would comply with the parameters of their chosen access option, this paper considers options for monitoring and enforcement.

1.3 At distribution, DNOs can only monitor customers' use of access rights where half hourly (HH) metering billing data is made available i.e. for larger customers. Distributor access to HH smart metering data for individual domestic and microbusiness customers is not currently permitted and so is not available for DNOs for billing or capacity management. This is set out in the BEIS Smart Metering Data Privacy framework and would need amendment to allow half-hourly (HH) demand monitoring from HH smart data. Even if this could be achieved the monitoring of potentially millions of customers' adherence to access choices would be impractical. The costs of having systems to store, monitor and react to agreed capacity breaches by domestic level customers would need to be considered. Whilst this is a feature of other countries' DNO activities, it is not in GB.

1.4 DNOs and IDNOs have limited powers to enforce a customers' compliance with access choices. For example, a DNO's right to immediately disconnect a customer's installation is limited to safety issues under ESQCR provisions. Even where a DNO is not reasonably required to continue to provide a connection under the Electricity Act, the DNO is required to give a minimum of seven working days' notice of its intention to disconnect. Fundamentally, a DNO's rights to apply the ultimate sanction, i.e. to threaten prompt disconnection are very limited. It should be noted that installing physical control equipment e.g. Active Network Management (ANM) to briefly or temporarily manage a customer's import or export is not the same as physical disconnection or physical de-energisation.

1.5 At transmission, all generators are metered. Although there are no financial penalties for overrunning Transmission Entry Capacity (TEC), which provides them with 24/7 access rights, other than imbalance costs, generators would be in breach of the Connection and Use of System Code (CUSC) and therefore their licence if they were to exceed their access right. For transmission connected demand, there is no equivalent to TEC today, with maximum usage limited to the maximum their connection assets allow them to use.

1.6 There are a range of options for how access rights could be monitored and enforced in the future from both a physical and commercial perspective. At one end of the scale, this could be based on trust, with ad-hoc checks on access with warnings provided on potential costs or physical repercussions if a user continues to exceed their access right. At the opposite end of the scale, all users could have physical assets which stop a user from exceeding their access right. They could have any cheaper agreed access right removed, resulting in additional costs and could risk users losing their licence (if they have one). This range will need to be balanced against the benefit and cost of implementing them. See Section 6 - 'Hierarchy of future enforcement options'.

1.7 Commercial solutions may be limited if signals through charges billed to suppliers are not reflected in customer bills. For example, if suppliers socialise costs, including exceeded

capacity charges, then DNOs won't be able to rely on customers changing behaviour to support more efficient network use.

1.8 Technical solutions, such as ANM, may be appropriate where a customer's breach is likely to cause issues for the network or other customers. Prompt de-energisation or physical control are likely to be the most appropriate solutions in such circumstances. A range of physical control mechanisms could be utilised, for example static timed access could be DNO equipment or customer owned equipment (subject to DNO approval). It is noted that physical control would come at a significant cost if ANM type control equipment was needed for all connections where the customer had opted for a non-24/7 access choice.

2 Recommended changes to monitoring and enforcement

2.1 Physical control of access is not new. Physical control devices are already used for ANM schemes, large single customer flexible connections and for timed flexible connections to ensure that exceedance does not damage plant. Physical control for domestic customer time-of-use tariffs has been around for decades. This is managed by traditional metering in the form of load switching, using time switches or the Radio Tele-switching Service (RTS). For domestic customers a solution will be needed via smart metering in order to maintain exiting time of use tariffs such as economy 7 when smart replaces traditional metering.

2.2 The current arrangements for commercial or contractual enforcement are much more light-touch than physical control. For customer service reasons, DNOs only use their limited de-energisation rights for breaches with potentially serious consequences. The Act focusses on the customer's rights to be connected and to remain connected, rather than clear provisions for the DNO to discontinue the connection. There is evidence that commercial mechanisms such as time-of use-charging and excess capacity charges, as part of the DNO's use of system charges, do not always sufficiently influence whether customers seek to avoid exceeding their agreed capacity.

2.3 Should the aim of the introduction of access choices be to drive better utilisation of networks (and therefore lower diversity) and, as a result, contribute to tighter operational margins in respect of asset capability limits, the supporting arrangements such as the terms and conditions of connections will need to be reviewed. A range of solutions may be needed to ensure sufficient management of electrical and commercial risks. We recommend specific ways forward below:

- The network operators and system operators should work with Ofgem to agree a clear and consistent approach about when users might be disconnected or de-energised for breaching access rights.
- Given the age and original intent of Electricity Act, including on the rights of customers to remain connected, Ofgem's input will be needed in developing consistent approaches across network operators for monitoring and enforcement of access.

- The development of new access choices may lead to the wider application of physical control equipment on new or modified connections, including on un-curtailed 24/7 connections, to ensure no exceedance of agreed maximum capacities. Network or system operators should work together to agree a consistent approach to when and how this might be adopted, including the mechanism for recovery of the costs associated with installing this equipment. These approaches should be consistent whether a user has one type of access product or multiple e.g. time-profiled and shared.

- Work on charge design should consider the impact of more defined and tradeable access rights, including potential shift from consumption based charging towards access-based capacity charges.
- If a user exceeds their agreed access rights, then this can create additional costs for network and system operators. It will be necessary to review how we calculate the charges that apply for exceeding agreed access rights, including a review of the methodology for the design and calculation of exceedance charges to ensure they accurately reflect the additional costs of users' exceeding their access rights.
- Excess capacity charges apply automatically on distribution via use of system billing where customers exceed there agreed capacity. Consideration needs to be given on whether such charges should be introduced for transmission connected customers, if aligned to the focused transmission reforms.
- Creation of appropriate mechanisms to ensure users are given appropriate incentives to comply with their access rights. This may include greater consideration to the ramifications of users failing to comply with their access rights obligations (e.g. the forfeit of cheaper alternative access rights).
- Consideration of the role of suppliers, third parties and DNOs in assisting customers to comply with agreed access rights in order to minimise occurrence of application of, for example, excess charges.
- The development of plans for the transition in advance of implementation, including articulation, communication, education and general engagement with customers.

2.4 For smaller customers where physical control equipment would be dis-proportionately costly, legal arrangements would be needed to apply significant sanctions for breach, including enforcing cost reflective liability payments and de-energisation as appropriate. These arrangements are likely to need a combination of clarifying existing rights, consistent applicability and new contractual rights or obligations. It should be noted that charges communicated via DUoS are passed to the customer's supplier and suppliers have choices on how they wish to communicate their costs in charges to customers.

2.5 Users who do not have meters under unmetered supplies arrangements could not be monitored or have their access rights enforced unless meters were installed.

3 Agreement of access rights

Transmission

3.1 Today, generators connecting to the transmission network receive transmission entry capacity (TEC) as part of their connection agreement via their Bilateral Connection Agreement (BCA), which provides generators broadly with 24/7 access. Where generators have been brought on to the system early, via connect and manage, their connection agreement will state the circumstances in which they will not have 24/7 system access.

3.2 Distribution connected generators can also have a Bilateral Embedded Generator Agreement (BEGA) which provides them with TEC as outlined above.

3.3 For transmission connected demand, they receive a BCA which generally does not include the section on Transmission Exit Capacity. Demand customers' and DNOs' do not have explicit access rights. The ESO's obligation, essentially 24/7, is only to service forecast need based on Demand Forecasts submitted during annual Grid Code forecasting, enshrined in the CUSC as the "Connection Site Demand Capability". DNO and Demand users' maximum usage is limited to the maximum their connection assets allow them to use. Critically there is no explicit contractual access right and the Demand

Forecasted value that the ESO is obliged to provide is usually a lesser value than the connection asset capability.

Distribution

3.4 As part of the connection process, all customers are required to agree defined limits for the electricity delivered to and/or supplied from the distribution system (maximum power requirement captured as the maximum import and/or export capacity). This maximum power requirement is used to size the connection to the customer's premises and for half hourly settled customers it is also used to set the Maximum Import Capacity (MIC) and Maximum Export capacity (MEC) used in DUoS billing. Non-half hourly settled customers do not have a MIC or MEC. The rules governing the customer's adherence to its maximum capacity will be laid down in its connection agreement. In circumstances where a site-specific connection agreement is not in place, the National Terms of Connection (NTC) will bind the customer. Customers can request increases in capacity at any time by applying to the DNO (or their IDNO as the case may be) and any necessary connection modification work would be chargeable.

3.5 For IDNO connections to DNOs, maximum capacities are also captured. Capacity ramping arrangements have been approved by Ofgem which allow a demand growth profile to be agreed prior to energisation and which may then be assessed on an annual basis. Such reviews may be carried out one year following the date of energisation and annually thereafter. The capacity details will be included within the individual Bilateral Connection Agreement for each site. IDNOs can apply to the DNO for additional capacity in the same manner as other customers and may volunteer to relinquish spare capacity at any time.

3.6 In contrast, reductions in a distribution customer's MIC/MEC will only be permitted once in a 12 month period. The new MIC/MEC will be applied from the start of the next billing period after the date that the request was received. No retrospective refund of charges will be allowed. Where a reduction is agreed, the original capacity may not be available in the future without the need for network reinforcement and associated cost.

3.7 Customers are not contractually permitted to exceed their maximum capacities and should not do so, as doing so could have a detrimental impact on the network and compromise safety. It is therefore important that DNOs have processes in place to capture maximum capacities and to ensure they are strictly adhered to.

3.8 Across both transmission and distribution, the contractual relationship for access is with the DNO / IDNO / ESO rather than a supplier as this provides more consistency for a user over the life of their asset.

4 Current approach to monitoring compliance with access rights

Distribution

4.1 The Distribution Connection & Use of System Agreement (DCUSA) obliges suppliers to provide to DNOs, without charge, such metering data as is required for the calculation of Use of System Charges and the operation, design and planning of the distribution system.

4.2 There is a distinction between instrumentation and the data used for monitoring networks and the data used for measuring customer's usage.

4.3 For HH settled customers, DNOs rely on the metering data provided by suppliers, which is used to measure customer consumption. For these customers, suppliers will provide

site specific import/export data, including customer maximum demand. DNOs use this data for regulatory reporting and for network planning and connection design work. Whilst DNOs may also use this data to actively monitor individual customer's usage, they may opt not to, unless they have specific reason to do so. Distribution use of system charges for HH customers connected at low voltage and high voltage that exceed their agreed capacity are billed excess capacity charges using the maximum demand data; the excess capacity charges are set at a higher rate than standard capacity charges. Capacity charges for customers connected at EHV apply at the same rate and there is no differential for maximum demands recorded above the agreed capacity. Reports can be run by the DNO to identify those customers exceeding their agreed capacity for follow up actions as necessary. DNOs can intervene for any issues created by customers.

4.4 For non-half hourly (NHH) settled customers, the DNO will receive aggregated consumption data and no maximum demand data, which means DNO monitoring of NHH customers is not possible. HH customers who exceed their agreed capacity are billed excess capacity charges using the maximum demand data. These charges apply automatically and are billed to the customer's supplier via each DNO's use of system bills. DNO's may opt to take extra steps in respect of exceedance and reports can be run by the DNO to identify those customers exceeding their agreed capacity for additional follow up actions as necessary. DNOs would intervene for any issues created by such customers.

Metering

4.5 The metering installed at a customer's premises is driven by the capacity of the connection and settlement rules under the Balancing and Settlement Code (BSC). Traditionally, small customers have been metered and settled on a NHH basis with electricity kWh consumption measured through periodic meter readings. Larger customers are metered and settled on a HH basis, with unit consumption measured over 30 minutes periods. Small and medium businesses previously metered NHH in profile classes 5 to 8 are transitioning to being metered and settled HH. In addition, Ofgem is undertaking a Significant Code Review to determine whether all customers, including domestic and small non-domestic smart metered customers, should transition to being HH settled. Domestic and small non-domestic customers with smart meters can currently elect to be HH settled.

4.6 The majority of homes in the UK are fitted with conventional meters, presenting readings on a simple, mechanical display. Other meter types include:

- Economy 7 meters, charging lower rates for electricity at night than in the daytime (have two readings – one for night and one for daytime).
- Prepayment meter, pay for energy in advance of usage operating via a top-up card or key.
- Smart meters provide information on how and when energy is used and this data is sent to the energy supplier. Distributors do not have access to this level of information.

4.7 CT (Current Transformer) metering is installed on connections with a load greater than 100 Amps (note: some smaller customers (<100 Amps) may find themselves with CT metering as a result of load reductions post connection).

- If maximum demand in any 30-minute period is more than 100 kWh, then a mandatory HH meter is required. This may also be installed on request.
- All customers that have a meter settled NHH with a profile of 05, 06, 07, or 08 now fall under the rules of the BSC change P272 and are transitioning to HH settlement.

Capacity Monitoring

4.8 Some DNOs have processes in place for monitoring exceedance or have run projects on underutilisation of capacity for non-domestic and larger HH settled customers using capacity reports driven from HH billing data. For those DNOs with processes for monitoring exceedance, the findings from the reports are communicated to the relevant customers.

4.9 Three DNOs have or have had processes to try and agree recovery of under-utilised capacity, to be recycled for other customers. Capacity recovery has however generally proved unsuccessful, especially from generators, suggesting the potential need for the introduction of improved cost signals. Some of the reluctance to reduce capacity is believed to be due to generators holding capacity (with no capacity cost signals) in the hope of more favourable generation or storage incentive schemes in the future. If 'given up' and subsequently utilised by another party, there is a risk that the generator may be required to contribute to the costs of future reinforcement.

4.10 Whilst some DNOs have processes for general exceedance, others focus on cases where power quality or asset concerns are caused by specific customer safety concerns.

4.11 At least two DNOs have processes with clear steps and customer communication points with one DNO using letters with notifications and two stages of escalation.

Power quality

4.12 Power quality issues can cause disturbance for customers and their equipment e.g. voltage fluctuations. Issues can be identified by DNOs or reported by customers. Customers exceeding their agreed capacity, e.g. to the point of stressing connection assets, can create power quality issues for themselves and other customers. Investigations of power quality issues may identify that a specific customer is causing the issue leading to necessary contact and escalation, as required. Metering data can provide useful evidence where the customer causing the issue is settled HH.

4.13 Investigations may involve the DNO installing additional temporary network monitoring equipment under its rights in the Distribution Code e.g. voltage recorders, in order to find the source of the issue.

Transmission

4.14 Monitoring and enforcement of access rights at transmission varies depending on whether a user may have an impact on the safety / security of the system if they were to breach their access right.

4.15 At the more "strict" end of the spectrum, some users have an intertrip which will physically stop them from going over their TEC due to system impacts if they were to do so. An intertrip is an automated control for the electricity network. This mainly happens on network spurs, for example on a windfarm connection to the Main Interconnected Transmission System (MITS). To date, intertrips have related to export limits rather than time-of-use.

From a commercial perspective:

4.16 Transmission connected generation participating in the balancing mechanism (BM) will provide their physical notice (PN) which cannot be higher than their TEC. The Imbalance Price is used to settle energy imbalance volumes. At the end of a Settlement Period, BSC Systems compare a user's contracted (traded) volume with the metered volume of energy

used in the Settlement Period. If a user is in imbalance of its contracted volume, then it will be subject to imbalance charges.

4.17 Charges are currently based on the TEC which users have, rather than the volume of electricity they produce. There is, therefore, technically no "charge" for exceeding TEC, other than charges associated with imbalance. There have been instances where, when calculating TNUoS tariffs for the year, the Electricity System Operator (ESO) has noted that on average exports were higher than TEC and have provided a written "warning" to users on the implications of doing so (as above about breach of CUSC). The ESO has also contacted users to understand the reasons why their export had been at a level higher than their TEC. This has not however been a common occurrence.

4.18 For demand users, their usage of the system is metered, and this information is used to charge them TNUoS based on their imports at triad periods. Transmission connected users do not generally have a defined maximum import capacity in their BCAs, however it has recently started to be added for storage and pump storage users.

5 Rights to enforce access rights

5.1 Where a customer's demand or export exceeds the maximum capacity or other parameters agreed with the network company, the breach may or may not cause network issues. Where a customer's connection and the network it connects to have spare capacity, a breach may not affect the network or other customers.

5.2 Where a breach puts strain on the network, the effect may manifest itself as network quality issues e.g. voltage reduction, drivers of reinforcement, overloaded assets and potential safety issues. Where a safety issue occurs, network operators may seek to disconnect or de-energise customers. Where a breach does not create network issues, communications with the customer and commercial mechanisms to regularise the situation may be more appropriate. The threat or possibility of disconnection is clearly necessary to drive correct behaviours, but network operators are reluctant to take such action unless necessary due to the impact on other customers or the network.

Transmission

5.3 At transmission, the Generation Licence, the CUSC and Grid Code contain rights, obligations and rules for the ESO and users of the transmission network with regards to connections and monitoring and enforcement of network use.

5.4 Condition 19.1 of the Generation Licence states that "Insofar as the licensee shall construct or operate a generating station, the licensee shall be a party to the CUSC Framework Agreement and shall comply with the CUSC."

5.5 Sections 2.3.2 and 3.2.3 of the CUSC state that a power station (generator) should not exceed its TEC. Doing so would place the generator in breach of the CUSC.

5.6 The consequence of breaching the CUSC is that doing so would place the generator in breach of its generation licence. If the ESO felt that a particular breach, or series of breaches, was a serious issue, it could report the matter to Ofgem for investigation. In

such circumstances, Ofgem would decide whether or not to take any action with ultimate powers including imposition of fines of up to 10% of a company's global turnover.

5.7 As demand users do not have TEC, there are no parameters and therefore no commercial or financial consequences of breaching. Their physical connection acts as a limit to how much can be imported.

5.8 Under the Grid Code (BC2.9), the ESO has the right to send users an emergency instruction to remove them from the transmission system where required for safety and/or security reasons.

Distribution

5.9 At distribution, the Electricity Act, the Distribution Code and the NTC contain rights, obligations and rules for DNOs and customers with regards to connections and monitoring and enforcement of network use.

Electricity Act 1989

5.10 Section 16 and 17 of the Electricity Act 1989 contain provisions for the duty to connect and maintain connections, including provisions for where it is not reasonable to do so (see Appendix 1).

5.11 Where a safety issue occurs network operators can disconnect customers under provisions in the Electricity Act.

The Distribution Code

5.12 The Distribution Code contains clear provisions for monitoring and for compliance, but is light on provisions for enforcement mechanisms for breach of capacity/access conditions. A customer's obligation to comply with the Distribution Code is addressed via the relevant Connection Agreement, either via a site-specific connection agreement or clause 16 of the NTC. For example Distribution Code clause '*DOC5.5 Procedure Related to Connection Point Parameters'* relates to the DNO setting parameters e.g. MIC/MEC and Access conditions, with the right to monitor compliance against those parameters. Relevant extracts of the Distribution Code are contained in Appendix 2.

5.13 Clause *DOC5.5.5* of the Distribution Code states that where the user is operating outside the specified parameters, the user will immediately restrict the Active Power and Reactive Power transfers to within the specified parameters. Clause *DOC5.5.6* states that where the User requires increased Active Power and Reactive Power in excess of the physical capacity of the Connection Point the User will restrict power transfers to those specified in the Connection Agreement until a modified Connection Agreement has been applied for from the DNO and physically established. The code has no provisions for enforcement if the customer breaches these two clauses.

The National Terms of Connection (the "NTC")

5.14 The NTC is governed under the DCUSA. The provisions of the NTC apply by statute and state the conditions for use of the network and remaining connected. Relevant extracts of the NTC are contained in Appendix 3. The NTC contains provisions for enforcing compliance, including the right to 'cut off' the flow of electricity where the DNO is entitled to do so under general law or industry arrangements.

5.15 The contractual consequences for customers exceeding their agreed capacities are currently as contained in the NTC, but these provide limited powers to DNOs. In circumstances where damage to the network or other related safety concerns might

result, the DNO could disconnect the customer using its powers under the ESQCR regulations.

5.16 Clause 12 of the NTC (Limitation of Capacity) is comprehensive in setting out a process, but appears to lack teeth in terms of driving prompt compliance. Fundamentally, however, a DNO's right to apply the ultimate sanction (i.e. to threaten prompt disconnection) is very limited.

5.17 Clause 12.10 of the NTC provides rights for the DNO, under certain circumstances, to "install additional equipment at the Connection Point designed to limit the import and/or export of electricity from or to the Distribution System to an amount equal to the Maximum Import Capacity and/or the Maximum Export Capacity", but this action would involve potentially significant time and expense. Retro-fitting physical control equipment on existing connections is complex and is not a swift solution. The connection work required, once planned and executed, would necessitate at least temporary de-energisation of the customer to complete the work. ANM and flexible connection solutions are available for larger customers but are disproportionately costly for smaller customers. No "off the shelf" solutions for physical connection management equipment are currently available to DNOs.

Site Specific Connection Agreements (Distribution)

5.18 Site Specific Connection agreements are applied bilaterally and are usually only used for larger customer connections, connections to IDNOs and for interconnectors between DNOs. The terms apply on a site specific basis, but are very similar across DNOs and have evolved to include a reference to the NTC. Some DNOs include firmer provisions for de-energisation for breach and some more closely reflect the NTC.

The Electricity Safety, Quality and Continuity (ESQCR) Regulations (applying to both Transmission and Distribution)

5.19 These regulations impose requirements regarding the installation and use of electrical networks and equipment owned or operated by generators, distributors, transmission operators, meter operators (and the participation of suppliers in providing electricity to consumers), who are collectively referred to as "duty holders" in the regulations. The regulations are focussed on preventing danger, interference and other safety issues.

5.20 The regulations are aimed at ensuring that connections and customers' installations are constructed, installed and electrically protected so as to prevent danger or interference with networks or the supply to any other consumer's installation. The regulations also cover how a customer's installations are used or arranged for use so the regulations have some relevance to access. Under regulation 26(3) a distributor may disconnect the supply to the consumer's installation without giving notice if such disconnection can be justified on grounds of safety. Given that the breach would need to be so serious as to create a safety issue, the regulations are likely to be of limited use in the context of enforcing access rights.

6 Current approach to ensuring compliance with access rights

Transmission

6.1 At transmission, generators have TEC, which provides clarity of maximum permitted export. Any export in excess of TEC is contrary to the provisions of the CUSC and constitutes a breach of the generation licence. In response to breaches of TEC, the ESO

will generally provide written “warning” to users, highlighting the potential implications of their actions.

6.2 Some generation users will have an intertrip installed, which physically prevents breaches of TEC and will result in generation output being reduced to zero. The intertrip will be installed on those parts of the networks where the potential system impacts of a TEC breach is likely to have a significant impact on the transmission system.

6.3 For transmission connected demand, there is no equivalent to TEC, with maximum usage limited by the capability of installed connection assets.

Distribution

6.4 Some DNOs have processes in place for general exceedance of maximum capacity, whilst others focus on those instances where power quality or asset concerns may result from a specific customer's breach. For any power quality or safety issues caused by exceedance the DNO can use its powers to de-energise under the ESQCR.

6.5 Where a customer is causing an overload, blown fuses or power quality issues, this is clearly more serious than a customer who is exceeding their agreed capacity with plenty of spare capacity in the connection and local network. Where a customer is not causing immediate issues, DNOs currently opt for escalating communications with breaching customers in the first instance reminding them of their obligations and potential consequences.

6.6 In a world of more clearly defined access choices, connection design decisions need to be taken on where physical control is necessary on new or modified connections and where more trust-based commercial approaches are more appropriate e.g. for smaller customers. The installation of physical control equipment for all customers is cost-prohibitive and disproportionate.

6.7 De-energisation or permanent disconnection are only used as a last resort action. Disconnections will be enforced where there are safety concerns and/or evidence of illegal activity, e.g. cannabis farming, illegal supplies, etc.

6.8 Disconnections could not be readily enforced for critical services, such as police, hospitals, and essential utilities and in respect of vulnerable customers on Priority Service Registers.

6.9 There are existing examples of demand or export control for different customer and connection types and consideration needs to be given as to what types of solutions are most appropriate for which types of customer connections. These examples may or may not include physical control equipment and include:

- **Active Network Management (ANM)** (physical control of curtailment) – typically for generators, where monitoring and control systems manage customers’ export power flows against a physical constraint and protect the DNOs’ assets. It is expensive to install so it is typically used for connections around 200kVA and above on high voltage and extra high voltage connections. With ANM systems, the customer has no predictability around when the ANM will constrain them (likely at periods of high generation output).
- **Timed connections** (physical control of curtailment) – where the customer has agreed at the time of connection not to operate in certain time bands. DNOs have size limits for such connections.
- **Timed connections (contractual agreement)** – where the parameters of the timed connection are set in the customer’s connection agreement and the demand is managed by the customer either through their own equipment or behaviour.
- **Firm/unfirm** – where the customer commits to operating with a lower demand when the system is not running in its normal configuration.

- **Metering control** (physical control of curtailment) – This is a crude form of curtailment used for low voltage connections with 2-rate tariffs (e.g. for Domestic Economy 7) to help the customer so that off-peak heating does not use day rate electricity. Time control can be via two-rate metering with internal time switches or via the BBC's radio teleswitch service (RTS).

Physical control

6.10 Physical control is appropriate for specific access products or types of connection, including for larger connections and may be a pre-condition of access in constrained areas e.g. ANM. The Economy 7 example shows that physical control can also be used to help smaller customers.

6.11 System protection devices are designed to protect network assets, rather than curtail access, although this can be the outcome of the operation of the device. Relying on blown fuses or activated circuit breakers is inappropriate for controlling access due to the resulting wear and tear on those devices. This points to the need for customer owned control equipment that responds to signals from the network operator (where physical control is deemed to be needed).

6.12 To curtail small LV customers, DNOs or the customer would need to install control equipment that is more sophisticated and more costly than simple fuses because when a fuse operates it needs a site visit by a low voltage authorised person to replace it. It is noted that through smart meters, Suppliers may have some ability to monitor supplies (data retrieval) and in the future may facilitate demand side response services.

6.13 It is highlighted that for higher voltage networks physical curtailment equipment needs to be managed or approved by the party with proper understanding of the network, i.e. the network operator. In a Distribution System Operator (DSO) environment it may be possible for curtailment actions for smaller customers, closer to real time to be taken by other parties e.g. aggregators. However, if operational system security margins are to be reduced in the future these actions would need to be closely coordinated with the network operator.

6.14 For larger customers, physical demand or export control can be agreed at the time of providing a connection, i.e. via a flexible connection. Figure 1 below details the types of flexible connection arrangements offered by DNOs to customers wishing to connect to distribution networks.

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

Timed Capacity Connections	This solution offers a connection with a fixed level of curtailment using either physical or contractual control. The customer manages their import/export level within a prescribed operating schedule agreed within their Connection Agreement. DNOs have size limits for these.
Export Limiting Devices	Automated equipment at the customer's substation controls the customer's demand / generation to ensure that the customer's Agreed Export Capacity is not exceeded.
Local Management Schemes	Network feeder monitoring is taken from the protection panels located at the customer's site. Capacity is temporarily reduced for prescribed feeder outages or monitored voltages / currents exceeding the limits prescribed in the Connection Agreement.
Remote Intertrip Schemes	Capacity is temporarily reduced to a pre-defined level (which may be zero) for prescribed system abnormal network conditions. These may be distant from the customer's site and are monitored in real-time.

Active Network Management (ANM)	In areas where there are multiple or complex constraints affecting one or more customers, full ANM systems will be implemented. These distributed control systems continually monitor the limits on the network and then allocate the maximum amount of capacity to customers in that area.

Commercial control

6.15 If physical control is deemed impractical, then a range of commercial controls could be possible, supported by adequate metering data or granular network monitoring data. Cost reflective time-of-use pricing or excess capacity charges might send sufficient signals if passed through by suppliers. Alternatively more robust bespoke 'penalty' signals may be possible in order to apply liability charges to fund corrective engineering works required by the DNO or to fund flexibility services provided by other customers, i.e. so the customer contributes to the costs of any problems they create. More robust approaches could also include the withdrawal of the customer's selected cheaper access option and imposition of standard default access. DNOs would not need to visit site and the DNO would incur minimum costs assuming revised charges/tariff could be simply billed to the customer's supplier.

Excess Capacity Charges (DCP161)

6.16 Excess Capacity charges were introduced from April 2018 and directed at distribution connected customers with HH settled meters. These charges seek to recover the additional costs that network companies incur when customers exceed their available and contracted capacity levels. For HH settled customers connected at low voltage and high voltage these charges are set to incentivise customers to reduce their maximum demand or agree a revised capacity commensurate with their requirements. The detailed application of these charges, including the methodology, is contained in Appendix 4. As these charges are billed by the DNO to suppliers it is uncertain whether the costs signals they provide are reflected in bills to customers.

Hierarchy of current enforcement options

6.17 The table below at figure 2 provides examples of enforcement under current arrangements.

6.18 Note at distribution, physical control equipment is used on ANM and timed flexible connections, with the equipment for timed connections owned by either the DNO or customer. Unmetered users are not considered in this table or the one below, as they are all based on trust.

Figure 2: Enforcement – Current Arrangements

Approach	Strict	Strong	Warnings	Trust
Physical	DNOs: Control equipment disconnects for breach. Hard wired. Alternative is - control equipment limits export or import e.g. ANM Tx: control equipment e.g. intertrip used to ensure system security	DNOs: Customer owned control equipment manages demand/export. Hard wired with the regime approved by the DNO. Where Exceedance leads to power quality or safety issues for the network or other customers the customer can face the prospect de-energisation.		
	Applicability: Network or system operator decides who this should apply to. Currently applies for some connections, where there are system safety/security requirements	*Applicability:* Network or system operator decides who this should apply to. Currently applies for some connections		
Financial			DNO monitors and for any exceedance may send warning letters. Excess capacity charges for all HH settled customers.	No additional monitoring from DNO unless electrical issues arise. DNOs: Excess capacity charges for all HH settled customers.

				Tx: Note no charges for using over capacity to date, however charges apply if a generator is out of balance (imbalance price)
			Applicability: HH settled Customers.	Applicability: Charges are current for DNOs, not at Tx
Legal	Licenced generation: Ofgem revoke generation licence	Licenced generation: Referral to Ofgem	Licenced generation: Warnings of the legal repercussions of breach	Licenced generation: Warnings of the legal repercussions of breach
	Applicability: Possible today. Only applies to licenced generation.	*Applicability:* Possible today. Only applies to licenced generation.	*Applicability:* Possible today. Only applies to licenced generation.	*Applicability*: Possible today. Only applies to licenced generation.

Hierarchy of future enforcement options

The table at Figure 3 below sets out some high level options that might apply for compliance with access choices. In practice the approach taken will depend on a range of factors including the size of the customer, any technical or safety consequences of breach (driving physical control options) and the cost of installing control equipment relative to the size of the customer. A secondary consideration would also be the type of access product a user had such as one access product e.g. time profiled or multiple e.g. time-profiled and shared although this is unlikely to make a significant difference compared to the previous list. Some options are already used for different types of connections/ customers.

Figure 3: Enforcement – Future Options

Approach	Strict	Strong	Warnings	Trust
Physical	Control equipment disconnects for breach. Hard wired e.g. ANM / intertrip	Customer control equipment manages demand/export. Hard wired	Customer and DNO/ESO monitors. Customer takes control actions	DNO / ESO periodically monitors and notifies customer to take control actions
	Applicability: Physical controls are currently already used for some users. The network and system operators are able to decide when physical controls are required, mainly when there are system security/safety requirements. Going forward, network and system operators may be more reliant on this type of solution, it may therefore apply to more users. At distribution, further work is required to ensure gain better understanding of when network operators can use physical controls and further work to improve consistency of application across DNOs.			

Commercial	Immediate withdrawal of cheaper access choice.	Periodic reviews leading to withdrawal of cheaper access choice and may face financial liability charges.	DNO/ ESO monitors and may face financial liability charges.	DNOs: Excess Capacity Charges with no additional; liability charges. Time of use pricing ESO: A charge could be introduced for exceeding capacity, however this would need to be in line with the focussed transmission reforms
	Applicability: Further consideration of what commercial conditions should be agreed as part of future arrangements (eg withdrawal of alternative access rights for repeated non-compliance) and who these should apply to. Further consideration required of the methodology for calculating charges that apply to users that exceed their access rights and who this applies to.			
Legal	Licenced generation: Ofgem revoke generation licence	Licenced generation: Referral to Ofgem	Licenced generation: Warnings of the legal repercussions of breach	Licenced generation: Warnings of the legal repercussions of breach
	Applicability: This option is already available today for licenced generation. Since it only applies to licenced generation, this approach is not of use to wider network users.			

7 Potential changes to monitoring and enforcement access rights

7.1 Is it recognised that when access rights are better defined there will be a need to monitor compliance of each customer within their access rights and enforce compliance of access rights for each customer. Figure 4 below describes how access compliance for each access option could be monitored.

7.2 Physical control is likely to be necessary to support time profiled access and to assist customers to comply with this access choice, including physical separation of controllable loads from other loads. On 2nd August 2019 the Department for the Business, Energy and Industrial Strategy (BEIS) published a consultation on the government's proposal to add proportional load control functionality to the Smart Metering System. This relatively small and incremental change will build on existing Auxiliary Load Control Switch (ALCS) and Home Area Network (HAN) Connected Auxiliary Load Control Switch (HCALCS) functionality to enable more precision and flexibility in the control of load on behalf of consumers than is currently possible. This is intended for use in effective management of significant loads such as electric heating systems and the smart charging

of batteries and electric vehicles. The consultation includes proposed drafting changes to the SMETS2 Technical Specification to deliver this outcome.

7.3 General point for distribution across all access categories: Consideration to be given to strengthening of existing network companies rights as contained in the NTC.

Figure 4: What would need to be monitored and how by access characteristic

Access characteristic	Option	What would need to be monitored and how? How would it be enforced?
Firmness	**Non-firm - physical drivers**	Monitoring At distribution, where ANM systems are currently being utilised, these monitor and control a set of user's access against: • Faults on the network • Post-fault running conditions • Planned outages • Capacity constraints, and • Voltage constraints. For local constraints, low-cost monitoring can be employed at the User's site (see local management schemes above). Where these schemes are employed the primary responsibility for monitoring is placed on the connected User. At transmission, where intertrips are currently being utilised, these monitor and control a user's access against: • Faults on the network • Overloads • Stability • Voltage and • Islanding Enforcement **Physical control**: At Distribution, ANM systems can be used which have the ability to autonomously send a signal to ramp up /down customer (predominantly DG) output. In circumstances where the customer fails to comply with this signal (within a predetermined period of time) the customer's breaker will be tripped and the customer taken off supply. Following such an event, the customer will be returned to service on a managed basis (to the appropriate capacity level at that time). This functionality can

		be extended to demand. For distribution connected generation, who are participating in their wider BM access, they would also be able to receive signals to ramp up/down through BM. At transmission, the balancing mechanism allows the ESO to send signals for users to ramp up/down. **Contractual**: Where the control and responsibility for monitoring is placed with the customer, there are options to provide financial penalties or remove the benefits of the reduced cost of access. De-energisation can occur at transmission and distribution where appropriate, e.g. safety, damage of network or interruptions to customer supplies.
	Non-firm - consumer outcomes	<u>Monitoring</u> Defined by: • Number of curtailments; • Aggregate time of curtailment; • Timed using windows - more static; • Through a curtailment index; and • Energy lost through curtailment. At distribution, ANM systems will monitor and report on each of the first three bullets above and rules may be applied to limit curtailment. The curtailment index approach (cap on curtailment) is currently utilised by ENWL, who gather data on each site's curtailment via a remote terminal unit (RTU) and planned outage schedules. On an annual basis each site's actual curtailment is calculated and overall average determined within a defined six year period. Where the actual curtailment exceeds the index ENWL will develop a range of options to bring curtailment back beneath the index. At transmission, systems and processes would be required to monitor the number of instances, compare this against a user's contract and prevent any further curtailment. This may also increase balancing costs if a user reaches their limits, and alternative sites may need to be turned down in their place which are financially firm. To monitor, energy lost through curtailment, the following information would be required: • Forecast output of customer; and • Duration and impact of curtailment event (enforced kVA reduction). ANM / ESO would need to capture and respond to this information. <u>Enforcement</u> **Statutory:** At distribution, consideration to be given to strengthening of existing DNO rights as contained in the NTC e.g. clauses 5, 7 and 12.

		At transmission, changes would be required to CUSC and contracts (with processes in place to define the levels that the consumer outcomes should be set at to feed into the contracts).
	Firm	At distribution, applicable in circumstances where customers have paid for firm access and are compensated for curtailment. To monitor, the network operator will be required to compile information on the number of curtailment events, their duration and impact. At transmission, the arrangements are already in place for financial firmness. **Statutory:** At distribution, consideration to be given to strengthening of existing DNO rights as contained in the NTC. At transmission, the arrangements are already in place.
Time-profiled	**Static time profiled**	<u>Monitoring</u> At distribution at the most basic level monitoring could be minimised through utilisation of existing RTS service and its future smart replacement e.g. for economy 7 to support domestic storage heating. Fairly simple load limiting devices could also be utilised with functionality to increase/reduce output/demand in predetermined time periods. Monitoring for small customers is also possible via smart metering technology (data retrieval by suppliers). Network companies do not have access to smart meter data. At transmission, data through the BM etc would be available to monitor when a transmission connected generator has exported onto the system, however processes / systems would be required to monitor this and compare against their access rights. This may be more complicated in real time compared to post-event. This would also be true for distribution connected generation, participating in wider BM access. <u>Enforcement</u> **Physical:** At most basic level enforcement could be achieved through utilisation of existing RTS or modern equivalent, e.g. remote signal provides instruction which dictates usage in given time periods. For small connections this could utilise Supplier owned smart or customer owned equipment. For larger connections this could be DNO or Supplier owned physical time-switching control equipment (with DNO approving the customer's regime. **Commercial:** Consideration should be given to appropriate addition use of system charges for exceeded capacity, specific to this access right.
	Dynamic time-profiled	<u>Monitoring</u>

		At distribution, ANM systems can/are being used for management of HV/EHV customers now. The extension of ANM to wide-scale LV application is generally considered possible but costly and would take time to implement. Consideration of alternative lower cost mechanisms (e.g. 4G) for communication provision may address this. Depending on the design of dynamic time-profiled access, the DNO would need to be able to measure and utilise other factors (e.g. wind speed, wholesale price, cloud cover) and input these it into a different kind of ANM type system. Note: Curtailment activities need to be managed by the party with proper understanding of the network, i.e. the network operator. Curtailment actions can be taken by any party in coordination with the network operator. At transmission, data through the BM etc would be available to monitor when a transmission connected generator has exported onto the system, however processes / systems would be required to monitor this and compare against their access rights. As above, this may be more complicated in real time compared to post-event, however, it would also be more complex on a dynamic basis as the data you are comparing against would be changing. This would also be true for distribution connected generation, participating in wider BM access. <u>Enforcement</u> **Physical:** At distribution, ANM systems can be used which have the ability to autonomously send a signal to ramp up /down customer (DG) output. In circumstances where the customer fails to comply with this signal (within a predetermined period of time) the customer's breaker will be tripped and the customer taken off supply. Following such an event, the customer will be returned to service on a managed basis (to agreed level). This functionality can be extended to demand. Consideration should be given to appropriate additional use of system charges for exceeded capacity, specific to this access right. At transmission, intertrips could be used if required for safety / security reasons or the BM could provide signals.
Time-limited	**Short term** *Time period: 1 to 12 months*	<u>Monitoring</u> Access rights defined in connection agreement. Time-limited connection: At end of time period, network company would disconnect customer supply. Time-limited capacity: At end of time period MIC/MEC would be reduced and enduring monitoring would follow existing procedures for monitoring of customer usage. <u>Enforcement</u> At distribution, the network company should have powers to enforce de-energisation at the end of the relevant 'time-limited' period. At transmission, the concept of limited duration TEC already exists.

	Long term *Time period: >1 year*	Monitoring Access rights defined in connection agreement. Time-limited connection: At end of time period, network company would disconnect customer supply. Time-limited capacity: At end of time period MIC/MEC would be reduced and enduring monitoring would follow existing procedures for monitoring of customer usage. Enforcement At distribution, the network company should have powers to enforce de-energisation at the end of the relevant 'time-limited' period. At transmission, the concept of limited duration TEC already exists.
Shared	**Local constraint**	Monitoring At distribution, monitoring could be managed via ANM hardware where all 'sharing' customers would require HH metering. Standard LIFO rules would be replaced by rules allocating, for example, capacity on an equal percentage basis or as otherwise agreed between the connecting parties. At transmission, all 'sharing' parties would also need to be individually metered. Processes / systems would be required to compare the meter data from all sharing parties, to compare against the shared access right to understand if it is compliant. Enforcement At distribution, ANM systems can be used which have the ability to autonomously send a signal to ramp up /down customer (predominantly DG) output. In circumstances where the customer fails to comply with this signal (within a predetermined period of time) the customer's breaker will be tripped and the customer taken off supply. Following such an event, the customer will be returned to service on a managed basis (to the appropriate capacity level at that time). This functionality can be extended to demand. At transmission, enforcement would depend on the impact on the wider system security / safety of whether an intertrip would be required or not.
	Wide area constraint	[As in local constraint]

Appendix 1: The Electricity Act

This Appendix contains relevant extracts of Section 16 and 17 of the Electricity Act.

S16 (5) (a) any reference to giving a supply of electricity includes a reference to continuing to give such a connection.

S17 Exceptions from duty to connect.
(1)Nothing in section 16(1) requires an electricity distributor to make a connection if and to the extent that—

(a) he is prevented from doing so by circumstances not within his control;
(b)circumstances exist by reason of which his doing so would or might involve his being in breach of regulations under section 29, and he has taken all such steps as it was reasonable to take both to prevent the circumstances from occurring and to prevent them from having that effect; or
(c) it is not reasonable in all the circumstances for him to be required to do so.

(2)Without prejudice to the generality of subsection (1) an electricity distributor is not required to make a connection if—

(a) making the connection involves the distributor doing something which, without the consent of another person, would require the exercise of a power conferred by any provision of Schedule 3 or 4;
(B)the distributor's licence does not provide for that provision to have effect in relation to him; and
(c) any necessary consent has not, at the time the request is made, been given.

(3)Subsection (1) (c) does not permit an electricity distributor to disconnect any premises or distribution system to which a connection is being maintained by him unless the distributor gives—
(a) where the connection is to premises, to the occupier or to the owner if the premises are not occupied;
(b) where the connection is to another distribution system, to the person who is authorised by a licence or exemption to run that system,
not less than seven working days' notice of his intention to disconnect the premises or distribution system

Appendix 2: The Distribution Code

This appendix contains relevant extracts from the Distribution Code.

DGC8 SYSTEM CONTROL
*Where a **User's System** (or part thereof) is, by agreement, under the control of the **DNO**, then for the purposes of communication and co-ordination in operational timescales the **DNO** can (for those purposes only) treat that **User's System** (or part thereof) as part of the **DNO's Distribution System** but as between the **DNO** and **Users**, it shall remain to be treated as the **User's System** (or part thereof).*
The above suggests that this provision could enable a DNO to take control actions in respect of a user's site.
DIN5.2 The DNO and all Users have a duty under this Distribution Code to provide such information and resources as are necessary to facilitate compliance with and implementation of the Distribution Code. The DNO can only plan and operate the DNO's Distribution System and provide information for the planning and operation of the National Electricity Transmission System, having regard to the requirements which Users have informed the DNO they wish to make of the DNO's Distribution System. The DNO must be able to rely upon the information which Users have supplied to it and will not be held responsible for any consequences which arise from its reasonable and prudent actions on the basis of such information supplied by any User or Users.
The above suggests that this provision provides the right for a DNO to have visibility of any proposed trades.
DOC5.5 Procedure Related to Connection Point Parameters
This section relates to the DNO setting parameters e.g. MIC/MEC and Access conditions with the right to monitor compliance against those parameters.
DOC5.5.1 The DNO from time to time will monitor the effect of the User on the DNO's Distribution System.
DOC5.5.2 The monitoring will normally be related to amount of Active Power and Reactive Power transferred across the Connection Point.
This above sets out the right for a DNO to monitor usage against agreed parameters.
DOC5.5.3 Where the User is exporting to or importing from the DNO's Distribution System Active Power and Reactive Power in excess of the parameters in the Connection Agreement the DNO will inform the User and where appropriate demonstrate the results of such monitoring.
DOC5.5.4 The User may request technical information on the method of monitoring and, if necessary, request another method reasonably acceptable to the DNO.
This above is a starting point for compliance communications.
DOC5.5.5 Where the User is operating outside the specified parameters, the User will immediately restrict the Active Power and Reactive Power transfers to within the specified parameters.
DOC5.5.6 Where the User requires increased Active Power and Reactive Power in excess of the physical capacity of the Connection Point the User will restrict power transfers to those specified in the Connection Agreement until a modified Connection Agreement has been applied for from the DNO and physically established.
The above places responsibilities on the user to take corrective actions, but no clear enforcement rights for the DNO.

Appendix 3: The National Terms of Connection (NTC)

This appendix contains relevant extracts from the NTC

The part highlighted in clause 7 below (in yellow) creates enforcement rights for the DNO if 'industry arrangements' include section 17(1) c of the Act. Section 16 of the NTC binds Ct metered customers in to compliance with the Distribution Code.

*7. **Cutting off the supply**. We may cut off the flow of electricity through the connection where we are entitled to do so under the general law. We may also cut off the flow of electricity where we are required to do so under a contract with an electricity supplier or because of the electricity industry arrangements under which we operate in accordance with our licence.*

SECTION 3
Note: This Section 3 only applies to connections with 'C/T metering' or connections to unlicensed distribution systems that do not have their own settlement meters at the boundary with the network but would most likely be metered with C/T metering if they were metered

4. THE CUSTOMER'S RIGHT TO BE (AND REMAIN) ENERGISED
The Customer's right to be (and remain) Energised is subject to the Company's right to De-energise the Connection Point in accordance with Clause 5, and is conditional upon:
4.1.1 the Customer having the ability to perform and comply with all of its obligations under this Agreement;
The above 4.1.1 may be helpful if connection agreements or a future revision of the NTC around Access included a provision that any customer who contracts for a specific access product must have the ability to perform and comply with the agreed Access conditions. E.g. customers own time-switching managing time profiled access

5. DE-ENERGISATION

Note: The following clauses 5.1.1 and 5.1.2 appear less useful for compliance purposes as there appears to be a requirement for a safety case. Clause s 5.3, 5.4, and 5.612 appear to be more useful for compliance purposes.

Emergency De-energisation

If, in the reasonable opinion of:

5.1.1 the Company, the condition or manner of operation of the Customer's Installation or other equipment, and/or the condition or manner of operation of the Distribution System, poses an immediate threat of injury or material damage to any person or property (including the Customer's Installation, the Distribution System, the National Electricity Transmission System, and the electrical systems and installations connected (directly or indirectly) to the Distribution System and/or the National Electricity Transmission System), then the Company shall have the right to immediately De-energise the Connection Point if it is necessary or expedient to do so to avoid the occurrence of such injury or damage; or
5.1.2 the Customer, the condition or manner of operation of the Distribution System or the Connection Equipment poses an immediate threat of injury or material damage to any person or property (including the Customer's Installation), then the Customer shall have the right with the prior agreement of the Company to De-energise the Customer's Installation if it is necessary or expedient to do so to avoid the occurrence of such injury or damage.
<u>De-energisation Generally</u>
5.3 Where the circumstances referred to in Clause 5.1.1 exist but with the proviso that the threat is not immediate, the Company may nevertheless De-energise the Connection Point, in which case the Company shall give the Customer as much advance notice of the De-energisation as is reasonably practicable in the circumstances.

5.4 The Company may De-energise the Connection Point pursuant to the Regulations, in which case the De-energisation shall be undertaken in accordance with any applicable requirements under the Regulations.
5.6 The Company may, at any time without the need to give prior notice to the Customer, De-energise the Connection Point if:
5.6.1 the Company is instructed or required to do so pursuant to the Act, its Electricity Distribution Licence, any Directive, the CUSC, the BSC, the DCUSA and/or the Electricity Supply Emergency Code (being the code of that name designated by the Secretary of State);
5.6.2 the Company reasonably considers it necessary to do so for safety reasons or for the security of the Distribution System or any other electrical system (including in order to avoid interference with the regularity or efficiency of the Distribution System);
5.6.3 the Company reasonably believes that the Customer has made unauthorised use of electricity or committed theft of electricity;
5.6.4 if any of the conditions in Clause 4.1 cease to be satisfied, or the Customer breaches any of the provisions of this Agreement (including Clauses 10, 12.3, 13 and 16);
5.6.5 the Customer's acts, omissions and/or continued Connection cause the Company to breach this Agreement or any law or Directive;
5.6.6 the Company is entitled to De-energise the Connection Point in accordance with any other connection agreement relating to that Connection Point (provided the Company acts reasonably in exercising such right); and/or the Company is otherwise permitted to do so under the provisions of this Agreement (including under Clause 7.5).

12. LIMITATION OF CAPACITY

Note: This clause 12 is comprehensive in setting out a process, but appears to lack teeth in terms of driving prompt compliance. The DCode appears tougher in terms of immediacy in respect of exceeding capacity.

The Company shall only be obliged to allow the import of electricity from, and/or the export of electricity to, the Distribution System through the Connection Point at levels equal to or below the Maximum Import Capacity and/or the Maximum Export Capacity (respectively).
Subject to the other provisions of this Agreement, the Company shall use reasonable endeavours to:
12.2.1 ensure that the Maximum Import Capacity and the Maximum Export Capacity is available at the Connection Point at all times during the period of this Agreement; and
12.2.2 maintain the connection characteristics at the Connection Point.
Exceeding Capacities
12.3 The Customer shall ensure that the import of electricity from, and/or the export of electricity to, the Distribution System through the Connection Point does not (at any time) exceed the Maximum Import Capacity and/or the Maximum Export Capacity (respectively). Where the Customer is unsure of the Maximum Import Capacity and/or the Maximum Export Capacity, it shall contact the Company (and the Company will inform the Customer of the applicable capacities).
12.4 on each occasion that the Customer breaches Clause 12.3 (and without prejudice to the Company's other rights and remedies, including under Clause 5), the Company may serve a written notice on the Customer specifying the circumstances of the breach and the courses of action available to the Customer under Clauses 12.5.1 to 12.5.3.
12.5 The Customer shall, on receipt of such a written notice (or, where the Customer disputes the content of the notice in accordance with Clause 12.6, following resolution of such dispute in favour of the Company), take the necessary actions to reduce the import and/or export of electricity to within the Maximum Import Capacity and/or the Maximum Export Capacity within the period of time specified in the notice; and within
30 Working Days after such notice or resolution:
12.5.1 propose a variation to the Maximum Import Capacity and/or the Maximum Export Capacity in accordance with Clause 12.12; or
12.5.2 provide the Company with an explanation as to why the Customer does not wish to submit a variation at this time; or.
12.5.3 propose to the Company an alternative timescale for the Customer to take one of the courses of action referred to in Clause 12.5.1 or Clause 12.5.2, such timescale to be subject to the Company's approval (such approval not to be unreasonably withheld or delayed); or

12.5.4 propose that an alternative connection agreement is entered into pursuant to Clause 22.2.
12.6 If the Customer disputes the Maximum Import Capacity and/or Maximum Export Capacity (as applicable) specified in the notice given by the Company under Clause 12.4 (or otherwise disputes that a breach of Clause 12.3 has occurred), the Customer and the Company shall attempt to resolve the dispute in good faith. Where the dispute remains unresolved after 20 Working Days, the provisions of Clause 21 shall apply.
12.7 Without prejudice to the Company's other rights and remedies, including under Clause 5), where the Customer:
12.7.1 fails to reduce the import and/or export of electricity to within the Maximum Import Capacity and/or the Maximum Export Capacity in accordance with Clause 12.5; or
12.7.2 proposes a variation pursuant to Clause 12.5.1, but no variation is agreed within a reasonable period thereafter (save where the variation has been referred to the Authority and pending determination by the Authority); or
12.7.3 provides an explanation referred to in Clause 12.5.2, but the Customer continually or repeatedly breaches Clause 12.3; or
12.7.4 proposes an alternative timescale pursuant to Clause 12.5.3, but that timescale is rejected by the Company (acting reasonably) or the Customer fails to comply with the alternative timescale, then Clause 12.8 shall apply.
12.8 Where this Clause 12.8 applies (as described in Clause 12.7), then the Company shall be entitled to:
12.8.1 propose a variation to the Maximum Import Capacity and/or the Maximum Export Capacity (as applicable) in accordance with Clause 12.12; or
12.8.2 provide the Customer with a Modification Offer as if the Customer had submitted an Application for a Modification requesting a Modification incorporating an increase in the Maximum Import Capacity and/or the Maximum Export Capacity (as applicable).
12.9 Not used
12.10 Where a variation or Modification Offer under Clause 12.8 has not been accepted in accordance with its terms (save where such variation or Modification Offer has been referred to the Authority and pending determination by the Authority), then the Company may install additional equipment at the Connection Point designed to limit the import and/or export of electricity from or to the Distribution System to an amount equal to the Maximum Import Capacity and/or the Maximum Export Capacity (as applicable).
12.11 Provided (and to the extent) the installation of additional equipment in accordance with Clause 12.10 is reasonably necessary to prevent danger or interference with the Distribution System or to avoid costs being borne by the Company or another customer in the case of future breaches of Clause 12.3, the Customer shall pay to the Company forthwith upon demand an amount equal to the reasonable costs and expenses incurred by the Company in installing and maintaining such equipment.

16. DISTRIBUTION CODE
16.1 Each Party undertakes to comply with all the provisions of the Distribution Code applicable to it.
16.2 In the event of any conflict between this Agreement and the Distribution Code, the Distribution Code shall prevail

Appendix 4: Excess Capacity Charges (DCP161) (Distribution)

Introduced from April 2018 and directed at distribution connected customers with half-hourly settled meters Excess capacity charges seek to recover the additional costs that network companies incur when customers exceed their available and contracted capacity levels. . Use of system charges for HH customers who exceed their agreed capacity include excess capacity charges using the maximum demand data; for customers connected at low voltage and high voltage the excess capacity charges are set at a higher rate than standard capacity charges. Capacity charges for customers connected at EHV apply at the same rate and there is no differential for maximum demands recorded above the agreed capacity.

Additional charges for the excess amount introduced which over and above the standard rate. The applicable rates will vary by region and voltage. Exceeded capacity charges are contained within the distribution network companies' Use of System Charging Statements.
https://www.scottishpower.com/userfiles/file/LC14_Statement_2019_SPD_SoLR_adjustment.pdf

The following basis of calculation to exceeded capacities is applied:

"Exceeded capacity
2.41. Where a Customer takes additional unauthorised capacity over and above the MIC/MEC, the excess will be classed as exceeded capacity. The exceeded portion of the capacity will be charged at the excess capacity charge p/kVA/day rate, based on the difference between the MIC/MEC and the actual capacity used. This will be charged for the full duration of the billing period in which the breach occurs.

Demand exceeded capacity

$$\text{Demand exceeded capacity} = \max(2 \times \sqrt{AI^2 + \max(RI, RE)^2} - MIC, 0)$$

Where:
AI = Active import (kWh)
RI = Reactive import (kVArh)
RE = Reactive export (kVArh)
MIC = Maximum import capacity (kVA)
2.42. Only reactive import and reactive export values occurring at times of active import are used in the calculation. Where data for two or more MPANs is aggregated for billing purposes the HH consumption values are summated prior to the calculation above.

2.43. This calculation is completed for every half hour and the maximum value from the billing period is applied.

Generation exceeded capacity

$$\text{Generation exceeded capacity} = \max(2 \times \sqrt{AE^2 + \max(RI, RE)^2} - MEC, 0)$$

Where:
AE = Active export (kWh)
RI = Reactive import (kVArh)
RE = Reactive export (kVArh)
MEC = Maximum export capacity (kVA)
2.44. Only reactive import and reactive export values occurring at times of active export are used in the calculation. Where data for two or more MPANs is aggregated for billing purposes the HH consumption values occurring at times of kWh export are summated prior to the calculation above.

2.45. This calculation is completed for every half hour and the maximum value from the billing period is applied.

Appendix 5: Flexible connection descriptions

1. TIMED CAPACITY CONNECTIONS
   This solution offers a connection with a fixed level of Curtailment.
   Some areas of the network have predictable load and generation profiles which enables adequate determination of when limitations will occur at design time. Connections will be given an operating schedule which will define the times and levels of capacity available to them.

   This connection is suitable for connection capacities under 0.5 MVA and connecting at 11 kV or less. It provides a reasonable balance between facilitating connections and reserving network capacity for individual customers. More optimal usage should be made of network capacity at higher voltage levels and therefore Timed Capacity Connections at 33kV and above should be avoided.

   In general, this constraint management is not expected to require communications. Ongoing enforcement of the Curtailment will be undertaken from the standard metering flows. Any breaches will result in the timed connection being withdrawn or further remote control being installed at the customer's cost.

2. EXPORT LIMITING DEVICES
   Customers who are seeking to increase the amount of generation installed to offset their import requirements (in circumstances where an increase in generation export capacity would require costly or time-bound upstream reinforcement) may choose to restrict the net export of their connection rather than wait for or contribute to the reinforcement.

   An Export Limiting Device measures the Apparent Power at the exit point of the installation and uses this information to either restrict generation output and/or balance the customer Demand in order to prevent the Agreed Export Capacity from being exceeded.

   The risk to the security of supply for existing customers is managed by ensuring compliance with technical requirements and by placing limits on the generation capacity installed, which reduces both the likelihood and effect of equipment failure.

   Export Limiting Devices are suitable for all capacities and voltage levels to reduce an Embedded Generator’s contribution to thermal or voltage infringements on the distribution network.

3. LOCAL MANAGEMENT SCHEMES
   Some networks are constrained due to local issues which can be identified and managed by low-cost monitoring from the protection panel at the User's site.

   By monitoring the feeder voltages and power flows at the User's site, or possibly the Point of Common Coupling, the constraint can be monitored and appropriate control actions taken.

   Capacity can be released when these limits or assets are within normal operating parameters. When there is no capacity available, the generation output will be reduced (possibly to zero) until the network is operating within limits.

4. REMOTE INTERTRIP SCHEMES
   Some networks are constrained due to a single upstream asset (i.e. a single limit being infringed under certain conditions). Through monitoring these conditions, capacity can be released when these limits or assets are within normal operating parameters. When there is no capacity available, the connection will be curtailed to a predefined limit, which may be zero.

   For interconnected networks, Remote Intertrip schemes should generally be avoided as they can become complex to implement and introduce difficulties in the future development of the network.

5. ACTIVE NETWORK MANAGEMENT

In areas where there are multiple or complex constraints affecting one or more customers, full Active Network Management systems will be implemented. These distributed control systems continually monitor the limits on the network and then allocate the maximum amount of capacity to customers in that area. Examples include:

- ANM Customer Substation: These are schemes which use an ANM controller to send Curtailment signals based only on the voltage and current measurements at a single substation

- ANM Circuit Schemes: These are ANM schemes which manage a limited number of customers and are managed at an HV circuit or Secondary Substation level

- ANM Zones: These are more complex ANM systems which manage areas of network supplied at Primary or Grid substation level and may encompass multiple substations.

Active Network Management schemes operate in real-time and monitor inputs, outputs, network flows and voltages at key points within the controlled zone. If the network is approaching limits, the ANM controller instructs actions to be taken. These could be changes in network topology or changes in the power into or out of the network, depending upon the characteristics of the particular system.

ANM schemes to maintain fault energy within equipment limits are presently under consideration / development.

Appendix 6: additional material if needed

Standby capacity for additional security on site
2.46. Where standby capacity charges are applied, the charge will be set at the same rate as that applied to normal MIC. Should a Customer's request for additional security of supply require the provision of capacity from two different sources, we reserve the right to charge for the capacity held at each source.

Minimum capacity levels
2.47. There is no minimum capacity threshold.

Application of charges for excess reactive power
2.48. When an individual HH metered MPAN's reactive power (measured in kVArh) at LV and HV Designated Properties exceeds 33% of its total active power (measured in kWh), excess reactive power charges will apply. This threshold is equivalent to an average power factor of 0.95 during the period. Any reactive units in excess of the 33% threshold are charged at the rate appropriate to the particular charge."