Charging Futures
Reforming electricity charging together
Access Task Force

Charging Futures
Reforming electricity charging together
Forward Looking Charges Task Force

Electricity Network Access & Forward Looking Charges: Initial Options for Change

A Paper by the Charging Futures Access & Forward Looking Charges Task Forces

February 2018

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Contents

Introduction & Background

i. This is the first joint paper of the Access and Forward Looking Charges Task Forces established under Ofgem's Charging Futures Forum[1].

ii. In July 2017 Ofgem announced plans to establish the Charging Futures Forum to provide direction to ongoing charging reviews and to develop an integrated work programme for these and other elements of Ofgem's work.

iii. This paper builds on the discussion paper published by Ofgem in November 2017 *"Reform of electricity network access and forward-looking charges: a working paper"*[2] that highlights the need to review the current regulatory framework in response to the rapidly changing energy system, including the transition to a future smart flexible energy system. Specifically, the working paper identified the need to ensure that as this transition progresses that the regulatory framework remains fit for purpose. This includes ensuring that network capacity is allocated and used in a way that minimises overall costs to consumers, part of which is providing network users with better signals about the costs and benefits they confer on the network at a given time or location. As a first step in delivering these objectives the discussion paper points to the need to identify issues and key regulatory 'gaps' in these areas that may need to be addressed.

iv. The overall purpose of this paper is therefore to inform Ofgem's assessment of the issues with the current network access and charging arrangements. In preparing it the Task Forces have sought to identify and outline potential options for change that may have the potential to address identified issues. It should be noted that the options set out in this paper should not be considered as exhaustive and it is recognised that other options exist that may or may not have different benefits, advantages or disadvantages to those described in this paper.

Charging Futures Forum

v. The Forum is chaired by Ofgem and is open to network users, network operators and energy consumers and/or their representatives. The Forum will have a central role in keeping stakeholders up-to-date on developing network charging reform and give them the opportunity to influence works being undertaken. The Forum will:

- enable stakeholders to provide policy input and technical expertise for policy developments which are in the scope of the arrangements;
- keep stakeholders informed about progress of the various work areas; and
- set up Task Forces to develop and evaluate potential options for change.

vi. Further information on the Forum, the Task Forces and work being undertaken can be found at http://www.chargingfutures.com/. This includes a number of working papers produced during the development of this paper that provide a useful information resource for stakeholders.

[1] For further information about the Charging Futures Forum and its Task Forces see http://www.chargingfutures.com/

[2] https://www.ofgem.gov.uk/publications-and-updates/reform-electricity-network-access-and-forward-looking-charges-working-paper

Charging Futures Task Forces

vii. Alongside the Forum, two Task Forces (the Access Task Force and Forward Looking Charges Task Force) have been established to assist in the policy development process. The objectives of these Task Forces are to consider what changes should be taken forward, in each policy area, in order to drive benefits to consumers through supporting more efficient use and development of network capacity. The Task Forces' work will be informed by Ofgem's working paper and will assess identified issues in detail, develop solutions and agree conclusions based on robust evidence and analysis.

viii. The Access Task Force will consider the options to define more explicitly the arrangements for user access to the GB electricity system (transmission and distribution). The Forward Looking Charges Task Force will consider the options for the improvement of the 'forward looking' elements of network charging, i.e. those elements that provide a signal to users about how their behaviours can increase or reduce future costs on the network and as a result the charges they receive.

ix. The outputs from the Task Forces will input into Ofgem's consultation in the summer 2018 on initial proposals for reform. The terms of reference for the Task Forces together with their membership can be found at http://www.chargingfutures.com/media/1108/final-cff-tf-tor_12jan18.pdf

Task Force Outputs

Deliverable	Dates
Produce a document identifying the initial options agreed for further assessment	December 2017/January 2018
Produce a document assessing each of the initial options, based on the agreed assessment criteria	February/March 2018
Produce a report outlining the TF's conclusions on what changes should be taken forward for further consideration	April/May 2018

x. This joint paper by the Access and Forward Looking Charges Task Forces constitutes the first of those outputs and considers initial options for change. The paper builds on and compliments Ofgem's working paper on the reform of network access and forward-looking charges and the issues and options for reform identified within it. These include how capacity might be allocated and reallocated and where cross-system changes to the charging methods could be beneficial.

Scope and Objectives

xi. The purpose of this paper is to inform Ofgem's assessment of the issues with the current network access and the forward looking elements only of charging arrangements. In preparing it the Task Forces have sought to identify and outline potential options for change that may have the potential to address identified issues. It should be noted that the options set out in this paper should not be considered as exhaustive and it is recognised that other options exist that may or may not have different benefits, advantages or disadvantages to those described in this paper.

Next Steps

xii. This paper constitutes part of the wider consultative process in taking forward initiatives under, and meeting the aims of, the Charging Futures Forum. Stakeholders are therefore encouraged to engage through the Forum and provide feedback on the options set out here. We would particularly welcome suggestions for additional options and/or the identification of gaps and areas where further analysis should be carried out.

xiii. Going forward the Task Force will look for opportunities to identify further options in addition to those set out in this paper and to undertake an assessment of the detailed options using a set of agreed assessment criteria. The Task Forces will report on the findings and conclusions of this assessment in March with a view to producing a final report and recommendations by April/May 2018.

xiv. This paper is structured as follows:

Part 1: 'Access' considers a number of aspects of users' access to the GB electricity system, specifically:

> **Section1: 'Access Options'** describes some of the building blocks which can be used in determining and defining different access options for customers;
>
> **Section 2: 'Initial Allocation of Access'** considers various approaches for the initial allocation of access rights to system users, including the desirable features of any approach;
>
> **Section 3: 'Options for Re-allocation and Trading of Access Rights'** explores the relationship between the arrangements for re-allocation of access rights and options for their definition and initial allocation, and sets out a number of options for the reallocation and trading of access rights.

Part 2: 'Forward Looking Charges' considers options relevant to the application of forward looking signals through charging arrangements, specifically:

> **Section 1: 'Locational and Temporal Signals'** considers options for the structure of forward looking charges to provide signals to users about their behaviours and impact on future network costs;
>
> **Section 2: 'Calculation of signal'** sets a number of factors that might be taken into account in the design of approaches for giving network users locational and/or temporal signal in order to influence their behaviours.
>
> **Section 3: 'Structure of Charges'** sets out a series of options for the structure of forward looking charges.

Conclusions and Next Steps captures progress to date and sets out the Task Forces' recommended assessment criteria for the evaluation of access and charging options for stage two of the work programme.

The Task Forces recommend the adoption of the following assessment criteria that have been informed by the desirable characteristics for access and forward-looking charging arrangements identified by Ofgem in its working paper:

Arrangements should:

1. efficiently meet the essential service requirements of network users;
2. optimise capacity allocation;
3. ensure that price signals reflect the incremental future network costs and benefits that can be allocated to and influenced by the actions of network users;
4. provide a level playing field for all network users;
5. provide effective network user price signals, i.e. price signals which can be reasonably anticipated by a user with sufficient confidence to allow them to take action;
6. appropriately allocate risk between individual network users and the wider body of users
7. support efficient network development;
8. be practical;
9. be proportionate.

Further information about the Charging Futures Forum and its Task Forces including how stakeholders can engage with the Forum can be found at http://chargingfutures.com/

Part One: Access

Section 1: Access Options

Summary

1.0 In paragraph 2.11 of its working paper, Ofgem identified access as being *"what network capacity a user has had allocated to them by a system operator in order to be able to either import or export electricity from their target market"*. The Task Force will build upon Ofgem's initial work, giving consideration to how existing arrangements might be improved for customers wishing to access the wider network. We start this process by identifying some initial options for change.

1.1 Access arrangements at transmission voltages are governed by the Connection and Use of System Agreement (CUSC) and are defined in bilateral connection agreements. Users connected to the National Electricity Transmission System (NETS) must have a connection agreement in place with the GB System Operator. The connection agreements establish the rights to be connected to and use the NETS under the CUSC.

1.2 At distribution voltages, access arrangements, in terms of connection and use of system, are derived through the Electricity Act and the Distribution Connection & Use of System Agreement (DCUSA). The DCUSA sets out the National Terms of Connection, which provide the terms and conditions upon which the network operator will maintain the connection of the premises to the Distribution Network Operator.

The Building Blocks

1.3 This section describes some of the building blocks which could be used in determining and defining future access rights for different customers. This section does not define how the charges associated with those rights should be determined but does, in some instances, provide different options for how those charges (or benefits) may be levied. The building blocks considered in this section are:

- Depth of Access;
- Lifespan of Access;
- Firmness of Access;
- Time of Use/Seasonal Access; and
- Volumetric Access.

1.4 It is possible that some of these building blocks can co-exist and are not, necessarily, mutually exclusive. Below we outline some options for combining building blocks and how the segmentation of user groups might be overlaid to produce more targeted access options. This includes thee potential options for combining building blocks to develop access products for domestic customers. It is noted however some of the options for larger demand and generation customers may apply equally to domestic customers. Note that these building blocks are only exhaustive insofar as they that have been discussed and defined by the Access Task Force. There may be further building blocks or combinations of these that can be considered.

Depth of Access

1.5 One of the building blocks for determining access is the depth of the access that a party may require. Some parties, for instance, may only require access from their connection voltage up to the Grid Supply Point (GSP) or down to LV (for example a generator connected at EHV in a GSP that always has net demand may only wish to have access at EHV, HV and LV). Where parties only require access to certain voltage tiers then these voltage tiers can be used as building blocks to define their access.

1.6 It may be reasonable that, where parties require a limited depth of access onto the network, they only pay for the tiers which they use. In order to use this element of access as a building block for defining access rights, a value associated with the cost of each network tier would need to be derived.

1.7 There are further considerations which will be required in order to fully assess the feasibility of this option as a building block for defining access rights:

- Providing access to the wholesale energy market to trade energy.
- "Enforcing" depth of access.
- Use of wider assets outside of the defined depth of access for voltage control and stability.

Lifespan of Access

1.8 Some customers may require access to networks over differing timescales. In this case, the lifespan of access rights can be used as a way to build and define those users' access rights. The timeframe and lifespan of the required access is likely to drive different connection solutions and may bring about different costs on the network. This building block can be put into defined time bands (for example less than 5 years, 5-20 years and greater than 20 years) or they can be determined on a bespoke basis at the time of connection/initial allocation of capacity rights.

1.9 There are some points which will need further consideration in defining the costs that will be imposed on the electricity network in respect of the lifespan of access rights. These include:

- Treatment of stranded assets in non-constrained areas;
- Value of access in constrained areas; and
- How to charge for this building block of access (e.g. use of system or connection charging).

Firmness of Access Rights

1.10 A fundamental building block for determining access will be the firmness of that access. Ofgem considers that this piece of work, paragraph 2.14 to 2.16 of its working paper, is looking primarily at the flexibility of capacity and the firmness of access rights.

1.11 Firmness i.e. whether something is firm, or un-firm is used in the context of both demand and export to describe a number of different things. Firmness is used to differentiate between a customer's connection to a distribution network that remains available in a first fault scenario and

those that do not. Single circuit connections are a clear example of an un-firm connection whereby the connection becomes unavailable after a fault and remains unavailable for the duration of the fault repair. As some networks become constrained the term un-firm has also been used to describe situations where the local network is not fully available to be used by the customer and may be limited under some circumstances for example, to place a limit on the customer's capacity level under certain network conditions or limits time of use. In addition, firmness has been used in the context of commercially firm access to the transmission system. Simply using the terms firm and un-firm may no longer be adequate to provide the level of clarity required by customers in reformed access arrangements.

1.12 The need for upstream reinforcement may result in limitations to access. Some customers may opt to have their network access curtailed at certain times by the network company, thus avoiding reinforcement costs and expediting the timescales for getting connected. Existing examples of such arrangements include active network management, intertrips and local management schemes. Customers may have the opportunity to agree, for a given connection, a total access capacity which is made up of an element that is firm and the remainder, non-firm. Where a customer has firm and/or non-firm access they are likely to have this access agreed in capacity terms (kW or kVA).

1.13 The firmness of the physical connection is not widely considered in this paper although it is possible to consider that the firm capacity for some connections may be as little as 0kVA.

1.14 It is possible for a network operator and the customer to enter into site-specific agreements which may determine a different mechanism for the purposes of compensation payments to the customer. This could be, for example, a fixed price per instance that a customer is turned off (or down).

1.15 One point that has not fully been considered in this paper, but should be considered further in allocating, and particularly re-allocating, access rights is the ability of sharing firm (and non-firm access rights). Examples could be different generating technologies sharing export capacity to generate at different times of the day or houses in a street sharing access to charge their electric vehicles at different times of the day. This concept is touched on in Section 3 of this paper, "Options for medium/long-term re-allocation and trading" of access rights.

Time of Use/Seasonal Access rights

1.16 In addition to differing lifespans of access, access rights could also vary according to time of use, ranging from over a day to over seasonal periods throughout the year. For example, a customer

could secure a 15-year contract to access the network and also agree that for each year of that contract, they will be curtailed at certain times of the day or seasons of the year.

1.17 The options taken forward for the time of use signal sent by access charges could include a number of desirable features:

- Where shifting time of use negates the need for reinforcement, this should have explicit value to the user;
- Conversely, where greater access is required and creates reinforcement, users triggering the requirement should bear at least some of the cost;
- In both cases, the choice of access over a day or longer period should have a clear financial value so that users can effectively incorporate it into their investment decisions.

1.18 There are a number of options by which this time of use signal could be implemented including:

- Connection Charging – Analogous to the network company being able to reduce the customer's access capacity during constrained network periods via curtailing their connection, this option would allow the customer to request a lower capacity at the time of system peak, benefiting from a reduced connection charge as a result by negating the need for reinforcement.

- Varying capacity charge for time bands – Customers would be charged for capacity of access by varying levels during different times of day/year. This would reflect the costs incurred for providing customers access at those periods. Under this option customers would be able to vary their maximum capacity available throughout the day/year and therefore would be able to benefit from lower charges if they can shift their access requirements away from time of system peak.

1.19 Whichever option is taken for implementation, there is a significant range of granularity that could be chosen for the time of use signal. For example, the time band could be as granular as explicit half hourly access or it could be much less granular through using the existing approach at distribution level with Red, Amber and Green time bands. How time bands are set should reflect the benefits of customers moving the capacity away from system peak.

1.20 Furthermore, hybrid approaches could be developed to combine time bands and seasonal bands in order to best reflect network requirements. Further work would be required in order to determine the benefits of such different options for time of use access blocks.

1.21 The possibility for time of use and seasonal time of use access should be considered in conjunction with all the other options for access charging at various stages. It is likely that time of use access can be overlaid onto any of the other options and would allow for a more dynamic and user-led approach to network capacity and access management by sending clear and relevant pricing signals to those customers.

Volumetric Access Rights

1.22 The Ofgem working paper explicitly indicates that access to capacity is the driver of the work being undertaken. It is important, however, to consider if volumetric access can be a reasonable proxy for capacity.

1.23 Volume could act as a building block for access as customers could purchase a certain amount of access from the network companies based on the volume of energy they require to be imported or exported. This volume access may be unlimited, refined to specific times of day or could have a limited lifespan (e.g. over a year or other period). For example, use up to a certain kWh during a specific period could be charged at a given rate for access, above this to a second kWh threshold charged at an increased rate and so on.

The Fusion of Building Blocks

1.24 As highlighted above, the following sets out the Task Force's initial considerations on how fusions of building blocks could be used to develop products more tailored to the needs of particular customers or customer groups.

Inter-Network Access rights

1.25 Whilst this paper focusses on the allocation of customer (consumers, generators etc.) rights it is also important to consider, distinctly, the rights that networks have for access to other networks. This can be in the case of DNO networks connecting to the transmission system, IDNO networks connection to DNO networks or, indeed, any other form of connectivity between different networks and different network operators. The allocation of rights for import and export of electricity across boundaries should not distort or alter the market for end consumers to obtain access to any depth of the network, nor should it distort competition in the distribution, generation or supply of electricity. Some options for allocating access rights between network operators are listed below:

- No explicit allocation – Under this option the access rights between network operators are not limited or bound by explicit agreement. "Infinite" electricity can flow both ways across network boundaries; and

- Defined capacity allocation – This option ensures that the maximum capacities for import and/or export are defined in a connection agreement between the network operators. There are varying levels of how this option could work from a simple agreement of capacity to a more detailed agreement considering the time of use, firmness and other building blocks for access which may be available for end consumers.

1.26 There are options for charging for access rights on either of the above options but these options for charging will need to be considered further. It is possible that different arrangements could be in place across different types of network boundary (DNO/TO, IDNO/DNO) and that the charging arrangements which support the allocation of access rights may also be different.

Determining the user segmentation to be used when applying access options

1.27 Users of the electricity networks are diverse and are likely to require different access options to most efficiently meet their needs. Within this, it is important that user groups who less actively participate in the network have the access rights they need.

1.28 At present, access rights are applied on a highly granular basis for some users – specifically, half-hourly billed larger demand users on the distribution network and distribution- or transmission-connected generation. For these users, each will have a specific kVA capacity agreed upon connection. Smaller users who are not half-hourly metered, principally small businesses and domestic customers, are not allocated access rights to the same granularity.

1.29 In the future, it may be practical and desirable to extend the use of more granular access rights for a wider group of users. In so doing, it is important to remain technology neutral and let the bands that drive system costs determine these tiers (i.e. not let the technology types connecting drive the access tiers).

1.30 Across all users, capacity bandings could be used and if so, could be determined to develop price signals to reduce the need for reinforcement. The cost per kVA of capacity need not be consistent across each of the bandings. For example, a customer's first 'X' kVA may be charged at one rate whilst the next 'X' kVA may be charged at a different (higher or lower rate).

1.31 It will also be important to ensure that all customers, including vulnerable users, are able to efficiently secure access to the network without needing to respond to access cost pricing signals and that appropriate protections are in place. This is likely to be particularly the case for domestic customers.

1.32 At present, arrangements for domestic customers do not provide a method for distributors to determine and charge for access for domestic customers. Charges for access are notionally included in the fixed charge element of the use of system charges but this access is not defined beyond continued connection to the distribution system and energisation of that connection (subject to certain conditions).

1.33 In the future, it may be possible and desirable to give domestic customers greater choice over the level of access they require. This could be through tiered access rights such as the example below. It is assumed in this option that the access rights of customers are consistent through the day and year. **Please note all capacities provided below are hypothetical and require further consideration.**

- Standard Access – The basic level of access rights for customers that would allow for a flat maximum capacity of 5kVA demand at all times
- Medium Access – This access allows customer to draw a higher level of capacity from the network up to 10kVA
- High Access – This is the top level of access right for customers who require higher capacity of up to 20kVA.

1.34 This could be combined with allowing customers the ability to purchase additional access rights on a temporal basis on top of the tier of access that they have been granted or for which, they

are being charged. This could be on a yearly, seasonally, monthly, daily or half-hourly basis dependent on the granularity of the data available to distributors and the costs and benefits of providing such access rights.

1.35 There are also more granular option could be that domestic customers are charged different levels of access dependent on their consumption. One option could be to apply a different unit charge for tiered bands of kWh used in a given period (e.g. per month), for example: **Please note all capacities provided below are hypothetical and require further consideration.**

- 4p/kwh for the first 200kWh used in a month
- 6p/kWh for the next 200kWh used in that month
- 8p/kWh for any consumption above that

1.36 At an even more granular level and if the introduction of mandatory half-hourly settlement progresses, the cost of access during each HH period can be defined by the distributor using its charging methodology so as to provide cost reflective signals to consumers about when they should access the electricity network. This could be based on an ex post arrangement whereby domestic customers are charged based on the capacity that they have used during a period or on an ex ante basis where customers are contracted for a certain level of access during the HH periods (or red/amber/green periods) and charged according to that contracted capacity.

Section 2: Initial Allocation of Access

Summary

2.0 In the previous section some options for determining the level of access rights have been illustrated and ways of defining access have been considered. However, in order to get to the stage where customers are able to determine their access based on those building blocks the method of allocating access rights need to be considered.

Initial Allocation of Access – Desirable Features

2.1 Allocation of access should support overall system efficiency by providing a locational signal to users. The options taken forward for the locational signal sent by access charges should meet the principles that:

- Where connecting in a specific location negates the need for reinforcement, this should have an explicit, cost-reflective value to the user;
- Conversely, where connecting at that specific location creates reinforcement, users triggering this charge should bear at least some of that cost; and
- The value of connecting at different places in the network should have a clear financial value so that users can effectively incorporate it into their investment decisions.

2.2 The features above are explored further in Part 2 below regarding Forward Looking Charges, however the options considered for Access Rights must facilitate a charging methodology that achieves these features.

2.3 Each of these categories, as has been stated, assumes that there will be an inherently different method of allocating and contracting for access rights in the future. Below are listed some methods which could be used to determine the initial allocation of rights for, as a minimum, new customers.

Charges for Access Rights

2.4 An important consideration for all options below is how customers will be charged for their Access Rights. For example, this could be either:

- Charges up-front either at time of connection or at time of initial allocation that secure the allocated Access Rights for the defined duration. This could include costs of physical assets required to deliver the Access Rights (as per current approach to Connection charges).
- Use of system charges are levied to secure Access Rights on an ongoing basis.

This topic is not explored further at this stage, however this will be a key consideration in evaluating options in the next phase of this project.

Options for the allocation of Access Rights

2.5 Existing rights of customers are determined initially through their connection agreements. Broadly there are a number of ways that new capacity can be allocated:

i. **First come, first served:** Under this method of allocating rights, a customer who contracts for an access right will be allocated that access right in accordance with their application. They, implicitly, retain that access right until such time as it is surrendered by them.

ii. **Connect and Manage:** Mechanism allows generators to connect without the need for wider reinforcements taking place. This has the advantage of speeding up access to the market, when compared to the case if a first come, first served mechanism was used. However, the connect and manage approach has the potential to increase associated constraint costs behind some boundaries.

iii. **Auctions:** An auction mechanism could be used for both the allocation of existing rights (stress testing that those which currently hold rights value them appropriately when compared to potential new entrants), and for the allocation of new rights. The allocation of new rights would also help provide an investment signal for networks. There are many options for how an auction process may be implemented for allocating Access Rights for electricity networks, some of the considerations are covered in more detail below.

iv. **"Purchase" of off-the-shelf access products:** Customers are able to purchase pre-defined access products based either on simple maximum demand requirements or more complex access arrangements such as Time of Use access or Flexible access (for example smart charging of EVs at a domestic level). The cost associated with access would be reflective of the impact on the network

v. **Shared/Matched Access rights:** Access Rights could be allocated to be shared between multiple parties where they can demonstrate that there are synergies regarding their network impact. For example, they may have demand profiles that peak at different times of day or are able to match demand and generation locally on the network. This would make efficient use of network resources and allow these parties to share the charges associated with the Access Rights.

There are a number of options for this initial allocation including:

- The existing or an amended queue system for connection agreements and access capacity;
- Auctions for connection agreements and access capacity.

Key considerations for the Design of a Capacity Auction

2.6 There is a magnitude of sub options and requirements that would need to be considered in detail in order to run an auction system for allocating capacity rights. These issues and considerations are introduced below and will be considered further in the next phase of work that the Task Force undertakes.

The objectives for the auctioning of capacity should consider the following:

- Provision of a mechanism that allows parties to signal both the volume of access rights they require and the price they are prepared to pay.
- Process that allows baseline and incremental capacity to be allocated in a consistent way. Through the TAR process the following elements were identified as being critical building blocks to be considered when designing an auction process that is suitable for the allocation of capacity rights. A high level description of each of these building blocks is provided below:

a) Network Analysis: An auction design must include some form of network model that ensures that any rights allocated can be delivered by the associated network. A balance needs to be struck between the accuracy of any supporting network modelling and the transparency of the results that can be given to the auction participants on a dynamic basis.

b) Static / Dynamic auctions: In a static auction there is only one round of bidding, leading to a more simplistic process to administer, but with no opportunity to refine bids. In a dynamic auction there are multiple rounds of bidding, allowing bids to be revised, dependent on the information revealed in previous rounds.

c) Auction Products: The allocation of access through an auction mechanism, will only be efficient if the temporal aspects of any firm capacity product sold, are carefully defined. For example consideration needs to be given as to what the right structure for specific tranches of access, e.g. annual, weekly, within day, daily peaks, seasonal etc.

d) Baseline and incremental capacity: The design of an initial auction mechanism needs to consider the allocation of existing (baseline) and future (incremental) capacity. Baseline capacity would need to be tied in with network analysis that defines specific network capacity within a given geographical location. Incremental capacity could be offered if bids received in an auction are sufficient to trigger an investment in long-term Transmission assets.

e) Pricing Options: If the auction is set up as a pay as bid auction the users that are successful in the auction would be committed to pay the price that they bid. In a cleared (marginal price) system, users would pay the price of the last successful bid to be accepted. The main issue with the cleared option is that auction participants only receive a cleared price above zero where there is competition for capacity.

f) **Reserve Prices:** The requirement for an auction to include a reserve price interacts with other design considerations. Without a reserve price generators could secure long term baseline capacity at a price which is below the Long Run Marginal Cost (LRMC). This would drive a significant change to revenue recovery, with a knock on impact to the residual charge.

Auction participants: For a successful allocation methodology to be created through an auction system there are further considerations that would need to be looked at such as 1) What pre-qualification criteria would need to be met to participate, including financial commitments? 2) Should non-physical parties be able to participate? 3) What is the interaction between those parties that participate in the provision of balancing services and the capacity market, with those who are able to participate in an access auction?

Options for how allocation methods apply to different customer groups

2.7 There are some key differences with how Access Rights may be defined and allocated at a distribution level due to the relative complexity in terms of volume and types of customer connected to distribution networks. Owing to this an option would be to implement a 'tiered' approach to Distribution level Access right - Including definition, allocation and potential trading. The following provides an overview of these allocation options:

Option 1 Do nothing
If, following adequate analysis, benefits are not seen to outweigh the potential administrative burden of defining, allocating and trading access rights for particular customer groups, the current situation could be continued.

Option 2 Auction
As described above regarding transmission, Access Rights could be allocated to customers in an auction process. This could be run alongside the transmission process or kept separate.

Option 2a Auction for all customer groups
One option is to allocate Access Rights for all customers through an auction with larger customers participating directly and smaller customers represented indirectly through either suppliers, aggregator style organisations, cooperatives etc. This could potentially avoid any unfairness arising from only some customers having access to the auction process.

Option 2b Auction for larger customers
Following a review of practicalities, the auction process may only apply to certain customer groups based on either size, demand/generation etc. This would require a "line" to be drawn between those included in the auction and those who are not which may be subject to contention.

Option 2c Auction for customers on opt-in basis
An auction could be run for all parties willing to participate. Customer not participating would be allocated access rights using a default method (options considered below). Allowing customers to choose whether to participate could be open to "gaming" based on the perceived benefits/drawbacks of participating however would not force customers to bear a potentially large overhead of participation if they are not resourced for it.

Option 3 Allocation by standardised "Off The Shelf" Access Rights

Option 3a Define standardised Access Rights for all customers
This option would allocate Access Rights to customers based on a standardised approach regardless of size or type of connection i.e. no auction or other means of negotiated allocation is employed.

Option 3b Use standardised Access Rights for smaller customers
After determination of an economic level based on size or type of connection, use an auction/negotiated process for allocation to larger customers and use a standardised approach for smaller customers.

Option 3c Use standardised Access Rights for customers who do not opt-out
In conjunction with Option 2.c, standardised approach to allocating Access Rights would be used customers who do not opt-in to a competitive/negotiated allocation process.

The options for types of standardised Access Rights are discussed above under section 1 of this paper.

2.8 Consideration would have to be given to how the size of capacity available is determined for any auction event. This would be particularly true for options 2b or 2c as this capacity would have to be split between those customers included in an auction and those not included. This would have to take account of the relevant technical standards for the voltage level/demand group at which the customers are connected (i.e. P2/6).

Options for distinction between Generation and Demand

2.9 Access Rights could reflect the fact that generation customers may view Access Rights as a commercial product (i.e. exporting power is their core business) whereas Demand customers may see Access Rights as a fundamental requirement for operation of their business with the implications of lack of Access being non-linear. Therefore, access rights could be:

- Identical between Generation and Demand;
- Have different terms for Demand and Generation.

Options for distinction between tradeable and non-tradeable Access Rights

2.10 There are a number of options for providing distinction between tradeable and non-tradable rights:

1. All allocated Access Rights are tradeable between parties (taking account of local constraints);
2. Tradeable Access Rights are available but potentially at a premium to reflect likelihood of higher utilisation factors and increased administrative burden;
3. All Access Rights are non-tradeable.

Considerations for tradeable access rights

2.11

- Trading will be highly dependent on local conditions and will likely be subject to coefficients/exchange rates reflecting network power flows and location specific impacts. This information would need to be informed by the DNO.
- Trading is likely to lead to higher utilisation factors which would need to be accounted for during allocation stage.
- Access Rights could be traded in near real time or on a medium term basis through bilateral agreements.
- Consideration would need to be given to whether the DNO is party to any trading or is acting as a facilitator.

Change of Occupier Access Arrangements

2.12 Once access has been acquired by a party then consideration needs to be given around what happens when that party moves from the premises for which they have acquired access. This may be a domestic person moving to a new house, a high consumption heavy industry business relocating or even a generator relocating. There are three broad options which should be considered in this event, listed below. Each of these options can apply equally to any type of customer described above.

a) The Access rights stay with the premises

When a person or party has obtained access to the system and they move to new premises that access right and the associated conditions for that access remain with the original premises and the contracting person or party relinquishes those rights. The new occupant will pick up those access rights when they move into the premises and (subject to any arrangements of trading and changing access rights) those access rights will continue to run.

b) The Access rights move with the person

The Access right for which a person or party has contracted can be taken and transferred to any new premises they desire. When a person contracts with a network party for access rights they, rather than premises, become the beneficiary of those access rights. This is akin to satellite television deals which would novate premises with a customer notwithstanding that the infrastructure may not be in place in order to support that satellite television contract (indeed the customer may be required to pay a further installation fee).

c) The access rights are relinquished upon a change of occupancy event

With this option the access rights that are secured by a customer are relinquished by both the premises and the customer upon that customer ceasing to be the owner/occupier of those premises. In effect the access rights are “reclaimed” by the network company. Any subsequent customer who wishes to contract for access when they occupy the premise would be required to do from the start of the process. A variation of this option could be that the access rights are relinquished to a “minimum access level”. Any additional access which has been contracted by a customer is reclaimed by the network company, but a minimum access level is retained by the premises.

Summary of Initial Allocation of Access Rights

2.13 Although the options for initially allocating access rights may appear simple and well defined it is likely that the next phase of this paper will identify some of the key issues and considerations that need to be further explored in order to enable a full and complete assessment of the options. Many of these issues will deal with transitioning from existing access rights allocation to the preferred method of allocating rights in the future and how this process will not distort or restrict competition in generation, distribution and supply of electricity.

Section 3: Options for Re-allocation and Trading of Access Rights

Summary

3.0 The arrangements for re-allocation and trading of access rights will be heavily dependent on the options chosen for the initial allocation of access rights and network conditions. In particular, the following considerations must be kept in mind:

- **Lifespan of access:** The duration of access rights allocated to customers will influence options for re-allocation and trading of access rights.
- **Network conditions and "exchange rates":** Trading of access rights will be dependent on local network conditions. For example:

  a. Network capacity allocated to one customer may not be available for use by another customer connected to a different part of the network.
  b. Action on one part of the network to mitigate for a constraint may not translate as having the same impact at the part of the network where the constraint exists. For example, on an interconnected part of the network, a reduction of 1MVA of demand downstream of a constraint may not reduce demand at the constraint by 1MVA due to complex power flows on the network. Therefore, to evaluate how actions mitigate constraints, "exchange rates" will have to be calculated based on network studies to determine the contribution from various actors.

- **Method of allocation:** Some network access may have been allocated on a risk-managed basis. For example, if allocating access to high volumes of customers, diversity assumptions may have been made which would be diminished if access rights were traded.

- **Financial flows**: Re-allocation and trading of Access Rights will, in most circumstances, involve financial flows between parties. In some cases this will be on a bi-lateral basis however there may be circumstances such as market based approaches or network operator controlled approaches which may lead to non-zero-sum financial flows which will need to be treated equitably.

Options for medium/long-term re-allocation and trading

3.1 Below are options for how access rights may be traded between customers. These options seek to manage allocation of capacity between customers on a longer-term basis where their needs may change with time or where synergies can be achieved based on time of use or between demand and generation customers. Needs may change but also capacity and constraints on the system may change over longer periods which will change the value of traded rights.

Option 1 No trading of access rights: Customers are unable to trade their access rights with other network users. This would preserve current diversity assumptions particularly on parts of the network with high volume of customers.

Option 2 Bilateral trading of implied access rights: If a customer can demonstrate a reduction in import/export from an agreed baseline, this reduction can be traded with

another network user on a bilateral basis. Network operators would need to assess network impact of trading.

Option 3 Bilateral trading of defined access rights: If customers are allocated defined access rights, these rights could be traded on a bilateral basis. If this option is adopted, consideration must be given when allocating access rights, allocated capacity will be limited by physical capacity.

Option 4 Shared/Matched Access: As described in section 2 above, synergies may be realised between parties that operate on a localised area of network where, for example, they use energy at different times of day or can match demand to generation. This could be reflected by sharing of certain access rights (and associated charges) if certain conditions are met and realised. The process of matching/sharing these rights could be included in an option for re-allocation to allow the process to be dynamic.

Options for near real-time/operational re-allocation and trading

3.2 Below are three potential options for re-allocating or trading access rights in an operational/near real-time timeframe. These options would apply to managing either firm or non-firm access rights to manage a network where constraints materialise (e.g. in post-fault/abnormal running arrangements).

Option 1 Network operators manage flexible connections: Similar to current arrangements at distribution level, network operators manage flexible connections with non-firm access rights using last-in-first-off principle. Customers with firm access rights are unaffected.

Option 2 Customers trade constraint obligations: An approach explored in more detail in Baringa's report[1], a market based approach to dealing with a requirement to constrain. All customers connected to a constrained network can offer to fulfil the constraint requirement with the lowest offers being the first to be constrained. The cost of these offers is covered by all customers with a constraint obligation. This method allows all customers to participate and also provides a price signal for the management of constraints which can be used to indicate when reinforcement is more efficient.

Option 3 Approach similar to Balancing Mechanism extended to further customer groups: The current system of transmission access on the transmission system facilitates the sharing of physical access by market participants. Financially firm rights are allocated to all subject to the local enabling works being in place. The limit on the need for access is set by transmission connected demand and the efficient energy market. Power price rises and falls driven by demand and availability of renewable resources which in turn drives the need for thermal power stations. The power system is an integrated meshed system with thermal power stations located on stronger parts of the system such that absent wind demand can be met by thermal and nuclear stations.

[1] Baringa Consultants *"A market-based approach to delivering efficient network constraint management"* Study for UK Power Networks

There is a completely different picture at the distribution level. The closure of many merchant transmission connected power stations has given a clear indicator that connecting to the distribution system is commercially attractive driven by in part by distribution time of day tariffs as well as a range of other embedded benefits.

The same drivers to share access that are present on the transmission system are not present at a GSP level. The challenge is to develop a solution where connections are shared at a local GSP level with "bids" or tariffs to curtail output being targeted by the DSO at individual generators/larger demand customers with the highest avoidable cost to solve specific issues on specific days rather that blanket tariffs across GSP groups as at present.

This leads to GSP specific charging based on the type of plant and demand in a GSP which should drive new connections to lightly loaded GSPs. Defining rights at a local and GSP export level (D-CEC and D-TEC) will be required as well as forecast used and curtailment price from each active part. A limitation or "fair use policy" at domestic level based on load factor would be a good position to end up at although domestic would be outside of scope of any tradable access product.

Option 4 Shared/Matched Access: A near real-time re-allocation process could make allowances for dynamic matching or sharing of access rights as described in more detail above.

Unused capacity options

3.3 In order to fully consider the reallocation of access rights, it is important to consider instances where customers may not use their full allocation of capacity. The options taken forward for re-allocating unused capacity should ideally meet the following:

- Unused capacity should be re-allocated where there is a system benefit – in particular, it is likely to not be desirable for parties to retain capacity that they will never require;
- The definition of unused capacity must be clear;
- Where users have paid charges commensurate with their level of capacity, any re-allocation must be user-led and appropriately compensated;
- Where users have not paid commensurate charges, this may be reflected in the compensation received; and
- How commensurate charges are defined must be clear.

To address these, there are several options for taking account of unused capacity and they include:

Capacity reclaims

3.4 **Use it or lose it:** The network operator is able to apply a set of data-driven principles to unilaterally remove capacity from those parties who do not require capacity to the level that it is specified in their connection agreement. The customer may receive no financial recompense for this reduction in capacity or they may be fully compensated.

3.5 **Requests:** The network company asks customers to reduce their level of access on the basis that the customer is not using the access to the level specified in the customer's connection

agreement. Under this method the customer is likely to need financial compensation for them to agree to a reduction in their capacity (presently for energised distribution customers this will be via a reduction in the capacity element of their bill).

Summary of options for re-allocation/trading of access rights

3.6 Re-allocation or trading of access rights will have implications for how access rights are defined and initially allocated. Trading of access rights could lead to higher utilisation of allocated capacity which could have physical impacts on the loading of the network. However, if managed correctly, trading of access rights could lead to a more efficient use of the current network capacity by taking advantage of synergies between network users with complementary usage requirements such as matching demand and generation or encouraging use outside of peak times. Consideration must be given to the potential increase in network risk as well as the increased administrative burden of such arrangements.

Part Two: Forward Looking Charges

4.0 Forward-looking charges look to provide signals to users about how their behaviours can increase or reduce future costs on the network. This section considers options relevant to the application of forward looking signals through charging arrangements.

Section 1: Locational and Temporal Signals

Summary

4.1 Locational and temporal costs are the costs that are specific to the construction, owning and operating of a network which vary according to the location on the network to which a particular network user connects and the times at which they use their connection. These costs are generally driven by customer behaviour and can take many forms, including costs associated with initial connection and the ongoing operation and maintenance thereof.

4.2 Locational and temporal costs are influenced by the topography of where network is provided (e.g. dense urban networks might be more expensive to install than sparse rural ones); user density and mix (e.g. concentration of a single type of generation or demand); and the usage profile of network users. These factors cause a different locational 'cost' on different parts of the network.

4.3 Network assets can be considered in three groups when considering locational costs, namely:

- **Sole-user/extension assets** – These are the parts of a network which service an individual customer exclusively.
- **Local assets** – These are shared assets installed at the point of connection to connect the sole-user assets to the wider network.
- **Wider network** – the network required to serve many users.

4.4 Design standards and practices for each of these three areas varies depending on the voltage and type of customer connecting, for example the sole-user assets for a domestic or small non-domestic LV connection will be sized relative to the cut-out capability, whilst those for larger industrial users will be sized relative to the requested capacity of the connection.

4.5 Overall, locational and temporal network charging aims to give network users a cost reflective signal of their effect on the cost of network investment. This signal should incentivise network users to make more economically efficient decisions to achieve the most economically efficient outcome when considering the costs to the network and therefore cost to other users. The desirable features have been further explored in the Ofgem paper "Reform of electricity network access and forward-looking charges: a working paper".

Distribution of costs by location

4.6 All or some locational costs could be recovered by making charges specific to each individual user's connection or by sharing charges across all customers as an average within a geographic area such as:

- Nodal, i.e. determining the costs associated with power flows to a specific location on the network, at (for example) GSP or Primary (EHV) substation level.
- Zonal, i.e. determining the costs associated with power flows to either a group of nodes (calculated using 'electrical distance') or to a network group supplied from a particular node.
- National (i.e. non-locational).

Apportionment

4.7 If a new or modified connection requires reinforcement of the existing network (i.e. modification to the wider network through the installation of assets which add capacity, either network or fault level), the costs of this reinforcement may be apportioned between the new user and the users of the existing network. There are three options for allocating these locational costs:

- **Shallow** – the newcomer does not pay any reinforcement costs as part of their connection. Reinforcement costs are recovered through use of system charges across all network users.
- **Shallowish** – the newcomer pays a proportionate share of the reinforcement works completed within a defined boundary of their connection (in distribution, this boundary is identified by voltage levels). The remaining reinforcement costs are recovered through use of system charges across all network users. Additional provisions are in place to allocate costs to second-comers etc. who also benefit from the newly installed capacity.
- **Deep** – the newcomer pays all associated reinforcement works.

4.8 Differing apportionment arrangements reflect the impact that an individual user has on the overall development of a network, how their new requirements interact with other new or changing requirements and which party is best-placed to manage the impact and cost. The nature of the location and temporal signals resulting from apportionment signal are also affected by the phasing of these charges and requirements for securities or guarantees.

Time of Use

4.9 The options for structuring charges to reflect time of use are considered in section 3.

Section 2: Calculation of signal

Summary

5.0 Locational and temporal signals require detailed powerflow and network cost models, the choice of which will result in different signals.

Cost base

5.1 Several options exist for the cost base to be used when determining locational and/or temporal signals, including:

- 'Transport costs' – the cost of importing or exporting energy through an existing network.
- 'Expansion cost' – the cost of expanding an existing network for demand or generation, i.e. the levelised cost of future network based on a weighted average of the existing network.
- 'Remaining headroom' – the cost of addressing the next constraint in accordance with today's design standards and solutions, i.e. the levelised cost of future network based on a forecast of what future network is likely to be built.

Method of Calculation

5.2 There are a number of options for determining the locational costs associated with a particular network location:

- **Long Run Incremental Cost** (LRIC), which calculates the change in the costs imposed on the network operator (typically by reference to the change in the length of time remaining before reinforcement of assets will be required) of an increment of usage at a particular network location.

- **Forward Cost Pricing** (FCP), which calculates the expected cost of reinforcement for a given network group (i.e. a group of nodes), with charges calculated based on recovering that cost over the calculated length of time until that reinforcement is expected to necessary.

- **DC Load Flow Investment Cost Related Pricing** (DCLF ICRP), which calculates optimal network flows based on expected peak demand being met by existing generation, with charges calculated based on the impact of increments of demand at critical points on the network.

- **A probabilistic approach**, which assigns the costs of reinforcement to a user (or group of users) in proportion to the probability that an increment of usage by that user will trigger reinforcement on the assets to which that user is connected (e.g. heavily loaded assets are more likely to need reinforcement than more lightly loaded assets, so have a higher probability of requiring reinforcement).

5.3 Within each of the above options for calculating locational costs, a base load flow will be required against which the impact of an increment of usage can be assessed. Options for this baseline include:

- Background load flow, i.e. the observed flows at each point on the network over a defined historic period.

- Demand dominated and/or generation dominated, i.e. the power flows driven either exclusively by demand or by generation, for example DCLF ICRP assumes demand dominance in that the level of demand is forecast and the level of generation set to meet that demand.

- Local balancing and/or transmission flow-down, i.e. the extent to which local balancing is taken into account, or whether all units (at distribution) are assumed to flow from the transmission system to demand users.

5.4 If an objective of a network charges is to provide an investment price signal, then it may aim to achieve this in a way which reduces distortions to dispatch decisions. An option for achieving this may be to base a network charge on the underlying characteristics of particular individual, or types of user. Options for this may include:

- Regulatory, commercial, or otherwise measurable characteristics
- Historical performance
- If a type of user is relatively unresponsive to time of use price signals, then it may be an option to apply a time of use tariff to their dispatch profile while still minimising distortions to their dispatch behaviour. With dispatch profiles becoming increasingly unpredictable, this may need refreshing regularly.

Boundaries between methodologies

5.5 Consideration should be given to avoiding cliff-edge type boundaries created by different modelling approaches between different network operators (i.e. transmission and distribution) and between different voltage levels with each network, for example the current difference between connecting to distribution (in England and Wales) at 132kV and to the transmission network may not be reflective of the different cost bases of the network operators. Options include but are not limited to:

- Charging all 132kV connected customers according to a common methodology regardless of whether they are connected to a transmission or distribution network (132kV is a transmission voltage in Scotland and a distribution voltage in England and Wales).

- Levying cost reflective transmission charges on distribution network operators in respect of usage at GSPs. Such charges should reflect all drivers of cost on the transmission network including fixed costs, costs associated with the level of maximum demand and costs associated with GSPs exporting at times of low system demand. DNOs should then pass these cost signals on to their customers in an equivalent way alongside the additional costs of providing the distribution network. For users at the higher voltages of the distribution network this passed-on transmission charge might be more significant than the distribution network charge. For users lower down the distribution network the distribution charges would make up a larger proportion of their total bill.

Specific tariffs to reflect the benefits of local matching

5.6 Local matching occurs when generation and demand customers located at the same part of a network use the network at the same time and the resultant power flows offset at a common point of the network. Such situations would reduce the power flow at higher network levels and may therefore result in reduced future reinforcement and other associated cost savings for the network operator.

5.7 Specific tariffs could be introduced that would reflect these cost savings. These tariffs would charge separately for: the local network used in full by all the individual scheme participants; and the use of the network by the scheme in total above the common substation.

5.8 The level of such tariffs would be determined by disaggregating the standard tariffs by voltage level. The costs associated with the voltage levels at or below the common point of the network would be reflected in the 'downstream' tariff for use of the local network and would be applied to the individual use of the network by each customer. The costs associated with the voltage levels above the common point of the network would be reflected in the 'upstream' tariff to be applied to the net aggregate of the scheme only.

5.9 These tariffs are beneficial to customers in a local matching scheme if the use of system credits paid to a standard (non local matching) generator is lower than the maximum potential benefit of offsetting demand and generation under the specific tariffs. In these circumstances, local matching tariffs would remove the potential for market distortions caused by differences in the pricing of the use of the higher voltage levels of the network that could exist between a customer with a private wire network or behind-the-meter generation, and a scheme where all participants remained connected to the distribution network.

Section 3: Structure of charges

Summary

6.0 This section sets out a series of options for the structure of forward looking charges. Whilst many of the drivers behind which options from the sub-sections below will be most appropriate will be determined by which options from other areas (for example locational charges or type of access arrangement), these options are also worthy of consideration as stand-alone options, and where the practicality and feasibility of implementation will vary significantly from option to option.

'Building blocks' available using existing charging elements

6.1 If the existing charging elements were to be maintained, a combination of the following elements could be considered for future charges:

- **Fixed charges (£/year)** – charges which are applied on a per user basis as long as the user remains connected.
- **Unit rates (£/kWh)** – standard unit charges, applicable to energy usage with a number of sub-options for unit rates which vary by time of use.
- **Agreed capacity charges (£/agreed kVA)** – charges levied in respect of a user's agreed capacity with the network operator. Agreed capacities are generally specified in bilateral connection agreements, and as such are only in place for larger users.
- **Actual peak demand charges (£/peak kW or £/peak kVA)** – charges for peak usage, i.e. for half hourly metered users the usage in the peak half hour.
- **Reactive power charges (£/kVArh)** – charges for usage of reactive power, reflecting the difference between actual power (in kW) and apparent power (in kVA), and where the two diverge due to poor power factor which drives the need for increased network capacity.

6.2 As an example of how these could be used, costs which the network company will no longer face immediately (or within a short timeframe) if a user were to disconnect from the network could be recovered through fixed charges, costs which the network company may face if demand were to increase (or not decrease) could be recovered through unit charges, with remaining costs (for example past investments for existing infrastructure which are being considered by Ofgem's Targeted Charging Review (TCR)) attributed directly to fixed or capacity costs.

6.3 A key consideration will be whether unit charges are for gross or net demand, i.e. in respect of sites with demand and generation behind the meter, are charges based on the gross demand at the site, or the net of demand and on site generation.

Options for time of use signals

6.4 Within both unit charges and to a certain extent capacity charges there are sub-options for time of use or seasonal time of use, which include:

- **'Unrestricted' rates** – a charge which applies to every unit used (or capacity taken) in any time period.

- **Static timeband time of day** – charges which vary by time of day with time bands fixed throughout the year (akin to the existing red, amber and green unit rates for HH settled distribution connected users at LV and HV).

- **Critical Peak Pricing (CPP)** – charges which vary by time of day with a narrow peak band in which the cost per unit is significantly higher (akin to the existing 'super-red' period for distribution connected users at EHV which applies only to a relatively small number of time periods in the year, and at the extreme HH TNUoS triad charges which have a very narrow 'critical peak' period).

- **Variable time of day** – charges which vary (potentially up to real time) by time period depending on the level of demand at the time (TNUoS triad charges have some features of this, in that the time periods to which the £/kW unit rate will apply are variable based on the times of peak demand, albeit the rates themselves are fixed at the start of each year).

- **Inclining Block Rate (IBR) unit rates** – under this option a lower unit rate would be applied to usage below a certain threshold, and a higher unit rate to usage above this threshold (note – more than two 'blocks' could be used).

- **Inverted time of use signals** – this would result in payments being made to users for reduced usage in certain time periods and as such is a 'no-lose' scenario for the user (i.e. if a user does nothing to alter behaviour in the peak period their usage is charged at the standard rate; if they alter usage to within a certain threshold they receive a payment).

6.5 For all options, it will be important to consider other cost signals to which users are exposed, such as market based mechanisms including wholesale price fluctuations, balancing mechanisms and markets for flexibility services, and how cost signals given through forward looking charges interact with other cost signals,

6.6 Within each of these options locational granularity should be considered, i.e. the extent to which (for example) time periods and strength of cost signal should vary by location depending on the time of peak and network headroom at that location. The existing structures have the potential to give a cost signal to reduce demand in certain time periods which align with peaks on the system as a whole but may not align with peaks on a given user's local network or indeed on the higher voltage network assets which they use; the inverse of this would be timebands with high locational granularity at the expense of additional complexity.

Options for user segmentation

6.7 There are multiple options for the way in which different tariffs are allocated to network usage in respect of each end user (or each group of end users). These include:

- **Type of settlement** – tariffs allocated based on whether a user is HH or NHH settled. This means of segmentation is currently used for both distribution and transmission charging.

- **Type of metering** – for example tariffs allocated based on whether a user is Current Transformer (CT) or Whole Current metered (currently one of the segmentation criteria used for distribution charging) or whether the user has a smart meter.

- **Voltage of connection** – tariffs allocated based on the voltage of connection of the end user. This is currently one of the segmentation criteria used for DUoS charging.

- **Archetype to which the user conforms** – users could be grouped and charged into archetypes which are active and passive. WS2 of the Open Network Project identified four different user archetypes:

    - System Service Providers
    - Active Participant
    - Passive Participant
    - Passive Consumer

- **Common-mode behaviours** – for example PV users all generate when it's sunny

- **Type of end user** – tariffs allocated based on whether the connection is provided for (for example) domestic or commercial purposes. This is currently one of the segmentation criteria used for distribution charging. Sub options within this could include:

    - Domestic/commercial/industrial end user
    - Within domestic consumers, further segmentation could include vulnerability.
    - Type of 'access product' purchased – options may become more defined as the Access Task Force progresses.

- **Size of end user** – tariffs allocated based on the level of usage of each end user, possibly based on annual usage, maximum usage, or the physical capability of the connection assets.

- **User flexibility** – different tariff structures and tariffs could be required for users with flexible connections, or who participate in flexibility services, for example a user who makes all or part of their capacity available to be constrained off by the network operator or who participates in a Demand Side Response (DSR) scheme could be rewarded with lower underlying charges as a result.

- **Local matching** – local customer segmentations could be created based on the ability of a group of users to flex local generation to meet local demand.

- **Users connected to IDNO networks** – it is important to maintain a level playing field, such that user connected to IDNO networks face equivalent charges to those faced by user connected direct to DNO networks, and that IDNOs can achieve a fair margin. This is discussed in more detail in Appendix 1.

6.8 Consideration is also needed as to how costs are assigned to each user segment, with options including that user segment's proportion of network utilisation, or that user segment's contribution to peak demand.

Charges set ‘Ex Ante’ or ‘Ex Post’

6.9 Within all options, consideration should be given to whether charges are set ‘Ex Ante’ (i.e. based on forecast behaviour or agreed usage limits of a user or group of users) or ‘Ex Post’ (i.e. based on actual behaviour of a user or group of users).

6.10 At present, the majority of distribution charges are set ‘Ex Ante’ and applied ‘Ex Post’ (i.e. charges are set based on forecast behaviour of each group of users and then applied to actual usage), with the exception of agreed capacity charges which are both set and applied ‘Ex Ante’. Transmission charges for NHH users are set ‘Ex Ante’ and applied ‘Ex Post’, with an element of ‘Ex Post’ charge setting in transmission charges for HH users where the time periods to which unit rates will apply (triad periods) are determined ‘Ex Post’.

6.11 Some of the options considered above will be more compatible with one or the other of these – for example, variable time of day charges which are set at short notice to influence user behaviour in specific periods are likely to be required to be set ‘Ex Ante’ (albeit based on short term and close to time forecasts) in order for the signal to be given ahead of time; conversely charges for peak demand could be set ‘Ex Post’ provided the means by which they will be calculated is sufficiently transparent and network companies have access to sufficiently granular data.

6.12 If charges are set ‘Ex Ante’, the effectiveness of any forward-looking signal, particularly geographic or temporal, must be designed to allow appropriate responses. The interval between tariff periods and the notice given needs to balance excessive lag (to avoid the risk of late or ineffective user response) and excessive feedback (to avoid instability and volatility). Options include:

- No notice period
- A few months to just less than one year
- More than one year (present distribution tariffs are published annually for an annual period commencing 15 months into the future)

Type and timing of payment and the level of user commitment

6.13 Consideration will be needed for new costs which network operators will face in the future and how such costs are recovered, for example how should the costs associated with increasingly involved active network management operations be recovered. Further consideration is required here, with options having not yet been discussed by the Task Force.

6.14 Particularly with reference to connection charging, consideration is required on the timing of payment and the level of user commitment to such payments. Options include:

- **Deep connection charge paid in full up front before connection** – albeit distribution connection charges are ‘shallowish’, this is the approach now taken for distribution connectees, who are required to pay the connection charges due under the Common Connection Charging Methodology in full and up front.

- **Deep connection charge paid in full, annuitised over a period of time and secured by the user** – this is an option for transmission connected users, whereby their connection charge is annuitised over a period of time subject to their remaining connected. The user is required to secure the annuity in the event that they disconnect from the network.

- **Deep connection charge paid in full, annuitised over a period of time and secured by the network operator** – under this option a user would have the option to annuitise their connection charge over a period of time. If they were to disconnect from the network before the complete annuity period, the additional cost would be picked up by the network operator and effectively 'socialised' across the remaining customer base. This could simply take the form of a capacity charge calculated on the basis of the annuitised cost of providing the connection.

- **Shallow connection charge** – this charge would reflect (for example) only the cost of assets provided for the sole use of the connectee, with any reinforcement costs being recovered through charges to a larger group of users, albeit not necessarily all (i.e. reinforcement costs could be recovered on a locational basis).

- **No up-front connection charge** – all costs associated with connections are recovered through ongoing Use of System charges, either from a connectee specifically, or from a larger group of users (ranging from a local group of users to socialisation across all network users).

6.15 Consideration is needed on the aim of a cost signal which relates to network reinforcement, and how it should be give the signal at the appropriate time, with options including:

- Before the requirement, i.e. to avoid the need for new demand or generation waiting for reinforcement.
- At the point of requirement, i.e. timed to coincide with new demand or generation connecting
- Just after the requirement, i.e. to allow the final investment trigger to be driven by specific connection requests.

Conclusions & Next Steps

7.0 This paper constitutes the first main output from stage one of the Access and Forward Looking Charges Task Forces' work programme and will serve to inform Ofgem's assessment of the issues with the current arrangements identified in its working paper published in November 2017. The options set out in this paper will assist the development of detailed options to address the existing issues and inform the wider debate.

7.1 The next stage of the Task Forces' work programme will involve an assessment of the options identified in this paper. An agreed set of criteria will be used for this assessment to evaluate the advantages and disadvantages, as well as the risks and opportunities, of each option. This analysis will include a qualitative and, to the extent possible, quantitative assessment of the impact of each option. A paper of this second stage of the Task Forces' work programme will be published in March 2018.

7.2 The Task Forces recommend the adoption of the following assessment criteria that have been informed by the desirable characteristics for access and forward-looking charging arrangements identified by Ofgem in its working paper:

Arrangements should:

1. efficiently meet the essential service requirements of network users;
2. optimise capacity allocation;
3. ensure that price signals reflect the incremental future network costs and benefits that can be allocated to and influenced by the actions of network users;
4. provide a level playing field for all network users;
5. provide effective network user price signals, i.e. price signals which can be reasonably anticipated by a user with sufficient confidence to allow them to take action;
6. appropriately allocate risk between individual network users and the wider body of users
7. support efficient network development;
8. be practical;
9. be proportionate.

Further information about the Charging Futures Forum and its Task Forces including how stakeholders can engage with the Forum can be found at http://chargingfutures.com/

Communications in respect of this paper and the work of the Task Forces should be addressed to the Task Forces Secretariat, Energy Networks Association:
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Appendix 1: Implications for IDNOs Current Arrangements

Currently IDNOs do not connect directly to the transmission system. Therefore, for IDNOs the key issue will be how transmission charges are recovered through the DNO connection and charging methodologies. However, this may not always be the case. In the future IDNOs may seek connection to the transmission system. This may be because of technical constraint or because a connection to the transmission system offers the most economical solution. Locational signals given in connection and/or use of system methodologies for both transmission and distribution should drive the most economic and efficient solution from a total system perspective; i.e. differences between transmission and distribution methodologies should not incentivise perverse solutions or behaviours.

However, in the main, IDNOs will connect to the distribution system. Therefore, the focus of the rest of this section is on distribution methodologies.

The key requirement for IDNOs is that any move to locational charges must not have the effect of distorting competition or lead to margin squeeze. Even with locational charging there will be elements of costs that are recovered as an average across the DNO (e.g. residual charges). However, such averaging should not have an unduly distortionary effect. Key concerns are that changes to locational charges could result in cross subsidies between different network tiers (e.g. EHV, HV, LV, service line) and between network locations. Where average costs are to be used then it is important that they are allocated on a cost reflective basis (MEAV is not always the best cost driver).

DUoS Charges

- Currently, IDNO DUoS margins are determined in whole by DNO charging methodologies: IDNO tariff to the end consumer can be no more than the DNOs tariff to equivalent consumers (the all-the-way (ATW) tariff. In practice to IDNOs replicate the DNO tariff.
- The DNO determines the tariff to the IDNO through the Price Control Disaggregation Model (PCDM).

Both the CDCM and the PCDM (which is embodied as modelling step within the CDCM) are based on determining ATW tariffs and IDNO tariffs as average tariffs. The tariffs contain no locational pricing signals. Locational prices if any are given through the connection charge.

In principle locational charges from DNOs should not present an issue for IDNOs providing they remain cost reflective:

- The cost of constructing, owning and operating a given ‘last mile’ of network - say to a housing estate - is unlikely to change materially irrespective of where the housing estate is located.
- The cost of providing and operating the upstream system connecting to the last mile network will vary dependent on location.
- Therefore, to avoid margin squeeze for some sites (and excessive margins on other sites) different locational tariffs are likely to be required;

However, it is likely that in the future the local last mile networks will increasingly face their own challenges; it will no longer be safe to assume that one housing estate will face the same costs as another housing estate of similar size in a different location. Reinforcement of such networks

to meet future consumer needs will vary from location to location. Factors that may influence future reinforcement are:

- Socio economic – different classes of (domestic) are likely to have a different take up of new technologies (electric vehicles, district heating, heat pumps, storage, smart appliances, etc.).
- The age of networks – networks to new housing estates are more likely to be designed to accommodate new technologies and therefore less likely to require reinforcement that older networks.
- The end of gas – the government vision is that gas connections to new houses will end in the mid-2020s and that by 2050 homes will no longer connect to gas. Clearly there will be a transition to the 2050 vision. Where homes decommission from gas there is likely to be a potential need for reinforcement.

In addition to reinforcement, if an IDNO is required to discriminate between different classes of customer on factors other than cost; for example, subsidised tariffs for vulnerable customers, it is unclear how it finance such subsidy.

If the methodology used to determine IDNO charges is to change to a locational one, then the locational charges must not distort competition between the DNO and IDNO. The last mile costs to IDNO; i.e. the resulting locational tariff to the IDNO should be consistent with that the DNO offers to its own (notional) equivalent network.

For some sites where the locational DUoS charge to the IDNO is high, the IDNO could be incentivised to invest in alternative approaches to facilitate use of system (using the notional boundary charge as a reference point on which it can make savings.