



Access Task Force



Forward Looking  
Charges Task Force

# **Electricity Network Access & Forward Looking Charges: Final Report and Conclusions**

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

May 2018

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## 1. Introduction and Background

- 1.1 This section sets out background to the Charging Futures Forum (CFF) Access project and describes: the key drivers behind the work of the CFF and its Task Forces; their objectives; and the approach taken for carrying out work and delivering outputs. Other relevant work that has been carried out in parallel to that of the Task Forces is also highlighted.

### Task Forces' Final Report

- 1.2 This is the final report of the Access Task Force and Forward Looking Charges Task Force established under the CFF.
- 1.3 In July 2017 Ofgem announced plans to establish the CFF to provide direction to ongoing charging reviews and to develop an integrated work programme for these and other elements of Ofgem's work.
- 1.4 In November 2017 Ofgem published its '*reform of electricity network access and forward-looking charges: a working paper*'<sup>1</sup> which highlighted the need to review the current regulatory framework in response to the rapidly changing energy system, including the transition to a smart flexible energy system. Specifically, the working paper identified the need to ensure that, as this transition progresses, 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 users, part of which can be achieved by 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 working paper points to the need to identify issues and key regulatory gaps that may need to be addressed.
- 1.5 This final report builds on the Task Forces' '*initial options for change*'<sup>2</sup> paper published in January 2018, and the '*interim progress update*'<sup>3</sup> published in April 2018.
- 1.6 The overall purpose of this final report is to inform Ofgem's assessment of the options for reform of the current network access and charging arrangements. In preparing it the Task Forces have sought to identify and outline options for change that have the potential to create better future arrangements.
- 1.7 In compiling this report, the Task Forces have only considered the impact of changes on the electricity networks. It is recognised that a whole system approach will ultimately be needed to fully appreciate the impact on the energy system as a whole. In looking at these costs in isolation, the Task Forces have intentionally only considered network impacts, with wider system impacts being a matter for further consideration elsewhere.

### Drivers for this Work – the Changing Energy System

- 1.8 Great Britain has seen a rapid change in the way in which energy is produced, with growth in distributed and locally connected energy resources. At the same time the take up of new technologies and solutions such as behind the meter generation, electric vehicles, electric heating, smart meters and energy storage is increasing, and users are

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<sup>1</sup> <https://www.ofgem.gov.uk/publications-and-updates/reform-electricity-network-access-and-forward-looking-charges-working-paper>

<sup>2</sup> <http://www.chargingfutures.com/media/1130/access-and-flc-options-paper-final-published-12022018.pdf>

<sup>3</sup> <http://www.chargingfutures.com/media/1188/interim-progress-report-overview.pdf>

seeing greater choice and control over the way in which they use energy. These changes could lead to significant increases in peak demand and create constraints on some parts of the electricity network. Network reinforcement to address constraints can be costly, time consuming and disruptive, and could therefore present a barrier to the take-up of new technologies and changing patterns of usage.

- 1.9 The pace of change can be expected to hasten over the next decade and beyond, bringing unprecedented challenges in the way in which electricity networks are designed, operated and managed. By extension this also points to the need for change in the commercial, regulatory and technical arrangements that govern the way in which different users (for example domestic households (including vulnerable users); large and small generators; and large and small commercial demand users) connect to and utilise the electricity networks.
- 1.10 It is crucial that networks continue to meet the needs of all users, and continue to be managed in a way that is in the interests of current and future users. Central to this is ensuring that current network capacity is most effectively and efficiently utilised and that appropriate economically efficient signals indicate where there is need for new investment in networks, including traditional reinforcements. Put simply, it is increasingly important that the use of network capacity is managed over all timescales in a way which minimises the costs to users as a whole.
- 1.11 The emergence of smart technologies for smaller users that offer greater digitisation, visibility and control of the electricity networks together with new and innovative business models offer opportunities to adjust demand and supply at times and places where there are network constraints. This smart approach is already being used for users connected to the transmission network and it could deliver greater system benefits if these types of approaches were extended to users connected to the distribution networks as well, by potentially deferring or reducing the network reinforcement needed. If the way in which network capacity is allocated and utilised is to be optimised so as to minimise costs to users, not only is it necessary to explore different approaches and the models which govern those approaches, but also to ensure there is a level playing field for all network users. This means identifying and addressing issues and distortions that exist between and across the transmission and distribution networks which have the potential to affect investment and operational decisions by those already connected to the electricity system as well as those seeking to connect.
- 1.12 Ofgem's '*strategy for regulating the future energy system*'<sup>4</sup> set out its approach to regulation over the coming years in the context of the energy system transformation and current priority actions to address the key challenges and opportunities that future changes could create for different aspects of the energy market and regulatory arrangements. Ofgem also published its '*smart systems and flexibility plan*'<sup>5</sup> (joint with Government) to enable the development of a smart, flexible energy system that will reduce costs for users, and support the growth of innovative new businesses. Both of these documents describe how providing users with better signals about the costs and benefits they confer on the network at a particular time and place is a priority area to address.

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<sup>4</sup> <https://www.ofgem.gov.uk/publications-and-updates/our-strategy-regulating-future-energy-system>

<sup>5</sup> <https://www.ofgem.gov.uk/publications-and-updates/upgrading-our-energy-system-smart-systems-and-flexibility-plan>

## Charging Futures Forum (CFF)

1.13 The CFF is chaired by Ofgem and is open to network users, network companies and end users and/or their representatives. The CFF has a central role in keeping stakeholders up-to-date on developing network charging reform and gives them the opportunity to influence works being undertaken. The role of the CFF includes:

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

1.14 Further information on the CFF, the Task Forces and work being undertaken can be found on the charging futures website<sup>6</sup>.

1.15 Under the CFF, two Task Forces (the Access Task Force and Forward Looking Charges Task Force) were established to assist in the policy development process. The objectives of these Task Forces were to consider what changes could be taken forward, in each policy area, in order to drive benefits to users through supporting more efficient use and development of network capacity. The Task Forces' work has been informed by Ofgem's working paper (see paragraph 1.4) and has identified and assessed options that may create better arrangements.

1.16 Membership of the Task Forces includes a wide range of stakeholders. Their work includes a programme of ongoing engagement with wider stakeholders and interested parties, particularly through the CFF.

1.17 The Task Forces bring together a range of expertise and interests from across the energy industry and wider stakeholder communities. The working approach adopted by the Task Forces has been to use regular meetings as a forum to agree, review and discuss the work of the group and its outputs. Consistent with this approach, work has been taken forward by a subgroup of Task Force members in a collaborative working group format.

1.18 The Access Task Force has considered the options to define more explicitly potential arrangements for user access to the GB electricity system (transmission and distribution). The Forward Looking Charges Task Force has considered 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). This report is the final report of both Task Forces, with the work of the two having been combined into a single output.

1.19 Residual network charges (i.e. those elements of network charges that are not defined as forward looking) have not been included within the scope of the Task Forces. This is because the application of residual network charges is being progressed by Ofgem as a separate project under a Significant Code Review (SCR), known as the Targeted Charging Review (TCR). More information is available on the TCR on Ofgem's website<sup>7</sup>.

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<sup>6</sup> <http://www.chargingfutures.com/>

<sup>7</sup> <https://www.ofgem.gov.uk/electricity/transmission-networks/charging/targeted-charging-review-significant-code-review>

1.20 The outputs from the Task Forces will inform Ofgem's thinking ahead of its consultation on initial proposals for reform of network access and forward looking charging arrangements (if any), which is expected in summer 2018. The terms of reference for the Task Forces together with their membership can be found on the charging futures website<sup>8</sup>.

1.21 The Task Forces had three major deliverables, namely to:

- produce a document identifying the initial options agreed for further assessment in December 2017/January 2018;
- produce a document assessing each of the initial options, based on the agreed assessment criteria in February/March 2018; and
- produce a report outlining the Task Forces' conclusions on what changes could be taken forward for further consideration in April/May 2018.

1.22 The terms of reference of the Task Forces were ambitious. Its members have embraced this and committed significant time towards achieving them. However, it is important to note that the breadth of the work and the relatively limited time during which the Task Forces have met to finalise their conclusions necessarily means that the Task Forces have not been able to address all aspects comprehensively. The Task Forces' work should be considered the start of discussions on reforming network charging regimes, not the final word.

1.23 This final report by the Access and Forward Looking Charges Task Forces constitutes the final deliverable of these outputs. Following the conclusion of this report, the Task Forces will cease to exist. Feedback on this report is welcomed through the CFF.

### **Baringa Materiality Assessment**

1.24 Baringa has been commissioned by Ofgem to develop an analytical framework for the assessment of the materiality of issues with existing arrangements for network access and forward looking charges. The work will highlight issues resulting from the current arrangements and will identify areas impacted by the current arrangements and the types of impact. Baringa's assessment of impacts will be conducted with a qualitative approach, with supportive estimates and quantitative data being provided where possible. At the time of the Task Forces finalising this report, Baringa have yet to publish their assessment.

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<sup>8</sup> [http://www.chargingfutures.com/media/1108/final-cff-tf-tor\\_12jan18.pdf](http://www.chargingfutures.com/media/1108/final-cff-tf-tor_12jan18.pdf)



## 2. Task Force Work-plan

2.1 This section describes the work undertaken by the Task Forces in developing the first two phases of the work-plan as detailed in paragraph 1.21.

### Work-plan Background

2.2 The work-plan (shown in Appendix One) details the key activities, outputs and associated timelines of the work of the Task Forces since they were established in September 2017.

2.3 Task Force activity over the period was intensive with each of the Access and Forward Looking Task Forces meeting seven times, four of which were joint meetings. Output from the Task Forces was disseminated through the CFF website and mailing list; several meetings of the CFF; and targeted events including CFF workshops held in London and Glasgow.

### Stage 1: Initial Options Paper

2.4 The main stage one output of the Task Forces was the '*initial options for change*' paper published in January 2018. It sought to complement Ofgem's working paper on the reform of network access and forward looking charges and the issues and options for reform identified within it, including how capacity might be allocated and reallocated and where cross-system changes to the charging methods could be beneficial.

2.5 The initial options paper was broadly in two parts:

- **Part one focused on access** and considered a number of aspects of users' access to the GB electricity system. This included the identification of different building blocks that could be used in determining and defining various access arrangements for users. The question of initial allocation of access (i.e. the way in which a new user connects to the network) was also considered with various approaches identified for the initial allocation of access rights to users, including the desirable features of particular approaches. Options for reallocation and trading of access rights were also explored.
- **Part two focused on forward looking charges** and considered options relevant to the application of forward looking signals through charging arrangements. Aspects covered included: locational and temporal signals (i.e. how charges differ by the location of use and time of use to reflect the state of the network and encourage use of the network where and when it is most efficient); the options for structuring forward looking charges to provide signals to users about their behaviours and impact on future network costs; and the factors that might be taken into account in the design of different approaches. It also identified a number of options for the structure of forward looking charges.

2.6 Whilst not exhaustive, the options captured in the paper represented a significant number and range of approaches, each having different benefits, advantages or disadvantages.

2.7 Finally, the initial options paper recommended a number of assessment criteria, informed by the desirable characteristics for access and forward looking charging arrangements identified by Ofgem in its working paper. These criteria are set out below

and were used to guide the assessment stage of this work, the results of which are set out under sections 3 to 6 of this final report.

### **Assessment Criteria**

2.8 The agreed assessment criteria are that 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; and
9. be proportionate.

### **Definition of Building Block, Option & Cluster**

2.9 The terms 'building block', 'cluster', 'option' and 'scenario' are used throughout this report, each of which are described below. These are essential temporal, physical or commercial/regulatory features of the arrangements under which a user will connect to and utilise the electricity network.

- **Building block:** a key design parameter in the make-up of access or charging arrangements. Building blocks can be used to outline the key different possible choices for how network access rights and forward looking network charges could theoretically be constructed. Examples of building blocks include depth of access (e.g. access to the whole network, or access to only certain voltage levels); lifespan of access (i.e. the number of years for which a user has access); firmness of access (i.e. how physically secure the connection is and whether users are compensated if the network is unavailable, due to, for example, a network constraint); connection charging boundary (i.e. how much of the reinforcement triggered by a new connectee is paid for in a connection charge, and how much is paid for through ongoing usage charges); timing of payment of connection charge; and types of locational signal. Building blocks can co-exist and are not mutually exclusive.
- **Option:** a possible aspect of a building block of a new access or charging regime that can be picked at its most granular level. For example options for a new regime under the 'connection charging boundary' building block are either shallow (i.e. extension assets only), 'shallowish' (i.e. extension assets and a proportion of wider network reinforcements required) or deep (i.e. cost of all associated reinforcement across the entire wider network). Within a building block the options tend to be mutually exclusive alternatives, albeit different options under a given building block could be used in parallel for different users, or different options used for transmission and distribution respectively.

- **Cluster:** a combination of ‘building blocks’ that are naturally linked such that it is helpful to consider them together rather than in isolation. For example, the respective advantages and disadvantages of paying connection charges up front compared with being annuitised depends on whether the connection charging boundary is deep or shallow, because this would affect the likely magnitude of the connection charge. Not all building blocks naturally fall into clusters. For example, there are a number of other aspects of any access and charging regime that also need to be considered including: modelling and tariff design; the structure of charges; and market based approaches that could possibly be used to apply targeted approaches for the allocation of access to and utilisation of the electricity system. These are considered in isolation as individual building blocks.
- **Scenario:** a set of arrangements which describes a complete solution to how users would access the electricity network, and how they would be charged for doing so. Scenarios have generally been described at a very high level, and used as tools to enable the Task Forces to consider how different arrangements could impact different users. Section 9 discusses some scenarios in more detail, by bringing together the various clusters and building blocks into ‘plausible packages’.

## Stage 2: Development of Framework Scenarios, Clusters and Assessment Methodology

- 2.10 To help bring a ‘real world’ aspect to this work a number of framework scenarios were developed. These framework scenarios were found useful both in the development of the clusters and when considering questions of implementation of different options and the needs and limitation of different network users (user segmentation).
- 2.11 The Task Forces then took the outputs contained in the ‘*initial options for change*’ paper, developing them further and bringing them together into a number of combinations or ‘clusters’, each creating a particular set of conditions that could apply to system users, and so drive particular types of behaviour.
- 2.12 This left a number of building blocks not considered in the clusters, which were considered in isolation as they did not naturally fall into a cluster.
- 2.13 These different scenarios, clusters and remaining individual building blocks were then analysed and assessed against the nine criteria set out under paragraph 2.8. The approach followed for the assessment is described in more detail below.

### Framework Scenarios

- 2.14 Three framework scenarios were developed and used to help the Task Forces appreciate the advantages and disadvantages of different options by considering each at its most extreme. The framework scenarios are shown in Figure 1:

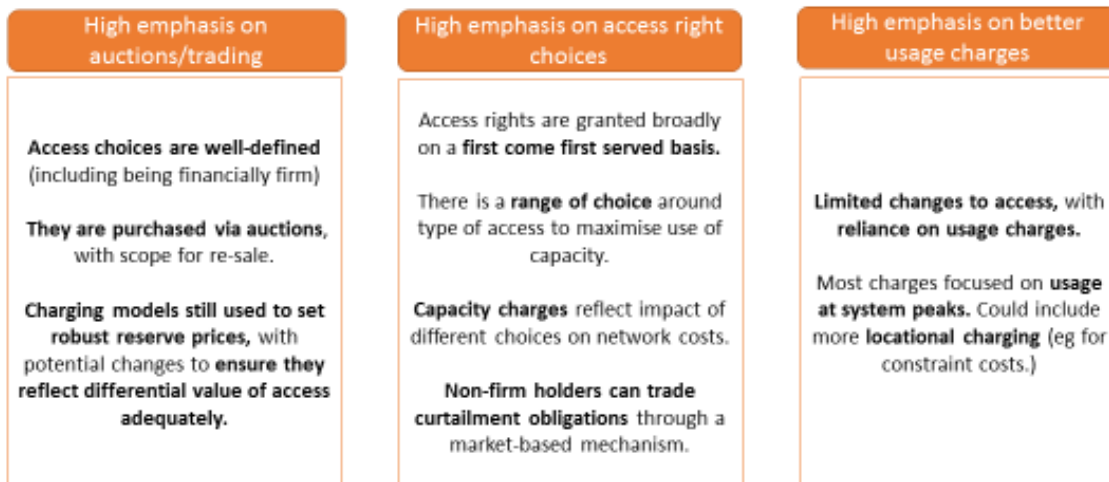


Figure 1 - Three Framework Scenarios

2.15 The first scenario (high emphasis on auctions/trading) focusses on an approach for the allocation and reallocation of access rights, the second (high emphasis on access right choices) focusses on providing user choice with regard to which access product is suitable for a users' needs, whilst the third (high emphasis on better usage charges) relies on cost signals through ongoing usage charges to drive the efficient utilisation of capacity. A more detailed description of the three scenarios and the results of their evaluation are set out under section 3.

#### Development and Grouping of Options

2.16 The initial options paper included 18 building blocks with 56 associated options. The high level framework scenarios discussed above cover some but not all of these building blocks, hence a lower level analysis is required. Given the number of options involved, it is not feasible to assess every combination. A number of the building blocks were therefore grouped into two clusters, while the remainder of the building blocks were evaluated individually.

2.17 Cluster one (C1) comprises those building blocks which influence user investment (both new connections users and those already connected). These building blocks are not mutually exclusive and hybrid options may exist. For simplicity, hybrid options have not been considered at this stage. Each of the building blocks considered here is defined in more detail in the initial options paper. The building blocks considered are:

- **Connection charging boundary** (shallow, 'shallowish', or deep);
- **Timing of payment of connection charge** (unsecured annuity, secured annuity, or paid upfront, i.e. whether users are required to place a form of deposit for a connection charge paid over a number of years);
- **Locational granularity of ongoing charges** (none, some (e.g. zonal, i.e. relating to a group of nodes), or high (e.g. nodal, i.e. relating to the point where a specific user connects)); and
- **Degree of user commitment** (i.e. the financial liability on connectees) to wider reinforcement (none, securitised until connected, or securitised after connection, i.e. whether users are required to place a form of deposit or not).

2.18 These four building blocks are inherently interlinked. This is because, when making an investment decision, a user would be expected to consider the liabilities they are taking on as part of that decision, which would include the initial connection charge, the ongoing charges that user will face (including any annuitisation of the connection charge and ongoing usage charges) and any other securities required up to and after the point of connection.

2.19 Figure 2 shows how these elements are grouped together under C1:

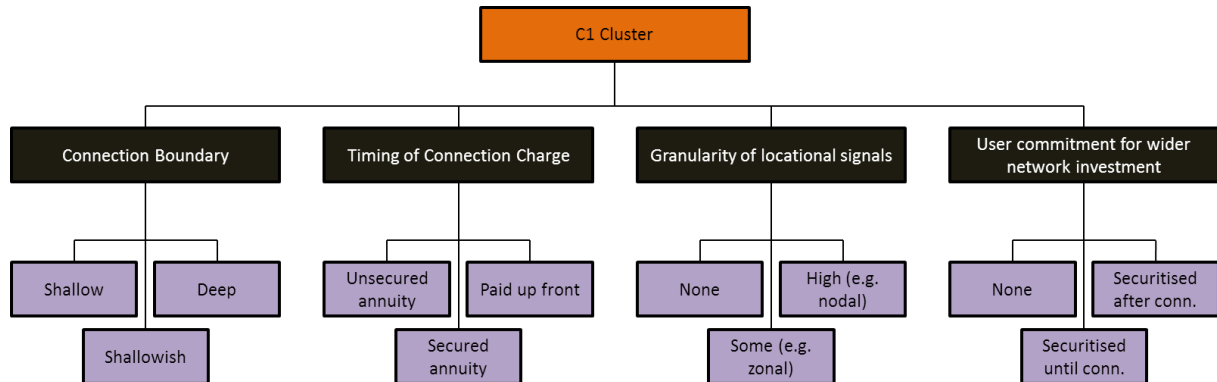


Figure 2 – Tree diagram of C1

2.20 Cluster two (C2) comprises those building blocks which influence users' operational decisions. This may be through the ongoing usage charges that apply or mechanisms for reallocating existing capacity. These building blocks are not mutually exclusive and hybrid options may exist. For simplicity, hybrid options have not been considered at this stage. Each of the building blocks considered here is defined in more detail in the initial options paper. The building blocks considered are:

- **Short-term reallocation** (none, bilateral trading (i.e. trading between two parties, possibly facilitated by a third party), or an extension of the Balancing Mechanism);
- **Medium-term to long-term reallocation** (none, bilateral trading, or market trading);
- **Temporal signals** (none, average/static (e.g. averaged across time such as day/night) or granular/dynamic (e.g. granular Settlement Periods)); and
- **Locational granularity of temporal signals** (none, zonal (averaged across locations) or nodal (granular)).

2.21 These four building blocks are inherently interlinked. This is because, when making an operational decision, a user would be expected to consider all of the costs and benefits associated with that decision, whether those costs and benefits are derived from 'selling' their access rights to other users or into a market, or costs and benefits derived from time of use signals.

2.22 Figure 3 shows a ‘tree diagram’ representation of C2:

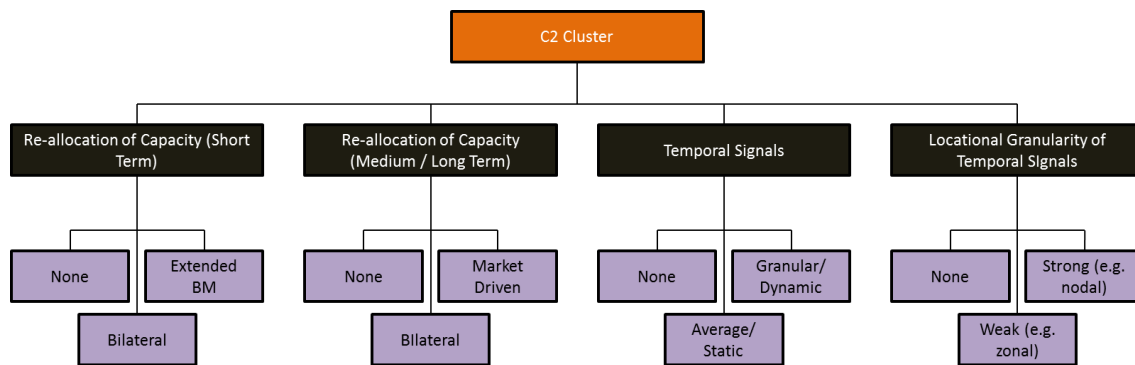


Figure 3 - Tree diagram of C2

### Cluster Options Selected for Assessment

2.23 Given the high number of possible cluster options (81 possible combinations for each cluster) the Task Forces focused on a number of cluster combinations that combined to form mutually reinforcing combinations of options in order to provide a representative range of different approaches. A total of four C1 cluster combinations and five C2 cluster combinations were chosen for further analysis and assessment. These are detailed in sections 4 and 5 respectively.

### Other Building Blocks

2.24 Other building blocks do not naturally fit into a cluster so are dealt with in their own right. These are:

- **tariff design and charging models** (see section 6);
- **properties of access rights** (partially covered by the framework scenarios, and further in section 7); and
- **initial allocation of access rights** (partially covered by the framework scenarios, and further in section 8).

### Assessment Methodology

2.25 To assist in the assessment of options against the assessment criteria (as detailed in paragraph 2.8), the assessment criteria were aligned with their associated Connection and Use of System Code (CUSC) and Distribution Connection and Use of System Agreement (DCUSA) applicable objectives. Details of this grouping can be found in Appendix Two.

2.26 The Task Forces considered the merits of a quantitative (i.e. ranking) versus qualitative (i.e. pros and cons) approach to assessing each option against the assessment criteria. Some Task Force members felt that a quantitative approach could aid the Task Forces in reaching conclusions and create an argument for a set of proposed arrangements better facilitating the applicable code objectives (as scoring would be carried out against the baseline); whilst others felt that a scoring approach could be overly complex in the time available and risk becoming a distraction. The qualitative approach was ultimately progressed.

2.27 A number of approaches were developed and applied in order to carry out the qualitative assessment stage of the work.

- All Task Force members were asked to describe their view of the advantages and disadvantages of each of the scenarios, clusters and individual building blocks against the nine assessment criteria. The results of the assessments were captured in a number of Excel workbooks. This ensured that a range of user perspectives were captured within the assessment.
- Task Force meetings were used to enable a collective assessment to be carried out. This generally took the form of subject matter overview presentations followed by break-out sessions, discussions and feedback.
- Throughout the work programme and in the production of outputs, including reports, individual Task Force members were provided the opportunity to review and provide feedback and input to the work.

2.28 All feedback received through these various approaches was captured and incorporated into the assessments.

2.29 The results of the assessments are summarised in the following sections. The full results of the assessments are available in Appendix Three (framework scenarios), Appendix Four (C1), Appendix Five (C2), Appendix Six (tariff design) and Appendix Seven (charging models).

### **Stage 3: Assessment**

2.30 The remaining sections of this report describe the third stage of the Task Force work involving the assessment of the options which had been identified.

### 3. Assessment of Framework Scenarios

3.1 This section summarises the views of Task Force members on the advantages and disadvantages of the three framework scenarios when considered in the context of the nine assessment criteria. The full views provided can be found in Appendix Three.

#### Framework Scenarios

3.2 The Task Forces initially considered three high level scenarios, as detailed in paragraph 2.14, namely:

- high emphasis on auctions/trading;
- high emphasis on access right choices; and
- high emphasis on better usage charges.

#### *High Emphasis on Auctions/Trading*

##### *Advantages as expressed by Task Force members*

- Optimising capacity allocation:
  - Could optimise allocation behind a constraint (e.g. targeted auctions for local constraints). This would depend on the 'product' being auctioned (e.g. auctioning access rights for a Settlement Period would give a very different outcome to auctioning evergreen (i.e. without a finite lifespan) access rights).
  - May create a market in which suppliers or aggregators compete to create portfolios which optimise allocation.
- Providing effective network user price signals:
  - An auction taking place behind a constraint reveals the value of network access at a given location.

#### High emphasis on auctions/trading

Access choices are well-defined (including being financially firm)

They are purchased via auctions, with scope for re-sale.

Charging models still used to set robust reserve prices, with potential changes to ensure they reflect differential value of access adequately.

##### *Disadvantages as expressed by Task Force members*

- Creating a level playing field:
  - There are challenges in safeguarding smaller users, which then risk creating the potential for gaming across boundaries.
  - Capacity is allocated at 'value' rather than 'cost' as it is now – those with the deepest pockets will always win.
- Appropriate allocation of risk:
  - If access for smaller users is protected, this would place disproportionate risk on larger users. There is a potential parallel with current micro-generation assigned 'rights' compared to larger generation which is required to apply for 'access'.
- Cost-reflectivity:
  - Prices would reflect the value to users rather than the cost of the network. This may result in extremely expensive clearing prices equivalent to the entire value of the user's underlying business. For example, if particular users failed to secure access to the network, then a renewable generator could not generate, a factory could not operate, while hospitals and schools may have to close.
- Support efficient network development



- Auctions provide a poor price signal for network investment. Network companies may have poor visibility of the current and future bid stack, so it will be very difficult for network companies to predict what the impact of a given network investment will be on future auction clearing prices.
- Practicality and proportionality:
  - Barriers to creating a level playing field are mitigated if more users participate in an auction, but an auction for a large number of users will be difficult to administer.
  - This is a revolution from the status quo which would represent significant legal issues (for those already connected) as well as practical and financial barriers to set-up for new users. The benefits of this option would need to be beyond doubt in order to satisfy investor confidence.
  - An auction in itself could create the perception of the possibility of non-access as an outcome. This could be seen by developers as an additional barrier to developing their projects.
  - An auction requires a specified capacity of network to sell. There is no fixed availability of network capacity. Firstly, if demand exceeds existing network capacity, then additional network capacity can be built. Secondly there is circularity because the network capacity available to be auctioned depends on the level of sharing and the particular mix of users across the network which in turn would depend on the result of the auction, which is not known in advance.
  - The amount of capacity allocated to smaller users is not clear under present arrangements as the majority of small users do not have an agreed capacity. This would need to be clarified to enable auction participation.
  - It could potentially be difficult for network companies to enforce capacity constraints on unsuccessful bidders, without resorting to de-energisation.
  - Auctions fail to address the key issues which the Task Force was set up to consider. If one of the biggest identified issues with current arrangements relates to increasing congestion on distribution networks causing a need to provide more efficient price signals to smaller users and demand (including behind the meter generation, demand side response and electric vehicles), then it is this very group for which auctions are least appropriate and least effective.

### **High Emphasis on Access Right Choices**

#### *Advantages as expressed by Task Force members*

- Providing effective price signals, and appropriately allocating risk:
  - Creates a clear, upfront price signal to which users can respond (either by changing e.g. time of use if already connected, or connecting elsewhere if not).
  - Clearly designed products enable users to know what risk they are taking upfront.
- Supporting efficient network development:
  - Network companies have visibility (potentially many years in advance) of the access rights users have requested, and so can develop networks accordingly.

#### High emphasis on access right choices

Access rights are granted broadly on a **first come first served basis**.

There is a **range of choice** around type of access to maximise use of capacity.

**Capacity charges** reflect impact of different choices on network costs.

**Non-firm holders can trade curtailment obligations** through a market-based mechanism.

### *Disadvantages as expressed by Task Force members*

- Cost-reflectivity:
  - Risks over-valuing ‘access’ and under-valuing ongoing behavioural changes.
- Practicality:
  - Creates a potential need for significantly more detailed Connection Agreements for larger users (detailing e.g. time of access at given levels).
  - The requirement to much more closely define access rights for smaller users could be challenging.
  - Users may purchase or lease properties with lower access rights than expected or needed.

### *High Emphasis on Usage Charges*

#### *Advantages as expressed by Task Force members*

- Cost-reflectivity:
  - Assuming the calculation of charges is done on a sound basis, charges should accurately reflect costs and benefits which can be allocated to the behaviour of certain users.
- Creating a level playing field:
  - Each user should face the same charges (for an equivalent unit of energy, i.e. at the same time and location).

High emphasis on better usage charges

Limited changes to access, with reliance on usage charges.

Most charges focused on usage at system peaks. Could include more locational charging (eg for constraint costs.)

#### *Disadvantages as expressed by Task Force members*

- Optimising capacity allocation:
  - Potential for conflict between time of use signals and other cost signals (e.g. the Balancing Mechanism).
  - No improvement on ‘implicit’ sharing of capacity (i.e. how far a network company makes use of users’ different patterns of usage to achieve optimal network usage) which exists under the status quo (unless a greater emphasis were put on capacity charging applied to all user types).
  - There are practical difficulties with creating granular locational prices at low voltage (LV) and high voltage (HV), meaning that some degree of socialisation (i.e. costs shared across a wider body of users) will be retained. Socialised or average tariffs could drive inefficient behaviour in some areas and conflict with the effective allocation of capacity.
- Providing effective price signals which can be predicted with confidence to take action:
  - There is a trade-off between time of use prices being effective which users can respond to compared with time of use prices being cost-reflective. This is because, in order to best facilitate user responses, time of use prices should tend to be static (i.e. fixed) and set in advance, however this would not be particularly cost-reflective. By contrast, for time of use prices to be most cost-reflective, they would need to be dynamic (i.e. change as network conditions change) at high granularity, which would likely result in a volatile signal which may be difficult to predict and therefore respond to for network users. Banded time of use charges (i.e. across several half hour periods) could help to mitigate this until the system is ‘smart’ enough to work real-time.

- Tariffs calculated at high locational granularity could be heavily influenced by the actions of other users on the local network over which a user has no control (i.e. a user could face higher charges despite having made the 'right' usage changes due to the actions of their 'neighbours' on the network).
- Uncertainty on network charges increases investment costs.
- Cost-reflectivity:
  - Network investment is generally driven by changes in user capacity requirements, not changes in user profile use - if a user happens to increase or reduce their use at a key time in one particular year (and therefore reduce their time of use network charges in that year), this does not necessarily reflect the cost of network that the network company needs to build to serve that user in that, or future years.
- Support efficient network development:
  - Without contracted access rights, network companies would have relatively poor visibility of the future demands on the network.
  - Network companies would have relatively little control over the operation of the network because it would be difficult for them to predict how users at different locations would respond to particular price signals at a particular time.

## Summary

- 3.3 The analysis of the three framework scenarios identified a range of advantages and disadvantages with the different approaches under consideration. However, the Task Forces recognised that many of the options considered cut across the scenarios and may have a different impact on individual users.
- 3.4 The framework scenarios describe potential future arrangements at a very high level. Consequently it is difficult to draw conclusions from the consideration of these framework scenarios without defining arrangements in more detail. The subsequent sections seek to add this further level of detail.

## 4. Assessment of C1 – Influences User Investment

4.1 This section summarises the views of Task Force members on the advantages and disadvantages of four C1 cluster combinations when considered in the context of the nine assessment criteria. The building blocks which define C1 are described in detail in paragraph 2.17. The full views provided can be found in Appendix Four.

### Four Cluster Combinations

4.2 Under C1, four cluster combinations have been considered. The first two of these combinations represent options which are broadly consistent with existing arrangements in use at transmission and distribution respectively, with a further two different options. The options considered are:

- C1-A – shallow connection charging with user commitment;
- C1-B – shallowish connection charging with upfront capital payment;
- C1-C – deep connection charging with upfront capital payment; and
- C1-D – shallow connection charging with focus on strong ongoing usage signals.

4.3 Each of these cluster combinations is considered in the subsequent sections.

### C1-A – Shallow Connection Charging with User Commitment

#### Description

4.4 This approach is broadly similar to existing arrangements at transmission level. Figure 4 represents the options selected under each building block to define cluster combination C1-A.

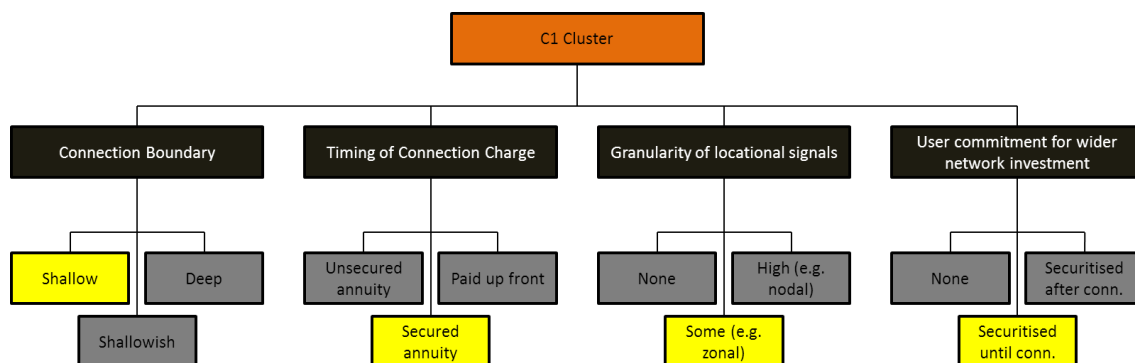


Figure 4 - C1-A shallow connection charging with user commitment

4.5 The features considered under this cluster combination include the following:

- Shallow connection boundary – the connection charge reflects the cost of extension assets only (i.e. those assets needed to connect the new connectee to the existing network). The cost of assets beyond extension assets is reflected in ongoing usage charges.
- The connection charge is paid on an annual basis. The new connectee is required to provide user commitment for the period that the connection charge is outstanding.
- The ongoing usage charges include locational signals that broadly reflect the regional drivers of investment costs which are set zonally, i.e. nodes (being points on the network where individual users connect to the wider network) are grouped

into zones with similar properties, with the same locational signal being applied to all nodes within a zone.

- The new connectee is required to provide user commitment for wider network investment until connected.

#### *Advantages as expressed by Task Force members*

- Zonal charges can be easier to understand (than more granular nodal charges) and can provide strong locational signals subject to appropriate zone size.
- Lack of large upfront connection charges may help smaller players.
- A move towards shallow connection charges should provide enduring price signals to reduce usage of the network (through ongoing usage charges) where the usage charges (instead of the sunk cost of upfront connection charges) are sufficiently granular.
- Network companies will see a clear incentive to assess alternatives to traditional reinforcements.
- Shallow connection charges can encourage trading or constraint management systems and the development of Distribution System Operator models.
- If implemented, this option would increase consistency across transmission and distribution.
- This option should be practical and easy to administer for larger users, albeit transitional arrangement could be challenging for distribution connected users who have already paid shallowish connection charges.

#### *Disadvantages as expressed by Task Force members*

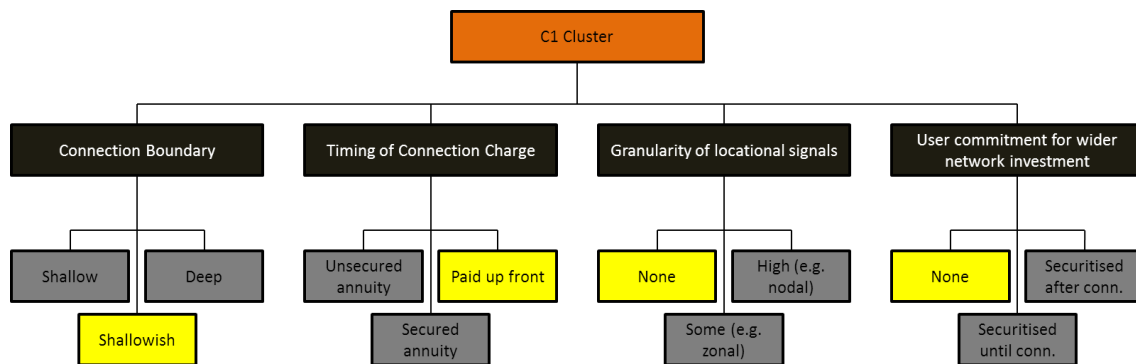
- Limited locational signals (for type of connection) to new connectees (shallow connection charging boundary) with weaker penalty for overstating initial requirements post connection.
- Uncertainty over the level and volatility of future locational ongoing usage charges for users who are already connected to the network.
- If charging models rely on confidential user data, this may create transparency issues (with charging models which cannot be published) and so increase uncertainty for connected users.
- An appropriate level of zonal pricing that avoids excessive socialisation of connection costs may not be practical or feasible at lower voltage levels. The level of zonal pricing would need to be very granular under a shallow connection policy to ensure new connectees pay their fair share of the cost of connecting to the network via the ongoing usage charges applied. Applying highly granular locational charging at LV or HV has significant issues that need to be addressed, namely the practicality of implementation (as it would require network companies to maintain powerflow models of their LV and HV networks) and the potential for a postcode lottery (e.g. with rural users potentially facing a substantial increase in their network charges).
- Limited user commitment (only until the point of connection and not beyond) could increase risk of network asset stranding (i.e. where a network asset is built and only used for a short period of time), the cost of which would inevitably be borne by the wider body of users. The risk of stranding is, however, significantly reduced by the requirement for user commitment until connection, and can be further mitigated by effective communication and use of Connection Agreement milestones so that the network company does not build assets where a developer is not also progressing.

- User commitment is potentially burdensome to administer at lower voltages due to the high volume of users.
- This could have the effect of essentially shifting charges from developers to end users (an example being a new housing development) and removing any incentive on developers to accurately specify capacity requirements commensurate with future needs. Ultimately it could lead to cheaper construction costs with higher energy bills.
- Current arrangements at transmission require commitment from the user in the form of securities for local and wider reinforcement works required for their connections which can act as a barrier to more remote connections (e.g. island connections).
- Implementation could be complicated by dealing with legacy users (i.e. users with existing connections on current terms – everyone who is currently connected or has an existing Connection Agreement) or having a split charging arrangement.

### **C1-B – Shallowish Connection Charging with Upfront Capital Payment**

#### *Description*

4.6 This approach is broadly similar to existing arrangements at distribution level. Figure 5 represents the options selected under each building block to define cluster combination C1-B.



*Figure 5 - C1-B shallowish connection charging with upfront capital payment*

4.7 The features considered under this cluster combination include the following:

- Shallowish connection boundary – assets paid on the following basis:
  - Extension assets (i.e. assets required to connect the new connectee to the existing network) – paid for in full by the new connectee.
  - Reinforcement assets (i.e. existing network assets which require work in order to accommodate the new connectee) – in most circumstances apportioned between the new connectee and the wider body of users on a capacity basis.
- The connection charge is paid in full in advance of connection.
- The ongoing usage charges include limited (or no) locational signals to influence behaviour.
- There is no user commitment requirement for wider network investment regardless of whether the new connectee has contributed or not.

#### *Advantages as expressed by Task Force members*

- Upfront charges encourage locating demand and/or generation where capacity is already available.

- Shallowish charges ensure the new connectee contributes some upfront costs of connection, reducing the risk of stranded assets (which can also be mitigated by effective communication and use of Connection Agreement milestones so that the network company does not build assets where a developer is not also progressing).
- A move to shallowish charges for new transmission connectees would vary the risk allocation and reduce uncontrollable risk to users of future tariff increases.
- Minimal change for the majority of users.
- This option allows for lower granularity of locational charges, which may make it more feasible to implement at lower voltages.
- High connection costs in constrained areas incentivise network companies and prospective connectees to develop more efficient solutions to the benefit of all users.
- If implemented, this option would increase consistency across transmission and distribution.
- In the case where developers are connecting but are not the end user, shallowish connection charging provides an investment cost signal to the party able to control investment behaviour (i.e. the developer rather than end user).

#### *Disadvantages as expressed by Task Force members*

- The obligation to pay upfront creates a barrier to connection and does not deal with the existing issues of queues of new users in constrained areas.
- Relatively weak ongoing price signals limit the network company's ability to influence user behaviours and increases costs of network management by encouraging high-cost investment rather than potentially cheaper flexibility.
- Lack of ongoing locational signal could result in inefficient use of the network and higher costs to end users.
- Shallowish connection charging boundary makes it difficult to integrate flexibility and compensated connect and manage regimes. There may be implications for the Balancing Mechanism of a move to deeper connection charges.
- Connection charges can become prohibitively high in constrained areas. This is unfair for new and future users and can encourage earlier connectees to use up spare capacity to avoid higher connection charges.
- A shallowish boundary without user commitment can leave other network users exposed to the costs of new/augmented requirements or the costs of asset stranding (although not to the extent seen under a shallow connection policy).
- Requires a complex connection charging methodology, which is well established at distribution level but would require significant development at transmission.
- This approach socialises deeper connection costs which are more likely to benefit many user and therefore should not be fully paid by a new connectee.

## C1-C – Deep Connection Charging with Upfront Capital Payment

### Description

4.8 This approach is broadly similar to the arrangements that existed for distribution connected generation prior to 2005. Figure 6 represents the options selected under each building block to define cluster combination C1-C.

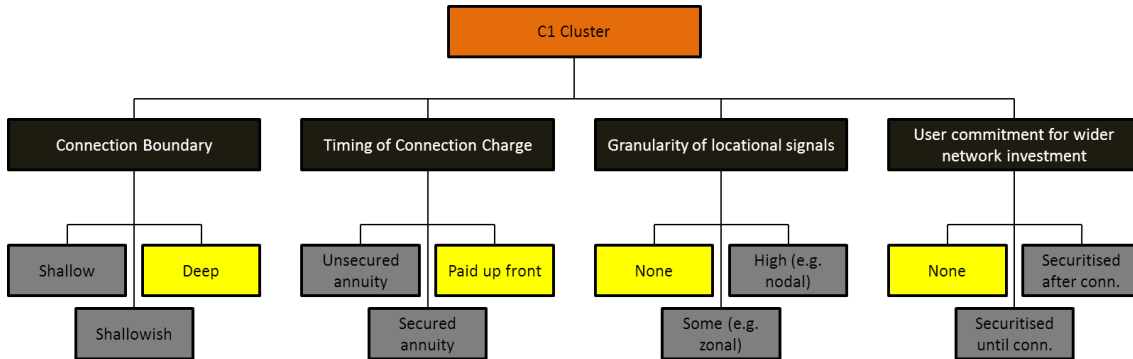


Figure 6 - C1-C Deep connection charging with upfront capital payment

4.9 The features considered under this cluster combination include the following:

- Deep connection charging boundary – the new connectee pays for all assets required to provide the connection, including the full extent of any necessary network reinforcement (network reinforcement being reasonably attributed to the new connectee to avoid undue depth of charging or excessive user commitment).
- The connection charge is paid in full in advance of connection.
- The ongoing usage charges include limited (or no) locational signals to influence behaviour.
- There is no user commitment requirement for wider network investment.

### Advantages as expressed by Task Force members

- A strong upfront locational signal means that entire cost of connection rests with the new connectee.
- Enables new connectees to make clear decisions on the basis of the cost of connection.
- Removes uncertainty associated with future (and potentially volatile) ongoing usage charges.
- Protects existing users from risk related to new connectees.
- Costs of stranded assets less likely to fall on the wider body of users.
- Incentivises prospective connectees to seek flexible alternatives.
- Simple to implement for the majority of users.
- Gives a clear signal upfront (especially for larger sites) at the time of connection.
- In the case where a developer pays the connection charge and an end user becomes liable for the ongoing usage charges, deeper connection charges ensure the locational signal goes to the party able to control it (i.e. the developer).

### Disadvantages as expressed by Task Force members

- Strong upfront signal in isolation makes reallocation of capacity difficult and may encourage capacity hoarding (unless effectively mitigated through, for example, use it or lose it rules), which disadvantages large demand and smaller users and community groups, may encourage off-grid solutions and could stall further network development.

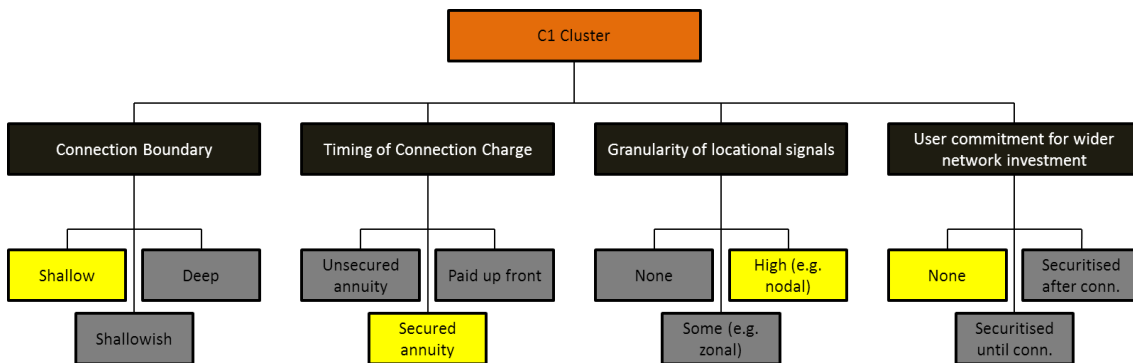


- Connection charges can become high in constrained areas. Deep connection charges place excessive risk of reinforcement on individual users, and may result in parties paying for reinforcement never used.
- No forward looking price signals to encourage behaviours post connection would result in a lack of incentive to be flexible.
- Technology which can reduce constraints/network costs would have less incentive to connect.
- Increases cost of the Capacity Market.
- Transition challenging.

### **C1-D – Shallow Connection Charging with Focus on Strong Locational Ongoing Usage Signals**

#### *Description*

4.10 C1-D is in many ways similar to C1-A, but with more granular locational ongoing usage charges, meaning that specific costs associated with a given new connectee can be reflected back onto that connectee through ongoing usage charges. Figure 7 represents the options selected under each building block to define cluster combination C1-D.



*Figure 7 – C1-D shallow connection charging with focus on strong locational ongoing usage signals*

4.11 The features considered under this cluster combination include the following:

- Shallow connection boundary – the connection charge reflects the cost of extension assets only. The cost of assets beyond extension assets are reflected in ongoing usage charges.
- The connection charge is paid on an annual basis. The new connectee is required to provide user commitment for the period that the connection charge is outstanding.
- The ongoing usage charges include highly granular locational signals reflective of local drivers of investment costs.
- There is no user commitment requirement for wider network investment.

#### *Advantages as expressed by Task Force members*

- Granular locational usage charges present a strong locational/temporal signal (highly cost-reflective).
- A shallow connection boundary is efficient for capacity allocation (i.e. no sunk cost and users face cost-reflective usage charging instead). The remainder of the user base is protected through securitisation without risk of cross-subsidy through granular locational charges (i.e. reinforcements triggered within a given network area would not be paid for by users elsewhere).

- Good for smaller users, encourages connections, and provides cost certainty as a small upfront cost and annuitised connection charge provides a degree of cost certainty.
- Places an incentive on the network company to assess alternatives to traditional reinforcements as capacity limits are reached, and to encourage flexible responses.
- Simple to administer, with no interaction required with the Capacity Market.

#### *Disadvantages as expressed by Task Force members*

- The connection charge does not contain a locational element for any reinforcement which may drive unnecessary costs or inefficient connections.
- Lack of upfront charge or contribution to reinforcement through the connection charge does not create commitment from the new connectee (i.e. may encourage speculative applications).
- Users may be unfairly treated based on their location or if energy usage is not their core business which they have little control over and may unfairly penalise those with infrequently high usage over peak times.
- Highly granular charges may be complex, volatile and difficult to forecast (location/time etc.) and respond to and so lead to inefficient user investment decisions.
- Difficulty developing a consistent approach and a level playing field between transmission and distribution.
- Nodal pricing may not be practical or feasible at lower voltage levels. Applying nodal locational charging at LV or HV has significant issues that need to be addressed, namely the practicality of implementation (as it would require network companies to maintain powerflow models of their LV and HV networks) and the potential for a postcode lottery (e.g. with rural users potentially facing a substantial increase in their network charges).
- This could have the effect of essentially shifting charges from developers to end users (an example being a new housing development) and reducing incentives on developers to accurately specify capacity requirements commensurate with future needs. Ultimately it could lead to cheaper construction costs with higher energy bills.

### **Summary – User Investment Decisions**

4.12 A greater alignment of the principles, methodologies and arrangements for connection and ongoing usage charging at transmission and distribution levels is desirable to avoid boundary issues. This could be achieved by:

- a common shallow connection charging boundary across all voltage levels in transmission and distribution to encourage flexible responses from all connected users (i.e. connection charges would just include extension assets with reinforcement costs treated through ongoing usage charges); and
- locational ongoing usage charges at transmission and distribution EHV only generated by complimentary methods/models; and an HV/LV representative model adjusted for locational issues e.g. a generation dominated network.

4.13 Studies indicate that use of user flexibility is likely to result in a lower cost network and one that is more resilient to uncertainty. A shallow connection charging boundary, most

likely with the connection charge only covering extension assets at the time of connection, will facilitate the use of flexibility by providing a direct price signal to compare the cost of flexibility against network asset solutions. A shallow connection charging policy on distribution networks would require more locational ongoing usage charges further down the network. Applying a shallow connection charging policy further down the network will therefore depend on how feasible it is to apply locational ongoing usage charges at lower voltage levels whilst applying appropriate protection to more difficult to serve communities.

- 4.14 Shallowish connection charges can create prohibitively high connection charges for new users in constrained distribution areas leading to queues for connection. This may be inefficient for the energy system. On the other hand, shallowish connection charges may be appropriate in circumstances where it is not desirable to give strong locational signals – for example, it may not be appropriate to give highly locational cost signals to smaller (particularly residential) users as this risks creating a ‘postcode lottery’; if strong locational signals are not in place for some users, a shallow connection charging boundary would not be appropriate as the costs associated with the connection of a new user would be inappropriately socialised. Some users may prefer the stability of charges achieved through a deeper connection charging boundary than the potential volatility of ongoing usage charges if the connection charging boundary were shallow.
- 4.15 Deep connection costs can act as a barrier to new investment and reduce the ability to influence a user’s behaviour once they have connected – Ofgem moved away from a deep connection policy in 2005 for distribution connected generation for this reason. Moving to a deep connection boundary could act as a barrier to developing flexibility services; given the electricity industry is likely to become increasingly reliant on flexibility this barrier is likely to be undesirable.
- 4.16 C1-A (shallow connection charging with user commitment) or C1-D (shallow connection charging with a strong focus on locational usage signals) would fit the above requirement in terms of connection charging boundary. The difference between C1-A and C1-D is the degree of granularity of ongoing usage charges. Whilst greater granularity can be more cost-reflective it can also result in more volatile charges which are hard to predict and hence less likely to influence behaviour. From a practical implementation point of view, it may be preferable to limit locational signals to EHV connections, and hence a shallowish connection charging policy may remain appropriate at HV and LV.
- 4.17 To reduce the risk of stranded asset costs, it is in the interests of all parties to ensure that, where network capacity is increased in response to a user request, that increased capacity is utilised. For this reason user commitment is a key requirement. In terms of practical implementation, this could be restricted to larger connection capacities (e.g. greater than 1MW). User commitment until at least the time of connection and potentially for a period beyond connection would reduce the risk of stranded asset costs. These requirements could be met by securitisation of a proportion of cost committed to provide the capacity until connection (a feature of C1-A) whilst the beyond connection user commitment could be met by a requirement to pay for any agreed capacity for at least a fixed period of time (e.g. 5 years). Any introduction of post-connection user commitment would need to be assessed against the cost of users obtaining the financial backing required to provide such commitment, which may be disproportionate to the benefit delivered.

- 4.18 There is a risk shallow connection charges reduce incentives on developers to accurately specify capacity requirements commensurate with future needs, especially where there is no ongoing relationship between the developer and the end users, e.g. a new housing estate. For example, if a shallow connection charging boundary was in place a developer could over-request network capacity (ensuring headroom for their development) without incurring additional cost. If all of the requested capacity were not subsequently developed, either ongoing usage charges would only be recovered in respect of the actual connected capacity (leaving a shortfall to be recovered elsewhere) or the locational ongoing usage charges of the connected users would be inflated to recover the full cost of the requested reinforcement, neither of which impact the developer. It may be possible to alleviate this risk by creating a dis-incentive for developers to overstate capacity requirements by ensuring they retain a liability should the capacity on a new development be underused.
- 4.19 For LV domestic and small business users, the introduction of core and non-core (i.e. greater than core) access rights would ensure that additional requirements, which lead to reinforcement, are recovered from the users who drive this cost. To avoid distortions due to early or late adoption, costs for non-core use would be recovered via ongoing usage charges reflective of the costs of reinforcement. By contrast, ongoing usage charges for core use may be applied by user segment rather than geographic location to avoid an arbitrary 'postcode lottery'.
- 4.20 There are likely to be significant issues with transitioning to shallow connection charging arrangements for all voltage levels. The requirement to incorporate grandfather rights for existing users would need to be considered, potentially delaying the benefits of the change and giving some users a disincentive to update connection arrangements, for example, to release underutilised capacity. However access to local flexibility markets and balancing/trading at a local level could be made dependent on existing users accepting new arrangements.

## 5. Assessment of C2 – Influences User Operations

5.1 This section summarises the views of Task Force members on the advantages and disadvantages of five C2 cluster combinations when considered in the context of the nine assessment criteria. The building blocks which define C2 are described in detail in paragraph 2.20. The full views provided can be found in Appendix Five.

### Four Cluster Combinations

5.2 Under cluster two, five cluster combinations have been considered as follows:

- C2-A – temporal signals;
- C2-B – extended Balancing Mechanism;
- C2-C – full range of operational signals;
- C2-D – bilateral trading; and
- C2-E – market trading.

5.3 Each of these cluster combinations is considered in the subsequent sections.

### C2-A – Temporal Signals

#### Description

5.4 This approach uses temporal (time of day) tariffs to influence user behaviour. Figure 8 represents the options selected under each building block to define cluster combination C2-A.

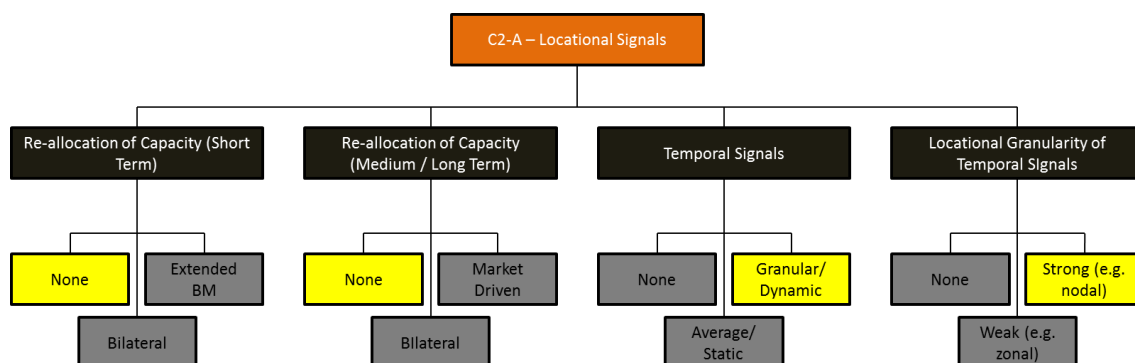


Figure 8 - C2-A temporal signals

5.5 This cluster combination considers temporal (time of day) tariffs that can be used to influence user behaviour. There are a range of possible implementations, ranging from peak/off peak usage charges down to dynamic short-term prices that reflect costs on a more granular basis (potentially down to individual Settlement Periods) and for individual locations. These are not mutually exclusive, and it would be possible, for example, to extend the use of red, amber and green timebands further down the network and also introduce dynamic pricing for certain groups of users. The features considered under this cluster combination include the following:

- The introduction of ongoing usage charges which are more temporal in nature. This is not restricted to consumption but could also include other elements such as temporal capacity charges.
- Introducing dynamic temporal signals (e.g. time signals which vary dynamically every Settlement Period with minimal notice).

- Introducing temporal charges that are set at a highly granular (e.g. nodal) locational basis (e.g. each primary substation has a different set of temporal signals – a primary substation might serve a small town or a large commercial user).
- There are no mechanisms for the reallocation of capacity rights.

#### *Advantages as expressed by Task Force members*

- Dynamic pricing reduces the need for participation in complex mechanisms (such as the Balancing Mechanism) and so avoids placing high costs on users.
- Under temporal locational charging, users pay more when contributing towards constraints, with common price signals regardless of whether a user is connected to the transmission or distribution network improving price reflectivity of distribution and transmission connected assets. This facilitates a more level playing field.
- Dynamic and/or locational temporal price signals can provide a signal for users who cannot, or choose not to, participate in the Balancing Mechanism.
- Static time of use signals can be predictable and reflective if calculated ex ante (i.e. in advance) and charged ex post (i.e. after the fact), allowing users to reliably forecast their charges and modify their behaviour in response.
- Time of use price signals may be effective for reflecting future network costs if used as a proxy for user operational characteristics (such as reflecting the type of profile of a particular demand user), rather than providing an explicit time of use price signal to which a user is expected to respond.

#### *Disadvantages as expressed by Task Force members*

- If time of use price signals fail to be fully cost-reflective, then they would provide an unfair competitive advantage to users who are better able to take action to avoid them, but for time of use price signals to be fully cost-reflective, they need to be dynamic at high resolution (e.g. changing each Settlement Period). This would make it very difficult for users to predict when planning their dispatch.
- There is a risk of undesirable social outcomes if all demand is exposed to strong temporal signals, for example if cost-reflective charges result in very high charges at peak times, essential demand will be being penalised for unavoidable usage at peak times.
- Exposes the network company to the risk that users may over/under respond to time of use price signals, so the network company may have to pre-emptively reinforce its network to be able to meet demand in a situation where users do not respond. This is in contrast to options where the network company has greater control over user specific responses and so can see the value users place on access before deciding whether to reinforce.
- There are potentially practical constraints and high costs in setting and applying dynamic and/or locational prices for smaller users.
- As there is no short-term reallocation of capacity in this option, the value users place on access in constrained areas of the network must be revealed by the ongoing usage charges in order to show where reinforcement is cost-effective.
- Time of use prices may be an ineffective approach for reflecting future network costs if network investment is driven more by a user's capacity than by a user's particular operational behaviour in any given year.
- There is a trade-off between operational time of use prices being effective which users can respond to (static set in advance) compared with operational time of use

prices being cost-reflective (dynamic high granularity set in real-time). It may be challenging to identify a useful balance between these two issues.

### C2-B – Extended Balancing Mechanism

#### Description

5.6 This approach gives the network company a short-term mechanism to allocate real-time access. Figure 9 represents the options selected under each building block to define cluster combination C2-B.

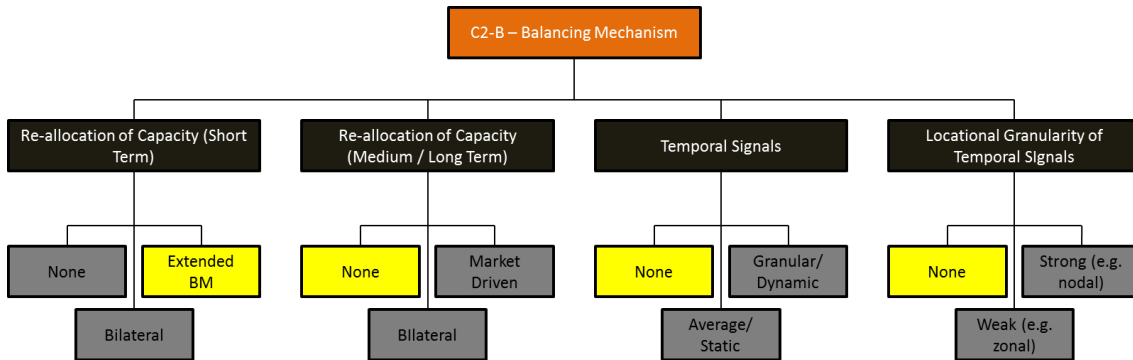


Figure 9 - C2-B extended Balancing Mechanism

5.7 The features considered under this cluster combination include the following:

- Dynamic management of constraints and optimisation of dispatch at both transmission and distribution in real-time (i.e. efficiently operating the system by considering the cost of constraint and allocating access).
- There is no use of medium or long-term reallocation of capacity.
- There is no use of temporal signals.

#### Advantages as expressed by Task Force members

- Users who place a high value on access get to keep it, while users prepared to give up their access are compensated and 'made whole'.
- An extended Balancing Mechanism would be effective at providing spot price (i.e. real-time) signals to those users who can respond to them, while avoiding imposing operational risk and price signals on those users who can't.
- The operational risk of operating the system falls on the network company, which is best placed to manage it.
- An extended Balancing Mechanism would give signals to both generation turn down and demand turn up (assuming a generation driven constraint).
- An extended Balancing Mechanism would take into account locational signals and could optimise demand/generation around constraints.

#### Disadvantages as expressed by Task Force members

- High engagement needed to participate, which could limit participation.
- May need a 'de minimis' level at which this approach works, in which case there is a risk of excluding some users from participation.
- Risk of distortion if users with firm access are bidding alongside users with non-firm access.
- Relies on a cost-reflective investment signal being given through another charging mechanism.

- Would need to develop a methodology to stop gaming by exacerbating constraints, as an extended Balancing Mechanism would likely provide a greater benefit if constraints are exacerbated.
- Relies on verification that action is taken as contracted – this is likely to be difficult to implement for smaller users without smart systems.

## C2-C – Full Range of Operational Signals

### Description

5.8 This approach incorporates a number of the other features from within the C2 cluster to develop a full range of operational price signals which could be used to drive user behaviour, and has been included to enable a discussion on how different operational signals could interact. Figure 10 represents the options selected under each building block to define cluster combination C2-C.

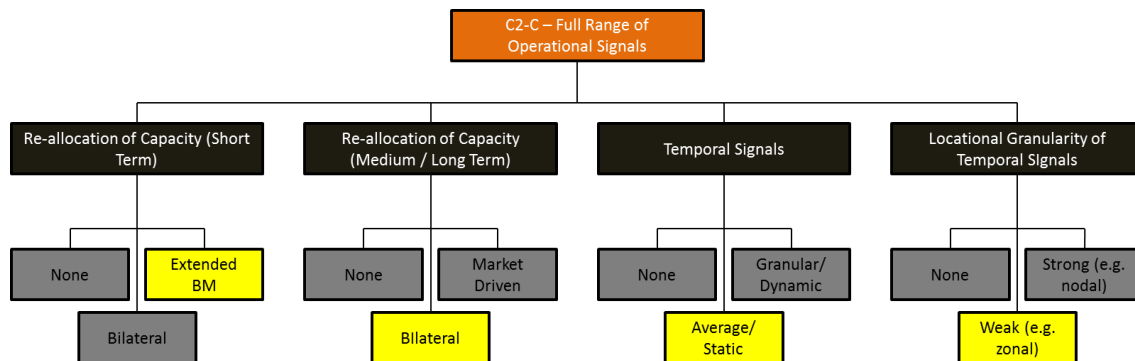


Figure 10 - C2-C full range of operational signals

5.9 The features considered under this cluster combination include the following:

- A short-term mechanism to dynamically manage congestion and optimise dispatch in real-time at both transmission and distribution (i.e. efficiently operating the system by considering the cost of constraint and allocating access).
- Trading by users of well-defined medium-term and long-term access rights directly with one another. Potential exchanges will require sufficient physical interconnection and may not be possible in some circumstances due to network constraints. To ensure physical compatibility, the network company would either publish an exchange rate (i.e. how much 1MW of capacity in one area of the network is worth in another area; 1MW in an unconstrained area is likely to be worth less in an area that is more constrained) in advance or assess each trade.
- Tariffs provide some temporal granularity (e.g. peak and off peak charges).
- Tariffs are set in advance (e.g. at the start of each year) and provide some locational granularity (i.e. charges that broadly reflect the regional drivers of investment costs).
- Signals could be applied to all users or could be applied to give different signals to different users (e.g. constraint signals to larger users and tariff signals to smaller users).

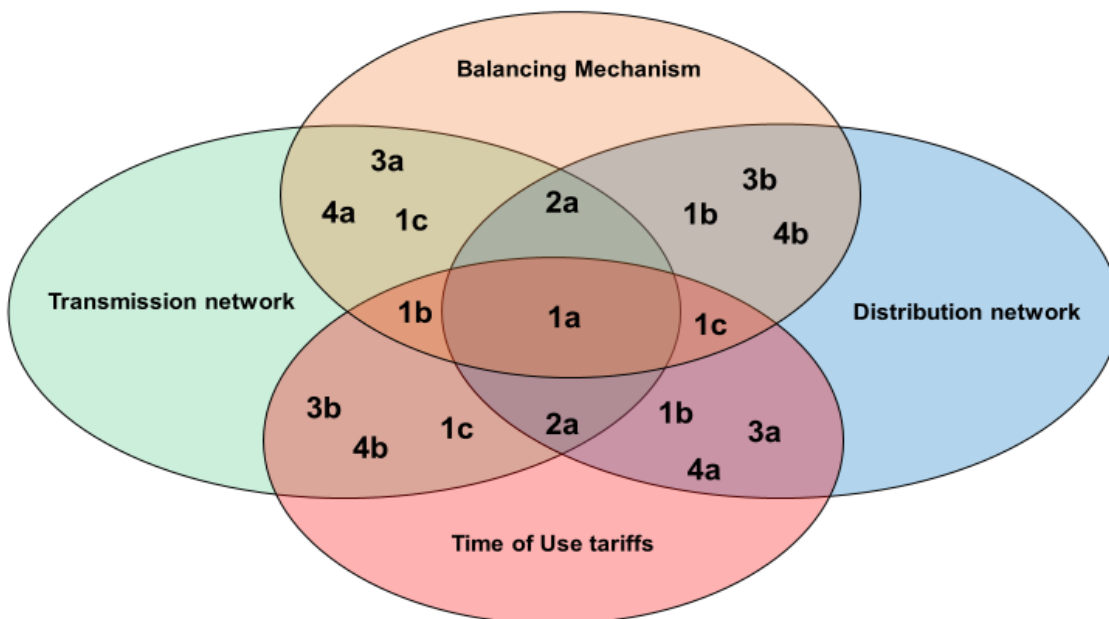
### Interactions between Different Operational Signals

5.10 There are several possibilities for how the full range of operational signals could be used, including:



1. The full range of operational signals applied to all users for the use of a single network. For example, all users could be exposed to time of use signals, an extended Balancing Mechanism and bilateral or market trading opportunities for access to the distribution network.
2. Different operational signals applied to different users for the use of a single network. For example, an industrial user could be exposed to an extended Balancing Mechanism for access to the distribution network, whilst a smaller user was exposed to time of use price signals for access to the distribution network.
3. The full range of operations signals applied to all users for the use of different networks. For example, all users could be exposed to time of use signals for access to the distribution network whilst also being exposed to an extended Balancing Mechanism for access to the transmission network.
4. Different operational signals applied to different users for the use of different networks. For example, an industrial demand user could be exposed to an extended Balancing Mechanism for access to both the transmission and distribution networks, whilst a smaller user was exposed to time of use signals for access to the transmission network and bilateral or market trading opportunities for access to the distribution network.

5.11 Figure 11 shows a pictorial representation of each of these options, with a simplification to only consider an extended Balancing Mechanism and time of use signals.



*Figure 11 - Interactions between different operational signals*

1. Full range of operational signals for all users:
  - 1a – users exposed to both an extended Balancing Mechanism and time of use signals for both the transmission and distribution networks.
  - 1b – users exposed to both an extended Balancing Mechanism and time of use signals for only the transmission network, while the distribution network uses either an extended Balancing Mechanism or time of use signals.

- 1c – users exposed to both an extended Balancing Mechanism and time of use signals for only the distribution network, while the transmission network uses either an extended Balancing Mechanism or time of use signals.
2. Different operational signals applied to different users:
    - 2a – some users exposed to an extended Balancing Mechanism for both the transmission and distribution networks, while other users are exposed to time of use price signals for both the transmission and distribution networks.
  3. Full range of operational signals for a user for different networks:
    - 3a – users are exposed to an extended Balancing Mechanism for the transmission network and time of use signals for the distribution network.
    - 3b – users are exposed to time of use signals for the transmission network and an extended Balancing Mechanism for the distribution network.
  4. Different operational signals applied to different users for different networks:
    - 4a – some users are only exposed to an extended Balancing Mechanism for the transmission network, while other users are only exposed to time of use signals for the distribution network.
    - 4b – some users are only exposed to time of use signals for the transmission network, while other users are only exposed to an extended Balancing Mechanism for the distribution network.

#### *Full Range of Operational Signals for all Users*

5.12 It may not be economically efficient to provide operational signals from both time of use signals and an extended Balancing Mechanism, and enable bilateral trading to the same users for the operation of the same network. This is because, if any one of the elements fails to be fully cost-reflective at any given time, this would result in market distortions, conflicting incentives and arbitrage gaming opportunities to inefficiently avoid paying the price signals which the network companies intended.

#### *Different Operational Signals applied to Different Users*

5.13 If the respective pros and cons of time of use signals, an extended Balancing Mechanism, and bilateral trading were different for different types of user, then it may be possible to use the entire range of operational signals but target each towards the user that will respond to it most.

5.14 For example, if a type of user tends not to operationally respond to Balancing Mechanism price signals (e.g. domestic core demand), then there may be a system benefit in exposing that type of user to time of use operational price signals from network tariffs instead. A key disadvantage of this approach is that it may result in different types of user being exposed to different price signals, even though they may cause the same cost or benefit to the network, which may result in a distortion to competition.

5.15 It may be practically challenging to prevent some users (e.g. behind the meter generation assets) from being exposed to both types of operational price signals for the same network. For example, behind the meter assets may respond to both demand time of use operational signals, as well as choosing to participate in an extended Balancing Mechanism as demand side response, and possibly via an aggregator. If there was a

desire to ensure behind the meter generators only faced one set of price signals (either time of use or an extended Balancing Mechanism but not both), then it may be necessary to exclude behind the meter assets from participating in the extended Balancing Mechanism. A key disadvantage of this approach would be that it is likely to result in less efficient balancing actions.

- 5.16 A similar approach could be taken with bilateral trading at a different time horizon to the extended Balancing Mechanism (in line with existing arrangements at transmission level), to mitigate conflicting price signals between trading and the extended Balancing Mechanism.

#### *Full Range of Operational Signals for a User for Different Networks*

- 5.17 If the respective pros and cons of time of use price signals, an extended Balancing Mechanism, and bilateral trading were different for different networks, then it may be possible to use them differently, e.g. an extended Balancing Mechanism for the operation of the transmission network and time of use price signals for the operation of the distribution network.

- 5.18 For this to be economically efficient, it would be essential for time of use price signals to be fully cost-reflective, otherwise the incentives for the operation of one network (e.g. distribution time of use) may distort competition and the operation of another network (e.g. transmission Balancing Mechanism) and distort competition in the wholesale market.

#### *Different Operational Signals Applied to Different Users for Different Networks*

- 5.19 In this scenario, for example, generators connected to the distribution network may be excluded from participating in an extended Balancing Mechanism for the operation of the transmission network and instead distribution connected assets may only be exposed to time of use price signals for the operation of the distribution network.

A key disadvantage of this approach would be that it is likely to result in significantly less economic efficiency if distribution connected assets are excluded from competition to provide services for the operation of the transmission network and could weaken existing reform to widen access to the Balancing Mechanism through the Trans European Replacement Reserves Exchange project ('project TERRE') and its associated code modifications. Given the risk of creating advantage or disadvantage for some users, differences in which signals users are exposed to would need to be well-justified.

#### *Providing One Type of Operational Signal for All Users for All Networks*

- 5.20 In this scenario, users would be exposed to only one type of price signal for operational dispatch, which may involve providing only time of use price signals without any form of extended Balancing Mechanism (i.e. cluster combination C2-A), or alternatively only an extended Balancing Mechanism without any form of time of use signals (i.e. cluster combination C2-B). Alternatively, the system could rely on only bilateral trading or market trading (i.e. cluster combinations C2-D and C2-E respectively), with no operational price signals from either time of use tariffs or an extended Balancing Mechanism at all. This approach of using only one form of price signal could avoid potential distortions which may arise from providing two or more different types of price signal for the same purpose of incentivising users' operational decisions.

### *Advantages as expressed by Task Force members*

- Location and time of usage impact investment, therefore sending these signals to users is truly cost-reflective.
- Weak locational and time of use signals may support access for all.
- Potential for simple underlying time of use price signal for some users (e.g. domestic) with an extended Balancing Mechanism on an opt-in basis.
- Effective price signals across timescales encourage aggregation and competition in supply, allowing economies of scale.
- An extended Balancing Mechanism allows users to reflect their own costs to the network company, which includes time of use and other network charges; therefore better dispatch is achieved when users set their own costs.
- Ability to hedge network access through medium-term products allows users to manage the risk of the costs of network access and buy the access they require.
- Incentive on users to flex usage and therefore collectively make better use of existing capacity.
- An extended Balancing Mechanism model provides price discovery (i.e. how different users value access to the network) and clear economic evidence to evaluate whether it is economically efficient to make particular network reinforcement investments.

### *Disadvantages as expressed by Task Force members*

- Different approaches on different networks risk the approach on one network distorting the other.
- The network companies' attempts to use an extended Balancing Mechanism tool to manage operational dispatch may be hampered if users are also self-dispatching for time of use price signals.
- If some types of users are exposed to time of use tariffs, while different types of user are exposed to an extended Balancing Mechanism, users which cause the same cost or benefit may face different charges.
- Difficult for this to work efficiently if different users have chosen different types of access rights.
- Volatile and complex signals limit the influence on user behaviour and so could lead to excessive reinforcement.
- Bilateral trading favours larger parties, reducing capacity trading overall.
- Bilateral trading enables some users to arbitrage between other price signals which may lead to economically inefficient behaviour in the extended Balancing Mechanism and time of use responses via adverse selection (e.g. users using bilateral trading to avoid paying the cost-reflective ongoing usage price signals which the network company intended them to pay).
- This would be very complex to optimise and there is a risk that the extended Balancing Mechanism and time of use signals may not align.
- This approach relies on high granularity of data - further work would be required to understand any practical considerations arising from this.

## **C2-D – Bilateral Trading**

### *Description*

5.21 This approach has been developed to explore the benefits of developing a bilateral traded market for access rights, and has been created to enable the benefits and disadvantages to be explored. However, in reality, it could sit alongside some of the other options. Under this approach, users would trade access rights directly between

one another (potentially with use of a centralised enabling system) with the network company only involved to either assess the viability of each trade or to provide exchange rates for specific trades. Figure 12 represents the options selected under each building block to define cluster combination C2-D.

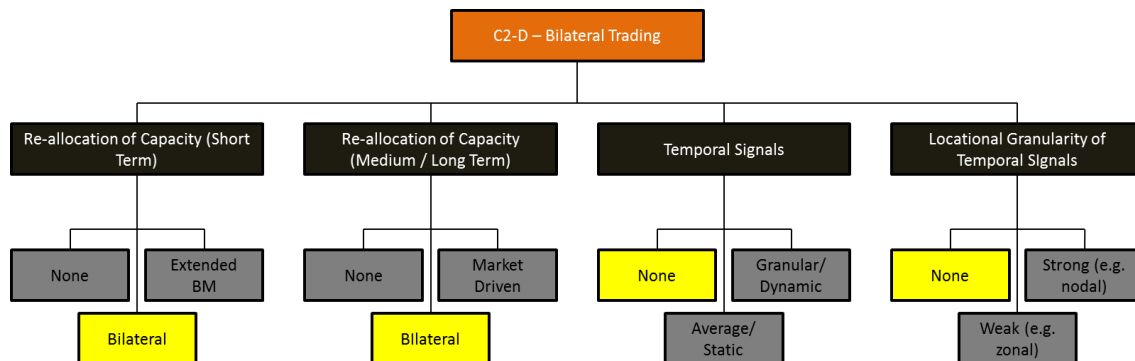


Figure 12 - C2-D bilateral trading

5.22 The features considered under this cluster combination include the following:

- Access rights are initially allocated by the network company and then reallocated on a short-term, medium-term or long-term basis with other users.
- Direct trading by users with one another of well-defined access rights.
- Potential exchanges will at the very least require the local connection assets to be sufficient and may not be possible in some circumstances due to wider network constraints. To ensure physical compatibility, the network company would either publish an exchange rate in advance or assess each trade.
- There are no locational or temporal tariffs with this option.

#### *Advantages as expressed by Task Force members*

- Users trading bilaterally could potentially ensure efficient allocation of existing capacity.
- Requirements for capacity allocation on suppliers could encourage supply market competition, lowering costs for users trading access.
- The ability to aggregate demand and generation together could offset risk through a portfolio approach, vertical integration and economies of scale.
- Users will have sufficient view of their own costs once capacity has been secured to make decisions about operation.
- If combined with a deep connection boundary, risk may be reduced for users who would otherwise be committed to paying deep connection charges.

#### *Disadvantages as expressed by Task Force members*

- The network company would have poor control of the short-term operational dispatch of particular users, which would make it difficult for the network company to efficiently operate the system on an operational timeframe.
- Bilateral trading favours larger parties, reducing capacity trading overall.
- Bilaterally traded prices are more likely to be opaque, not publicly available and very difficult to predict since they are based on a negotiated agreement based on the value to the respective parties and their relative bargaining strengths.
- There is a risk of economic distortions caused by using secondary trading to arbitrage network charging arrangements which may result in users being able to

avoid paying the cost-reflective ongoing usage charges which the network company intended them to pay.

- Exchange rates are needed when trading access between different types of user. It would be impractical for the network company to calculate these for different types of users for different locations in real-time if there were a high volume of bilateral trading.
- Networks need a safeguard system, so that network companies have the power to block trade transactions in case they may put the system at risk.
- Trading in general cannot offer the user best value. By definition the access is purchased/traded at 'value' and not cost (as it is now). As such the user will always be paying over the odds.
- Smaller users need to be allocated a capacity to be able to take part in the mechanism.
- Could disadvantage smaller users who give away access rights, which they need at a later date.

### C2-E – Market Trading

#### Description

5.23 Figure 13 represents the options selected under each building block to define cluster combination C2-E.

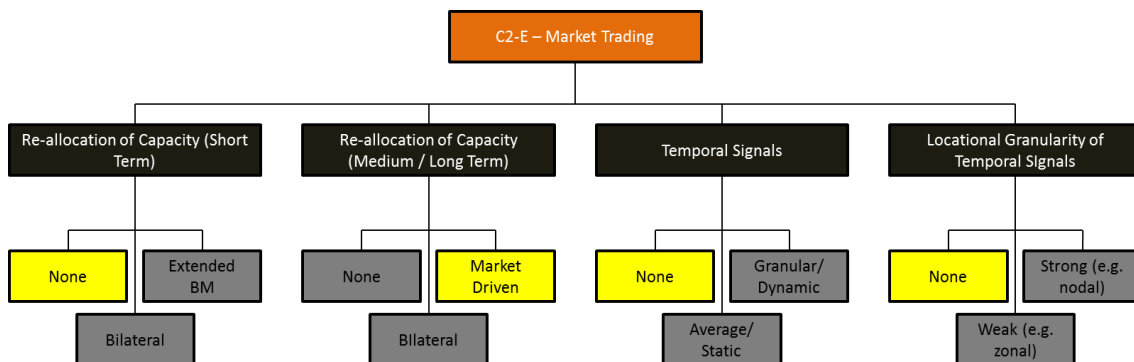


Figure 13 - C2-E market trading

5.24 The features considered under this cluster combination include the following:

- Access rights are reallocated on medium-term or long-term basis with other users.
- Trading of well-defined access rights is via a market open to all users.
- Potential exchanges will at the very least require the local connection assets to be sufficient and may not be possible in some circumstances due to wider network constraints. To ensure physical compatibility, the network company would either publish an exchange rate in advance or assess each trade.
- There is no short-term reallocation of rights or management of congestion.
- There are no locational or temporal tariffs with this option.

5.25 A specific example of this approach would be to use trading to improve managing capacity behind a constraint. Current constraint management arrangements at distribution may require non-firm users to curtail their usage on a 'last in, first off' basis. This may be sub-optimal and an approach could be adopted that incorporates market dynamics. This might take the form of flexible users bidding to have the curtailment requirement fulfilled by another user.

5.26 By comparison, the transmission network deals with this same issue using an auction structure to trade curtailment via a central market known as the Balancing Mechanism. Users provide bids and offers, which reflect the marginal cost of reducing or increasing their generation. This results in a merit order (i.e. ordering of bids and offers by cheapest to most expensive), which enables the system operator to select the most economically efficient curtailment action from the entire market.

#### *Advantages as expressed by Task Force members*

- Market trading would publicly display the value being revealed by users allowing a wider audience to participate and therefore react.
- The network company can add network conditions.
- The absence of a requirement to participate in complex mechanisms such as an extended Balancing Mechanism avoids placing proportionately higher costs on users for whom energy is not their core business.
- Requirements for capacity allocation on suppliers could encourage supply market competition, lowering costs for users trading access.
- Users will have sufficient view of their own costs once capacity has been secured to make decisions about operation.
- The ability to aggregate demand and generation together could offset risk through a portfolio approach, vertical integration and economies of scale.

#### *Disadvantages as expressed by Task Force members*

- The network company would have poor control of the short-term operational dispatch of particular users, which would make it difficult for the network company to efficiently operate the system on an operational timeframe.
- A market could be complex to design and create a complex environment in which to operate.
- It would be difficult for users to anticipate what the market clearing price may be when planning dispatch.
- If secondary trading enables some users to arbitrage different charges at different times, then net price signals received by users may be different from that which the network company intended when the charges were originally calculated.
- There could be a risk of speculative behaviour, putting some users at a competitive disadvantage.
- Trading in general cannot offer the user best value. By definition the access is purchased/traded at 'value' and not cost (as it is now). As such the user will always be paying over the odds.

### **Summary – Influencing User Operations**

5.27 There are a number of ways in which it is possible to influence a user's operation once connected to the network. These options are not mutually exclusive, and it may be possible to target different approaches for different types of users. Following discussions within the Task Forces some clear messages have emerged in the area of user operations.

5.28 Reallocation of access rights could offer benefits in certain scenarios. Providing users with a wide range of access choice and the ability to vary this choice through the lifetime of their connection will allow users to connect quickly (ahead of wider network reinforcement) and to trigger efficient reinforcement at a time when user requirements indicate this is appropriate.

- 5.29 Within this, tools that allow fine tuning of real-time user operations can have an important role to play in network charging, allowing control in a way which is not possible through providing time of use price signals alone, particularly to resolve constraints, and ensuring a more efficient use of the network for both demand and generation users. There are many different ways in which this fine tuning could be achieved. One option may be to extend to more voltage levels and users a structure similar to the current transmission network's Balancing Mechanism where users are compensated for their actions to balance the system. Another option may be something closer to distribution active network management arrangements where users are not currently compensated for constraints. Furthermore, if there is a need to have grandfather rights as part of a connection charging boundary change, trading of curtailment obligations could be a useful option. The implementation of this solution could be costly to develop, administer and participate in so consideration is needed as to whether the benefits make it worthwhile. Typically, it is expected that this solution would be more viable for larger users.
- 5.30 Reallocation of capacity through market-based or bilateral trading is likely to need to be supported by network planning studies which ensure sufficient network capability and exchange rates, particularly for trading across wide geographic areas. It may be practical to set a capacity threshold for reallocation. Ensuring a level playing field between larger and smaller users is likely to be important if bilateral trading is implemented. Whilst auctions were not favoured by most Task Force members, they could be seen as a potential way of valuing and/or trading constraint obligations (with the transfer value between locations needing to be established by the network company).
- 5.31 Time of use charges can also have an important role to play in a solution for network charging, reflecting that the costs of owning and operating a network vary across the day and year and if applied consistently, supporting alignment between transmission and distribution. These costs can be reflected in ongoing usage charges to incentivise users to change their behaviour where it is economically efficient for them to do so. Dependence on only user responses to time of use charges may not be sufficiently resilient to prevent reinforcement to meet security of supply standards.
- 5.32 Locational charges can also have an important role to play. Widespread locational network charging is easier to deliver at transmission and EHV because existing loadflow models and network monitoring already approach high levels of granularity at these voltages. Implementing a similar granularity of locational charging at HV and LV would require improvements in the loadflow models and network monitoring used for these voltages.
- 5.33 It is important to consider that different types of operational signal may be better suited for different types of user or for different situations. It is also important to minimise distortions which may arise if two or more different forms of price signal may provide conflicting operational signals, or provide gaming opportunities; this could distort user operations and lead to less efficient outcomes. However, how such different user types are defined may be complex and care is needed to make sure distortions are not created.
- 5.34 Reform of how user operations are influenced through charging must include consideration of the feasibility and possible unintended consequences of the options being considered.



- 5.35 It is important that any solution put in place includes measures to avoid gaming. It must also ensure a level playing field between small and larger participants – a risk particularly noted with respect to bilateral trading. It requires users to have an agreed capacity and under the current arrangements, this would restrict the solution to larger users.
- 5.36 If reform results in more complex arrangements, the interaction between the different signals used needs to be considered carefully. Any distortions should be minimised which may arise if two or more different forms of price signal provide conflicting operational signals, or provide gaming opportunities; this could distort user operations and lead to less efficient outcomes. There also needs to be a balance found between reflecting the state of the network and its cost drivers and ensuring that users can respond to the signal confidently and without excessive reliance on intermediaries.
- 5.37 If reform results in highly volatile signals, it will be important to consider any social impacts of exposing core electricity needs (however defined) to such signals. It will also be important to understand whether such signals can be managed effectively within revenue recovery models.

## 6. Assessment of Tariff Design and Charging Methodology Options

6.1 This section summarises the views of Task Force members on the advantages and disadvantages of tariff design and charging model options in the context of the nine assessment criteria.

### Tariff Design

6.2 The design of new network tariffs can draw on existing elements that are currently in use at either transmission and/or distribution, or new elements could be created. The elements that have been considered by the Task Forces are shown below and include some new tariff elements which are not currently used. These are not mutually exclusive and hybrid options may exist.

6.3 A combination of the following charging elements could be considered for forward looking 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 day and/or time of year:
  - **Unrestricted Unit Rates** – a charge which applies to every unit used in all time periods (e.g. currently used for the majority of non-half-hourly settled domestic users at distribution).
  - **Static Time of Day Unit Rates** – charges which vary by time of day with time bands fixed throughout the year (e.g. the red, amber and green unit rates for half-hourly site specific settled distribution connected users at LV and HV).
  - **Seasonal Time of Day Unit Rates** – charges which vary by time of day and also time of year (e.g. the charges levied on pseudo-half-hourly Unmetered Supplies users at distribution).
  - **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 (e.g. 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 half-hourly transmission triad charges which have a very narrow ‘critical peak’ period).
  - **Variable Time of Day Unit Rates** – charges which vary (potentially up to real-time) by time period depending on the level of demand at the time (transmission 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 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).
- **Capacity Based Charges (£/agreed kVA, or £/kW)** – charges levied in respect of a user’s agreed capacity with the network company. Agreed capacities are generally specified in bilateral Connection Agreements, and as such are only in place for larger users at present. Four options have been considered:

- **Standard capacity charge** – The capacity charge is applied to the capacity agreed between the user and the network company. The rate is constant across all time periods.
- **Variable capacity charge** – The capacity charge is applied as temporal charge that can vary by time of day and/or time of year
- **Excess Capacity Charges** - (£/peak kW or £/peak kVA) – charges levied alongside capacity charges where the user exceeds their agreed capacity.
- **Notional capacity charges** – Applying capacity charges to smaller users who do not have an agreed capacity. Instead a representative notional capacity is determined.
- **Reactive Power Charges (£/kVAh)** – 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.

### **Fixed Charges**

#### *Advantages as expressed by Task Force members*

- Simple to implement.
- Fixed charges are completely predictable for the end user.
- Charges are not affected by usage, so users shouldn't be able to avoid them, ensuring cost recovery over a wide base.
- May be used to give a forward looking cost signal for costs which will be avoided if the user disconnects.
- May be appropriate for particular groups whose response would not improve if the cost was more locationally cost-reflective, or if the fixed charge reflects a particular element of cost which is the same for a given type of user or a given location.

#### *Disadvantages as expressed by Task Force members*

- Does not incentivise the 'right' behaviour on its own.
- Limited cost-reflectivity so will not create a level playing field on its own.
- Risk of over-valuing 'off-grid' or behind the meter solutions if fixed charges are too high.
- Vulnerable users may be overcharged.
- Question if these are predictable year-on-year.

### **Unit Rates**

#### *Advantages as expressed by Task Force members*

- Depends on the extent to which costs are driven per kWh and on the ability to limit volatility.
- A time bounded unit rate could signal the contribution to peak demand across a diverse network and averaging over a period of time (such as the annual load factor in transmission) would avoid conflicts between investment and dispatch signals.
- A unit rate is relatively easy for some users to avoid by taking action - to the extent that these actions result in lower network costs, this is cost-reflective.
- Potentially cost-reflective for some elements of the charge and hence better at allocating risk.
- At LV, energy usage reflects the cumulative contribution to any network reinforcement requirements, protecting disproportionate allocation of costs to an individual user.

#### *Disadvantages as expressed by Task Force members*

- If the unit rate is designed to incentivise investment decisions, then it may incentivise inefficient dispatch behaviour.
- Risk of over-valuing reduced usage if not targeted locationally or temporally.
- Time bounded unit rates cannot be accurately applied to non-half-hourly metered users as the network company has no visibility of the time of use.

#### **Unrestricted Unit Rates**

##### *Advantages as expressed by Task Force members*

- Simple for users to understand.
- Easily applied to all users.

##### *Disadvantages as expressed by Task Force members*

- Limited cost-reflectivity so will not create a level playing field and not appropriate for a forward looking charge.
- Only action which can be taken is to reduce overall usage - moving usage to other times has no impact on charges faced.
- Lack of cost-reflectivity means inappropriate risk allocation.
- Risks over-valuing lower overall usage and under-valuing reduced usage at peak.

#### **Static Time of Day Unit Rates**

##### *Advantages as expressed by Task Force members*

- Depends upon the bands used, but is a versatile option to allow cost-reflective forward looking charges and should create a level playing field.
- Prices and time periods are known in advance, so users can respond to them.
- May be useful to signal low cost network periods to demand users, such as low/zero locational network charges overnight.
- To the extent that usage of the network in fixed time periods drives network costs and/or benefits, static time of use charges can be cost-reflective.

##### *Disadvantages as expressed by Task Force members*

- May incentivise inefficient operational dispatch decisions relating to the differential between the static peak band and the actual periods of constraint - this is because periods of system stress are a function of outturn factors such as weather, demand and market events, and so are inherently not static.
- If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost-reflective of incremental future network investment.
- If set globally, may encourage 'wrong' behaviours, e.g. increased generation in generation dominated areas.
- In this situation, the network company would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location.
- Static signals might be too crude to drive an appropriate response and it is doubtful (especially at lower voltages) whether sufficiently sophisticated systems exist to reflect actual constraints. In addition time bands would need to be sufficiently granular to drive the correct level of response.

## **Seasonal Time of Day Unit Rates**

### *Advantages as expressed by Task Force members*

- Depends upon the bands used, but this is a versatile option to allow cost-reflective forward looking charging and may create a level playing field.
- Prices and time periods are known in advance, so users can respond to them.
- May be useful to signal low cost network periods to demand users, such as low/zero locational network charges overnight.
- To the extent that usage of the network in fixed time periods drives network costs and/or benefits, static time of use charges can be cost-reflective.
- Easily applied to users with half-hourly metering.

### *Disadvantages as expressed by Task Force members*

- May incentivise inefficient operational dispatch decisions relating to the differential between the static peak band and the actual periods of constraint. This is because periods of system stress are a function of outturn factors such as weather, demand and market events, which are inherently not static.
- If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost-reflective of incremental future network investment.
- If set globally, may encourage 'wrong' behaviours, e.g. increased generation in generation dominated areas.
- In this situation, the network company would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location.
- Cannot be applied to users with non-half-hourly metering.

## **Critical Peak Pricing**

### *Advantages as expressed by Task Force members*

- Depends upon the bands used, but this is a versatile option to allow cost-reflective forward looking charging and should create a level playing field.
- Assuming the critical peak period and price are known in advance, users can respond easily.
- To the extent which network usage in the critical peak period drives network costs and/or benefits, critical peak prices can be cost-reflective.

### *Disadvantages as expressed by Task Force members*

- May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress.
- Peak demand charging on its own would fail to provide an effective price signal for generation dominated zones where network investment is required to mitigate constraints caused by generation.
- If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost-reflective of incremental future network investment.
- In this situation, the network company would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location.

### **Variable Time of Day Charges**

#### *Advantages as expressed by Task Force members*

- Potentially can be very cost-reflective and hence appropriate for a forward looking charge.
- Potential for very effective response for users with smart technology.
- May tend to provide more cost-reflective operational dispatch price signals than static time of use tariffs.

#### *Disadvantages as expressed by Task Force members*

- Favours users with smart technology who can respond to short-term price signals automatically. Therefore, it may be difficult for some (particularly small demand) users to respond.
- If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost-reflective of incremental future network investment.
- In this situation, the network company would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location.
- May be challenging to calculate real-time dynamic tariffs and therefore likely to be more difficult to implement.
- May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress.
- As a method of providing an operational dispatch incentive, it may be disproportionate and detrimental to expose all users to dynamic time of use tariffs, even if many of those users cannot respond to them.

### **Inclining Block Rates**

#### *Advantages as expressed by Task Force members*

- Meets service requirements of low usage users at low cost, whilst exposing higher usage users (e.g. electric vehicle owners) to higher costs.
- Easily applied to users with half-hourly metering.

#### *Disadvantages as expressed by Task Force members*

- Smaller users may find it difficult to monitor when their usage is remaining within the lower block in order to take action to avoid going over the threshold into the higher block.
- May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress.
- Not cost-reflective - an increment of usage does not impose fundamentally different costs if driven by a high usage user than by a low usage user.
- Dependent on the level of the rising blocks - risk of penalising large households compared to smaller households for the same type of 'essential' usage.

### **Agreed Capacity Charges**

#### *Advantages as expressed by Task Force members*

- Particularly well suited as an option for incentivising user investment decisions.
- If incremental future network investment is driven by user capacity, then this could provide an effective cost-reflective price signal.
- Easily applied to larger users with bilateral Connection Agreements

- Could be used with generators and load users grouped together.
- It may be appropriate to reflect that different types of user (of the same agreed capacity) may cause different incremental future costs to the network.
- Users can obtain certainty by contracting in advance for the capacity (or 'access') they require.

#### *Disadvantages as expressed by Task Force members*

- Limited cost-reflectivity so will not create a level playing field and creates inappropriate risk allocation.
- Does not provide any operational dispatch price signal; therefore agreed capacity charges would need to be combined with some other mechanism (e.g. an extended Balancing Mechanism) to provide operational dispatch incentives.
- Difficult to apply to smaller users who do not have bilateral Connection Agreements (unless operating as a group).

### **Peak Demand Charges**

#### *Advantages as expressed by Task Force members*

- Can be cost-reflective if costs are driven by a user's peak demands at certain times; hence can provide a level playing field and appropriate risk allocation.
- Requires sufficiently predictable windows of charge.
- Encourages right amount of capacity to be bought.
- Depends on the extent to which users can respond and the extent to which appropriate flexibility can be purchased.

#### *Disadvantages as expressed by Task Force members*

- Depends on the specific definition of peak, and so whether this results in stable or predictable tariffs.
- Likely to be difficult (particularly for small users) to respond to as requires a high level of visibility of usage at all times in order to identify and reduce peak usage.
- Network costs are driven by network peaks rather than individual user's peaks.
- Network peaks are becoming increasingly unpredictable and so the 'peak demand charge' timings in a day/week/season will increasingly be more varied, which could result in unpredictable charges.

### **Reactive Power Charges**

#### *Advantages as expressed by Task Force members*

- Can be predictable for larger users with sophisticated understanding, and action can be taken through upfront investment in power factor correction equipment.
- Can be cost-reflective if proportional to the extent to which network costs and/or benefits are driven by reactive power usage beyond the need for greater capacity.
- Supports market for reactive power service providers.
- Depends on the extent to which users can respond and the extent to which appropriate flexibility can be purchased.

#### *Disadvantages as expressed by Task Force members*

- Smaller users are unlikely to be aware of reactive power or be able to make changes to respond.
- A modification or exemption may be required for users which are providing a reactive power service.
- Impossible to apply for users without four quadrant metering.

## Charging Methodology

6.4 There are three primary considerations for the charging methodology to be used – the cost base of the charging model, the means by which locational charges are derived, and the extent to which the methodologies used for the transmission and distribution networks should align.

### Cost Base

6.5 Three options have been considered for the cost base building block, namely:

- **transport model** – cost of importing or exporting energy through an existing network;
- **expansion model** – levelised cost of future network based on a weighted average of the existing network; and
- **remaining headroom model** – cost of addressing the next constraint in accordance with today's design standards.

### Transport Model

#### *Advantages as expressed by Task Force members*

- Likely to result in stable and predictable prices.
- Likely slightly more complex than existing LV and HV charging model but simpler than existing EHV and transmission.

#### *Disadvantages as expressed by Task Force members*

- Gives no indication of capacity and simply allocates costs of maintaining the status quo.
- Does not include cost based on absolute cost impact.
- Lack of locational signals results in all user actions being given the same cost signal regardless of the actual cost and/or benefit derived.
- Lack of cost-reflective charges means that risk will not be appropriately allocated.
- Requires locational and constraint costs to be reflected through other means e.g. a deeper connection boundary.
- Depends how granular/nodal this is worked out at. At a granular level, this can become a disadvantage: backwards-looking tariffs reflect lumpy investment as steep volatility, potentially driven by other user's new connections.
- Price signal for flexible generators muted.
- Gives no signal as to how a network develops and so no information to the network company or user for better use of the network.

### Expansion Model

#### *Advantages as expressed by Task Force members*

- Signals areas of low and/or high capacity.
- Symmetric treatment of demand and generation.
- All users face the same symmetric cost-reflective price signal regarding both increasing and reducing their access right to use the system, irrespective of when they connected.
- Avoids step changes in signals due to asset investment (saw-tooth effect), so should be possible for an expansion model to result in reasonably stable prices.
- Use of upfront assumptions (expansion constant and fixed asset costs) reduces the need for the network company to make internal assumptions and so increases transparency.



- Avoids the highly complex requirement to attribute specific network investments to specific network users.
- Allocates risk, by avoiding exposing users to the consequences of decisions taken by network companies which may result in over, or under reinforcement of the network at particular times.
- Proven track record of practicality since this approach is already used by the existing transmission charging arrangements. More complex than the existing LV and HV charging models, simpler than the existing EHV charging models, and complexity as per status quo for transmission.

#### *Disadvantages as expressed by Task Force members*

- Does not recognise specific reinforcement costs of addressing capacity constraints.
- If this model only provides relative locational signals (i.e. not absolute locational cost signals) this could distort the market and impact competition.
- Actual costs may be different from the average cost of reinforcement at any given location - but this could be a somewhat localised signal by design.
- This difference between actual costs and the signals provided means less cost-reflective charges and therefore users do not face full incentives. The overall network is likely to be less efficient as a result. Furthermore, risk may not be appropriately allocated between users.
- Symmetric treatment ignores engineering factors related to fault-level reinforcement etc. This could be addressed by approaches such as using different security factors for different types of user, or different tariff elements.
- Signals may need to be strengthened by further locational and constraint cost signals to be reflected though other means e.g. the transmission year round tariff element, or a deeper connection boundary.
- Can provide stable price signals but to the detriment of cost-reflectivity and hence this will not be effective.

#### *Remaining Headroom Model*

##### *Advantages as expressed by Task Force members*

- Signals areas of low and/or high remaining capacity and scale of increasing capacity.
- Increased recognition of reinforcement cost.
- More closely linked to actual network and required costs/benefits due to users actions and hence less distortion to competition.
- Demand treatment highly reflective of security of supply standards.
- Likely to provide better forward looking charges for demand users.
- Site specific (but rule based) reinforcement costing.
- Most cost-reflective approach means risk likely to be best allocated and likely to lead to more efficient use of the network.
- Highly cost-reflective by exposing users to the cost and/or benefit of network reinforcements which their behaviour has the potential to drive and/or avoid.
- Changes in security of supply standards are reflected in the treatment of demand.
- Taking account of spare capacity on the network can lead to more efficient locational decisions.
- Status quo for EHV distribution charging and should be practical to use across all voltages.

### *Disadvantages as expressed by Task Force members*

- The predictability of the signal would be reduced, so users cannot effectively make investment decisions which increases costs in short-term constraint management.
- In the current distribution charging model, distribution connected generation would not be subjected to a locational signal as there is no underlying security of supply standard for generation on the distribution network.
- Attributes specific network investments to specific network users which may over-expose individual users to the risk that reinforcement is required.
- If set nodally or zonally, then existing user's tariff can be affected by other users' behaviour. Users may see this as a source of volatility and reduction in cost-reflectivity, unless individual tariffs can be locked-in.
- Penalising tariffs in constrained areas may discourage new providers of flexibility (only contracted to relieve the worst excess, thereby taking the network to just full, hence likely to incur a high tariff related to zero remaining headroom).
- Significantly more complex than existing LV and HV charging models, and more complex for transmission.
- Relies on the network company to make subjective assumptions regarding what future demands on the network may be in order to forecast what future headroom may be and therefore what future network reinforcement may be required. These forecasts will be subject to uncertainty, which can expose users to additional risk.
- Relies on the network company to make a subjective judgement to attribute particular network reinforcements to particular network users.

### *Locational Charging*

6.6 Three options have been considered under the building block for generating locational charges, namely:

- a **'500MW' model** (as used at LV and HV currently) or 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, i.e. a 'cost allocation' model;
- **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 capacity at nodes on the network, i.e. an 'incremental' model; and
- **forward cost pricing** 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 be necessary, i.e. a 'contingency' model.

### *Probabilistic Approach*

#### *Advantages as expressed by Task Force members*

- Generalised model reflective of current engineering practice.
- Likely to result in stable prices, therefore resulting in predictable price changes which are likely to result in predictable user responses.
- Recognises the cumulative effect of multiple users connecting to the network.
- Relatively easy to implement - status quo at HV and LV, whilst simplification would be required for use at EHV and transmission levels.

### *Disadvantages as expressed by Task Force members*

- There would be no locational element to charges, so not specific to any site, i.e. all user actions would be given the same cost signal regardless of the actual cost and/or benefit derived.
- Draws on proprietary data/engineering approaches.
- No or limited locational signal means charges are not cost-reflective and hence likely to be distorted which does not create a level playing field (risk will not be appropriately allocated). This also means that users do not face appropriate incentives and hence the overall network is likely to be very inefficient.
- Likely to require assumptions from the network companies when operating the model which are subject to uncertainty and may vary between network companies.
- Price signal for flexible generators muted.

### **DC Load Flow Investment Cost Related Pricing**

#### *Advantages as expressed by Task Force members*

- This uses an incremental load flow weighted average of the existing network as a measure of expansion in order to calculate the long run marginal cost caused by adding incremental capacity. The model would work by adding capacity (e.g. 1MW) of either generation or demand at particular nodes on the network, which is then offset by a corresponding reduction of either generation or demand at either a specific reference node or distributed across the network.
- Signals areas of low and/or high capacity against an approximation of planning standards.
- Symmetric treatment of demand and generation – all users face the same symmetric cost-reflective price signal regarding both increasing and reducing their access right to use the system, irrespective of when they connected.
- Use of upfront assumptions (expansion constant and fixed asset costs) reduces the need for the network company to make internal assumptions and so increases transparency.
- Avoids attributing specific network investments to specific network users.
- Some users consider this to be more cost-reflective than a transport model or 500MW model.
- Avoids step changes in signals due to asset investment (saw-tooth effect), so should be possible to result in reasonably stable and predictable charges based on changes in use of the network, and so allows users to change behaviour.
- Proven track record of practicality since this approach is already used by the existing transmission charging arrangements. Status quo for (some) EHV distribution charging and transmission.
- Can reflect the different costs caused by different users by the way tariffs are applied. For example, transmission has developed this methodology to include two different charging backgrounds to reflect different drivers of investment (peak security and year round), reflecting users' operating characteristics associated with the constraint costs by using a function for annual load factor, as well as addressing implicit sharing by classifying generators into different types: carbon, low carbon, conventional and intermittent.

#### *Disadvantages as expressed by Task Force members*

- Use of DC Load Flow is a tool to simplify the study of a network - reflective for an interconnected system but less reflective of physical power flows on certain types of networks.

- Too far removed from a dynamic operational model - flexibility providers operationally supporting the network may be modelled here as causing issues in the limited snapshot model, producing a disproportionately high tariff.
- Only provides relative locational signals, not absolute cost signals, which is likely to distort the market and impact competition.
- Symmetric treatment ignores engineering factors related to fault-level reinforcement etc. This could be addressed by approaches such as using different security factors for different types of user, or different tariff elements.
- If this model results in the lack of an absolute cost signal, this could result in distortions and so may not create a level playing field (meaning that risk may not be appropriately allocated).
- Potential to result in volatile prices (particularly with the long run incremental cost approach currently used for some EHV users), with a user's charges often influenced by the actions of other users in the same location.
- Relatively short-term predictability but still limited in the longer-term and is still not fully cost-reflective.
- Actual costs may be different from the calculated average cost of reinforcement at any given location.
- At a simple level, this could be unreflective of differing operational profiles.
- Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient.
- Significantly more complex than existing LV and HV charging models, and unlikely to be possible to extend this approach to LV and maybe even HV charges.

### **Forward Cost Pricing**

#### *Advantages as expressed by Task Force members*

- Signals areas of low and/or high remaining capacity and scale of increasing capacity.
- Demand treatment highly reflective of security of supply standards.
- Whilst likely to provide volatile signals, this does give the most cost-reflective approach.
- Site specific (but rule based) reinforcement costing.
- Can be highly cost-reflective by exposing users to the cost and/or benefit of network reinforcements which their behaviour has the potential to drive and/or avoid, therefore risk is likely to be efficiently allocated, although a Task Force member expressed a view that this approach is not necessarily more cost-reflective than the other methods considered.
- Status quo for (some) EHV distribution charging.
- More closely linked to actual network and required costs/benefits due to users actions and hence less distortion to competition.

#### *Disadvantages as expressed by Task Force members*

- Allocates prices to network groups rather than nodes, so the approach can optimise allocation between groups but not within a group.
- Distribution connected generation would not be subjected to a locational signal as there is no underlying security of supply standard for generation on the distribution network.
- A more cost-reflective signal for demand can be an advantage, but approach needs to be adapted to provide similar for generation.

- High volatility and low predictability in approach reduces the ability of network users to respond to signals. This deteriorates further with a user's charges often influenced by the actions of other users in the same location.
- Volatility unwelcome to most users.
- Significantly more complex than existing LV and HV charging models, and more complex for transmission.
- Relies on the network company to make subjective assumptions regarding what future demands on the network may be in order to forecast what future headroom may be and therefore what future network reinforcement may be required. These forecasts will be subject to uncertainty, which can expose users to additional risk.
- Relies on the network company to make a subjective judgement to attribute particular network reinforcements to particular network users.
- Fails to provide a symmetrical investment signal because it does not incentivise existing users to reduce their use of the network.
- This may require a relatively complicated and subjective methodology for dealing with the issue that network investment is lumpy. Otherwise the entire cost of a new network circuit could be allocated to an individual user, despite the new circuit being built to serve many different existing, new and expected future users.

### ***Alignment of Charging Methodologies***

6.7 Three options have been considered under the alignment of methodologies across the transmission and distribution networks building block, namely:

- single model across all voltage levels;
- transmission and distribution charging model different but with common assumptions; and
- different charging models across transmission and distribution.

### ***Single Model across Transmission and Distribution***

#### ***Advantages as expressed by Task Force members***

- Avoids distortionary investment incentives which may be simply be an artefact of different charge calculation models.
- Allows users to make comparable decision between transmission and distribution investments.
- Comparable costs give the ability to more efficiently allocate agreements to generation, reducing cost to users and reducing the risk of stranded assets.

#### ***Disadvantages as expressed by Task Force members***

- May not reflect different planning standards or engineering practice etc.
- In theory, this would provide a harmonised approach however it may lead to too much complexity.
- Requires significant work to achieve development of a common model which appropriately reflects the attributes of all transmission and distribution networks which have different planning and construction standards.

### ***Transmission and Distribution Models Different but with Common Assumptions***

#### ***Advantages as expressed by Task Force members***

- Aligned models are less likely to create distortions between networks.
- More likely to allow appropriate comparison between connection and use of the network at different voltages.

- May be possible to agree common assumptions more easily than it would be possible to achieve a common model.
- Potential to deliver benefits of commonality without the need for full alignment of charging assumptions which relate to different engineering standards.

#### *Disadvantages as expressed by Task Force members*

- Some discontinuities will remain.
- Different allocation of risk in Scotland compared to England, which is not justified by the underlying engineering/physics.
- Alignment of assumptions could be challenging given the different engineering standards which apply.
- Results in some distortion.

#### **Different Charging Models across Transmission and Distribution**

##### *Advantages as expressed by Task Force members*

- Models can more closely reflect different planning standards or engineering practice.
- Avoids the need for complex work to align charging assumptions which relate to different engineering standards.

##### *Disadvantages as expressed by Task Force members*

- Potential for distortionary investment incentives which may be simply an artefact of different charge calculation models.
- Different allocation of risk in Scotland compared to England, which is not justified by the underlying engineering/physics.
- Modelling differences would require enduring fix and not just interim methods.
- Current distortions are still present.

### **Summary – Tariff Design and Charging Methodology**

6.8 The choice of tariff design and the specific economic model used to implement the charging methodology needs to be appropriate to the choice of C1 and C2. The advantages and disadvantages against the assessment criteria have been evaluated on a standalone basis, but ultimately the advantages and disadvantages will be relative to the choices of C1 and C2 and other areas. Nonetheless, the discussions within the Task Forces have resulted in some key messages in the area of tariff design and modelling.

6.9 Cost-reflective time of use tariffs create incentives for users to amend their behaviour to benefit the network. At present distribution network charges only vary by time of use for a portion of users (primarily larger users, although some smaller users are exposed to two rate tariffs). Extending time of use tariffs to all users would be beneficial as it extends the price signal to all users and drives innovation as smaller users become incentivised to reduce their costs. In order for any benefit to be derived from network time of use tariffs, it is necessary for these to be passed through to end users. Seasonal tariffs offer a more targeted price signal. At present the only seasonal network charges are at transmission (for half-hourly settled users) and Unmetered Supplies that are settled on a pseudo-half-hourly basis. Moving to a seasonal price would allow network companies to set more cost-reflective charges for users. The visibility of appropriate data to allow users to forecast future charges is seen as vital to any of the proposed solutions.

6.10 Capacity charges do not currently provide a universal incentive for users to profile their capacity. Distribution capacity charges are currently a flat rate based on the agreed

capacity of the user. Under the current arrangements the transmission Balancing Mechanism complements the network capacity charges by providing an incentive for users to relinquish operational use of the network at times when there may be insufficient network capacity. The current development of active network management schemes could perform a similar operational role for the distribution network; however this could conflict with the application of time of use tariffs.

- 6.11 Inclining block rates could potentially penalise users with high consumption but flat profiles. The rationale for inclining block rates is to use increased consumption as a proxy for capacity. However, in some cases (such as economy 7 or 10 users) high consumption is primarily during the off-peak period and therefore the additional consumption should not incur the higher rate. The design of future tariffs might need to reflect the use of core and non-core capacity; however this is also true of a number of other elements which could be taken forward as part of any change to network access arrangements.
- 6.12 A natural split exists between LV/HV networks (where the bulk of users connect) and EHV/transmission. Although three charging methodologies exist at EHV and transmission, they are trying to achieve the same aim of cost-reflective locational prices. There is merit in trying to rationalise and increase commonality to avoid distorting demand and generation users' decisions to connect at distribution EHV or transmission respectively (i.e. avoiding perverse incentives), and to ensure that users are exposed to the costs they impose on the whole system and just the network to which they are connected. However, locational charging at HV and LV is not yet possible or practical and could have unintended consequences for some users. It will need to be determined, if changes are felt to be appropriate, whether this should be a single model covering all voltages or two models which reflect the different arrangements.

## 7. Access Properties

7.1 This section further defines and considers the key building blocks which, when considered together, would define the terms on which a user accesses the electricity network. It then summarises feedback received from various stakeholder groups from within the Task Forces, before considering whether different access arrangements will be necessary for domestic and micro business users (including vulnerable users).

### Access Building Blocks

7.2 The Ofgem working paper identified the key building blocks of access as:

- time aspects;
- firmness;
- geographic nature; and
- associated conditions.

7.3 The Task Forces' initial options report redefined access rights in terms of:

- **Depth:** The concept where users only require access to certain voltage tiers and that these voltage tiers can be used as building blocks to define their access. In practical terms this is related to the physical firmness of access and the degree to which access is shared between users on different parts of the network;
- **Lifespan:** The timeframe and lifespan of the required access is likely to drive different connection solutions and may bring about different costs on the network;
- **Time of Use:** Access could vary according to time of use, ranging from time of use within a day to seasonal periods throughout the year;
- **Firmness (financial and physical):** Whether a user's access is firm or non-firm is used in the context of both demand and generation to describe either: the level of physical resilience (known as physical-firmness i.e. more than one spare circuit); or financial protections (i.e. compensation for times when access is not available); and
- **Standardisation of access:** Access options could be defined in standardised terms to reflect the network complexity and number and type of users. Different options which reflect the specific characteristics of specific users could be offered alongside 'off the shelf' solutions, with options applied to all users on a universal basis, a segmented basis, or an opt-in basis.

7.4 Views were sought from network users on their preferred options for these access characteristics, which are described further below.

### *Users' and Access Providers' Perspectives*

7.5 The Task Forces considered how they thought different users would value choices in access rights at point of connection, and gathered feedback from Task Force members characterised according to a set of stakeholder groups, namely:

- large, transmission connected generation users;
- distribution connected generation and storage users;
- community energy users;



- large demand users; and
- domestic users.

7.6 For completeness the Task Forces also gathered feedback from potential access providers, in this context:

- the Electricity System Operator; and
- Distribution Network Operators.

7.7 The views expressed by Task Force members on network users' and access providers' perspectives are collated in Appendix Eight, and are summarised below. Regardless of the options selected under each of the access properties, there will be a need to ensure that the charges associated with each combination are cost-reflective.

#### *Depth*

7.8 All types of network users expressed a preference for full network access (i.e. across transmission and distribution networks) for participation in national energy markets. Distributed generation, community energy users, large demand and domestic users expressed a preference to have the option of only being part of a local energy market instead, if opportunities existed, although concerns were raised about market splitting and how local arrangements would work in practice, especially the contribution to or avoidance of wider networks costs.

#### *Lifespan*

7.9 Most large demand and generation network users preferred a wide range of lifespan choices from short term (i.e. by month) to long term (i.e. 40 years plus), whereas others, including domestic users preferred evergreen rights.

#### *Time of Use*

7.10 Again most large demand and generation network users preferred a wide range of time of use choices for contracted access rights from varying capacity at different times (i.e. within day, month or year) to long term (i.e. 40 years plus), while others preferred less optionality with access rights for all users flat annually. There may be an opportunity for domestic users to respond to varying time of use, but access safeguards must be in place for some domestic users to have static or fixed access.

#### *Firmness (Financial and Physical)*

7.11 There was a range of views regarding whether all users should be financially firm, financially non-firm, or have the choice. All network users expressed a preference to be connected to a highly reliable electrical network (e.g. >99.99% reliability), with generators and storage stating that unavailability should result in financial compensation. It was noted that the introduction of financially firm arrangements at the distribution network level would be a significant change likely requiring careful definition, amendment to security standards and more importantly acceptance from other network users that they would fund any unavailability payments.

#### *Standardisation of Access*

7.12 There was a mixed response across network users on the level of standardisation versus bespoke access arrangements with a leaning towards standardisation. Large transmission connected generation stated a preference for the same rights for all, with

community energy users preferring access choices that enable local supply to match demand and domestic users preferring simple to understand arrangements.

## **Safeguarding for Domestic Users (Including Vulnerable Users) and Micro-businesses**

- 7.13 Domestic users and micro-businesses (including vulnerable users) require network access to meet their essential needs. This core level of access is presently supplied on a non-firm basis, only interrupted for the minimum duration should a fault occur. Most small users will not be aware of and potentially not interested in flexible arrangements where they could be interrupted more frequently to manage network congestion.
- 7.14 Work under the Energy Network Association's Open Networks project has identified different levels of future engagement with flexibility<sup>9</sup>. *Passive customers* (such as many domestic, micro businesses and vulnerable users) may not be able to, or may choose not to, actively engage in flexible arrangements. This should not become an obstacle to equitable access for their essential needs. Vulnerable users may find it particularly difficult to navigate more complex access arrangements and could face the risk of making the wrong choices in securing low cost access. However, the potential growth of flexibility services is dependent on some electricity users having the option to adopt a more flexible arrangement.
- 7.15 Amendments to the access rights of users will need to protect smaller users from inadvertently relinquishing core access rights, which they may later regret. Likewise, protections will be needed to ensure new users (due to a house move, new connection or similar) have the same core access rights and protections to also meet their essential needs.
- 7.16 As domestic energy choices change, access requirements may extend beyond a core level for essential needs and may trigger reinforcement of the wider network. The Task Forces have not defined what is considered core or non-core access, but differentiation between the two could allow the development of specific arrangements for users who require more than the core. Arrangements for non-core access could allow the forward looking costs of related wider reinforcement to be clearly signalled, enabling users to make informed choices (such as choosing an interruptible electric vehicle charging arrangement or responding to time of use tariffs).
- 7.17 Whilst auctions and other forms of market trading could allow larger commercial users to secure access based on their ability and willingness to pay, such arrangements could directly conflict with the need to ensure equitable access for a household's essential needs. Even with aggregation of smaller users into larger pools, perhaps via suppliers or new actors, there is concern that virtually identical users would end up with different outcomes depending on the 'buying power' and risk tolerance of a particular pool.
- 7.18 This thinking points to a benefit in defining simple core access arrangements for vulnerable users and for those domestic and micro-business who only want access under similar arrangements as they enjoy now. This should not preclude other options for those users who want to engage more with future flexible arrangements.

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<sup>9</sup>[http://www.energynetworks.org/assets/files/electricity/futures/Open\\_Networks/Customer%20Category%20descriptions%20190613.pdf](http://www.energynetworks.org/assets/files/electricity/futures/Open_Networks/Customer%20Category%20descriptions%20190613.pdf)

## 8. Initial Allocation of Access

8.1 This section further defines and assesses methods of initial allocation of access rights, before going into further detail on auctions, defining various permutations of auctioning access rights, supplemented with expressed opinions from Task Force members.

### Initial Allocation

8.2 Three options have been considered for the initial allocation of access rights, two of which are developments of a 'first come, first served' approach:

- First come first served:
  - First come first served with additional queue management.
  - First come first served with Connect and manage.
- Auctions/trading.

#### *First Come First Served*

8.3 Under this method of allocating access rights, a user 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 i.e. their access is evergreen. The arrangements in distribution are perceived to be economically inefficient and unfair for some user types (for example larger distribution connected generation); however new users will continue to seek certainty of required capacity being available at the point of their investment decisions. This approach provides a challenge for queue management for users waiting to connect, in that there is nothing to prevent a first connectee inefficiently blocking later projects.

#### *First Come First Served with Queue Management*

8.4 Under this method, additional queue management steps are taken to prevent inefficient blocking. There are many potential options for dealing with first come first served queue management, including use of development milestones whereby the prospective connectee must commit to progression milestones to demonstrate how they will achieve their connection date. If the prospective connectee does not meet the progression milestones or is not ready to connect in line with the milestones, they will lose their initial queue position and another prospective connectee further down the queue (i.e. a prospective connectee who has accepted their connection offer at a later date) can progress. Alternatively, queue management may be carried out by providing a price signal based on user commitment for the cost of network reinforcement, or enabling users to trade their position in the queue on a bilateral basis. This would ensure capacity made available by reinforcement is utilised at the earliest opportunity.

#### *First Come First Served with Connect and Manage*

8.5 This mechanism allows users (presently only generators under transmission arrangements) to connect where physically possible once extension assets are complete without the need for wider reinforcements to be initiated immediately. However, this only provides physically non-firm access, with financially firm access being secured through a separate process. This has the advantage of speeding up access to the market when compared to the basic first come, first served mechanism. However, the connect and manage approach has the potential to increase associated constraint costs behind some boundaries e.g. through constraint payments. At transmission, the user retains financially firm access and is paid when constrained off the system. At distribution, users connected to flexible connections do not have firm

access under a connect and manage type agreement and accept the possibility of some curtailment when a constraint occurs, without constraint payments.

## ***Auctions and Trading for Initial Allocation***

### *Universal Auctions*

8.6 The use of universal auctions for the allocation of access rights has raised some concerns amongst Task Force members. Advantages and disadvantages are summarised in the earlier section on the 'high emphasis on auctions/trading' framework scenario (following paragraph 3.2), with a common theme being that there is a need to safeguard smaller users from the complexities of auction participation, and the risk of undesirable social and economic consequences associated with being unsuccessful in an auction and so losing network access. This report provides more on the potential effects on vulnerable users in paragraphs 7.13 to 7.18.

### *Targeted Auctions*

8.7 An alternative to a universal use of auctions to allocate access is to use targeted auctions under certain situations or scenarios where they may provide a more focused benefit. Below are two potential scenarios (initial allocation of existing or new unallocated capacity and identifying 'spare' capacity to support initial allocation) where targeted auctions may offer benefit and an illustrative example for how they could be applied. However, it should be noted that even targeted auctions had limited support among Task Force members, including because of complexity and potential volatility in outcomes.

8.8 There may be issues in seeking valuation prices for capacity across different auction windows given that investment to create capacity is lumpy by nature. Consideration is required on the potential merits of using a reserve price, possibly based on long-run marginal costs for incremental capacity. If the reserve price was not met, the investment in new capacity would not take place and constraints would continue to be managed operationally. Combining targeted auctions with managed secondary trading might reveal more consistent prices. However, in a commercial auction there may need to be mitigation measures if trading created the risk of over-inflating the value of capacity.

### *Initial Allocation of Existing or New Unallocated Capacity*

8.9 Auctions could be used to allocate any existing unallocated capacity and also any new capacity being released onto the network from new investment or changes in network use. An example of how this could be done is described below:

- Volume of capacity available determined 12 months ahead (i.e. existing network capacity and any planned reinforcement).
- Auction assigns firm access to successful bidders but all users get access (i.e. unsuccessful bidders are assigned non-firm access).
- Revenue generated from the auction could be used to invest in the network, allowing some users with non-firm access to subsequently convert to firm access.

8.10 The use of auctions in this scenario would have the largest influence on how users make decisions at the time of investment with little impact on use of the network once connected.

8.11 Holding auctions for large numbers of users presents significant timing and process issues. ‘Gating’ the auction process (i.e. holding an auction on a specific date) may have implications, including for the consenting processes of participating parties.

#### *Identifying ‘Spare’ Capacity to Support Initial Allocation*

8.12 It may be possible to establish mechanisms to identify ‘spare’ or unused capacity allocated to existing users that could be ‘recycled’ to improve the efficiency of initial allocation. However, establishing a definition of spare capacity needs careful consideration.

8.13 It is potentially inappropriate for a user to have evergreen rights to unused capacity, especially without ongoing cost signals. Users could be incentivised through cost-reflective charges to use or release unused capacity. Consistent arrangements for demand and generation users’ capacity retention may be achieved by appropriate application of stronger capacity charges.

8.14 The new arrangements could either be mechanistic based on, for example, the generation users capacity that is subject to a contract (such as under the Capacity Market or Contract for Difference); unused capacity identified through ‘use it or lose it’ arrangements; or demand or generation users willing to change usage behaviour. This capacity could then be made available to all users through an auction-style process.

8.15 This arrangement is likely to affect both users’ investment decisions and also their usage behaviour where a connection to the network already exists.

8.16 It is important to note that network companies already take account of implicit sharing via the diversity of users, including LV diversity, such that apparent spare or unused capacity may already be being used by other existing users. For example, the spare capacity for the times when a gas peaker is not running may have already been implicitly allocated to existing renewable generators, so is not in fact unused, spare, or blocking other new users.

8.17 The concept of reallocating spare capacity will be more relevant when considering a scenario with deep connection charges and weaker ongoing usage signals e.g. where there is no avoidable ongoing usage price signal to incentivise users to give up surplus connection capacity.

#### ***Task Force Members’ Views***

##### *Advantages of Targeted Auctions/Market-Based Approaches as Expressed by Task Force Members*

- Access is allocated based on users’ perceived value and ability to pay rather than first come first served which may increase the range of financially viable projects.
- These mechanisms can reveal the value of access to users, and so provide a signal to network companies where investment might be prioritised based on where genuine demand is high at that point in time.

##### *Disadvantages of Targeted Auctions/Market-Based Approaches as Expressed by Task Force Members*

- Charges based on the outcome of auctions will be value-reflective rather than cost-reflective which would be a disadvantage as cost-reflectivity is a desirable feature of future arrangements.

- Auctions will naturally favour those with the most funds, but will not necessarily release network capacity since auction winners could continue pay to maintain a holding position without necessarily progressing construction.
- Likely to exclude non-expert participants such as communities.
- The different business models of businesses participating may put them at an advantage or disadvantage.
- Auctions would be complex to implement, with a potentially high administration burden on participants.
- High uncertainty of allocation of access.
- Participants will find it difficult to align the timescales of their grid connection and planning permission under a 'gating' process (i.e. holding an auction on a specific date).
- Depending on the auction method chosen, this may unfairly benefit those users who may find themselves at the front of the queue since they would be able to sell an asset (queue position), which they themselves had not paid for. This could result in unintended consequences such as a rush to join the queue as early as possible on a speculative basis.
- Auctions may still need to co-exist with queuing systems or pre-qualification for an auction as users will bring forward connection applications at different times. The queue will need to be reconciled against holding an auction to ensure fairness between participants.
- There could be severe impacts on local economies of a large user losing access in an auction.
- Auctions are not seen to work with secure transmission networks built to GB Security and Quality of Supply Standards (GB SQSS).

## Summary

8.18 Task Force members considered two options for initial allocation of access rights, namely auctions and first come first serve, as well as the consequential impacts of their implementation.

8.19 Following on from these two options, different permutations of auctions have also been assessed at high level, including the use of targeted auctions or universal auctions. In addition to this, two variations of a first come first served methodology have also been evaluated by Task Force members. Summaries have been provided of each of the options along with the pros and cons. Whilst there has been a range of views between Task Force members, the following key messages were consistent across the Task Force:

- There will always be an element of first come first served whether it relates to the connections process or in relation to the readiness of a user's project to participate in an initial allocation process. Auctions with gate closure may be difficult to align with the timescales of multiple users' construction projects.
- There are significant levels of risk associated with implementing universal auctions for access rights. There is pure economic merit in access being subject to a commercial auction because access would be secured by those who value it most and are more likely to utilise it fully; however there may be wider socio-economic consequences where some users are securing better access than others. The risks extend beyond the energy industry and could have detrimental impact across

the wider economy as well as on vulnerable and smaller users. This impact has not been analysed or evaluated in full.

- There is value in considering the potential for auctions on a targeted basis, allowing the procurement of access rights on a competitive basis. However, such an approach would need to be taken with careful deliberation on how it would impact current and future network users as well as how it would integrate into the existing regulatory framework. This would likely have a greater effect on investment decisions as opposed to operational dispatch decisions. It should be noted that any form of auction would present significant operational, economic and political challenges that would require full and comprehensive evaluation.
- The reallocation of 'spare' capacity may present the opportunity to make more efficient use of existing levels of capacity for initial allocation. The mechanics of this approach would require consideration to how the term 'spare' is defined e.g. it may be voluntarily surrendered if unused or require a mechanistic approach based on a user's contracted terms. This arrangement is likely to be more relevant when considering a scenario with deep connection charges and weaker ongoing usage signals.

## 9. Plausible Packages

9.1 This section aims to highlight the links between different clusters combinations and building blocks, and provide examples of how these might be linked together.

### Overview

9.2 Figure 14 provides a condensed overview of all of the cluster combinations and building blocks that have been discussed in the previous sections. Certain options may be combined into 'plausible packages' that could be taken forward as potential new arrangements for network charging and access. This section attempts to describe the sum of those packages.

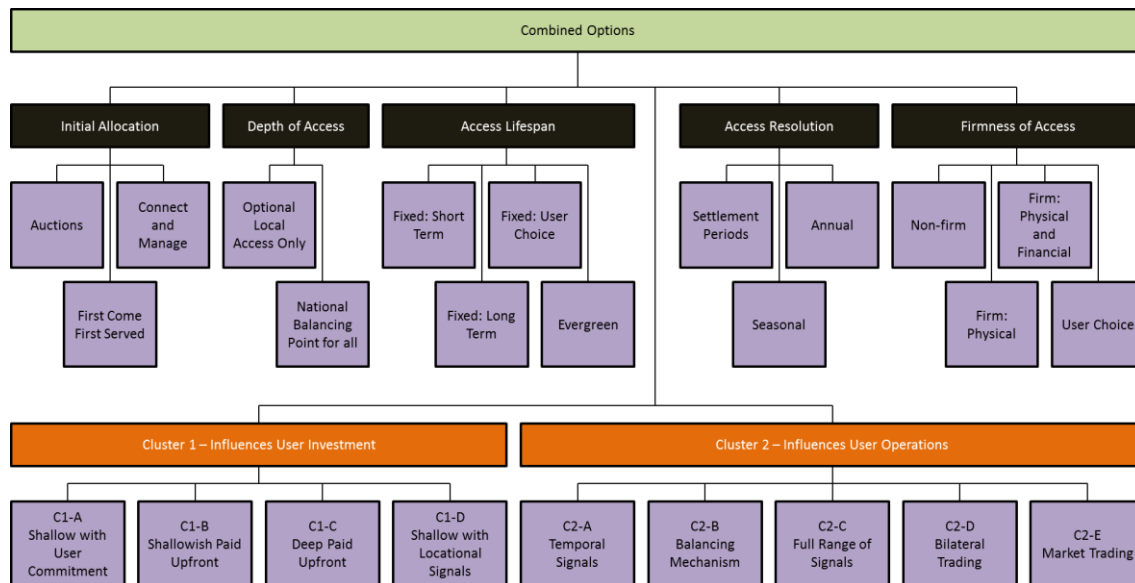


Figure 14 - Tree diagram showing how options combine

9.3 It should be noted that in order to implement certain packages there are dependencies between the options described, including that:

- changes to the access regime will require a charging methodology that reflects the new arrangements;
- a new charging arrangement may be conditional on the definition of access rights;
- the implementation of auctions is conditional on the definition of access rights;
- certain options to influence user investment would require charging models that are able to provide strong locational signals; and
- certain options to influence user operations would require the network companies to actively manage their networks and send appropriate operational signals either through dynamic charging or other mechanisms.

### Illustrative Examples

9.4 The following packages have been developed from the work described in the previous sections. They are not intended to be fully worked up examples; rather they are representative of different ways in which network access and charging arrangements might be developed. The packages have been selected by Task Force members on the basis of their observations of the different combinations that are available in the two clusters. They are provided therefore as a starting point for discussion about future approaches. Whilst all four of these packages use a shallow connection charging



boundary, this does not preclude similar packages which could incorporate a shallowish connection charging boundary, with the effect of increasing the connection charge signal and correspondingly reducing ongoing usage signals. The four packages are as follows:

- Package one – emphasis on ongoing usage charges with limited user choices.
- Package two – emphasis on ongoing usage charges with high user choice.
- Package three – emphasis on bilateral trading and an extended Balancing Mechanism.
- Package four – emphasis on time of use signals with no contracted access.

**Package One: Emphasis on Ongoing Usage Charges with Limited User Choices (including cluster combinations C1-A and C2-B)**

9.5 This scenario is designed to deliver a clearly defined access product to make it easier for network companies to price cost-reflectively. Ongoing usage charges are calculated as a function of specific user characteristics to reflect how different types of users cause different types of network cost (e.g. transmission uses different classifications: conventional, intermittent, carbon and low carbon), and reflects the impact of different users on the cost of constraints by a measure of their annual load factor.

9.6 Shallow connection charges mean that users are free to respond to those price signals by increasing or reducing their contracted capacity, which reduces the need for secondary trading.

9.7 This package is relatively close to the existing transmission arrangements, so is a relatively low change option and effectively involves bringing distribution in line with transmission.

9.8 Figure 15 gives a representation of package one.

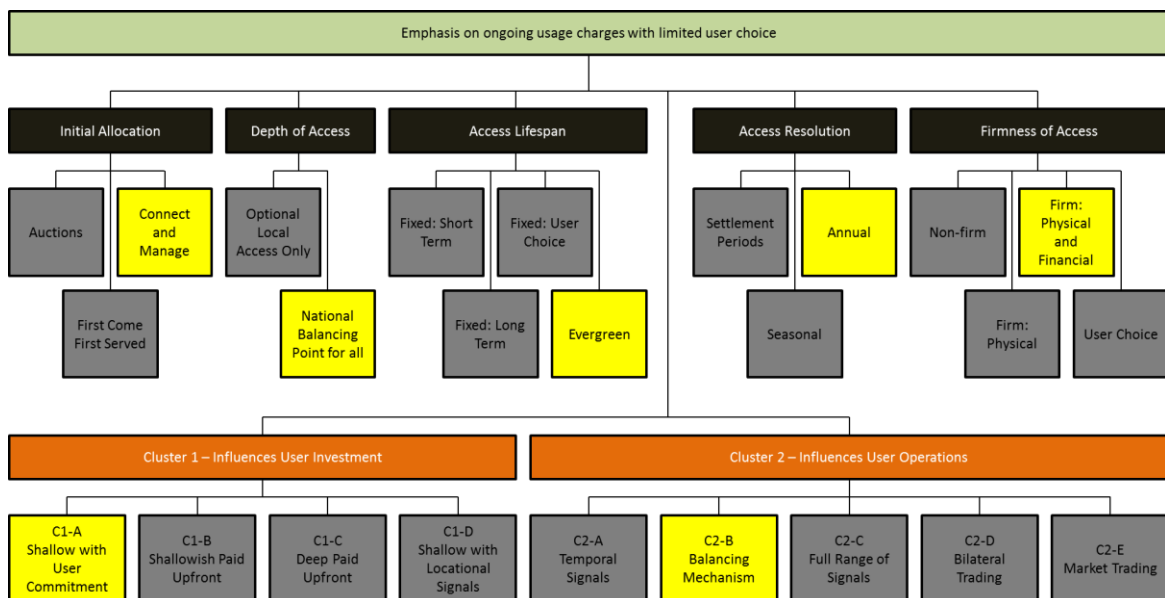


Figure 15 - Emphasis on ongoing usage charges with limited user choices

9.9 The features of this package are described below:

- **Initial allocation** – initial allocation would be on the basis of access right choices on a connect and manage basis. At any time, users could apply to the network company to ask for an initial allocation of access.
- **Locational investment signals** – the network company would use a charging model to calculate cost-reflective locational ongoing usage charges, which users would be liable to pay on an ongoing basis as long as they continue to have access to the network.
- **Access depth** – all users would have access to the National Balancing Point and there would be no choice for users to restrict their access to local access only.
- **Duration of access** – access lifespan would be evergreen, so users would not have the option of choosing between time limited access products of different specific durations.
- **Granularity of access** – access resolution would be annual, so users would not have the option of choosing between specific access periods such as by season, by Settlement Period, or any other specific time period.
- **User commitment for connection** – under this package a new connectee seeking connection to the GB electricity network would be required to provide user commitment security for shallow connection charges. These connection charges would relate to specific assets required to connect the user to the wider electricity network. The new connectee would retain the liability to pay for the connection over the lifetime of the relevant assets.
- **User commitment for wider reinforcement** – the new connectee would provide security for wider network reinforcements that are required as a result of the new connection. The liability for these wider network securities would fall away once the new connectee was connected to the network (i.e. once the connection was energised and operational).
- **Firm access** – all users would have firm access. Firm capacity rights would be both financially firm and physically firm. Firm financial rights would be associated with a level of compensation for the firm rights if the network were unavailable via an extended Balancing Mechanism.
- **Non-firm access** – users would not have the option of choosing non-firm access, either physical or financial.
- **Changing access rights medium-term to long-term** – users would be able to apply directly to the network company to request to change their contracted access. There may be specific minimum notice periods, such that users would only be able to reduce their access in a way which enables them to avoid paying ongoing charges at a minimum of e.g. 12 months' notice before the year for which the access applies.
- **Changing access rights short-term** – there may be an arrangement under which users could apply to the network company for some form of special short-term access product for users who wish to change their contracted access within year.

This product would be at less attractive prices compared with contracting for access in advance in order to encourage users to contract in advance.

- **System operation** – operational signals would be provided by an extended Balancing Mechanism. All users would be entitled to participate in the extended Balancing Mechanism, either directly or via an aggregator. Participation would only be compulsory for larger users and on an opt-in basis for smaller users. Generators would post physical notifications of the capacity they expect to generate along with bid and offer prices for reducing or increasing that generation, with a similar approach used for demand and demand side response.

9.10 Under this package, new arrangements would be needed for connection at the distribution level, with alignment between connection arrangements at transmission and distribution. This approach is very similar to existing arrangements for transmission; however, it would likely require a new charging model approach for distribution. It would also benefit from a consistent definition of nodal capacity across both transmission and distribution to derive locational marginal signals across zones. The charging model would need to reflect the dual drivers of network investment cost, firstly to ensure security of serving demand and secondly to ensure the economic transport of power. There would need to be consideration regarding how an extended Balancing Mechanism approach could best be implemented for smaller users.

**Package Two: Emphasis on Ongoing Usage Charges with High User Choice (including cluster combinations C1-A and C2-B)**

9.11 This package is similar to package one, except with more optionality for users.

9.12 This package delivers a high range of choice for users, which may make it more difficult for network companies to provide a cost-reflective price for every permutation of options. The high degree of optionality means that users do not need to trade their access rights, because they are able to choose whatever combination of access rights they would like.

9.13 Figure 16 gives a representation of package two.

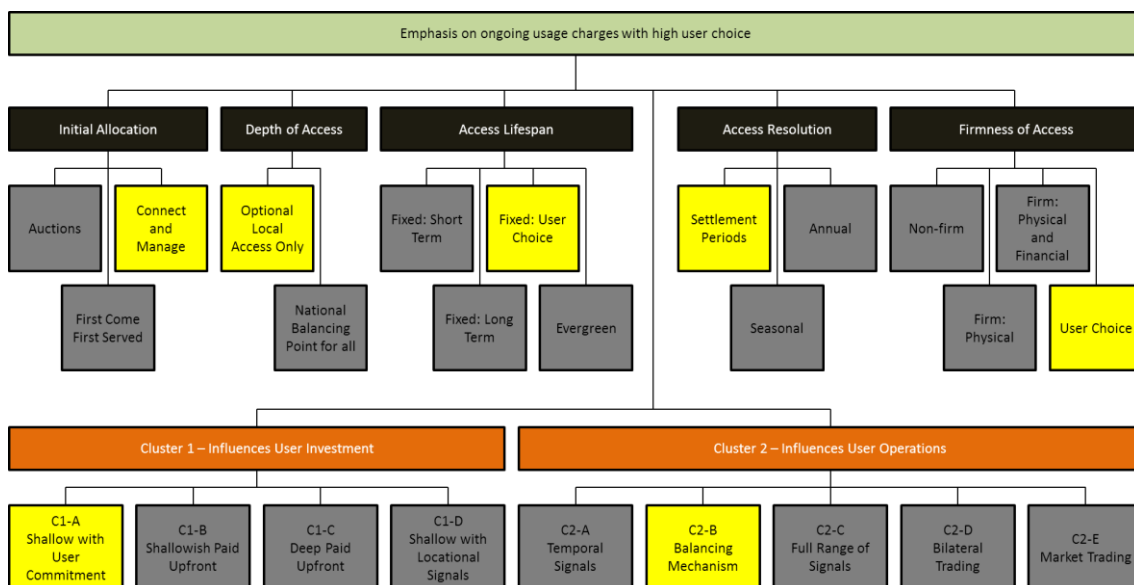


Figure 16 - Emphasis on ongoing usage charges with high user choice

9.14 The features of this package are described below:

- **Initial allocation** – initial allocation would be on the basis of access right choices on a connect and manage basis. At any time, users could apply to the network company to ask for an initial allocation of access.
- **Locational investment signals** – the network company would use a charging model to calculate a cost-reflective locational ongoing usage charge, which users would be liable to pay on an ongoing basis as long as they continue to have access to the network. The network company would need to calculate different prices to reflect the many different combinations of access options which users would be able to choose between.
- **Access depth** – users would have the choice of access depth, which may be to the National Balancing Point or may be limited to local access only.
- **Duration of access** – users would have a choice, whereby access rights would be based on the ability to use the system up to the level of the capacity of the right for a specified duration which could be a Settlement Period or for a number of Settlement Periods over more than a year.
- **Granularity of access** – users could choose a high level of granularity up to individual Settlement Periods.
- **User commitment for connection** – under this package a new connectee seeking connection to the GB electricity network would be required to provide user commitment security for shallow connection charges. These connection charges would relate to specific assets required to connect the user to the wider electricity network. The new connectee would retain the liability to pay for the connection over the lifetime of the relevant assets.
- **User commitment for wider reinforcement** – the new connectee would provide security for wider network reinforcements that are required as a result of the new connection. The liability for these wider network securities would fall away once the new connectee was connected to the network (i.e. once the connection was energised and operational).
- **Firm access** – all uses would have a choice of firm access. Firm capacity rights could be either financially firm and/or physically firm. Firm financial rights would be associated with a level of compensation for the firm rights if the network is unavailable via an extended Balancing Mechanism.
- **Non-firm access** – users would have the option of choosing non-firm access. This would result in them paying much lower locational ongoing usage charges compared with firm access. This is because when users choose non-firm access, they would not be compensated for being constrained off to manage network constraints and the network company would not need to incur the network reinforcement cost which would otherwise have been needed. Network companies would be required to identify congested parts of the network in advance of usage (if not, users would be penalised for not anticipating congestion which cannot be forecast).

- **Changing access rights short-term** – there may be some form of special short-term access product for users who wish to change their contracted access within year. This product would be at less attractive prices compared with contracting for access in advance in order to encourage users to contract in advance.
- **System operation** – operational signals are provided by an extended Balancing Mechanism. All users are entitled to participate in the Balancing Mechanism, either directly, or via an aggregator. Participation would only be compulsory for larger users and on an opt-in basis for smaller users. Generators would post physical notifications of the capacity they expect to generate along with bid and offer prices for reducing or increasing that generation, with a similar approach used for demand and demand side response.

9.15 Under this package, new arrangements would be needed for connection at the distribution level, with alignment between connection arrangements at transmission and distribution. This approach would require substantial changes to charging arrangements for both transmission and distribution and a consistent definition of nodal capacity across both transmission and distribution to derive locational marginal signals across zones. The charging model would need to reflect the dual drivers of network investment cost, firstly to ensure security of serving demand and secondly to ensure the economic transport of power. The new charging methodology would also be required to calculate price signals to reflect the multiple permutations of potential options available to users to ensure opportunities to inefficiently arbitrage between options and prices are avoided. Additionally, careful package design will be required to ensure that the benefits delivered through the additional optionality are of advantage to both users and the system. There would need to be consideration regarding how an extended Balancing Mechanism approach could best be implemented for smaller users.

***Package Three: Emphasis on Bilateral Trading and an Extended Balancing Mechanism (including cluster combinations C1-A, C2-B and C2-D)***

9.16 Under this package, network companies would be the network capacity setter and price taker, which offer fixed network capacity and leave the market to allocate and reallocate rights to those who value them most.

9.17 There would be relatively low optionality, because trading requires a well-defined product to trade – if users had the option of changing their arrangements themselves, they would not need to trade it, so there would be no market.

9.18 In developing these arrangements the network company would need to calculate appropriate cost-reflective exchange rates to ensure that, even after trading, all users continue to be exposed to cost-reflective price signals regarding investment, avoiding opportunities for users to arbitrage or game charging arrangements through trading opportunities to the detriment of other users

9.19 This package would require substantial change of the existing arrangements.

9.20 Figure 17 gives a representation of package three.

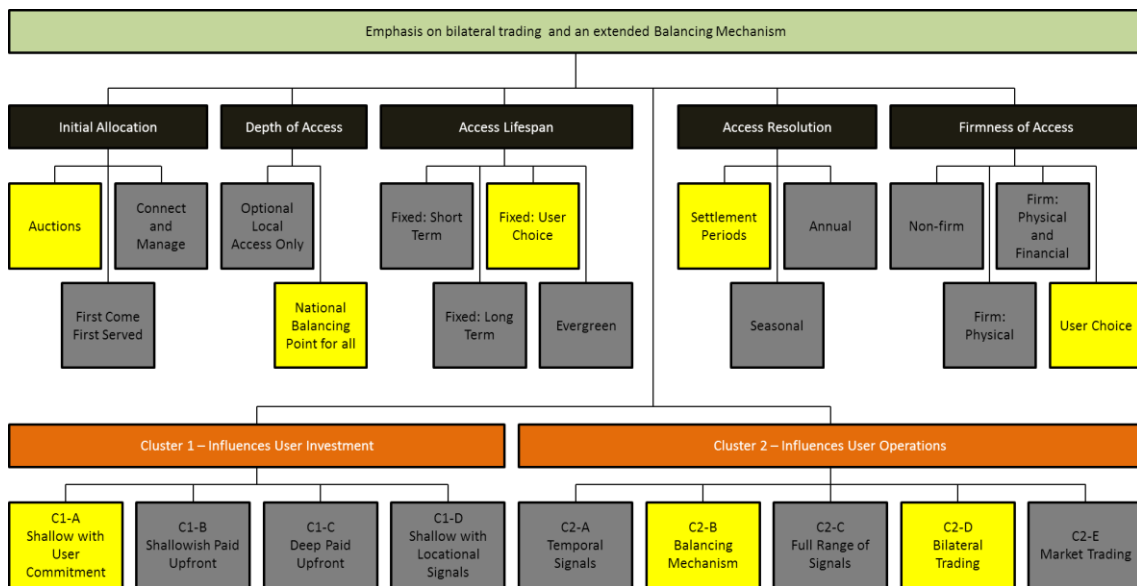


Figure 17 – Emphasis on bilateral trading and an extended Balancing Mechanism

9.21 The features of this package are described below:

- **Initial allocation** – network companies would release capacity rights based on the availability of firm capacity rights across the wider transmission and distribution networks. Capacity rights would be fully trade-able with other users<sup>10</sup>. Users may be able to acquire rights from the network company only at specific times as part of discrete initial allocation releases (first come first served or connect and manage or some competitive process (e.g. competitive tender)).
- **Locational investment signals** – locational investment signals would be determined by the value of access to users at particular locations. This would arise from a competitive approach of allocating access. Alternatively a form of charging model could be used to calculate locational prices users would pay to purchase initially allocated access from the network company within a particular release.
- **Access depth** – no optionality, with all users having access to the National Balancing Point.
- **Duration of access** – firm capacity rights would be based on the ability to use the system up to the level of the capacity of the right(s) for a specified duration which could be a Settlement Period or for a number of Settlement Periods over more than a year.
- **Granularity of access** – users can trade at a high level of granularity up to individual Settlement Periods.
- **User commitment for connection** – a new connectee seeking connection to the GB electricity network would be required to provide user commitment security for shallow connection charges. These connection charges would relate to specific assets required to connect the user to the wider electricity network. The new

<sup>10</sup> There is a key question as to whether the capacity rights at one location are equivalent to the capacity rights at another location, or whether some form of 'exchange rate' is required, set by the network company, to achieve equivalence of capacity rights across a network

connectee would retain the liability to pay for the connection over the lifetime of the relevant assets.

- **User commitment for wider reinforcement** – the new connectee would provide security for wider network reinforcements that are required as a result of the new connection. The liability for these wider network securities would fall away once the new connectee was connected to the network (i.e. once the connection was energised and operational).
- **Firm access** – users would have the choice of firm access. Firm capacity rights could be either physical and/or financial:
  - Physical rights would be subject to suitable anti-hoarding measures such as use it or lose it.
  - Financial rights would be associated with a level of compensation for the firm rights if the network is unavailable (i.e. reliability options).
- **Non-firm access** – users would be able to choose to use non-firm capacity to access the system. However, users would be required to curtail operations in the event that congestion on the relevant part of the network occurred. Network companies would be required to identify congested parts of the network in advance of usage (or else users would be penalised for not anticipating congestion, which cannot be forecast).
- **Changing access rights medium to long term** – once connected, the new connectee would become an existing user with the maximum import or export capacity at that location set out in a Connection Agreement. Existing users would procure additional capacity rights by either by:
  - purchase from the network company who would release capacity rights into the wider market; or
  - acquisition of rights in bilateral traded markets or through market platforms.
- **Changing access rights short-term** – users would be able to fine tune their firm capacity holdings through the use of a ‘capacity balancing mechanism’ which operates close to real-time. The capacity balancing mechanism would enable users to acquire incremental rights or sell rights that reflect their operational requirements. A user would be able to hedge congestion costs through the capacity balancing market. Since the market will operate close to real-time the value of capacity will be closely linked to the short run operating costs of the electricity system (i.e. the price of electricity on traded markets).
- **System operation** – the network company would be able to buy back rights in the event that there is significant congestion of the relevant network. Users would be able to submit bids and offers to sell or buy capacity through the capacity balancing mechanism. Anti-hoarding measures may be required to ensure that users cannot exercise locational market power.

9.22 Under this package, new arrangements would be needed for connection at the distribution level, with alignment between connection arrangements at transmission and distribution. Arrangements would be needed to facilitate the trading of capacity rights

either bilaterally or through traded markets, with appropriate anti-hoarding measures introduced. In order to enable such trading, import and export capacity rights would need to be explicitly stated in Connection Agreements. A new approach would also be needed to manage congestion which allows for the exchange of access rights close to real-time.

**Package Four: Emphasis on Time of Use Signals with no Contracted Access (including cluster combinations C1-A and C2-A)**

9.23 Under this package, network companies would be the price setter and capacity taker, meaning the network company has little or no control of user behaviour, other than setting time of use price signals based on a forecast of how the network company expects different users to respond in the way which is consistent with a secure network.

9.24 There would be an emphasis on users paying for what they use instead of contracting for a particular access product in advance.

9.25 When determining ongoing usage charges, the network company would not take into account what type and where a user is, but would simply set a price for a particular time and leave users to use what they want, when they want.

9.26 This could be based on incremental change of the existing arrangements.

9.27 Figure 18 gives a representation of package four.

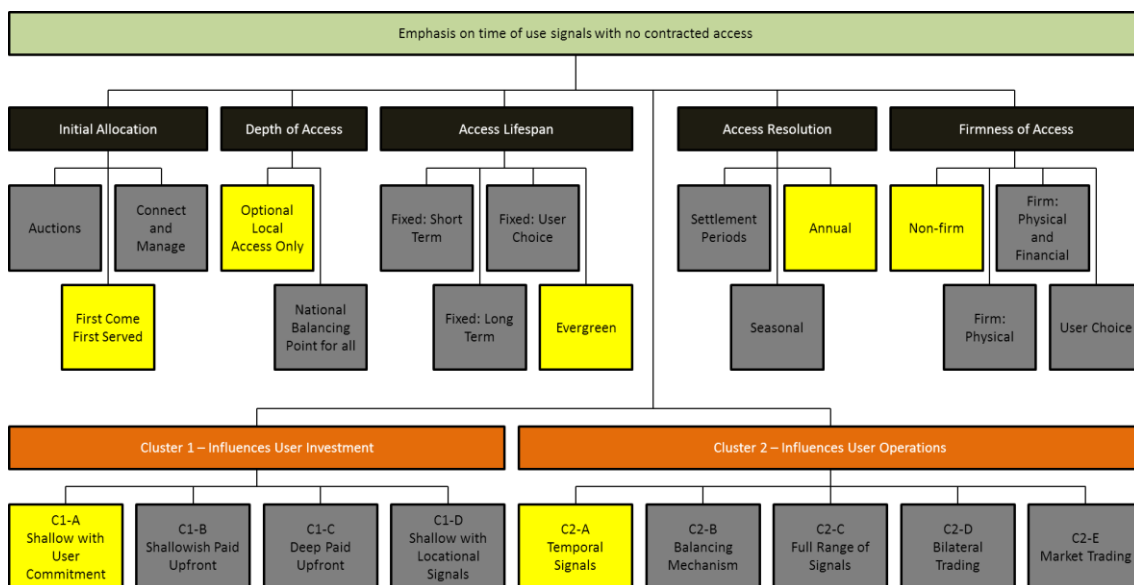


Figure 18 - Emphasis on time of use signals with no contracted access

9.28 The features of this package are described below:

- **Initial allocation** – initial allocation would be on the basis of usage charges on a first come first served basis. Emphasis would be on users paying for what they use instead of contracting for a particular access product in advance.
- **Locational investment signals** – the choice of where to connect to the wider electricity network would be determined by the locational network tariffs applied on a similar basis to both generation and demand. These would be derived from a tariff model that is applied to both the transmission and distribution networks.



The tariffs would be on a zonal basis, with the zones related to collections of nodes on the system with similar long run marginal cost characteristics.

- **Access depth** – users would have the choice of access depth, which may be to the National Balancing Point, or may be limited to local access only.
- **Duration of access** – access lifespan is evergreen, so users would not have to choose between different options of fixed durations. This is consistent with the approach that users do not need to contract for specific access in advance, but simply pay for what they use.
- **Granularity of access** – there would not be any options regarding granularity, because users would not have to contract in advance for particular levels of access, so can instead use as much capacity as they want, when they want.
- **User commitment for connection** – under this package a new connectee would be required to provide user commitment security for a shallow connection charge. This charge would relate to the specific assets required to connect the user to the ‘wider electricity network’ (a consistent definition would be required that relates to both the transmission and distribution networks). The user would retain the liability to pay for the connection over the lifetime of the relevant assets.
- **User commitment for wider reinforcement** – the new connectee would provide security for wider network reinforcements that are required as a result of the new connection. The liability for these wider network securities would fall away once the new connectee was connected to the network (i.e. once the connection was energised and operational).
- **Firm access** – there is no concept of financially firm access. Since users would simply pay for what they use, users would not have a contractual access product, so cannot have firm access.
- **Non-firm access** – all users are non-firm. Users would pay for what they use, so they would simply benefit from avoiding having to pay time of use charges if they did not use the system at a particular time.
- **Changing access rights medium-term to long-term** – there would be no need for users to engage in contractual changes to their access rights in the medium-term to long-term, because users would simply pay for what they use.
- **Changing access rights short-term** – there would be no need for users to engage in contractual changes to their access rights in the short-term, because users would simply pay for what they use.
- **System operation** – existing users would be subject to strong signals that reflect the close to real-time operating costs (in £ per MWh) for the total system (for example costs in each Settlement Period). These signals would be derived ex ante and designed to influence user behaviour and in particular user dispatch. Operational signals would be designed to discourage usage of the electricity network when it is highly congested. This means that user costs would be high at such times reflecting the higher costs of operating the network (and resolving

congestion). Under a generation driven constraint, generation users could only avoid such costs by curtailing output; similarly under a demand driven constraint, demand users could only avoid such costs by curtailing demand. At other times costs for using the network would be relatively small.

9.29 Under this package, new arrangements would be needed for connection at the distribution level, with alignment between connection arrangements at transmission and distribution, with a new charging model approach and a consistent definition of nodal capacity needed across both transmission and distribution to derive locational marginal signals across zones. This new approach would be required to have the capability to provide an ex ante price signal to reflect the cost of congestion at different locations.

## Summary

9.30 The plausible packages presented in this report are representative of different ways in which network access and charging arrangements might be developed. They are included as a starting point for discussion and it is recognised that there are many other options that have not been explored and indeed alternative ways in which each of the packages could be further developed and refined.

9.31 Further review of plausible packages is recommended, combining individual options into a single universal methodology combined with a more detailed assessment regarding how different packages are best reflected through the choice of charging models and tariff structures.

9.32 Practical package design details should be considered, regarding how particular options may work in practice, such as:

- targeted auctions for initial allocation;
- short-term and long-term trading;
- auctions for initial allocation;
- use of an extended Balancing Mechanism;
- the creation of markets for trading access;
- safeguarding core or basic capacity for domestic ;
- options for depth of access – regarding access that is less than to the National Balancing Point;
- treatment of unused capacity; and
- the connection charging boundary.

9.33 Some important questions to consider when assessing different structural combinations of options include:

- For a package based on contracted capacity with a low level of optionality for users, could this “one size fits all” type of access product sufficiently meet the needs of different users?
- For a package which includes a high degree of optionality for users, to what degree could the network company calculate price signals to reflect every permutation of options to avoid opportunities for users to inefficiently arbitrage between different options and prices? Otherwise, it may be possible that greater optionality could deliver value to the users making the choices, but possibly to the detriment of other users and may not necessarily deliver additional value to the system.

- For a trading based approach, to what degree can the network company calculate appropriate cost-reflective exchange rates to ensure that, even after trading, all users continue to be exposed to cost-reflective price signals regarding investment, avoiding opportunities for users to arbitrage or game charging arrangements through trading opportunities to the detriment of other users?
- For an approach based on time of use tariffs, could this provide an effective signal to reflect the drivers of network investment costs, while also providing network companies with sufficient control to efficiently manage network congestion in the absence of operational tools such as a Balancing Mechanism, or active network management?

## 10. Summary and Recommended Further Work

10.1 The work of the Task Forces described in this report is summarised in this section, followed by some further considerations.

### Report Section Summaries

#### *Cluster One – Influences User Investment (Section 4)*

10.2 A greater alignment of the principles, methodologies and arrangements for connection and ongoing usage charging at transmission and distribution levels is desirable to avoid boundary issues. This could be achieved by:

- a common shallow connection charging boundary across all voltage levels in transmission and distribution to encourage flexible responses from all connected users (i.e. connection charges would just include extension assets with reinforcement costs treated through ongoing usage charges); and
- locational ongoing usage charges at transmission and distribution EHV only generated by complimentary methods/models; and an HV/LV representative model adjusted for locational issues e.g. a generation dominated network.

10.3 A shallow connection charging boundary facilitates the use of flexibility by providing a direct price signal to compare the cost of flexibility against network asset solutions, and also reduces the risk of a barrier to some new users connecting which can be created when connection charges are high. A shallow connection charging policy on distribution networks would require more locational ongoing usage charges further down the network. Applying a shallow connection charging policy further down the network will therefore depend on how feasible it is to apply locational ongoing usage charges at lower voltage levels whilst applying appropriate protection to more difficult to serve communities. Whilst greater granularity can be more cost-reflective it can also result in more volatile charges which are hard to predict and hence less likely to influence behaviour. Some users may prefer the stability of charges achieved through a deeper connection charging boundary than the potential volatility of ongoing usage charges if the connection charging boundary were shallow. From a practical implementation point of view, it may be preferable to limit locational signals to EHV connections, and hence a shallowish connection charging policy may remain appropriate at HV and LV.

10.4 There are likely to be significant issues with transitioning to shallow connection charging arrangements for all voltage levels. The requirement to incorporate grandfather rights for existing users would need to be considered, potentially delaying the benefits of the change and giving some users a disincentive to update connection arrangements, for example, to release underutilised capacity.

10.5 To reduce the risk of stranded asset costs, it is in the interests of all parties to ensure that, where network capacity is increased in response to a user request, that increased capacity is utilised. User commitment until at least the time of connection and potentially for a period beyond connection would reduce the risk of stranded asset costs, but could be burdensome to deliver for a high volume of customers (i.e. if applied at all voltage levels). Any introduction of post-connection user commitment would need to be assessed against the cost of users obtaining the financial backing required to provide such commitment, which may be disproportionate to the benefit delivered.

### ***Cluster Two – Influences User Operations (Section 5)***

- 10.6 Reallocation of access rights could offer benefits in certain scenarios. Providing users with a wide range of access choice and the ability to vary this choice through the lifetime of their connection will allow users to connect quickly (ahead of wider network reinforcement) and to trigger efficient reinforcement at a time when user requirements indicate this is appropriate.
- 10.7 Within this, tools that allow fine tuning of real-time user operations can have an important role to play in network charging, allowing control in a way which is not possible through providing time of use price signals alone. There are many different ways in which this fine tuning could be achieved. One option may be to extend to more voltage levels and users a structure similar to the current transmission network's Balancing Mechanism where users are compensated for their actions to balance the system. Another option may be something closer to distribution active network management arrangements where users are not currently compensated for constraints.
- 10.8 Reallocation of capacity through market-based or bilateral trading is likely to need to be supported by network planning studies which ensure sufficient network capability and exchange rates, particularly for trading across wider geographic areas. Ensuring a level playing field between larger and smaller users is likely to be important if bilateral trading is implemented. Whilst auctions were not favoured by most Task Force members, they could be seen as a potential way of valuing and/or trading constraint obligations (with the transfer value between locations needing to be established by the network company).
- 10.9 Time of use charges can also have an important role to play in efficiently operating the network as the costs of owning and operating a network vary across the day and year. Dependence on only user responses to time of use charges may not be sufficiently resilient to prevent reinforcement to meet security of supply standards.
- 10.10 It is important to consider that different types of operational signal may be better suited for different types of user or for different situations. However, how such different user types are defined may be complex and care is needed to make sure distortions are not created.
- 10.11 Reform of how user operations are influenced through charging must include consideration of feasibility and possible unintended consequences of the options being considered. This includes mechanisms to avoid gaming, inefficient interactions between signals, excessively complex signals to which users cannot respond effectively as well as any unintended social or other consequences if such reforms lead to more volatile signals.
- 10.12 It is also important to minimise distortions which may arise if two or more different forms of price signal may provide conflicting operational signals, or provide gaming opportunities as this could distort user operations and lead to less efficient outcomes.

### ***Tariff Design and Charging Models (Section 6)***

- 10.13 The choice of tariff design and charging model chosen is mainly dependant on the decisions made regarding cluster one and cluster two. Task Force discussions have highlighted this choice as an implementation decision as there are a wide range of tariff elements and models that can be used to complement the cluster one and cluster two decisions.

- 10.14 Whilst the advantages and disadvantages in section 6 have mainly been focussed on an absolute basis, rather than relative, it is important to consider further analysis of these pros and cons relative to the cluster one and cluster two decisions once these have been made.
- 10.15 Extending time of use tariffs to all users would be beneficial as it extends the price signal to all users and drives innovation as smaller users become incentivised to reduce their costs. In order for any benefit to be derived from network time of use tariffs, it is necessary for these to be passed through to end users. Moving to a seasonal price would allow network companies to set more cost-reflective charges for users. The visibility of appropriate data to allow users to forecast future charges is seen as vital to any of the proposed solutions.
- 10.16 The development of active network management schemes could provide incentive for profiling capacity at distribution level, similar to the Balancing Mechanism at transmission.
- 10.17 The design of future tariffs might need to reflect the use of core and non-core capacity; however this is also true of a number of other elements which could be taken forward as part of any change to network access arrangements.
- 10.18 There is merit in trying to rationalise and increase commonality across transmission and distribution to avoid distorting demand and generation users' decisions to connect at distribution EHV or transmission respectively (i.e. avoiding perverse incentives), and to ensure that users are exposed to the costs they impose on the whole system and just the network to which they are connected. However, locational charging at HV and LV is not yet possible or practical and could have unintended consequences for some users. It will need to be determined, if changes are felt to be appropriate, whether this should be a single model covering all voltages or two models which reflect the different arrangements.

### ***Access Properties (Section 7)***

- 10.19 There was a wide range of views expressed by Task Force members on network users' preferences for access rights. Although there was little or no preference for bespoke arrangements, the responses indicated they value choice across all the other access characteristics (i.e. depth, lifespan time of use, and level of firmness). Regardless of the options selected under each of the access properties, there will be a need to ensure that the charges associated with each combination are cost-reflective.
- 10.20 It was noted that the introduction of financially firm arrangements at the distribution network level would be a significant change likely requiring careful definition, amendment to security standards and more importantly acceptance from other network users that they would fund any unavailability payments.
- 10.21 Core and non-core access rights for domestic and small commercial users connected at LV should be considered (i.e. a basic capacity for essential services with options to buy additional access for things like electric vehicle charging).

### ***Initial Allocation of Access (Section 8)***

- 10.22 There will always be an element of first come first served when initially allocating capacity to new users, which can be further developed by adopting queue management and/or connect and manage mechanisms at transmission and distribution, but there may

be value in applying targeted auction or market based approaches in specific circumstances to improve the efficiency of connecting new users, for example managing access allocation behind constraints. However universal auctions are not recommended by the Task Forces due to the inability to match gate closure with the timing of users' projects and also the risks of unintended consequences from new users not securing the access they need from the auction process.

### **Plausible Packages (Section 9)**

10.23 The Task Forces created four plausible packages as a starting point for discussion about future approaches and further review of packages, which combine individual options into a single universal methodology, would benefit from further consideration. This should be combined with a more detailed assessment regarding how different packages may be best reflected through the choice of charging models and tariff structures.

### **Further Detailed Considerations**

10.24 The broad terms of reference for the CFF Access and Forward Looking Charges Task Forces were ambitious, especially given the relatively short timescales allocated to complete the work. This has necessarily meant that the Task Forces have only considered issues at a relatively high level and it has not been possible to carry out in depth or quantitative analysis at this stage. The Task Force membership encompassed a wide range of different experience and expertise from across the industry, which has enabled a better understanding of potential advantages and disadvantages of different options for change. This work should be considered the start of an industry discussion which is expected to be further developed through Ofgem's forthcoming consultation.

10.25 The work has identified many key issues and questions which the Task Forces consider would benefit from further consideration. These include issues such as:

- Quantitative assessment of the key drivers of costs on both transmission and distribution networks such that the forward looking charges are cost-reflective on an absolute basis to create a level playing field that is sustainable. This work should draw a clear link between the RIIO framework which defines what the costs actually are (and how they can vary and over what timescales) and the charging framework which recovers those costs. Such work will allow a transparent regime where network users can see areas where their decisions will save costs on the networks.
- Practical design details regarding how particular options may work in practice in the distribution and transmission contexts, such as:
  - targeted auctions for initial allocation and other options for short-term (e.g. an extended Balancing Mechanism) and long-term trading;
  - the definition and application of core or basic capacity for domestic and small commercial users;
  - the rollout and associated reinforcement costs for new low carbon technologies;
  - the treatment of unused capacity including in relation to the application of user commitment at distribution voltages;
  - safeguarding newly connecting and the wider body of users from the high costs of serving remote or sparse networks; and
  - users' behaviours in response to cost and price signals outlined in various options.

- The application of use cases to assess how feasible the access right preferences described by network users would work together in practice across both transmission and distribution networks and are aligned to cost-reflective charges; for example:
  - depth of access (i.e. the option for local access only rather than full access to the national energy market);
  - standardisation of access (i.e. is it practical to offer only bespoke products); and
  - financial firmness (i.e. how the option for financial firmness would work for generation connected to distribution networks recognising the necessary impact on connection charging, and connection and operating policies and standards).
- Particular design features which may be able to mitigate some of the potential disadvantages identified in the work.
- Implementation and transitional arrangements including the possibility of phasing or grandfathering will also need to be considered.

10.26 The Task Forces have not been able to evaluate whether different approaches produced different treatment for users such as generators, behind the meter assets, large commercial users, or small domestic users and so any further work would benefit from looking into this aspect. This should take into consideration outcomes for flexibility service providers and ensure that vulnerable users are treated appropriately and a balance needs to be struck between meeting the needs of existing compared with future users.

10.27 The Task Forces noted the potential broader impacts and interactions arising from different options which would need to be assessed, including:

- how far options would better facilitate independent participation by users or would require stronger reliance on intermediaries;
- the relationship between the options considered and design standards (i.e. the GB Security and Quality of Supply Standard (GB SQSS) which applies to transmission and Engineering Recommendation P2/6 which applies to distribution);
- how the signals sent by network charges would interact with the wholesale price, Balancing Mechanism and Capacity Market;
- how far different options could be susceptible to gaming;
- how the different options considered could interact with the potential creation of local markets; and
- how the different options could impact on the owners and operators of private networks, independent licensed distribution networks and offshore transmission networks.

10.28 The Task Forces note the potential impact and linkages to other programmes with a direct relation to this work, including:

- a quantitative impact assessment of the scale of existing issues requiring to be addressed, which is being developed by Baringa. Draft interim results of Baringa's work were made available to the Task Force. It is expected that this will help to inform prioritisation of future work;
- the Targeted Charging Review;
- the Energy Networks Association's Open Networks programme;



- the development of RIIO-2; and
- ongoing changes to retail competition.

10.29 The Task Forces wish to raise that whilst the disadvantages of options which have been put forward by Task Force members and presented in this paper may cover some of the consequences of implementing a given option, this is not a comprehensive study and there is a risk of adverse unintended consequences. Risk of unintended consequences of the implementation of any changes taken forward should be fully considered.

10.30 In the later stages of Task Force activity, Ofgem highlighted that, for distribution network companies, the recovery of network costs incurred in the provision of flexible and active network management connections had links to wider policy questions, many of which are subject to debate across the industry and within the scope of access reform. The Task Forces started working on the topic and discussed some pertinent aspects for further consideration. However, because active network management can be used to manage a broad range of circumstances, ranging from fairly straightforward individual connections to a wide area active network management scheme, as well as having a key role in the facilitation of future Distribution System Operator models, it was agreed that the topic required more detailed consideration across a range of potential charging approaches. Discussions with Ofgem concluded that thinking on the topic should be developed further within the Energy Network Association's Open Networks project, specifically under Workstream 4.

## 11. Glossary

Term	Definition
Active Network Management (ANM) system	Control systems that manage generation and load for specific purposes. This is usually to keep system parameters (voltage, power, frequency) within predetermined limits.
Balancing Mechanism	A trading system run by the Electricity System Operator that allows it to agree actions with generators to increase or decrease generation.
Connection Agreement	An agreement between a network company and a user which provides that the user has the right for its installation to be connected.
Connection and Use of System Code (CUSC)	CUSC constitutes the contractual framework for connection to, and use of, the national electricity transmission system.
Distribution Connection and Use of System Agreement (DCUSA)	The DCUSA is a multi-party contract between the licensed electricity distributors, suppliers, generators and Offshore Transmission Owners of Great Britain. It is a requirement that all licensed electricity distributors and suppliers become parties to the DCUSA.
Distribution Network Operator (DNO)	An electricity distributor that operates one of the 14 distribution services areas and in whose electricity distribution licence the requirements of Section B of the standard conditions of that licence have effect.
Distribution System Operator (DSO)	The operator of the Distribution System.
Electricity System Operator	An organisation entrusted with ensuring supply and demand are balanced second to second and in the longer term, and managing power flows across the network safely and reliably. National Grid is the Electricity System Operator for Great Britain.
Engineering Recommendation P2/6	The security of supply standard for demand connected to distribution networks.
Extra-High Voltage (EHV)	Nominal voltages of 22kV and above.
GB Security and Quality of Supply Standard (GB SQSS)	Sets out the criteria and methodologies for planning and operating the GB Transmission System.
Grid Supply Point (GSP)	A metered connection between the National Grid Electricity Transmission system and the DNO's distribution system at which electricity flows to or from the Distribution System.
High Voltage (HV)	Nominal voltages of at least 1kV and less than 22kV.
kVA	Kilovolt ampere.
MVA	Megawatt ampere.
kVArh	Kilovolt ampere reactive hour.
kW	Kilowatt.
MW	Megawatt.
kWh	Kilowatt hour (equivalent to one "unit" of electricity).
Low Voltage (LV)	Nominal voltages below 1kV.
National Balancing Point	A virtual trading location for the sale, purchase and exchange of electricity.

Ofgem	Office of Gas and Electricity Markets – Ofgem is governed by GEMA and is responsible for the regulation of the distribution companies.
Settlement	The determination and settlement of amounts payable in respect of charges (including reconciling charges) in accordance with the BSC.
Settlement Period	Each day is split into 48 Settlement Periods, with Settlement Period 1 equivalent to 00:00 to 00:30.
Supplier	An organisation with a supply licence responsible for electricity supplied to and/or exported from a metering point.
TERRE	Trans European Replacement Reserves Exchange (TERRE) is the European implementation project for exchanging replacement reserves in line with the Guideline on Electricity Balancing.
Unmetered Supplies	Exit points deemed to be suitable as unmetered supplies as permitted in the Electricity (Unmetered Supply) Regulations 2001 and where operated in accordance with BSC Procedure 520.
Use of System Charges	Ongoing charges which are applicable to those parties which use the Distribution and Transmission Systems.

# 12. Appendices

## Appendix One – Task Force Timeline



## Appendix Two – Code Objectives and Assessment Criteria

12.2 Figure 19 shows the applicable Connection and Use of System Code (CUSC) and Distribution, Connection and Use of System Agreement (DCUSA) objectives:

High Level Objective	Relevant Connection and Use of System Code (CUSC) Charging Objective (Applicable to Transmission)	Relevant Distribution Connection and Use of System Agreement (DCUSA) Charging Objective (Applicable to Distribution)
Licence Compliance	n/a	1 That compliance by each DNO Party with the Charging Methodologies facilitates the discharge by the DNO Party of the obligations imposed on it under the Act and by its Distribution Licence
Effective Competition	(a) That compliance with the use of system charging methodology facilitates effective competition in the generation and supply of electricity and (so far as is consistent therewith) facilitates competition in the sale, distribution and purchase of electricity	2 That compliance by each DNO Party with the Charging Methodologies facilitates competition in the generation and supply of electricity and will not restrict, distort, or prevent competition in the transmission or distribution of electricity or in participation in the operation of an Interconnector (as defined in the Distribution Licences)
Cost Reflectivity	(b) That compliance with the use of system charging methodology results in charges which reflect, as far as is reasonably practicable, the costs (excluding any payments between transmission licensees which are made under and in accordance with the STC) incurred by transmission licensees in their transmission businesses and which are compatible with standard condition C26 (Requirements of a connect and manage connection)	3 That compliance by each DNO Party with the Charging Methodologies results in charges which, so far as is reasonably practicable after taking account of implementation costs, reflect the costs incurred, or reasonably expected to be incurred, by the DNO Party in its Distribution Business
Developments in Network Businesses	(c) That, so far as is consistent with sub-paragraphs (a) and (b), the use of system charging methodology, as far as is reasonably practicable, properly takes account of the developments in transmission licensees' transmission businesses;	4 That, so far as is consistent with Clauses 3.2.1 to 3.2.3, the Charging Methodologies, so far as is reasonably practicable, properly take account of developments in each DNO Party's Distribution Business
Compliance with European Regulation	(d) Compliance with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency	5 That compliance by each DNO Party with the Charging Methodologies facilitates compliance with the Regulation on Cross-Border Exchanges in Electricity and any relevant legally binding decisions of the European Commission and/or the Agency for the Co-operation of Energy Regulators
Efficiency of Implementation	(e) Promoting efficiency in the implementation and administration of the system charging methodology	6 That compliance with the Charging Methodologies promotes efficiency in its own implementation and administration

Figure 19 - Applicable CUSC and DCUSA Objectives

12.3 Figure 20 shows the assessment criteria, and the objectives to which the Task Forces believe they relate.

Assesment Criteria	Primary Related Objective	Secondary Related Objectives
1 Efficiently meet the essential service requirements of network users	Developments in Network Businesses	Licence Compliance
2 Optimise capacity allocation	Effective Competition	
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	Cost Reflectivity	Effective Competition
4 Provide a level playing field for all network users	Effective Competition	
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	Effective Competition	Cost Reflectivity
6 Appropriately allocate risk between individual network users and the wider body of users	Effective Competition	
7 Support efficient network development	Developments in Network Businesses	
8 Be practical	Efficiency of Implementation	Compliance with European Regulation
9 Be proportionate	Efficiency of Implementation	

Figure 20 - Assessment criteria mapped to DCUSA and CUSC objectives

## Appendix Three – Advantages and disadvantages of Framework Scenarios as Expressed by Task Force members

### 12.4 High emphasis on auctions/trading

Assessment Criteria		High emphasis on auctions/trading: Access products are well-defined (including being financially firm) and purchased via auctions, with scope for re-sale. Charging models still used to set robust reserve prices, with potential changes needed to ensure they reflect differential value of access adequately.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Larger users - potential to optimise allocation of scarce capacity (i.e. behind a constraint).</li> <li>- A large body of aggregators, offtakers and suppliers could compete to create portfolios and optimise capacity allocation.</li> </ul>	<ul style="list-style-type: none"> <li>- There is no fixed network capacity to allocate - Available network capacity depends on the mix of users.</li> <li>- Interaction with Capacity Market and Balancing Services might make cheapest flexible resources more expensive.</li> <li>- Generators - risk of 'pricing out' of the market for smaller players, so may not optimise in terms of finding most efficient, but rather find those with deepest pockets</li> <li>- Smaller users - little or no benefit; will be so reliant on assumptions made by intermediaries with the need for safeguards to avoid undesirable consequences for auction losers.</li> <li>- Auctioning capacity has many issues; it is unclear how an auction mechanism involving individual parties could optimise capacity</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- If auctions are market wide (a big if!), all users are competing for equivalent products, so a level playing field would be created.</li> <li>- Supplier may be able to offer cheaper fixed rate tariffs by buying large blocks of access</li> </ul>	<ul style="list-style-type: none"> <li>- Risk of gaming, e.g. Some participants may be better placed to carry out speculative capacity bids to buy up capacity in order to later sell on secondary market. Equivalent to ticket touts for events. Difficulty of drawing line between 'large' and 'small' for the purpose of smaller user safeguards.</li> <li>- Smaller users - Likely to need significant safeguards/'carve-outs' resulting in a distortion of the 'pure' level playing field created by exposing all users to the risk of losing in the auction.</li> <li>- Potential for large users to game the system, and so make smaller users uncompetitive.</li> <li>- Could make Standard Variable Tariffs more expensive as it becomes difficult for suppliers to forecast customer numbers in regions under variable tariffs (cannot purchase access in advance as unknown customer base)</li> <li>- Unlikely to create clear long term signals</li> <li>- Risks over rewarding network users who are mobile</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Assuming auction takes place behind a constraint, would provide strong locational cost signals</li> </ul>	<ul style="list-style-type: none"> <li>- Very difficult for users to respond to price signals</li> <li>- Auction clearing prices likely to be highly volatile and difficult to predict, making this a poor investment signal.</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users		<ul style="list-style-type: none"> <li>- Smaller users - if protections are not put in place for smaller users, places disproportionate risk on individuals, of either being exposed to high prices if auction clears at a high price or of losing network access if they (or an intermediary working on their behalf) loses in the auction</li> <li>- Larger users - if protections are put in place for smaller users, places disproportionate risk on larger users who could be left to 'divvy-up' remaining capacity after allocation to smaller users</li> <li>- Impact of loss of connection on individual users could be immense</li> <li>- Likely to inefficiently allocate risk</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Potential to provide highly locational price signals.</li> <li>- An appropriate reserve price would ensure prices never fell below incremental costs of providing capacity</li> <li>- Higher costs will indicate constraints in a region, and users could respond by investing in new kit or reducing usage</li> </ul>	<ul style="list-style-type: none"> <li>- Auction price will not reflect 'incremental future costs and benefits that can be allocated'; rather it will reflect the willingness to pay of the auction winners</li> <li>- Potential conflict between holding a competitive auction and giving long-term locational signals</li> </ul>
	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- From an idealistic standpoint, this option has the potential to improve capacity allocation and so efficiently meet longer term requirements by minimising expenditure.</li> <li>- Portfolio approaches could allow users to share network access over different times by buying together as a group or under a 'neat' supplier portfolio</li> </ul>	<ul style="list-style-type: none"> <li>- Users will be prepared to pay up to the value of their business/project to obtain network access, even then they may fail to secure access. This means businesses (hospitals/schools?) as well as generation assets could close due to failure to secure network access.</li> <li>- Smaller users - unlikely to meet essential requirements without significant safeguards</li> <li>- Larger demand users - potentially under-values stability; industrial users would not see a regular auction as an efficient means of meeting their requirements which are inherently stable and long term</li> <li>- Due to practical issues with holding an auction, this is unlikely to be an 'efficient' means of meeting essential service requirements</li> </ul>
Efficiency of Implementation	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Larger users - demand in each auction (i.e. the differential between the clearing price and the reserve price, or the number of bidders) will provide network operators with a signal of where additional capacity is needed</li> </ul>	<ul style="list-style-type: none"> <li>- Auctions provide a poor price signal for network investment - DNO/TO may have poor visibility of current and future bid stack, so very difficult for DNO/TO to predict what the impact will be of a given network investment on future auction clearing prices.</li> <li>- Lumpiness of network investment - Will tend to exacerbate the volatility of auction clearing prices</li> <li>- Smaller users - safeguards required to ensure user's essential requirements are met are likely to render this option similar to the status quo for information provided to the network operator</li> <li>- Auctions do not provide for strategic planning that is most cost effective</li> </ul>
	8 - Be Practical		<ul style="list-style-type: none"> <li>- Practically very difficult to implement. There is not a single national network capacity, but a myriad of different available capacities. Available capacity will vary by location and by mix of user type. Available capacity in some areas will also depend on the success of users in other areas. Therefore the locational mix of successful users is subjective and indeterminate.</li> <li>- If auctions are more targeted, potentially practicality improves but this introduces level playing field concerns</li> <li>- Would require changes to Capacity Market arrangements to avoid conflict</li> <li>- Too many issues to make this a practical option for demand customers</li> </ul>
	9 - Be Proportionate		<ul style="list-style-type: none"> <li>- Auctions fail to address the issue with current arrangements relating to increasing congestion on networks causing a need to provide more efficient price signals to smaller users (Inc. EV), then it is this very group for which auctions are less appropriate and least effective.</li> <li>- Minimal benefits derived from major administrative effort</li> <li>- Too many issues make this disproportionate</li> </ul>

## 12.5 High emphasis on access right choices

Assessment Criteria		High emphasis on access right choices: Access rights are granted broadly on a first come first served basis, with a range of choice around type of access to maximise use of capacity. Capacity charges reflect impact of different choices on network costs. Changes so that non-firm holders can trade curtailment obligations through a market-based mechanism.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Larger users - potential for a significant improvement to capacity allocation by offering a greater range of products as standard (e.g. time restricted off-peak 'budget' access products)</li> <li>- Smaller users - potential for some benefit for users wanting 'premium' products (e.g. the ability to charge EV at peak time)</li> <li>- Generators - more scope for (flexible) sharing of access rights between non-coincident generation technologies</li> <li>- Depending on which access products are created, this does have the potential to effectively allocate capacity</li> </ul>	<ul style="list-style-type: none"> <li>- Smaller users - likely to be reliant on significant assumptions on the behaviour of each end user. For a disengaged user this could simply be a more administratively involved means of maintaining the status quo.</li> <li>- Smaller users - may create a perverse incentive to avoid smart metering and/or avoid informing the network operator what equipment is connected to avoid the need for 'premium' access products and instead rely on assumptions on typical demand</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- If market wide, all users will be competing for equivalent products, creating a level playing field.</li> <li>- Larger users - removes a distortion between users who only wish to use the network at off-peak times (but under current arrangements are required to reserve the capacity they require regardless of when they use it) and users who wish to use the network at peak times. Reserving capacity at peak drives higher network cost than off-peak which could be reflected in the cost differential between access products</li> </ul>	<ul style="list-style-type: none"> <li>- Smaller users - could be disadvantaged at the expense of larger users who have the resource to engage more effectively and so purchase the access they need whilst smaller users may find it more difficult to differentiate</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Clear price signals which can be responded to</li> <li>- Users can reserve/change access rights (many years) in advance and have visibility of what the likely charges associated with those access rights will be. This enables users to respond to those price signals when making investment decisions.</li> <li>- Can create clear price signals</li> </ul>	<ul style="list-style-type: none"> <li>- Potential to over-value the provision of access and consequently under-value changes in usage behaviour</li> <li>- Will still be dependent on network modelling so improvements will be required to address perceived flaws in the current approaches</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- If users pay a cost reflective price for their access right, then they are paying for a level of network access service from the DNO/TO. It is within the control of the DNO/TO to make decisions regarding network reinforcement which results in higher/lower cost, or degradation of service, so it is right that users are insulated from this risk.</li> <li>- Exposes users to some risk by exposing them to the cost of providing (e.g.) peak time access differentiated from the cost of off-peak access.</li> <li>- Clearly designed products should mean users know what they are buying and the risks they are taking</li> </ul>	<ul style="list-style-type: none"> <li>- Depending on locational granularity, potential for 'premium' access products to become extremely expensive, and potentially over-expose users to the risk of networks becoming congested, where arguably some of this cost should be shared with the wider body of users</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Network charges are a price for receiving a network access service</li> <li>- It is relatively straight forward for network charges to reflect the cost to the DNO/TO of providing the network access service.</li> </ul>	<ul style="list-style-type: none"> <li>- May over-value providing access and under-value ongoing usage - e.g. likely to be a limited ongoing signal of the benefit to the network of using less than the access product purchased</li> <li>- Will remain dependent on the modelling used to price the available products, which needs to be improved to be more cost-reflective</li> </ul>
	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- When users pay a cost reflective price for network access, they should be able to expect their essential service requirements of access will be met. It is then appropriate that in the event that service may not be delivered, the user is compensated for that degradation of their service.</li> <li>- May allow the network operator to effectively allocate capacity based on the access products purchased and so meet long term requirements efficiently</li> <li>- With the right products, this could be an efficient approach</li> </ul>	<ul style="list-style-type: none"> <li>- Given the number of products will be restricted, there is a risk that users purchase access products conservatively (i.e. the option which provides more than they need rather than less) which the network operator must then allow for - leading to unused capacity</li> </ul>
Development in Network Businesses	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- DNO/TO have good visibility (potentially many years) in advance of what access rights different users are going to request - This enables DNO/TO to effectively plan network investment accordingly</li> <li>- Potential for better use of existing network through better capacity 'sharing' based on time of use.</li> <li>- Alongside information from other sources, planning could be strategic</li> <li>- With the right products, this could be an efficient approach</li> </ul>	<ul style="list-style-type: none"> <li>- Could place incentive on developers to opt for minimum access option, only for network operator to later be required to reinforce to meet the actual needs of users.</li> <li>- May require the network operator to 'guarantee' access to the level of the product purchased, resulting in unnecessary headroom.</li> </ul>
	8 - Be Practical	<ul style="list-style-type: none"> <li>- Transmission - this approach is already closest to existing charging arrangements</li> </ul>	<ul style="list-style-type: none"> <li>- Smaller users would require some means of agreeing the level of access with each end user (or an intermediary working on their behalf), requiring a huge number of bilateral agreements</li> <li>- Larger distribution connected users would require more detailed connection agreements specifying more detail on the access product purchased, and detailed considerations on the consequences of over-use beyond access product purchased</li> <li>- Would need new planning approach (and software), alongside new criteria to manage risk of stranded assets</li> </ul>
Efficiency of Implementation	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Transmission - requires least change and disruption for users</li> <li>- Larger distribution connected users - benefits are potentially significant, with relatively small implementation hurdles</li> </ul>	<ul style="list-style-type: none"> <li>- Smaller users - major implementation challenges for minimal benefit</li> </ul>

## 12.6 High emphasis on use of system charges

Assessment Criteria		High emphasis on better usage charges: Limited changes to access, with reliance on usage charges, with most charges focused on usage at system peaks. Could include more locational charging for constraint costs.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- No direct impact on capacity allocation, but cost-reflective usage charges have the potential to impact the way in which existing capacity is used</li> <li>- Predictable pricing signals optimise the dispatch and connection of assets</li> <li>- As a standalone option this may be less effective at allocating capacity, but combined with access products this could be effective</li> </ul>	<ul style="list-style-type: none"> <li>- TOU price signals may conflict with other short-term mechanisms to allocate capacity such as Balancing Mechanism (BM). Application of both TOU and BM price signals for the same network may be incompatible, however, conflict may be avoided if users only face one or the other, instead of both. However, under the BM, users set their own price, therefore any price dispatched under the BM is reflective of that user's value, which includes costs for network use and access.</li> <li>- No improvement on the 'implicit' sharing of capacity which exists under the status quo</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- With cost-reflective usage charges, each user will face the same charges (for an equivalent unit of energy, i.e. at the same time and location), creating a level playing field.</li> </ul>	<ul style="list-style-type: none"> <li>- TOU tariffs are easier to avoid, which may cause some distortions and be less fair.</li> <li>- Potential for volatility in charges overly favouring flexible users</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Dependent on predictability of pricing - if prices and time periods are predictable, users should be in a position to respond.</li> <li>- Prices could be highly locational and therefore focused on parts of the network that is near to full capacity, providing strong price signals.</li> <li>- Static TOU tariffs can provide predictable prices which give a clear investment signal</li> </ul>	<ul style="list-style-type: none"> <li>- It would be very difficult for users to forecast what their charge at any given time, or total annual charge will be, therefore very difficult to make investment decisions.</li> <li>- Static time of use signals set in advance do not reflect the value or quantity of available capacity at that particular time - So they are an economically inefficient tool for incentivising user responses.</li> <li>- It is essential that charges are highly cost-reflective to avoid inefficiencies, which may result in more volatile signals.</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- Lower socialisation (e.g. locational) arguably allocates risk more appropriately - where user behaviour has the potential to avoid costs users are exposed to strong cost signals; other users are not.</li> <li>- Cost-reflective charges provide the most robust risk allocation</li> </ul>	<ul style="list-style-type: none"> <li>- Dynamic TOU price signals will be volatile by value and also volatile by timing - This exposes users to substantial risk regarding what their total annual network charge is going to be, caused by factors outside of their control.</li> <li>- Prices could be very high in certain time bands - for example if a STOD structure was selected, then could have a high peak price.</li> </ul>
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- Assuming the calculation of charges is done on a sound basis, charges should accurately reflect costs and benefits which can be allocated to the behaviour of certain users.</li> <li>- Sufficient transparency of network conditions and ex post charging allows parties to respond to their pricing signals</li> <li>- Cost-reflective charges inherently achieve this criteria</li> </ul>	<ul style="list-style-type: none"> <li>- Network investment is generally driven by changes in user capacity, not changes in user profile "use" - If a user happens to reduce their "use" at a key time in one particular year (therefore reduces its network charges in that year), this does not necessarily reflect the cost of network the DNO/TO needs to build to serve that user in that, or future years</li> <li>- Static TOU tariffs are not cost reflective - Because the particular periods of constraint, or high stress on the network are driven by weather and outturn market conditions, the specific timing of which can not be known in advance.</li> <li>- Highly cost-reflective charges create risks for some (rural?) customers due to low socialisation of costs</li> </ul>
	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- Potential for user responses to cost signals to reduce long run costs for all network users.</li> <li>- Charging aggregated portfolios allows suppliers to spread costs across all market participants and offset with local solutions (i.e. generation and storage), to ensure essential service needs are met</li> </ul>	<ul style="list-style-type: none"> <li>- The essential requirements of customers who cannot respond to cost signals are likely to be charged more under this option. May leave some customers priced out of the market if prices are very high.</li> <li>- Particular problem for smaller and/or domestic users; users who are less likely to monitor and respond to TOU electricity market pricing may receive shocks to their annual network charge if they consume power at the "wrong" time.</li> <li>- Highly cost-reflective locational charging may disadvantage vulnerable users with low usage, so may require some protections (e.g. minimum usage) to protect vulnerable users.</li> </ul>
Efficiency of Implementation	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Evolving cost signals will reflect congestion on the network at each time and location, enabling user responses which avoid the need for reinforcement and improve efficiency.</li> <li>- Emphasises efficient use of the network</li> </ul>	<ul style="list-style-type: none"> <li>- DNO/TO have poor visibility of what the future demands on the network may be. This provides a relatively poor price signal for network reinforcement.</li> </ul>
	8 - Be Practical	<ul style="list-style-type: none"> <li>- User will not be required to make up front assumptions on their future use of the network, so more similar to status quo for end users.</li> </ul>	<ul style="list-style-type: none"> <li>- More complicated and burdensome than existing arrangements. TOU tariffs would need to be more dynamic, varying over time and by location at sufficient granularity. This would require a significantly more complicated tariff model and require it to be updated many times per day.</li> <li>- Difficult to send appropriately granular but appropriately stable location and temporal cost signals for the mass market.</li> <li>- Consumers will need education and good information (e.g. in home display) to be able to respond to pricing signals</li> <li>- Requires improved network modelling to ensure charges are cost-reflective</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Does not require immediate user engagement.</li> <li>- Benefits of charges that reflect the absolute costs that users impose on the network mean the increased complexity is proportionate</li> </ul>	<ul style="list-style-type: none"> <li>- Would introduce substantial additional complexity for both users and network operators, while delivering price signals which are less effective at incentivising economically efficient responses.</li> <li>- Consumers will need education and good information (e.g. in home display) to be able to respond to pricing signals</li> </ul>



## Appendix Four – Advantages and disadvantages of C1 Combinations as Expressed by Task Force members

### 12.7 C1-A – shallow connection charging with user commitment

Assessment Criteria		C1-A: Existing transmission arrangements Broadly similar to existing arrangement at Transmission level. Shallow connection boundary and locational signal allow user behaviour to be influenced as system costs change over time and better facilitates capacity trading/reallocation. Securitisation requirements can be a barrier for smaller users.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>Implicit network sharing</li> <li>Shallow boundary facilitates capacity reallocation</li> <li>Zonal requirements are easier to understand than nodal, allowing parties to plan better</li> </ol>	<ol style="list-style-type: none"> <li>Weaker penalty for overstating initial requirements post connection (security falls away)</li> <li>Relatively weak locational signal gives weaker incentive on location</li> </ol>
	4 - Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>Lack of large upfront connection costs can help smaller players.</li> <li>Consistent arrangements across T and D give immediate improvements by removing the discrepancy across the T/D boundary</li> <li>Can depend on initial allocation method</li> </ol>	<ol style="list-style-type: none"> <li>Securitisation tends to favour larger players who can rely on their credit ratings. Securitisation would be virtually impossible to manage at the small business/domestic level.</li> <li>Users are treated the same in terms of connection charges regardless of whether they trigger or not reinforcement</li> </ol>
	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	<ol style="list-style-type: none"> <li>If DUoS moved towards more shallow connection, this would provide a stronger price signal to reduce usage of the network - because a more "use of system" based charge is an avoidable cost, while by contrast a "connection" charge becomes an unavoidable sunk once it is paid and/or committed to.</li> <li>Zonal pricing provides sufficient granularity to provide an accurate price signal - Without introducing the problems of volatility and unpredictability which would come from more nodal pricing.</li> <li>Annuitized connection charge allows a user a good degree of certainty, albeit an annuitised shallow connection charge is likely to be immaterial.</li> </ol>	<ol style="list-style-type: none"> <li>Size of, and method of deciding zones can result in volatile charges .</li> <li>Shallow connection charges combined with zonal charging creates weak cost signals which may not be sufficiently strong to generate any response</li> <li>Strong time of use signals are appropriate only where the charging model is sufficiently predictable so users can predict with charges and make decisions with clarity. This is of importance to new build generators (esp low carbon) where network charges can have sig. impact on project viability.</li> </ol>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>Annuitisation and securitisation to connection ensures appropriate allocation of risk at point of connection</li> </ol>	<ol style="list-style-type: none"> <li>A shallower "use of system" based charge exposes users to the risk that after they have made their investment decision, the usage charge may increase substantially due to changes in regulations, government policy, or the actions of other users - This is a particular issue for low/zero marginal cost generators, or large industrial demand customers who after their investment decision have incurred substantial sunk cost of their own assets and are therefore not able to respond to an increasing network use of system price signal. This is a risk they face out with of their control.</li> <li>With user commitment only extending to time of connection, risk tends to fall on wider body of users. Despite requiring securitisation of annuity, creates risk of asset stranding related to reinforcement assets which disproportionately shields the connectee from risk</li> <li>Shallow connection charges socialises otherwise concentrated risk</li> <li>Investment decisions have been made on the back of existing arrangements.</li> </ol>
	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	<ol style="list-style-type: none"> <li>If DUoS moved towards shallow charging, then every year, users would face a price signal which reflected the incremental future network cost. By contrast the current "shallowish" DUoS approach places more emphasis on providing a connection price signal at the point that users make their initial investment decision.</li> <li>Locational element of forward looking charge allow the price signal to be varied as the network and usage of the network changes.</li> </ol>	<ol style="list-style-type: none"> <li>Unpredictable behaviour by a user could trigger reinforcement costs which are never recovered from the user triggering them in full</li> <li>Relatively weak price signals (shallow connection charges and zonal locational charges).</li> <li>Lack of locational connection charge signal makes this charges unlikely to reflect costs. Requires strong zonal charge.</li> </ol>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>A move for DUoS from "paid up front" to "annuitised" may better meet requirements of users - A more level playing for access, as well as lower cost to customers if the cost of capital of the DNOs is cheaper than the cost of capital of network users.</li> </ol>	<ol style="list-style-type: none"> <li>Uncertainty over path of future locational signals can present an investment risk.</li> <li>Provides limited locational signal to connectees, and so does not provide cost signals to users to locate efficiently on the network</li> </ol>
	7 - Support efficient network development	<ol style="list-style-type: none"> <li>A DUoS move towards more shallow connection provides a new avoidable price signal fore users to reduce their use of the network - This can result in more efficient use of the network, so reduce the need for the DNO to incur cost for network reinforcement</li> <li>Incentive on network company to assess alternatives to traditional reinforcements as capacity limits reached.</li> <li>Shallow connection charges can encourage trading or constraint management systems and development of DSO models where real time signals of network constraints and flexibility can be delivered.</li> </ol>	<ol style="list-style-type: none"> <li>Less of an up-front signal/commitment from users to network companies around their enduring needs</li> <li>Limited user commitment beyond connection risks asset stranding</li> <li>Shallow connection charges enable customers to connect where they wish without being exposed to the costs driven on the network and hence may drive unnecessary costs which the wider body of users will have to bear</li> <li>Current charging regime does not incentivise the 'right' generation to come onto the grid at the 'right' location</li> </ol>
Efficiency of Implementation	8 - Be Practical	<ol style="list-style-type: none"> <li>Shallow boundary and annuitisation allows all users to connect</li> <li>Generally practical for large users.</li> <li>Easy to administer (albeit transition could be challenging) with straightforward connection charging and reasonably simple zonal ongoing charges</li> <li>Shallow connections may be required for 'system flexibility</li> </ol>	<ol style="list-style-type: none"> <li>For DUoS, a more granular (zonal) locational charge may be more complicated to calculate - However, since TNUoS operates this way already, it should be manageable.</li> <li>User commitment arrangements become increasing difficult to administer as customer size decreases (multiple bilaterals?) and are probably impractical at the small business/ domestic level. Significant issues in moving to this from anything other than a shallow connection boundary.</li> <li>Transition would be challenging for distribution users who have already paid shallowish connection charges</li> </ol>
	9 - Be Proportionate	<ol style="list-style-type: none"> <li>The benefits in terms of economic efficiency of price signals should outweigh the practical issues related to a more complicated tariff model.</li> <li>Shallow boundary would mitigate the issue of relatively deeper connection boundary at distribution</li> <li>Some granularity of locational signal may somewhat help mitigate increasing demand at distribution</li> <li>Shallow connection charges are needed to fully use non network flexibility</li> </ol>	<ol style="list-style-type: none"> <li>Difficult to implement for smaller users</li> <li>Not proportionate as minimal benefit delivered</li> </ol>

## 12.8 C1-B – shallowish connection charging with upfront capital payment

Assessment Criteria		C1-B: Existing distribution arrangements Broadly similar to existing arrangement at Distribution level. There is some granularity of locational charges due to there being 14 DNOs but this is not caused by design of the charging framework. A minority of customers (EHV) do have locational charges. Less volatility in locational charges but no forward looking locational signal to influence behaviour. More difficult to facilitate capacity trading/reallocation.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>1. Upfront signal encourages locating demand where capacity exists.</li> <li>2. Shallowish connection boundary results in capacity being initially allocated to users who value it</li> </ol>	<ol style="list-style-type: none"> <li>1. A move of TNUoS towards deeper ("shallowish") connection may introduce a greater need for secondary trading of connection rights, - which may be less efficient.</li> <li>2. Shallowish boundary at distribution is a barrier to investing in connections, potentially affecting optimal capacity allocation</li> <li>3. Lack of locational signals</li> <li>4. Moving to a deeper connection charge will have implications for behaviour in the Balancing Mechanism, for example how do parties with physically firm access rights bid into the BM and how does this interact with TCLC</li> </ol>
	4 - Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>1. Lack of ongoing user commitment can help smaller players.</li> <li>2. Consistent arrangements across T and D give immediate improvements by removing the discrepancy across the T/D boundary.</li> <li>3. Shallowish connection charges ensure a connectee appropriately contributes to the cost of their connection, thus protecting the wider body of users</li> </ol>	<ol style="list-style-type: none"> <li>1. Change of TNUoS from "shallow" to "shallowish" and "paid up front" could result in a previously unexpected call on cash reserves for network users. Users with less strong balance sheets may be subject to a financial shock.</li> <li>2. Obligation to pay up front creates barriers to some users</li> <li>3. Questions about previous connectees who use up spare capacity - the connectee who drives reinforcement is liable for the apportioned (shallowish) cost of reinforcement which may have been driven by a series of multiple connectees to that point</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. Connection charges will not be change over time based on other users actions on the network causing congestion</li> <li>2. Shallowish connection charge provides some signal to users at time of connection</li> <li>3. Lack of granularity assists with forecasting future charges</li> <li>4. Strong up front connection charges enable users to make a very clear decision on the basis of the cost of connecting and the value of that connection to the user</li> </ol>	<ol style="list-style-type: none"> <li>1. Existing Transmission users would face no ongoing locational price signal which they could respond to - The locational "use of system" price signal would disappear and most users could not respond to the new deeper "connection" charge unless they were prepared to close their assets before the charging arrangements changed.</li> <li>2. Although connection charge is paid up-front, often difficult to estimate reinforcement required when making application</li> <li>3. Lack of ongoing locational charges allows users limited scope to adjust behaviour on an ongoing basis as price signals are relatively weak</li> </ol>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>1. If TNUoS moved to "shallowish" with reduced "use of system" charges, this would reduce the uncontrollable risk to users of future tariff increase - That their "use of system" charges may increase after they have incurred their sunk cost investment decisions.</li> <li>2. Opportunity to vary the risk allocation by varying the rules defining the shallowish boundary.</li> <li>3. Ensures connectees are exposed to a proportion of the reinforcement costs they create, ensuring the wider body of users is shielded from the risk of inefficient connections</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of user commitment</li> <li>2. Lack of locational signals</li> <li>3. Depend on precise rules of shallowish boundary - can result in risk mainly with wider body of users</li> <li>4. Lack of location ongoing charges effectively socialises risk of ongoing reinforcements being required, rather than exposing users who have the ability to influence the cost to more of the risk</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. Users face a charge broadly reflective of their expected impact on the network at the time of connection which reflects the investment that is made to deliver their requirements</li> </ol>	<ol style="list-style-type: none"> <li>1. If TNUoS moved towards deeper connection charges and no locational charges, then existing transmission users would no longer face a price signal which reflected future network costs.</li> <li>2. Lack of locational signal in forward looking charges leaves reliance on temporal signals.</li> <li>3. Lack of ongoing locational signal likely to under-value ongoing behavioural changes, where changes in behaviour post-connection may influence future network costs</li> </ol>
	1 - Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>1. Customers have a more stable/known up-front charge to secure sufficient capacity for their needs rather than a potentially volatile ongoing UoS charge</li> <li>2. With more of the locational charge in the connection charge this can assist the investment case as there is a lower risk on locational charge volatility.</li> <li>3. Strikes a reasonable balance between enabling users to connect whilst not placing an undue cost burden on existing connectees</li> </ol>	<ol style="list-style-type: none"> <li>1. May be less efficient if a move to "paid up front" may result in higher cost to customers if network user cost of capital is greater than TO cost of capital</li> <li>2. Obligation to pay up front creates barriers to some users</li> <li>3. Connection charges can become prohibitively high in constrained areas on the network and have a 'diff edge' as constraint reached.</li> <li>4. Lack of ongoing locational signal could result in inefficient use of the network and so unnecessary costs for users</li> </ol>
Development in Network Businesses	7 - Support efficient network development	<ol style="list-style-type: none"> <li>1. Low requirement on Network companies to speculate on users' requirements</li> <li>2. Can send a strong signal about capacity limits being reached and encourages users to connect where it is most efficient to do so for network development</li> </ol>	<ol style="list-style-type: none"> <li>1. A move of TNUoS to no ongoing locational use of system price signals may result in less efficient locational investment decisions, so more expensive network reinforcement - However, the disadvantage may be small since it is important to note that generator locational investment decisions are driven primarily by other factors (not network charges) such as the availability of resource (wind, or hydro), policy decisions such as subsidy for PV, or offshore wind, locations where it is possible to obtain planning consent (society prefers large power stations to be built away from areas of demand such as towns and cities), availability of access to gas grid for fuelled stations and access to cooling, such as suitable coastal sites.</li> <li>2. Comparing costs of constraints and network investment may be more difficult where more network costs are recovered up front</li> <li>3. Depends on the parameters in the shallowish boundary design, but can stall further network development in constrained areas due to high connection charges.</li> </ol>
	8 - Be Practical	<ol style="list-style-type: none"> <li>1. If TNUoS moved to be more like DUoS, then we already know that this approach is practical to operate</li> <li>2. Arrangement exist and would be minimal change for the majority of users.</li> <li>3. Easy to administer with simple ongoing charges</li> </ol>	<ol style="list-style-type: none"> <li>1. Obligation to pay up front creates barriers to some users</li> <li>2. Shallowish boundary creates barriers to some users</li> <li>3. Integrating flexibility and compensated connect and manage regimes difficult due to shallowish connection boundary.</li> <li>4. Would require a more complex connection charging methodology at transmission, and transition could be challenging with the potential for a 'diff-edge' before which customers could connect more cheaply</li> </ol>
Efficiency of Implementation	9 - Be Proportionate	<ol style="list-style-type: none"> <li>1. Least change for most users</li> <li>2. Benefits clear, albeit with improvements which could be made</li> </ol>	<ol style="list-style-type: none"> <li>1. For TNUoS to change to be more like DUoS may be disproportionate, because it would cause some disruption, but fail to solve the key issues the change is expected to address</li> <li>2. Lack of ongoing locational signals cannot help support a more active distribution network with flexibility</li> <li>3. Upfront payment of connection charges on a shallowish boundary is a material issue as identified by Baringa</li> </ol>

## 12.9 C1-C – deep connection charging with upfront capital payment

Assessment Criteria		C1-C: Strong connection charging Similar to the arrangement that existed at distribution level for DG connections prior to 2005. Whilst it gives a strong initial locational signal, up front costs can be so high that no connections take place. There is no incentive to release capacity that is not needed nor any ability to allocate risk between connectee and wider body of users.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>Strong upfront locational signal means that entire cost of locational decision rests with connectee.</li> <li>Deep connection charging results in capacity being initially allocated only to those who value it very highly</li> </ol>	<ol style="list-style-type: none"> <li>A move to ("deep") connection may introduce a greater need for secondary trading of connection rights, - Which may be less efficient than price signals provided by "use of system" charges. Secondary trading clearing prices would reflect the value to the users instead of reflecting the cost to the DNO.</li> <li>Deep boundary paid upfront will be a significant barrier to some users, affecting optimal capacity allocation and may lead users to exit grid</li> <li>Strong up front signal in isolation makes any reallocation of capacity very difficult and encourages hoarding.</li> <li>Lack of locational ongoing charges could result in the value of ongoing usage of capacity being hidden from users, and so result in inefficient allocation</li> <li>May result in capacity 'hoarding' due to sunk cost. This could be removed should there be a penalty e.g. combined with use it or lose it</li> <li>Interferes with behaviour in the BM, as parties may need to bid above marginal costs to ensure cost of network connection recovered.</li> </ol>
	4 - Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>Deep connection charges ensure a connectee contributes fully to the cost of their connection, thus protecting the wider body of users</li> <li>Ensures connectee fully contributes to the cost that they impose on the system</li> </ol>	<ol style="list-style-type: none"> <li>A move to "deep" connection charging with "paid up front" would provide a competitive advantage to users with stronger balance sheets and therefore disadvantage smaller users and community groups.</li> <li>Questions about previous connectees who use up spare capacity - the connectee who drives reinforcement is liable for the full apportioned cost of reinforcement which may have been driven by a series of multiple connectees to that point</li> </ol>
	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	<ol style="list-style-type: none"> <li>Connection charges will not change over time based on other users actions on the network causing congestion</li> <li>Lack of granularity in wider ongoing charges assists with forecasting future charges</li> <li>Strong up front connection charges enable users to make a very clear decision on the basis of the cost of connecting and the value of that connection to the user</li> <li>Users able to make predictable investment decision based on certain connection charge</li> </ol>	<ol style="list-style-type: none"> <li>No forward price signal to encourage action (locational or otherwise).</li> <li>There is potential that connection costs could change between winning a CM agreement and connecting leading to inefficient bids in subsidy scheme raising costs for all network users.</li> </ol>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>True reflection of wider network cost is funded by the individual user, wider users are not at risk of funding stranded assets due to significant change in behaviour of the single user</li> <li>Protects existing connectees from all risk related to new customers once they are connected</li> <li>Unlikely to get 'stranded assets' as there will be a lower SRMC. (downside of this is less plant will connect)</li> </ol>	<ol style="list-style-type: none"> <li>Individual customer bears full network cost regardless of future changes in usage, network companies are in a position to dynamically allocate capacity and therefore reduce overall risk</li> <li>Deep connection places excessive risk for reinforcement on individual users</li> <li>No ability to allocate risk to the wider body of users.</li> <li>Exposes the wider body of users to risks associated with failed schemes if not funded upfront.</li> <li>High levels of risk on connectee</li> <li>Increases cost of the Capacity Market by raising costs of parties bids, effectively reallocating the risk back to all consumers</li> </ol>
	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	<ol style="list-style-type: none"> <li>Users face a charge fully reflective of their expected impact on the network at the time of connection which reflects the investment that is made to deliver their stated requirements</li> <li>Strong cost reflective price signal at time of connection.</li> </ol>	<ol style="list-style-type: none"> <li>Connection charge based on forecast future network reinforcement is subjective because it is based on the DNO/SO making assumptions about the future which may turn out to be wrong</li> <li>Users may be charged for future network reinforcement which may never actually happen</li> <li>It is not possible to objectively, or accurately attribute specific deep network reinforcement to individual users because network reinforcement is lumpy and partly based on anticipatory investment regarding future users.</li> <li>Connection charges tend not to reflect "benefits" which users cause from avoided reinforcement and no incentive for sharing/trading</li> <li>Lack of ongoing locational signal likely to under-value ongoing behavioural changes, where changes in behaviour post-connection may influence future network costs</li> </ol>
	1 - Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>Can provide certainty on network costs to assist investment case as there is a low risk on locational charge volatility.</li> <li>Avoids connected customers contributing to the costs of new connections</li> </ol>	<ol style="list-style-type: none"> <li>No change in charge if users' core needs change over time</li> <li>Deep boundary paid upfront will be a significant barrier to some users, affecting optimal capacity allocation and may lead users to exit grid</li> <li>Connection costs become high (and have a 'cliff edge' as constraint reached) in constrained areas preventing the development of users projects.</li> </ol>
Development in Network Businesses	7 - Support efficient network development	<ol style="list-style-type: none"> <li>Incentive on users to flex usage and location to avoid upfront costs. Strong upfront locational signal minimises risk of stranded asset costs (if costs recovered up front).</li> <li>Strong connection price signal encourages users to connect where it is most efficient for network development</li> <li>Incentive for users to 'flex' usage and location</li> </ol>	<ol style="list-style-type: none"> <li>A change to no ongoing locational price signals may result in users making less economically efficient investment decisions, which may result in a greater need and cost of network investment</li> <li>Deep boundary paid upfront will be a significant barrier to some users, affecting optimal capacity allocation and may lead users to exit grid</li> <li>Strong upfront locational signal becomes so strong in constrained areas that further network development stalls.</li> <li>Lack of ongoing location signal leaves the network operator no means of giving ongoing signals for better use of the network.</li> <li>Technology which can reduce constraints has less incentive to connect (i.e. storage) if up front connection costs are higher and use of system charges are lower</li> </ol>
	8 - Be Practical	<ol style="list-style-type: none"> <li>Simple to implement</li> <li>Easy to administer with straightforward connection charging and simple non-locational ongoing charges</li> <li>Easy to adopt however difficult for transition</li> </ol>	<ol style="list-style-type: none"> <li>Transition will be challenging - to move existing users with shallow connection charges to deep connection charges.</li> <li>Deep boundary paid upfront will be a significant barrier to some users, affecting optimal capacity allocation and may lead users to exit grid</li> <li>Difficult to see how to implement in a network using flexibility products.</li> <li>Transition likely to be challenging with the potential for a 'cliff-edge' before which customers could connect more cheaply</li> <li>Will require to changes to CM, wholesale and ancillary services markets.</li> </ol>
Efficiency of Implementation	9 - Be Proportionate	<ol style="list-style-type: none"> <li>Works best for users with large portfolios of projects (can choose which project to invest in to find cheaper connections).</li> <li>Numerous benefits to connected customers who are protected from the costs driven by new connectees</li> </ol>	<ol style="list-style-type: none"> <li>Disproportionate, because it would cause significant disruption and may fail to solve the key issues.</li> <li>Deep boundary paid upfront will be a significant barrier to some users, affecting optimal capacity allocation and may lead users to exit grid</li> <li>Size of connection charges on constrained networks is unlikely to be proportionate</li> <li>Disproportionate barrier to connection</li> </ol>

12.10C1-D – shallow connection charging with focus on strong ongoing usage signals

Assessment Criteria		C1-D: Strong usage charging "Nodal" type locational signal due to either difficulty of defining zones or this being impractical due to the multi voltage layers at distribution level. Annual payment to recover connection charge but no securitisation of wider works. Provides forward looking price signals but highly granular locational signals can be volatile and hard to predict and lack of user commitment can lead to speculative applications reducing the efficiency of capacity allocation.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>1. Strong locational signal</li> <li>2. Shallow connection boundary is efficient for capacity allocation if users face cost reflective ongoing use of system charges instead</li> <li>3. Efficient for capacity allocation the flexibility of charging (e.g. no sunk cost)</li> </ol>	<ol style="list-style-type: none"> <li>1. Weaker upfront signal from users of their needs which could make planning more difficult. Networks are left to react to user behaviour.</li> <li>2. Lack of user commitment and shallow boundary may encourage speculative applications.</li> </ol>
	4 - Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>1. Shallow would mean users face the same ongoing "use of system" price signals</li> <li>2. Shallow boundary with annuitisation allows all users to connect</li> <li>3. Lack of large upfront connection costs can help smaller players.</li> <li>4. Risk of cross-subsidy with shallow connection charges is avoided through highly locational ongoing charges</li> </ol>	<ol style="list-style-type: none"> <li>1. Stronger locational signals could lead to users with similar usage being charged very differently based on their location which they have little control over</li> <li>2. For large demand users volatility of network tariffs may place proportionately higher costs on users for whom energy is not core business</li> <li>3. Nodal type changes can be volatile and hard to forecast.</li> <li>4. Modelling is challenging - if based on time to reinforce and a new connectee drives reinforcement, time to reinforcement will be low and so ongoing charges low creating a cross-subsidy</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. If truly cost reflective, this will provide the best possible signal to users allowing them to take the action that best reduces their impact on the network.</li> <li>2. Connection charges more predictable and locational signals can reflect changing capacity available.</li> <li>3. Annuitised connection charge allows a user a good degree of certainty, albeit an annuitised shallow connection charge is likely to be immaterial.</li> <li>4. Nodal charges likely to give strong cost signal on an ongoing basis</li> </ol>	<ol style="list-style-type: none"> <li>1. Volatile (potentially very volatile) nodal prices are difficult for users to predict, so very difficult for users to take them into account when making investment decisions</li> <li>2. Price volatility inevitably puts higher prices to end customers</li> <li>3. Granularity of charges makes charges less predictable (different to volatile).</li> </ol>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>1. Annuitisation and securitisation to connection ensures appropriate allocation of risk at point of connection</li> <li>2. Securitisation until connected protects the wider customer base from risks before connection</li> </ol>	<ol style="list-style-type: none"> <li>1. Nodal pricing is volatile, so puts more risk onto users - This is not appropriate since users can not control the factors causing the volatility and users will generally not be able to make investment decisions in response to those volatile prices - so users would be exposed to greater risk with no associated system benefit.</li> <li>2. Network companies/wider users bear risk of significant changes in user behaviour that trigger investment, if the use is not sustained wider customers will bear this cost</li> <li>3. Lack of user commitment</li> <li>4. Risk strongly allocated to wider body of users due to shallow boundary and lack of user commitment.</li> <li>5. Despite requiring securitisation of annuity, creates risk of asset stranding related to reinforcement assets which disproportionately shields the connectee from risk, albeit over time the connectee would expect to contribute to that reinforcement through ongoing locational charges</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. Users would face an ongoing price signal which reflected the incremental future network cost or benefit which they caused.</li> <li>2. Strong locational signal</li> <li>3. Users would face an ongoing price signal which reflected the incremental future network cost or benefit which they caused.</li> <li>4. Ongoing locational charges should be highly cost reflective, with incremental future costs and benefits reflected on an ongoing basis if it can be calculated accurately (modelling burden)</li> </ol>	<ol style="list-style-type: none"> <li>1. If a user has infrequent but high peak usage, this could trigger significant reinforcement which is not recovered through usage charges due to infrequent high usage</li> <li>2. Lack of connection costs signal.</li> <li>3. Connection charge does not reflect costs or benefits locally</li> </ol>
	1 - Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>1. Shallow boundary and annuitisation allows all users to connect</li> <li>2. Shallow charges and lack of user commitment reduce upfront development costs to users</li> <li>3. Meets the requirements of connecting customers by enabling them to connect at low up front cost and with confidence of long term costs.</li> <li>4. Provides ongoing locational signal to connectees, and so provides cost signals to users to both locate and then use (e.g. temporarily) the network efficiently</li> <li>5. If time of use signals are efficient and predictable users can modify consumption patterns or invest with more certainty</li> </ol>	<ol style="list-style-type: none"> <li>1. Potentially volatile based on surrounding users' behaviours, therefore cost for essential requirements may change unpredictably</li> <li>2. Uncertainty over path of future locational signals can present a significant investment risk with nodal charging.</li> </ol>
Development in Network Businesses	7 - Support efficient network development	<ol style="list-style-type: none"> <li>1. A DUoS move towards more shallow connection provides a price signal to reduce network usage - This can result in more efficient use of the network, so reduce the need for the DNO to incur cost for network reinforcement. TNUoS is already shallow.</li> <li>2. Incentive on network company to assess alternatives to traditional reinforcements as capacity limits reached.</li> <li>3. Ongoing cost signals enable users to take action to use the network efficiently and so enable the network operator to develop efficiently</li> <li>4. Low connection cost (albeit may not be in the right location)</li> <li>5. Supports development of flexible generation, storage and demand which can respond to clear ToU signals</li> </ol>	<ol style="list-style-type: none"> <li>1. Nodal pricing may result in less efficient user investment decisions, which in turn causes less efficient network investment - If the additional tariff volatility caused by moving from zonal to nodal results in a reduced ability for users to take the price signal into account when making investment decisions.</li> <li>2. Lack of user commitment</li> <li>3. Risk that highly locational signals are so volatile that they are ignored by customers. Lack of user commitment can result in speculative applications that risk stranded asset development.</li> <li>4. Shallow connection charges enable customers to connect where they wish without being exposed to the costs driven on the network within the connection charge and hence may drive unnecessary costs which the wider body of users will have to bear</li> </ol>
	8 - Be Practical	<ol style="list-style-type: none"> <li>1. Shallow boundary and annuitisation allows all users to connect</li> <li>2. Fits well with using non-network solutions to expand capacity.</li> <li>3. Connection charge simple and easy to administer. It is possible to manage volatile charges if they are predictable</li> <li>4. No required interaction with the Capacity Market</li> </ol>	<ol style="list-style-type: none"> <li>1. Nodal tariffs may be more difficult to publish and more difficult for users to understand.</li> <li>2. Calculating/modelling more cost reflective charges for all users would be a huge exercise, especially if in near-real-time</li> <li>3. Lack of user commitment</li> <li>4. Volatility in pricing will be difficult for some users to manage</li> <li>5. Strong locational signal may be practically difficult</li> <li>6. Transition arrangements challenging for distribution</li> </ol>
Efficiency of Implementation	9 - Be Proportionate	<ol style="list-style-type: none"> <li>1. Shallow boundary would mitigate the issue of relatively deeper connection boundary at distribution</li> <li>2. Strong locational signal may somewhat help mitigate increasing demand at distribution</li> <li>3. Shallow connection charges are needed to fully use non network flexibility</li> <li>4. Simple connection charge easy to administer</li> </ol>	<ol style="list-style-type: none"> <li>1. Move to nodal prices instead of zonal would introduce additional complexity and additional risk while the impact on the cost to the system may be zero, or detrimental.</li> <li>2. Lack of user commitment may not help resolve increasing use of lower voltages</li> <li>3. Difficult to implement for smaller users</li> </ol>

## Appendix Five– Advantages and disadvantages of C2 Combinations as Expressed by Task Force members

### 12.11 C2-A – temporal signals

Assessment Criteria		C2-A - Temporal Signals There are strong tariffs that have a high degree of locational and temporal granularity. There are no options for reallocation of capacity rights in this option. For example: tariffs could be nodal and change every 30mins	
		Advantages	Disadvantages
Effective Competition	2- Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>Strong TOU and locational signals</li> <li>Harmonised price signals would improve price reflectivity of distribution and transmission connected assets in the BM</li> </ol>	<ol style="list-style-type: none"> <li>Difficult for DNO/SO to predict how users will respond to dynamic TOU price signals, which makes this a blunt and ineffective tool for the short-term operational reallocation of capacity for managing network constraints.</li> <li>Assuming BM remains in place for transmission system, then DUoS TOU price signals would need to be fully cost reflective and dynamic at high resolution.</li> <li>Failure to achieve this would fail to optimise short-term capacity allocation because they would provide detrimental conflicting operational price signals compared with the BM.</li> </ol>
	4- Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>Static TOU tariffs are easier to understand for all users</li> <li>(Large demand users) Absence of requirement to participate in complex mechanisms such as the BM avoid placing proportionately higher costs on users for whom energy is not core business</li> </ol>	<ol style="list-style-type: none"> <li>If TOU price signals fail to be fully cost reflective, then they would provide an unfair competitive advantage to users who are better able to take action to avoid them.</li> <li>(Large demand users) Volatility of network tariffs may place proportionately higher costs on users for whom energy is not core business</li> </ol>
	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	<ol style="list-style-type: none"> <li>The time at which customers use their energy is an important factor in their impact on the network (networks are built to meet requirements of peak demand which is highly temporal), therefore reactions to temporal signals will have a meaningful impact on the network</li> <li>Strong locational and TOU signal</li> <li>Provides a level playing field for whole system costs - users pay during periods of constraints</li> <li>Transparent and predictable signals provides clear signals to dispatch. Ideally avoiding dynamic UoS charges.</li> </ol>	<ol style="list-style-type: none"> <li>For TOU price signals to be fully cost reflective, then they need to be dynamic at high resolution. This would make it very difficult for users to predict when planning their dispatch.</li> <li>Static TOU price signals would provide price signals users could better respond to, but these would fail to be effective for short-term operation of constraint management.</li> <li>Likely very volatile signal</li> <li>Volatile prices will inevitably increase cost to consumer</li> </ol>
	6- Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>Increasing volatility and predictability of tariffs provides a clear signals for users to modify consumption or invest in new assets to avoid higher charges</li> </ol>	<ol style="list-style-type: none"> <li>Volatile cost reflective dynamic TOU price signals would expose users to increased risk of network and operational conditions outside of users' control and which they will find it difficult to respond to, so there is little/no system benefit to exposing users to those risks.</li> <li>Exposes DNO/SO to the risk that users may over/under respond to TOU price signals</li> </ol>
	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	<ol style="list-style-type: none"> <li>Dynamic TOU price signals updated in real time at high resolution may provide a cost reflective price signal for operational dispatch only.</li> <li>TOU price signals may be effective for reflecting future network cost if used as a proxy for user operational characteristics (such as reflecting the type of profile of a particular demand customer), rather than providing an explicit TOU price signal which users are expected to respond to.</li> <li>Static TOU signals can be predictable and reflective if calculated ex ante and charged ex post, allowing users to reliably forecast their charges and modify behaviour in response.</li> </ol>	<ol style="list-style-type: none"> <li>Static TOU price signals set in advance would fail to provide cost reflective operational price signals.</li> <li>TOU price signals are an ineffective approach for reflecting "future network cost" for incentivising user investment decisions. Static TOU are not cost reflective, while dynamic TOU are too unpredictable to inform user investment decisions.</li> <li>Lack of ability to re-allocate capacity</li> <li>Dynamic TOU signals are not predictable and make it difficult to influence user behaviour</li> </ol>
	1- Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>(Large demand users) Absence of requirement to participate in complex mechanisms such as the BM avoid placing proportionately higher costs on users for whom energy is not core business</li> </ol>	<ol style="list-style-type: none"> <li>(Large demand users) Volatility of network tariffs may place proportionately higher costs on users for whom energy is not core business</li> </ol>
Developments in Network Businesses	7- Support efficient network development	<ol style="list-style-type: none"> <li>Incentive on users to flex usage and therefore collectively make better use of existing capacity</li> <li>Predictable UoS charges encourage development in flexible capacity such as storage which can defer network investment</li> </ol>	<ol style="list-style-type: none"> <li>If TOU price signals are ineffective at providing cost reflective price signals which users can respond to with investment decisions, then they would fail to support efficient network development.</li> <li>Lack of ability to re-allocate capacity.</li> <li>Volatile and complex tariffs limit the influence on user behaviour and so could lead to excessive reinforcement</li> </ol>
	8- Be Practical	<ol style="list-style-type: none"> <li>(Large demand users) Absence of requirement to participate in complex mechanisms such as the BM avoid placing proportionately higher costs on users for whom energy is not core business</li> <li>Minimal change required to CM arrangements</li> </ol>	<ol style="list-style-type: none"> <li>Dynamic TOU price signals updated in real time would require substantial resource, which may not be practical.</li> <li>Lack of trading.</li> <li>Very volatile pricing.</li> <li>Likely very difficult to administer</li> </ol>
Efficiency of Implementation	9- Be Proportionate	<ol style="list-style-type: none"> <li>Strong locational and TOU signal may somewhat help mitigate increasing demand at distribution</li> <li>Fair for whole system costs. E.g. you pay for the system when you are using it</li> </ol>	<ol style="list-style-type: none"> <li>The complexity of real time dynamic TOU price signals would not be proportionate given the increased risk and low benefits it would deliver.</li> </ol>

12.12C2-B – extended balancing mechanism

Assessment Criteria		C2-B - Balancing Mechanism Access can be sold and bought in the short term between users and networks. This could be through a type of extended balancing mechanism across both transmission and distribution. There are no locational and temporal signals in this option.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>1. Ability to trade in the short-term - realise the true value</li> <li>2. Aggregator market is large and competitive, there would be plenty of scope for participants to provide BM aggregation services</li> </ol>	<ol style="list-style-type: none"> <li>1. (Large demand users) Participation in BM may prove complex and effectively remove significant capacity from the market</li> </ol>
	4 - Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>1. Transition to Smart Flexible System should open the door to users of all types and sizes participating in the BM for services to the SO for operating the transmission system. Since users will be bidding in to the BM anyway, it should be relatively practical to extend the BM to include DSO action for managing the Distribution system.</li> </ol>	<ol style="list-style-type: none"> <li>1. This may disadvantage customers who do not have the knowledge/resources to take part in the mechanism</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. The BM is effective at providing operational price signals to those users who can respond to them, while avoiding imposing operational risk and price signals on those users who can't respond to them.</li> <li>2. Provision of a market mechanism for constraint improves situation at distribution</li> <li>3. BM takes into account locational signals and can optimise consumption/generation around constraints</li> </ol>	<ol style="list-style-type: none"> <li>1. Relatively high engagement needed from users wishing to react, this could limit participation and therefore actions taken.</li> <li>2. (Large demand users) Participation in BM may prove complex to the point where users cannot respond to the signal created.</li> <li>3. Lack of temporal signals</li> </ol>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>1. As long as network charges provide a cost reflective locational price signal for investment, then the BM approach of ensuring users are "made whole" is appropriate. The operational risk of operating the system then falls on the SO, which is best placed to manage it.</li> <li>2. Provision of a market mechanism for constraint improves situation at distribution</li> </ol>	
	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	<ol style="list-style-type: none"> <li>1. BM constraint costs are used to provide a clear and effective network investment signal using Cost Benefit Analysis in meeting the Economy Criteria of the Transmission investment standards SQSS. This network investment cost is then reflected through the TNUoS Year Round tariff element. It would be possible to use a similar approach for DUoS.</li> <li>2. Provision of a market mechanism for constraint improves situation at distribution</li> <li>3. Costs of constraints within network can be allocated to create area specific DBSUs or imbalance prices creating a signal to parties to buy energy behind constraints</li> </ol>	<ol style="list-style-type: none"> <li>1. (Large demand users) Participation in BM may prove complex to the point where users cannot respond to the signal created.</li> <li>2. Lack of locational/TOU signals.</li> </ol>
	1 - Efficiently meet the essential service requirements of network users	<ol style="list-style-type: none"> <li>1. In this model, network users place bids in the BM to reflect the value to that user of their short-term access to the network. In this way users who place a high value on access get to keep it, while users prepared to give up their access are compensated and "made whole".</li> <li>2. Complimentary to locational TOU signals as parties can bid into the mechanism with knowledge of their own costs</li> </ol>	<ol style="list-style-type: none"> <li>1. (Large demand users) Participation in BM may prove complex to the point where users cannot respond to the signal created.</li> <li>2. Lack of locational/TOU signals</li> </ol>
Development in Network Businesses	7 - Support efficient network development	<ol style="list-style-type: none"> <li>1. BM model provides price discovery and clear economic evidence to evaluate whether it is/is not economically efficient to make particular network reinforcement investments.</li> <li>2. Provision of a market mechanism for constraint improves situation at distribution</li> <li>3. short-term trading and reallocation can support investment in storage to take advantage of locational pricing signals</li> </ol>	<ol style="list-style-type: none"> <li>1. (Large demand users) Participation in BM may prove complex to the point where users cannot respond to the signal created.</li> <li>2. Lack of locational/TOU signals</li> </ol>
	8 - Be Practical	<ol style="list-style-type: none"> <li>1. The Balancing Mechanism already operates for existing users which are a Balancing Mechanism Unit (BMU). It is therefore a proven approach which could be extended to other smaller users.</li> <li>2. Not too complex to create large integrated system as a EU level scheme is also being developed</li> <li>3. Competition from aggregators will provide multiple routes to market</li> <li>4. Minimal changes to CM</li> </ol>	<ol style="list-style-type: none"> <li>1. BM requires a not-insignificant level of engagement from users beyond simply changing their behaviour, this may not be practical for smaller customers.</li> <li>2. (Large demand users) Participation in BM may prove complex to the point where users cannot respond to the signal created</li> <li>3. Could require licence changes to exemptions so parties must be in BM</li> </ol>
Efficiency of Implementation	9 - Be Proportionate	<ol style="list-style-type: none"> <li>1. Balancing Mechanism approach provides substantial benefits with limited additional complexity.</li> <li>2. Provision of a market mechanism for constraint improves situation at distribution</li> <li>3. Minimal changes to CM</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of locational and TOU signals exacerbate changing use at distribution</li> </ol>

12.13C2-C – full range of operational signals

Assessment Criteria		C2-C - Full Range of Operational Signals There are a range of signals designed to influence user behaviour.: - A form of extended balancing mechanism across T&D for ST trading of access rights between users and networks - Users can trade M-LT access rights with other users - There are tariffs that vary temporally and locational. They are not very strong and may be set by zones for 3 hour periods for example.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	1. Ability to trade in the short-term and medium-term both in a market and bilaterally 2. Some locational and TOU signals 3. Suppliers and aggregators can use portfolios to provide aggregate capacity to So across range of timescales	1. Different approaches on different networks - If TOU tariffs fail to be cost reflective, then TOU tariffs on one network (e.g. Distribution) can distort BM dispatch for managing other networks (other Distribution networks and Transmission network) 2. Different approaches on same network - Dynamic TOU would create a problem even if TOU tariffs are cost reflective because there will be two different price signals for the same purpose of allocating short-term capacity on an operational basis. Feedback effects could lead to unintended consequences, unpredictable and volatile prices which would be economically inefficient and result in higher cost to customers. 3. Volatile and complex signals limit the influence on user behaviour and so could lead to excessive reinforcement
	4 - Provide a level playing field for all network users	1. (Large demand users) Weak locational and TOU signals may support access for all 2. Effective price signals across timescales encourages aggregation and competition in supply - allowing economies of scale	1. If TOU signals fail to be fully cost reflective for BM participants, then this would distort competition in the BM 2. Volatile and complex signals limit the influence on user behaviour and so could lead to excessive reinforcement 3. (Large demand users) Participation in BM may prove complex and effectively remove significant capacity from the market 4. Bilateral trading may favour larger parties
	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	1. This will provide the best signal to users of their impact on the network meaning any reaction will be meaningful to network investment impacts 2. BM allows parties to reflect their own costs to SO, which includes ToU and other network charges, therefore better dispatch is achieved when parties set their own costs.	1. If BM and TOU are providing different, contradictory price signals for the same users for the operation of the same network, then this would not provide effective price signals which users could respond to. 2. Bilateral trading enables some users to arbitrage between other price signals which may lead to economically inefficient behaviour in BM and TOU responses via adverse selection 3. (Large demand users) Participation in BM may prove complex 4. Complexity may hinder most optimal market solution
	6 - Appropriately allocate risk between individual network users and the wider body of users	1. Some locational and TOU signal 2. Provision of a market mechanism for constraint improves situation at distribution 3. Ability to trade allows change of use 4. Ability to aggregate customer and generation together could offset risk through portfolio approach, vertical integration and economies of scale	1. DNO/SO trying to use BM tools to manage operational dispatch may be hampered if users are also self dispatching for TOU price signals.
	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	1. Location and time of usage impact investment, therefore sending these signals to users is truly cost reflective 2. Provision of a market mechanism for constraint improves situation at distribution 3. Ability to trade allows change of use	1. If both TOU and BM price signals are provided to the same users for action to manage the same network, then the net effect would not be cost reflective. 2. There may be a risk that if some types of users are exposed to TOU tariffs, while different types of user are exposed to BM instead, then users which cause the same cost/benefit may face different prices.
	1 - Efficiently meet the essential service requirements of network users	1. The ability to hedge network access through medium to short-term products allows users to effectively manage the risk of the costs of network access and buy the access they require 2. The ability to buy extra access through short-term reallocation or signalling pricing in the BM allows parties to get the access they want	1. Potentially volatile based on surrounding users' behaviours, therefore cost for essential requirements may change unpredictably 2. Volatile and complex signals limit the influence on user behaviour 3. (Large demand users) Participation in BM may prove complex
Development in Network Businesses	7 - Support efficient network development	1. Should support type of development at correct location (assuming that these parameters are captured) 2. Incentive on users to flex usage and therefore collectively make better use of existing capacity 3. Provision of a market mechanism for constraint improves situation at distribution 4. BM model provides price discovery and clear economic evidence to evaluate whether it is/is not economically efficient to make particular network reinforcement investments. 5. Ability to trade allows change of use	1. If there is a conflict between the price signals provided by TOU and BM, then this will fail to provide an efficient price signal for network businesses to invest in network reinforcement or could lead to excessive reinforcement 2. (Large demand users) Participation in BM may prove complex and effectively remove significant capacity from the market 3. Bilateral trading may favour larger parties, reducing capacity trading overall
	8 - Be Practical	1. It may be practical to use different approaches (TOU Vs BM) for different types of user (e.g. demand Vs generation) or for the management of different networks (T Vs D). There may be reasons why a different approach may be more suitable in different circumstances. However, it is not practical to use both for the same users for management of the same network.	1. Calculating/modelling more cost reflective charges for all users would be a huge exercise, especially if in near-real-time 2. Could require licence changes to exemptions so parties must be in BM
Efficiency of Implementation	9 - Be Proportionate	1. If there is a sound economic justification then it may be proportionate to use different approaches (TOU and BM) for different types of user, or for different networks. 2. Provision of a market mechanism for constraint improves situation at distribution 3. Some locational and TOU signal may somewhat help mitigate increasing demand at distribution 4. Cost reflective approach	

12.14C2-D – bilateral trading

Assessment Criteria		C2-D - Bilateral Trading Users are able to trade their access rights in the ST&LT with other users. Trades are bilateral between parties. This allows unused or less valued capacity to be used by other parties. There are no locational or temporal tariffs with this option.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	1. Users trading bilaterally could potentially ensure efficient allocation of existing capacity, particularly where users are willing to change behaviour to "release" existing capacity once it is given value.	1. Bilateral trading involves a smaller, less liquid market, which could be expected to result in a less economically efficient result. May favour larger parties, reducing capacity trading overall 2. DNO/SO would have poor control of the short-term operational dispatch of particular users, which would make it difficult for DNO/SO to optimise capacity allocation on an operational timeframe. 3. Lack of locational and TOU signals
	4 - Provide a level playing field for all network users	1. By making requirements for capacity allocation on suppliers you could encourage supply market competition, lowering costs for consumers trading access.	1. Users with better contacts and resources would have a competitive advantage and risk speculative trading behaviour 2. Bilateral trading may favour larger parties, reducing capacity trading overall
	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	1. Parties will have sufficient view of their own costs once capacity has been secured to make decisions about operation 2. Mandatory and transparent platforms for trade notifications and reserve prices can provide price transparency	1. Bilateral traded prices are more likely to be opaque, not publically available and very difficult to predict since they are based on a negotiated agreement based on the value to the respective parties and their relative bargaining strengths. 2. Lack of locational and TOU signals 3. Lack of market for short-term and long-term constraint
	6 - Appropriately allocate risk between individual network users and the wider body of users	1. For deep connection boundary risk may be reduced for users who would otherwise be committed to paying deep connection charges. By contrast, for shallow connection, bilateral trading is not generally needed, as shown by TNUoS where it is an option which is rarely used. 2. Ability to aggregate customer and generation together could offset risk through portfolio approach, vertical integration and economies of scale	1. Lack of locational and TOU signals 2. Lack of market for short-term and long-term constraint 3. As suppliers forecast increasing use in a network, they will need to buy more access rights, and therefore be willing to pay more. This creates a price signal for generation or network development in those zones who can sell that capacity.
Cost Reflectivity	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	1. Ability to trade bilaterally	1. Price signals do not reflect investment cost, but they reflect the value to the respective users in the trade. A key question is what provides the anchor value for the access right being traded? - In TNUoS, this is the value of TEC. In DUoS, this is the value to the respective users of being constrained off without receiving compensation i.e. trading their place in the last in / first out order of curtailment. 2. Lack of locational and TOU signals 3. Lack of market for short-term and long-term constraint
Development in Network Businesses	1 - Efficiently meet the essential service requirements of network users	1. Firm access available for core capacity	1. Bilateral trading is better than nothing, but it is less liquid and transparent, so less effective at delivering the requirements of users than a BM.
	7 - Support efficient network development	1. Would reveal the true value of capacity to users (to some extent, market stronger for this) allowing networks to make informed decisions on whether investment is in best interest of customers on a holistic basis 2. Needs to be a market platform for trades to be notified to, no reason network operators would be unable to see this with prices included	1. Difficult for network businesses to obtain a price signal for network investment from bilateral trades between users. 2. Lack of locational and TOU signals 3. Lack of market for short-term and long-term constraint
Efficiency of Implementation	8 - Be Practical		1. Exchange rates are needed when trading access between different types of user. It would be impractical for DNO/SO to calculate these for different types of user for different locations in real time, if there was a high volume of bilateral trading. 2. Lack of network-user signals beyond firm access 3. Requires changes to CM arrangements
	9 - Be Proportionate		1. It would appear disproportionate to dismantle existing well functioning arrangements in the BM to replace it with bilateral trading, especially if bilateral trading were a less effective solution. 2. Lack of locational and TOU signals exacerbate changing use at distribution



12.15C2-E – market trading

Assessment Criteria		C2-E - Market Trading Users are able to trade their access rights in the ST&LT with other users. Trades are made within open markets. This allows unused or less valued capacity to be used by other parties. There are no locational or temporal tariffs with this option.	
		Advantages	Disadvantages
Effective Competition	2- Optimise Capacity Allocation	<ol style="list-style-type: none"> <li>1. More liquid than bilateral trading</li> <li>2. Ability to trade in the medium-term</li> </ol>	<ol style="list-style-type: none"> <li>1. DNO/SO would have poor control of the short-term operational dispatch of particular users, which would make it difficult for DNO/SO to optimise capacity allocation on an operational timeframe.</li> <li>2. No ability to trade in the short-term</li> <li>3. Lack of locational and TOU signals</li> </ol>
	4- Provide a level playing field for all network users	<ol style="list-style-type: none"> <li>1. (Large demand users) Absence of requirement to participate in complex mechanisms such as the BM avoid placing proportionately higher costs on users for whom energy is not core business</li> <li>2. By making requirements for capacity allocation on suppliers you could encourage supply market competition, lowering costs for consumers trading access</li> </ol>	<ol style="list-style-type: none"> <li>1. Risk of speculative behaviour putting some users at a competitive disadvantage</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. Unlike bilateral trading, market trading would publicly reveal the value being revealed by users allowing a wider audience to participate and therefore react</li> <li>2. Ability to trade in the medium-term</li> <li>3. Parties will have sufficient view of their own costs once capacity has been secured to make decisions about operation</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of locational and TOU signals</li> <li>2. Lack of market for short-term constraint</li> <li>3. Difficult to anticipate what the market clearing price may be when planning dispatch.</li> </ol>
	6- Appropriately allocate risk between individual network users and the wider body of users	<ol style="list-style-type: none"> <li>1. Ability to aggregate customer and generation together could offset risk through portfolio approach, vertical integration and economies of scale</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of locational and TOU signals</li> <li>2. Lack of market for short-term constraint</li> </ol>
	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	<ol style="list-style-type: none"> <li>1. Ability to trade in the medium-term</li> <li>2. As suppliers forecast increasing use in a network, they will need to buy more access rights, and therefore be willing to pay more. This creates a price signal for generation or network development in those zones who can sell that capacity.</li> </ol>	<ol style="list-style-type: none"> <li>1. If locational charges are calculated differently for different types of user, then secondary trading may enable users to arbitrage different charging formulas in a way which results in the full year charge they pay not being cost reflective of the cost they cause.</li> <li>2. Lack of locational and TOU signals</li> <li>3. Lack of market for short-term constraint</li> </ol>
	7- Support efficient network development	<ol style="list-style-type: none"> <li>1. Would reveal the true value of capacity to users allowing networks to make informed decisions on whether investment is in best interest of customers on a holistic basis</li> <li>2. Ability to trade in the medium-term</li> </ol>	<ol style="list-style-type: none"> <li>1. If secondary trading enables some users to arbitrage different charges at different times, then net price signal received by users may be different from what the DNO/SO intended when the tariffs were originally calculated.</li> <li>2. Lack of locational and TOU signals</li> <li>3. Lack of market for short-term constraint</li> </ol>
Efficiency of Implementation	8- Be Practical	<ol style="list-style-type: none"> <li>1. Little attempt to provide locational, TOU or operational short-term signals is relatively simple</li> </ol>	<ol style="list-style-type: none"> <li>1. Must be facilitated centrally</li> <li>2. Lack of operational network-user signals</li> <li>3. requires change to CM arrangements</li> </ol>
	9- Be Proportionate		<ol style="list-style-type: none"> <li>1. Lack of locational and TOU signals exacerbate changing use at distribution</li> </ol>

## Appendix Six– Advantages and disadvantages of Tariff Design Options as Expressed by Task Force members

### 12.16 Fixed charges

Assessment Criteria		Tariff Elements - Fixed Charges Charges which are applied on a per user basis as long as the user remains connected	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-head</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- Does not incentive the right behaviour and low usage customers pay for high usage.</li> <li>- Risk of [inefficient] user disconnection</li> <li>- Limited cost-reflectivity so not appropriate for a FLC</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- Simple</li> <li>- Depends on extent to which costs are driven per-head</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- Limited cost-reflectivity so will not create a level playing field</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Fixed charges are completely predictable for the end user</li> </ul>	<ul style="list-style-type: none"> <li>- A user cannot take action (other than disconnection) to avoid fixed charges, so arguably does not meet the 'to allow them to take action' element</li> <li>- Question if these are predictable year on year</li> <li>- Very predictable charge but not effective as not cost-reflective</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- Charges not affect by usage, so parties can't avoid them, recovering costs over wider base</li> <li>- Depends on extent to which costs are driven per-head</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- No competition</li> <li>- Could encourage consumers to disconnect, reducing charging base</li> <li>- Lack of cost-reflectivity means inappropriate risk allocation</li> </ul>
	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	<ul style="list-style-type: none"> <li>- May be used to give a forward looking cost signal for costs which will be avoided if the user disconnects</li> <li>- May be appropriate for particular groups who's response would not improved if the cost was more locationally cost reflective, or if the fixed charge reflects a particular element of cost which is the same for a given type of user or a given location</li> <li>- May be appropriate for local assets, where (assuming the asset is suitably sized) the cost to the network operator is stable over the life of the asset</li> </ul>	<ul style="list-style-type: none"> <li>- Risk of over-valuing 'off-grid' or behind the meter solutions if fixed charges are too high.</li> <li>- A generalised fixed charge is less likely to be cost reflective.</li> <li>- Not cost-reflective for FLC UoS charges</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- Vulnerable users know the cost</li> </ul>	<ul style="list-style-type: none"> <li>- Vulnerable users may be overcharged</li> </ul>
	7 - Support efficient network development		
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Easily applied to all users</li> </ul>	<ul style="list-style-type: none"> <li>- Does not contain incentive</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Simple to implement</li> </ul>	

## 12.17 Unit rates

Assessment Criteria		Tariff Elements - Unit Rates	
		Standard unit charges, applicable to energy usage with a number of sub-options for unit rates which vary by time of use.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-kWh</li> <li>- Depends on ability to limit volatility</li> <li>- Potentially able to be used to provide an appropriate FLC</li> </ul>	
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-kWh</li> <li>- Depends on ability to limit volatility</li> <li>- Could provide a level playing field</li> </ul>	
	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	<ul style="list-style-type: none"> <li>- A unit rate is relatively easy for some users to avoid by taking action.</li> <li>- A time bounded unit rate could signal the contribution to peak demand across a diverse network, and averaging over a period of time (such as the Annual Load Factor in transmission) would avoid conflicts between investment and dispatch signals.</li> <li>- Predictable charge</li> </ul>	<ul style="list-style-type: none"> <li>- If the unit rate is designed to incentivise investment decisions, then it may incentivise inefficient dispatch behaviour.</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- More cost-reflective and hence better at allocating risk</li> <li>- Depends on extent to which costs are driven per-kWh</li> <li>- Depends on ability to limit volatility</li> </ul>	
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- A unit rate is relatively easy for some users to avoid by taking action - to the extent that this results in lower network costs, this is cost-reflective.</li> <li>- Potentially cost-reflective for some elements of the charge</li> </ul>	<ul style="list-style-type: none"> <li>- Risk of over-valuing reduced usage if not targeted locationally or temporally</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- At LV reflects cumulative contribution to network reinforcement requirement, protecting disproportionate allocation of costs to an individual user.</li> </ul>	
	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Right price signal for right behaviour if time of use</li> <li>- Depends on the extent users can respond and appropriate flexibility can be purchased</li> </ul>	
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Unrestricted unit rates easily applied to all users</li> <li>- Time bounded units rates easily applied to HH metered users</li> <li>- Sends a price signal</li> </ul>	<ul style="list-style-type: none"> <li>- Time bounded unit rates cannot be accurately applied to NHH metered users as network company has no visibility of the time of use</li> </ul>
	9 - Be Proportionate		

## 12.18 Agreed capacity charges

Assessment Criteria		Tariff Elements - Agreed Capacity Charges	
		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.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-kW, and any modifiers for operational flexibility provided</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- Limited cost-reflectivity so not appropriate for a FLC</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-kW, and any modifiers for operational flexibility provided</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- Limited cost-reflectivity so will not create a level playing field</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Particularly well suited as an option for incentivising user investment decisions</li> <li>- If relatively predictable years in advance and viewed as stable, which this might not be</li> </ul>	<ul style="list-style-type: none"> <li>- Does not provide any operational dispatch price signal; therefore agreed capacity charges would need to be combined with some other mechanism (e.g. Balancing Mechanism) to provide operational dispatch incentives</li> <li>- Not effective as not cost-reflective</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- Depends on extent to which costs are driven per-kW, and any modifiers for operational flexibility provided</li> <li>- Depends on ability to limit volatility</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of cost-reflectivity means inappropriate risk allocation</li> </ul>
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- If incremental future network investment is driven by user capacity, then this could provide an effective cost reflective price signal</li> <li>- It may be appropriate to reflect that different types of user (of the same agreed capacity) may cause different incremental future costs to the network</li> </ul>	<ul style="list-style-type: none"> <li>- Not fully cost-reflective and hence less efficient</li> <li>- Dependent on tariff design and time of use signals, but unlikely to be cost reflective if a flat rate is applied to agreed capacity in all time periods</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- Users can obtain certainty by contracting in advance for the capacity (or 'access') they require</li> <li>- Values availability of the network</li> </ul>	
	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Incentivises users to agree appropriate capacities, so the network business obtain information regarding the future investment decisions of users</li> </ul>	
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Easily applied to larger users with bilateral connection agreements</li> <li>- Could be used with generators and load users grouped together</li> </ul>	<ul style="list-style-type: none"> <li>- Difficult to apply to smaller users who do not have bilateral connection agreements (unless operating as a group)</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Provides means of paying for 'availability' of the network even where generation is "behind the meter."</li> </ul>	

## 12.19 Peak demand charges

Assessment Criteria		Tariff Elements - Peak Demand Charges	
		Charges for peak usage, i.e. for half hourly metered users the usage in the peak half hour.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Likely to give a good FLC	- Depends on the specific definition of "peak", whether this results in stable, predictable (useful) tariffs
	4 - Provide a level playing field for all network users	- Likely to be more cost-reflective and hence provide a level-playing field	- Depends on the specific definition of "peak", whether this results in stable, predictable (useful) tariffs
	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	- More cost-reflective	- Likely to be difficult (particularly for small users) to respond to as requires a high level of visibility of usage at all times in order to identify and reduce peak usage - Can be harder to predict - Balancing mechanism approach likely to be more effective for providing operational signals
	6 - Appropriately allocate risk between individual network users and the wider body of users	- More cost-reflective and hence better at allocating risk	- Depends on the specific definition of "peak", whether this results in stable, predictable (useful) tariffs
Cost Reflectivity	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	- Can be cost reflective if costs are driven by user's peak demands at certain times - More cost-reflective and hence appropriate for an FLC	- Network costs are driven by network peaks rather than individual user's peaks
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	- Encourages the right behaviour and cost reflective of need. - Requires sufficiently predictable windows of charge	
	7 - Support efficient network development	- Encourages right amount of capacity to be bought - Depends on extent users can respond and appropriate flexibility can be purchased	
Efficiency of Implementation	8 - Be Practical	- Easily applied to users with HH metering	- Cannot be applied to users with NHH metering
	9 - Be Proportionate		

## 12.20 Reactive power charges

Assessment Criteria		Tariff Elements - Reactive Power Charges	
		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.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Depends on extent to which costs are driven per-kVA or per-kVAR, and any modifiers for operational kVAR flexibility provided (to T or DI)	
	4 - Provide a level playing field for all network users	- Depends on extent to which costs are driven per-kVA or per-kVAR, and any modifiers for operational kVAR flexibility provided (to T or DI)	
	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	- Can be predictable for larger users with sophisticated understanding, and action can be taken through up front investment in power factor correction equipment	- Smaller user unlikely to be aware of reactive power or be able to make changes to respond
	6 - Appropriately allocate risk between individual network users and the wider body of users	- Depends on extent to which costs are driven per-kVA or per-kVAR, and any modifiers for operational kVAR flexibility provided (to T or DI)	
Cost Reflectivity	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	- Can be cost reflective if proportional to the extent to which network costs and/or benefits are driven by reactive power usage beyond the need for greater capacity	- (Must add a modification or exemption for users which are providing a Reactive Power service)
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	- Supports market for reactive power service providers	
	7 - Support efficient network development	- Depends on extent users can respond and appropriate flexibility can be purchased - The control of reactive power flows is becoming increasingly important at distribution (to avoid voltage rise); effective price signals for reactive power (including incentivising reactive power flows where needed) could support efficient development of the network	
Efficiency of Implementation	8 - Be Practical	- Easily applied to users with four quadrant metering (measuring real import/export and reactive import/export - generally larger users)	- Impossible to apply for users without four quadrant metering
	9 - Be Proportionate		

## 12.21 Unrestricted unit rates

Assessment Criteria		Time of Use Options - Unrestricted Unit Rates A charge which applies to every unit used (or capacity taken) in any time period.	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation		- Limited cost-reflectivity so not appropriate for a FLC
	4 - Provide a level playing field for all network users		- Limited cost-reflectivity so will not create a level playing field
	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	- Simple for users to understand	- Only action which can be taken is to reduce overall usage - moving usage to other times has no impact on charges faced
	6 - Appropriately allocate risk between individual network users and the wider body of users		- Lack of cost-reflectivity means inappropriate risk allocation
Cost Reflectivity	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		- Risks over-valuing lower overall usage and under-valuing reduced usage at peak - Not cost-reflective for FLC UoS charges - Probably the least cost-reflective
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development		
Efficiency of Implementation	8 - Be Practical	- Easily applied to all users	
	9 - Be Proportionate		

## 12.22 Static time of use unit rates

Assessment Criteria		Time of Use Options - Static Time of Day Unit Rates 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).	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Depends upon the bands used, but is a versatile option to allow cost-reflective FLC	Time periods might vary in different parts of the network
	4 - Provide a level playing field for all network users	- Depends upon the bands used, but is a versatile option to create level-playing field	
	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	- Prices and time periods are known in advance, so users can respond to them	
	6 - Appropriately allocate risk between individual network users and the wider body of users	- More cost-reflective and hence better at allocating risk	
Cost Reflectivity	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	- May be useful to signal low cost network periods to demand users, such as low/zero locational network charges overnight - To the extent that usage of the network in fixed time periods drives network costs and/or benefits, static time of use charges can be cost-reflective	- May incentivise inefficient operational dispatch decisions relating to periods of constraint - this is because periods of system stress are a function of outturn factors such as weather, demand, market events - If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost reflective of incremental future network investment - If set globally, may encourage 'wrong' behaviours i.e. increased generation in generation dominated areas etc. - Static TOU is not reflective of operational dispatch costs especially as these are increasingly driven by the weather
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development		- In this situation, the network operator would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location
Efficiency of Implementation	8 - Be Practical	- Easily applied to users with HH metering	- Cannot be applied to users with NHH metering - Creates cliff-edges which may be a particular risk with automation
	9 - Be Proportionate		



## 12.23 Critical peak pricing

Assessment Criteria		Time of Use Options - 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 TNUs triad charges which have a very narrow 'critical peak' period).	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Depends upon the bands used, but is a versatile option to allow cost-reflective FLC	
	4 - Provide a level playing field for all network users	- Depends upon the bands used, but is a versatile option to create level-playing field	
	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	- Assuming the critical peak period and price are known in advance, users can respond easily	- May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress
	6 - Appropriately allocate risk between individual network users and the wider body of users		
Cost Reflectivity	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	- To the extent which network usage in the critical peak period drives network costs and/or benefits, critical peak prices can be cost-reflective	- Peak demand charging on its own would fail to provide an effective price signal for generation dominated zones where network investment is required to mitigate constraints caused by generation - If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost reflective of incremental future network investment
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development		- In this situation, the network operator would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location
Efficiency of Implementation	8 - Be Practical	- Easily applied to users with HH metering	- Cannot be applied to users with NHH metering - Capacity drivers and investment drivers need to be identified and these may change the peaks as this is not a static function. Is this set ex-ante? There may be linkages of 'managed connections'
	9 - Be Proportionate		

## 12.24 Variable time of use rates

Assessment Criteria		Time of Use Options - 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).	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Potentially can be very cost-reflective	
	4 - Provide a level playing field for all network users		- Favours users with smart technology which can respond to short-term price signals automatically - Potentially a good option but complexity may create barriers
	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	- Potential for very effective response for users with smart technology	- May be difficult for some users to respond to, particularly smaller demand users - May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress - Increased cost-reflectivity may make this less predictable
	6 - Appropriately allocate risk between individual network users and the wider body of users	- More cost-reflective and hence better at allocating risk	- If some users are not exposed to tariff, this increases the volatility/risk to others
Cost Reflectivity	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	- May tend to provide a more cost reflective operational dispatch price signals than static TOU tariffs - More cost-reflective and hence appropriate for an FLC	- If network investment is driven by user capacity, then a price signal which aims to affect user operational dispatch at times of peak demand may fail to be cost reflective of incremental future network investment
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development		- In this situation, the network operator would be a price setter and volume taker which may make it difficult to manage the operation of the network because they cannot control how much capacity will respond to the price signal, or at what location
Efficiency of Implementation	8 - Be Practical		- May be challenging to calculate real time dynamic tariffs - Likely to be more difficult to implement
	9 - Be Proportionate	- Would need to opt in	- As a method of providing an operational dispatch incentive, it may be disproportionate and detrimental to expose all users to dynamic TOU tariffs, even if many of those users cannot respond to them. Also disproportionate in comparison to alternative options for providing high resolution real time dispatch signals, such as a Balancing Mechanism approach which can provide a price signals for those users who choose to participate in the BM and therefore can respond to them.

## 12.25 Inclining block rates

Assessment Criteria		Time of Use Options - Inclining Block 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).	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation		
	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		<ul style="list-style-type: none"> <li>- Smaller users may find it difficult to monitor when their usage is remaining within the 'lower' block in order to take action to avoid going over the threshold into the 'higher' block</li> <li>- May clash and distort response to other price signals which are also designed to provide price signals which may be associated with periods of network stress</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users		
Cost Reflectivity	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		<ul style="list-style-type: none"> <li>- Not cost reflective - an increment of usage does not impose fundamentally different costs if driven by a high usage user than by a low usage user</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- Meets service requirements of low usage users at low cost, whilst exposing higher usage users (e.g. EV owners) to higher costs</li> </ul>	<ul style="list-style-type: none"> <li>- Dependent on the level of the rising blocks - risk of penalising large households compared to smaller households for the same type of 'essential' usage</li> </ul>
	7 - Support efficient network development		
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Easily applied to users with HH metering</li> </ul>	<ul style="list-style-type: none"> <li>- Cannot be applied to users with NHH metering</li> </ul>
	9 - Be Proportionate		

## Appendix Seven– Advantages and disadvantages of Charging Model Options as Expressed by Task Force members

### 12.26 Transport model

Assessment Criteria		Charging Model Options - Transport Model Cost of importing or exporting energy through an existing network	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation		<ul style="list-style-type: none"> <li>- Gives no indication of capacity simply allocates costs of maintaining the status quo</li> <li>- Does not include cost based on absolute cost impact</li> </ul>
	4 - Provide a level playing field for all network users		<ul style="list-style-type: none"> <li>- Lack of locational signals results in all user actions being given the same cost signal regardless of the actual cost and/or benefit derived</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Likely to result in stable prices</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of pointed locational signal</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users		<ul style="list-style-type: none"> <li>- Lack of cost-reflective charges means that risk will not be appropriately allocated.</li> <li>- Requires locational and constraint costs to be reflected though other means e.g. deeper connection boundary</li> </ul>
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- Likely to result in stable prices</li> <li>- Price changes are predictable</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of pointed locational signal</li> <li>- Does not provide cost-reflective signals or charges</li> <li>- Depends how granular/nodal this is worked out at. At a granular level, this can become a disadvantage: backwards-looking tariffs reflect lumpy investment as steep volatility, potentially driven by other user's new connections!</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		<ul style="list-style-type: none"> <li>- Price signal for flexible generators muted</li> <li>- Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient.</li> </ul>
	7 - Support efficient network development		<ul style="list-style-type: none"> <li>- Gives no signal as to how a network develops and so no information to the network operator or user for better use of the network</li> </ul>
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Likely slightly more complex than existing LV and HV but simpler than existing EHV and TNUoS</li> </ul>	<ul style="list-style-type: none"> <li>- Whilst a simpler approach, not practical to use a model which has such disadvantages</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Should be considered for sunk cost recovery - i.e. by the TCR</li> </ul>	

## 12.27 Expansion model

Assessment Criteria		Charging Model Options - Expansion Model Levelised cost of future network based on a weighted average of the existing network	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Signals areas of low and/or high capacity</li> <li>- Relatively predictable, magnitude of changes low during CM timescales</li> </ul>	<ul style="list-style-type: none"> <li>- Does not recognise specific reinforcement costs of addressing capacity constraints</li> <li>- Only provides relative locational signals, not absolute cost signals which is likely to distort the market and impact competition</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- Symmetric treatment of demand and generation</li> </ul>	<ul style="list-style-type: none"> <li>- Symmetric treatment ignores engineering factors related to fault-level reinforcement etc.</li> <li>- Only provides relative locational signals, not absolute cost signals which is likely to distort the market and hence not create a level-playing field</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Should be possible for an expansion model to result in reasonably stable prices</li> <li>- Use of up front assumptions (expansion constant and fixed asset costs) reduces the need for network operator to make internal assumptions and so increases transparency</li> <li>- Avoids attributing specific network investments to specific network users.</li> </ul>	<ul style="list-style-type: none"> <li>- Can provide stable price signals but to the detriment of cost-reflectivity and hence this will not be effective</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- Avoids attributing specific network investments to specific network users.</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of cost-reflective charges means that risk will not be appropriately allocated.</li> <li>- Requires locational and constraint costs to be reflected though other means e.g. deeper connection boundary</li> </ul>
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- Should be possible for an expansion model to result in reasonably stable prices</li> <li>- Use of up front assumptions (expansion constant and fixed price per km) reduces the need for network operator to make internal assumptions and so increases transparency</li> <li>- Provides cost reflective price signal assuming cost of expansion is reflected by the weighted cost of existing network</li> </ul>	<ul style="list-style-type: none"> <li>- Average costs do not reflect the actual cost of reinforcement at any given location - but this could be a somewhat localised signal by design</li> <li>- Does not provide cost-reflective signals or charges</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		<ul style="list-style-type: none"> <li>- Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient</li> </ul>
	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Symmetric treatment of demand and generation</li> </ul>	<ul style="list-style-type: none"> <li>- Symmetric treatment of demand and generation ignores engineering factors related to fault-level reinforcement etc.</li> </ul>
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- More complex than existing LV and HV, simpler than existing EHV, complexity as per status quo for TNUoS</li> </ul>	<ul style="list-style-type: none"> <li>- Whilst a simpler approach, not practical to use a model which has such disadvantages</li> <li>- Assumes no constraint assumption/capacity</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Unable to judge proportionality at this stage</li> </ul>	

## 12.28 Remaining headroom model

Assessment Criteria		Charging Model Options - Remaining Headroom Cost of addressing the next constraints in accordance with today's design standards	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	<ul style="list-style-type: none"> <li>- Signals areas of low and/or high remaining capacity and scale of increasing capacity</li> <li>- Increased recognition of reinforcement cost</li> <li>- More closely linked to actual network and required costs/savings due to users actions and hence less distortion to competition</li> </ul>	<ul style="list-style-type: none"> <li>- Predictability of signal reduced, parties cannot effectively make investment decisions</li> <li>- Sharing factor important - if secondary actions affect the primary decision to locate then costs are hard to predict. i.e. 'sawtooth pattern'</li> </ul>
	4 - Provide a level playing field for all network users	<ul style="list-style-type: none"> <li>- Demand treatment highly reflective of security of supply standards</li> <li>- Likely to provide a better FLC for demand</li> </ul>	<ul style="list-style-type: none"> <li>- Generation not subjected to a locational signal (due to no underlying security of supply standard)</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Site specific (but rule based) reinforcement costing</li> <li>- Most cost-reflective approach</li> </ul>	<ul style="list-style-type: none"> <li>- Subject to saw-tooth price increases or year to year volatility, with a user's charges often influenced by the actions of other users in the same location</li> <li>- Sacrifices predictability</li> </ul>
	6 - Appropriately allocate risk between individual network users and the wider body of users	<ul style="list-style-type: none"> <li>- Most cost-reflective approach means risk likely to be best allocated</li> </ul>	<ul style="list-style-type: none"> <li>- Attributes specific network investments to specific network users which may over-expose individual users to the risk that reinforcement is required</li> </ul>
Cost Reflectivity	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	<ul style="list-style-type: none"> <li>- Highly cost-reflective by exposing users to the cost and/or benefit of network reinforcements which their behaviour has the potential to drive and/or avoid</li> </ul>	<ul style="list-style-type: none"> <li>- Low predictability, reduces ability of participant to properly account for costs in long-medium term. Can lead to inefficient investment decisions which increases costs in short-term constraint management</li> <li>- If set nodally or zonally, then existing user's tariff driven by OTHER users' behaviour - wholly un-reflective - and ultimately all users will just see this as a source of volatility, unless individual tariffs can be locked-in</li> </ul>
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	<ul style="list-style-type: none"> <li>- Most cost-reflective approach likely to be most efficient</li> </ul>	<ul style="list-style-type: none"> <li>- Penalising tariffs in constrained areas - will discourage new providers of flexibility (only contracted to relieve the worst excess, thereby taking the network to just full, hence likely to incur a high tariff related to zero remaining headroom)</li> </ul>
	7 - Support efficient network development	<ul style="list-style-type: none"> <li>- Demand treatment highly reflective of security of supply standards</li> <li>- Taking account of spare capacity on the network can lead to more efficient locational decisions</li> </ul>	<ul style="list-style-type: none"> <li>- Generation not subjected to a locational cost signal (due to no underlying security of supply standard)</li> </ul>
Efficiency of Implementation	8 - Be Practical	<ul style="list-style-type: none"> <li>- Status quo for EHV distribution charging</li> <li>- Should be practical to use across all voltages</li> </ul>	<ul style="list-style-type: none"> <li>- Significantly more complex than existing LV and HV, and more complex for TNUoS</li> </ul>
	9 - Be Proportionate	<ul style="list-style-type: none"> <li>- Unable to judge proportionality at this stage</li> </ul>	

12.29500MW or probabilistic model

Assessment Criteria		Locational Signals - 500MW Model/Probabilistic Model Cost allocation' model	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Generalised model reflective of current engineering practice	- No locational element to charges so not specific to any site
	4 - Provide a level playing field for all network users		- Lack of locational signals results in all user actions being given the same cost signal regardless of the actual cost and/or benefit derived - No locational signal means charges are not cost-reflective and hence likely to be distorted which does not create a level-playing field
	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	- Likely to result in stable prices - Price changes are predictable	- Lack of pointed locational signal - Stable prices but no cost-reflectivity
	6 - Appropriately allocate risk between individual network users and the wider body of users		- Lack of cost-reflective charges means that risk will not be appropriately allocated
Cost Reflectivity	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	- Recognises the cumulative effect of multiple customers connecting to the network - Price changes are predictable	- Limited locational signal - Likely to require assumptions from the network operators when operating the model - Does not provide locational cost-reflective signals or charges
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		- Price signal for flexible generators muted - Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient
	7 - Support efficient network development	- Results in stable prices which are likely to result in predictable user responses	- Limited location signal - Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient - Outdated, therefore unfit for actively managed networks
Efficiency of Implementation	8 - Be Practical	- Relatively easy to implement - status quo at HV and LV, simplification for EHV and TNUoS - Over-simplification means this is relatively easy to implement	- Draws on propriety data/engineering approaches - No on builds 500MW increments, not true to life - Excludes reinforcement/reinstatement - Assumes new assets each year
	9 - Be Proportionate	- Unable to judge proportionality at this stage	

12.30DC Load Flow Investment Cost Related model

Assessment Criteria		Locational Signals - DC Load Flow Investment Cost Related/Long Run Incremental Cost Incremental model	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Signals areas of low and/or high capacity against approximation of planning standards	- Use of DC Load Flow is a tool to simplify the study of a network - reflective for an interconnected system but less reflective of physical power flows on certain types of networks - Too far removed from dynamic operational model - flexibility providers operationally supporting the network may be modelled here as causing issues in the limited snapshot model, producing a disproportionately high tariff - Only provides relative locational signals, not absolute cost signals which is likely to distort the market and impact competition
	4 - Provide a level playing field for all network users	- Symmetric treatment of demand and generation (in TNUoS)	- Symmetric treatment ignores engineering factors related to fault-level reinforcement etc. - Can it account for different operational profiles? - Lack of absolute cost signal means distortion likely which does not create a level playing field
	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	- Use of up front assumptions (expansion constant and fixed asset costs) reduces the need for network operator to make internal assumptions and so increases transparency - Avoids attributing specific network investments to specific network users	- Potential to result in volatile prices (particularly with LRIC approach), with a user's charges often influenced by the actions of other users in the same location - Relatively short term predictability but still limited in the longer term and is still not fully cost-reflective
	6 - Appropriately allocate risk between individual network users and the wider body of users		- Lack of cost-reflective charges means that risk will not be appropriately allocated - T and EHV should design with one another otherwise risk not shared
Cost Reflectivity	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	- More price reflective than transport model or 500MW model - Relatively predictable changes based on changes in use of network, allows parties to change behaviour	- Average costs do not reflect the actual cost of reinforcement at any given location. - Use of DC Load Flow is a tool to simplify the study of a network - reflective for an interconnected system but less reflective of physical power flows on certain types of networks - Unreflective of differing operational profiles
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		- Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient.
	7 - Support efficient network development	- Symmetric treatment of demand and generation	- Symmetric treatment ignores engineering factors related to fault-level reinforcement etc. - Lack of cost-reflective charges means that users do not face appropriate incentives and hence overall network likely to be very inefficient
Efficiency of Implementation	8 - Be Practical	- Status quo for (some) EHV distribution charging and TNUoS - LRIC used in conjunction with local circuits to increase specificity of tariffs	- Significantly more complex than existing LV and HV - Questioned the limit to the extent of additional increments - ICRP and LRIC should not be grouped
	9 - Be Proportionate	- Unable to judge proportionality at this stage	



## 12.31 Forward cost pricing model

Assessment Criteria		Locational Signals - Forward Cost Pricing Contingency model	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Signals areas of low and/or high remaining capacity and scale of increasing capacity	- Allocates prices to network groups rather than nodes - so can optimise allocation between groups but not inter-group - More closely linked to actual network and required costs/savings due to users actions and hence less distortion to competition
	4 - Provide a level playing field for all network users	- Demand treatment highly reflective of security of supply standards - Whilst likely to provide volatile signals, this does give the most cost-reflective approach	- Generation not subjected to a locational signal (due to no underlying security of supply standard) - More cost-reflective signal for demand is better, but approach needs to be adapted to provide similar for generation
	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	- Site specific (but rule based) reinforcement costing - Whilst likely to provide volatile signals, this does give the most cost-reflective approach	- Subject to saw-tooth price increases or year to year volatility, with a user's charges often influenced by the actions of other users in the same location
	6 - Appropriately allocate risk between individual network users and the wider body of users	- Most cost-reflective approach means risk likely to be best allocated	
Cost Reflectivity	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	- Highly cost-reflective by exposing users to the cost and/or benefit of network reinforcements which their behaviour has the potential to drive and/or avoid.	- High volatility and low predictability in approach reduces the ability of network users to respond to signals - Tariffs could be driven by other users
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users	- Most cost-reflective approach likely to be most efficient	- Volatility unwelcome to most users
	7 - Support efficient network development	- Demand treatment highly reflective of security of supply standards	- Generation not subjected to a locational signal (due to no underlying security of supply standard)
Efficiency of Implementation	8 - Be Practical	- Status quo for (some) EHV distribution charging	- Significantly more complex than existing LV and HV, and more complex for TNUoS
	9 - Be Proportionate	- Unable to judge proportionality at this stage	

12.32 Single model across transmission and distribution

Assessment Criteria		Single model across all voltage levels	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Avoids distortionary investment incentives which may be simply an artefact of different charge calculation models	- May not reflect different planning standards or engineering practice etc. - Whilst theoretically this would provide a harmonised approach, it may lead to too much complexity in the model
	4 - Provide a level playing field for all network users	- Avoids distortionary investment incentives which may be simply an artefact of different charge calculation models	- May not reflect different planning standards or engineering practice etc.
	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	- Allows users to make comparable decision between T&D investments	
	6 - Appropriately allocate risk between individual network users and the wider body of users	- Comparable costs allows more efficiently allocate agreements to generation, reducing cost to consumers and reducing risk of stranded assets	
Cost Reflectivity	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	- Avoids distortionary investment incentives which may be simply an artefact of different charge calculation models	- May not reflect different planning standards or engineering practice etc. - Principles of structure should align but not necessarily weighting between different tariff components across the network. - Shouldn't be a target proportion on fixed/unit.
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development	- Avoids distortionary investment incentives which may be simply an artefact of different charge calculation models	- May not reflect different planning standards or engineering practice etc.
Efficiency of Implementation	8 - Be Practical		- Requires significant work to achieve development of a common model which appropriately reflects the attributes of all transmission and distribution networks which have different planning and construction standards - Need harmonised connection boundary/user commitment - Requires governance changes to codes - Need to standardise pricing structure, principles and assumptions
	9 - Be Proportionate		- Benefits may be achievable without the need for a common model

12.33 Transmission and distribution charging models different but with common assumptions

Assessment Criteria		T&D charging model different but with common assumptions	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Aligns models - Aligned models are less likely to create distortions between networks	Some discontinuities will remain
	4 - Provide a level playing field for all network users	- Aligns models - Could be different models of the same type	- Some discontinuities will remain
	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	- More likely to allow appropriate comparison between connection and use of network at different voltages	
	6 - Appropriately allocate risk between individual network users and the wider body of users		- Different allocation of risk in Scotland compared to England, not justified by the underlying engineering/physics
Cost Reflectivity	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	- Aligns models - Common assumptions e.g. for growth	- Some discontinuities will remain
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development	- Aligns models	- Some discontinuities will remain
Efficiency of Implementation	8 - Be Practical	- May be possible to agree common assumptions more easily than it would be possible to achieve a common model	- Alignment of assumptions could be challenging given the different engineering standards which apply - Need to consider whether this requires harmonised connection boundary/user commitment
	9 - Be Proportionate	- Potential to deliver benefits of commonality without the need for full alignment of charging assumptions which relate to different engineering standards	- Results in some distortion

12.34 Different models across transmission and distribution

Assessment Criteria		Different charging models across T&D	
		Advantages	Disadvantages
Effective Competition	2 - Optimise Capacity Allocation	- Models can more closely reflect different planning standards or engineering practice etc.	- Potential for distortionary investment incentives which may be simply an artefact of different charge calculation models - Risk that ongoing mods could lead to divergence over time
	4 - Provide a level playing field for all network users	- Models can more closely reflect different planning standards or engineering practice etc.	- Potential for distortionary investment incentives which may be simply an artefact of different charge calculation models - Risk that ongoing mods could lead to divergence over time
	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		- Different allocation of risk in Scotland compared to England, not justified by the underlying engineering/physics
Cost Reflectivity	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	- Models can more closely reflect different planning standards or engineering practice etc.	- Potential for distortionary investment incentives which may be simply an artefact of different charge calculation models - May be more appropriate to split by voltage tiers not Transmission and Distribution
Developments in Network Businesses	1 - Efficiently meet the essential service requirements of network users		
	7 - Support efficient network development	- Models can more closely reflect different planning standards or engineering practice etc.	- Potential for distortionary investment incentives which may be simply an artefact of different charge calculation models
Efficiency of Implementation	8 - Be Practical	- Avoids the need for complex work to align charging assumptions which relate to different engineering standards	- Modelling differences would require enduring fix and not just interim methods
	9 - Be Proportionate		- Resulting distortion

## Appendix Eight – Users’ and Providers’ Perspectives

### 12.35 Large, Transmission-connected Generation Users:

- **Depth:** Sufficient access to the National Balancing Point in order to allow access to and trade in national energy markets. Distributed assets affect the flows on the transmission network irrespective of whether they choose to trade their power locally, or nationally.
- **Lifespan:** Some would prefer choice regarding fixed duration rights including long-term rights (e.g. number of years) and short-term rights (e.g. Settlement Periods), while others would prefer evergreen rights with no fixed duration and no optionality regarding Settlement Periods. Either approach is crucial with access rights matched with liability to pay tariffs for the life of the asset. This is particularly important to ensure generation can participate in the Capacity Market.
- **Time of Use/seasonal:** Some would prefer access choices, to vary their charge based on varying their access capacity at different times (within day, or within year), while others would prefer less optionality, so charges would instead be based on flat contracted access capacity across the whole year. Care should be taken in the design of access rights and charges to avoid the risk that optionality regarding the timing of access capacity may enable users to arbitrage between tariffs to avoid paying cost-reflective charges, or to crowd out access capacity of other users at particular times. There should be clear locational symmetry (same signal for demand and generation). Also important to ensure charges are practical
- **Financial firmness:** Some prefer choice between financially firm or non-firm rights, while others prefer no optionality, such that all users should have financially firm access. Firm access would result in financial compensation if network is unavailable and the ability to hedge risk. Also noting that having the choice of financially non-firm connections may create distortions in the Balancing Mechanism.
- **Physical firmness:** Right to flow on and off the network subject to physical capacity (however defined) and physical connection to the system. Network companies to maintain availability with standards (e.g. 99.99% reliability) with measures taken to avoid gaming if the choice of physically non-firm connections are offered
- **Standardisation of access choices:** Level playing field with same rights for all and same cost-reflective liabilities to pay for network (e.g. capacity charges/kW).

### 12.36 Distribution-connected Generation and Storage Users:

- **Depth:** Access to the National Balancing Point in order to trade across GB markets, with measures taken to levy tariffs across assets in front of and behind the meter. Distributed generation may also value ability to contract directly with local demand in some circumstances.
- **Lifespan:** Choice in long-term rights (e.g. number of years) and short-term rights (e.g. Settlement Periods); including very long-term rights (e.g. 40 years or more)
- **Time of Use/seasonal:** Time of use access rights that can be matched to the expected profile of the generation to allow optimisation between access rights and export.
- **Financial firmness:** Choice of financially non-firm rights are valued for generation able to flex

- **Physical firmness:** Where assets are providing balancing services, physically firm connections will be necessary (at the very least for those periods of delivery)
- **Standardisation of access choices:** Increases transparency and speeds up connection process.

#### 12.37 Community Energy Users:

- **Depth:** Choice of depth of access, including the option for only local access to balance local supply and demand or share network access between a number of local users
- **Lifespan:** Choice in long-term rights (e.g. number of years) favouring longer-term access
- **Time of Use/seasonal:** Clear locational symmetry (same signal for demand and generation)
- **Financial firmness:** Choice of financially firm or non-firm rights; including, for example, firm connection to the local LV network but non-firm beyond this
- **Physical firmness:** Right to flow on and off the network subject to physical capacity (however defined) and physical connection to the system. Network companies to maintain availability with standards (e.g. 99% reliability)
- **Standardisation of access choices:** Access choices that recognize value of matching supply and demand locally and leasing network choices such as annual fixed LV usage charge for local energy /local network leasing structure.

#### 12.38 Large Demand Users:

- **Depth:** For most, full access to the UK network including the National Balancing Point to trade on the wholesale market. Future peer-to-peer trading models that make use of industrial loads may not trade on the wholesale market. It remains possible that such models may not require full network access but this remains to be fully tested
- **Lifespan:** For most, evergreen access rights will be required. There is likely to be minimal demand for less than evergreen rights as anything shorter than evergreen (e.g. 10 years or 20 years) would create very high risks for large sites
- **Time of Use/seasonal:** Large variety of choice desired regarding limits on export/import during a season or other specific time periods for commensurate reduction in network charges for those larger users who can predict usage patterns over the year. This choice needs to be balanced with ensuring that it remains simple for users to engage in. Examples of where choice could be useful include holiday camps, shift patterns of factories, factories with planned maintenance in the summer and flexible water utility pump stations
- **Financial firmness:** For most, financially firm connections at least and physically and financially firm as security of supply is crucial in many sectors such as refineries, hospitals other large industrial processing sectors. Some large users may be able to accept financially non-firm connections. ITOs, IDNOs and private networks may not be able to accept non-firm in any context. Compensated buy-back of any unused capacity is essential
- **Physical firmness:** For almost all, 99.99% reliability is essential and some will need to invest in Uninterruptible Power Supply even above this standard. However, less than this may become more viable as the use of on-site generation and storage grows

- **Standardisation of access choices:** As far as possible, a more aligned approach to connection boundary between transmission and distribution is desirable. Access choices show clear financial value where demand offsets local generation and supports system balancing such as managing long-term constraints and nodal balancing (e.g. demand connecting in a generation dominated area).

#### 12.39 Domestic Users:

- **Depth:** Full access to the UK network, especially for vulnerable users to benefit from energy market economies of scale. Some domestic users may also value direct access to local generation.
- **Lifespan:** Evergreen access rights
- **Time of Use/seasonal:** If put in place, any time of use or seasonal access choices would require a level of automation and network company access to user data and would need to be simple to understand. Users need to be able to respond to these signals. Protections need to be in place for vulnerable users (especially those who cannot respond to signals - health reasons, for example). New property owners should not be disadvantaged due to previous owners/ developers access choice.
- **Financial firmness:** Financially firm access.
- **Physical firmness:** 99.99% reliability is essential. Non-firm options are unlikely to be useful without automation. A choice of access options could cause users to choose cheaper access which doesn't meet their requirements. This would create a two-tier connection option for domestic users where those that can afford access pay for it and those that can't might not be able to. New property owners should not be disadvantaged due to previous owners/ developers access choice.
- **Standardisation of access choices:** Physical firmness up to service fuse capacity is currently expected but a core entitlement with choice to pay more for extra capacity might be possible. New users should pay their fair share of access and upgrades to the local network to protect existing users. For example, local grid upgrades due to new electric vehicle connections may not benefit existing users as their access arrangements should not have changed. Any choices must be simple for users to understand at domestic level.

#### 12.40 Electricity System Operator:

- **Depth:** Choice for users to have access to the whole system and each market (including ancillary service provision). Network companies need to have certainty of delivery of services when called upon, irrespective of voltage level.
- **Lifespan:** User choice as the default – as long as considered in tandem with the level of user commitment required
- **Time of Use/seasonal:** More choice rather than less as the default, but consideration needs to be given to how network companies plan and operate the system. The more choice, the more complex and volatile the signals will be and less diversity can be assumed when allocating capacity
- **Financial firmness:** User choice of firm/non-firm financial rights and financial compensation if network is unavailable
- **Physical firmness:** User choice of firm/non-firm physical rights. Network companies will continue to require certainty of dispatch

- **Standardisation of access choices:** Network users having consistent choice in the access products and be exposed to similar costs to reflect these rights (e.g. higher cost for firm access rights).

#### 12.41 Distribution Network Operators:

- **Depth:** Choice for users for firm access up to the nearest Primary Substation, primary, bulk supply point, grid supply point and where required the transmission network to supply energy from distribution-connected assets, with future rights to the transmission network to be procured possibly through a new 'distribution transmission entry capacity' product
- **Lifespan:** User choice to contract based on short-term (Settlement Period, day or month) and long-term (multi-year) rights
- **Time of Use/seasonal:** User choice to contract based on time of use (e.g. non-peak times only) or seasonal (e.g. winter period from November to March only) rights
- **Financial firmness:** User choice to contract based on non-firm financial rights (without compensation) or firm financial rights (with compensation during constraint events)
- **Physical firmness:** Provide firm (N-1 or greater) and non-firm options (N-0) or physical connection arrangements to ensure users have the physical ability to export/import energy on and off the network (subject to their agreed capacity and having appropriately funded the agreed connection arrangements)
- **Standardisation of access choices:** Standard access rights for all, subject to availability and users' willingness to pay.