Charging Futures

Reforming electricity charging together

energynetworks association

Connection Boundary and User Commitment

Final report

20 November 2019

Contents

Executive summary

Executive summary

- This report will inform the Ofgem led Electricity Network Access and Forward-looking Charging Significant Code Review ('the Access SCR') and is one of a suite of reports produced by the Access SCR Delivery Group. This particular report focuses on the distribution connection charging boundary.
- The report describes the current arrangements at both distribution and transmission, highlighting where differences exist. The report describes the size of the distribution connections market and arrangements in other jurisdictions.
- The report goes on to describe a number of options for amending the current distribution connection charging arrangements, giving consideration to more shallow approaches. Each option has been assessed against a number of criteria guided by the Access SCR's guiding principles.
- Finally the report examines the rationale for introducing some form of liabilities and or securities in the event of more of the cost of network reinforcement being recovered from existing DUoS customers (as opposed to connecting users).
- The appendices describe the options in more detail, with worked examples of how options might work in practice and the illustrative impact these may have on the costs borne by different groups of users.
- The next stage, following completion of this report, will be for each of these options to be assessed in more detail, identifying which options could be taken forward together with proposals from other parts of the Access SCR.

Charging Futures

Introduction

Introduction

- This report seeks to inform the Ofgem led Electricity Network Access and Forward-looking Charging Significant Code Review ('the Access SCR').
- Ofgem launched the Access SCR on 18 December 2018. The overarching objective of the Access SCR is to ensure that electricity networks are used efficiently and flexibly, reflecting users' needs and allowing consumers to benefit from new technologies and services while avoiding unnecessary costs on energy bills in general. The outputs of the Access SCR will inform decisions on future changes to the industry codes that govern the way in which different users can connect to and utilise our electricity networks.
- To deliver the Access SCR, a Delivery Group has been established to provide input to Ofgem for its consideration in developing its SCR conclusions. The group is chaired by Ofgem, with members including National Grid Electricity System Operator (NGESO), distribution and onshore transmission network owners, the Energy Networks Association (ENA), relevant code administrators (e.g. DCUSA and CUSC), and a representative for Independent Distribution Network Operators (IDNOs). The purpose of the Delivery Group is to provide knowledge and experience of how the networks are planned and operated, to help develop and assess options. The Delivery Group has set up and tasked specific 'working groups' to consider and report on each of the aspects of the Access SCR. One such group has been established to consider the distribution connection charging boundary. This report sets out the findings of that group.

Introduction

- The report aims to describe the current arrangements for connecting to distribution and transmission networks in Great Britain. Work is ongoing to test the arguments that the current arrangements may not be acting in consumers' best interests, so is not described here.
- The working group was asked to develop and assess options for amending the distribution connection charging boundary (including do nothing). This includes an assessment of the feasibility of each option against the guiding principles and rationale of the SCR. The group was also asked to consider options for introducing some form of user commitment at distribution level.
- This report is accompanied by supporting material which provides more detail on the working group's findings and assessment.
- This report and supporting material should be not be read in isolation but instead considered alongside the findings of other SCR working groups, as there are many areas which are interlinked.

Charging Futures

Connections

Background

Current arrangements

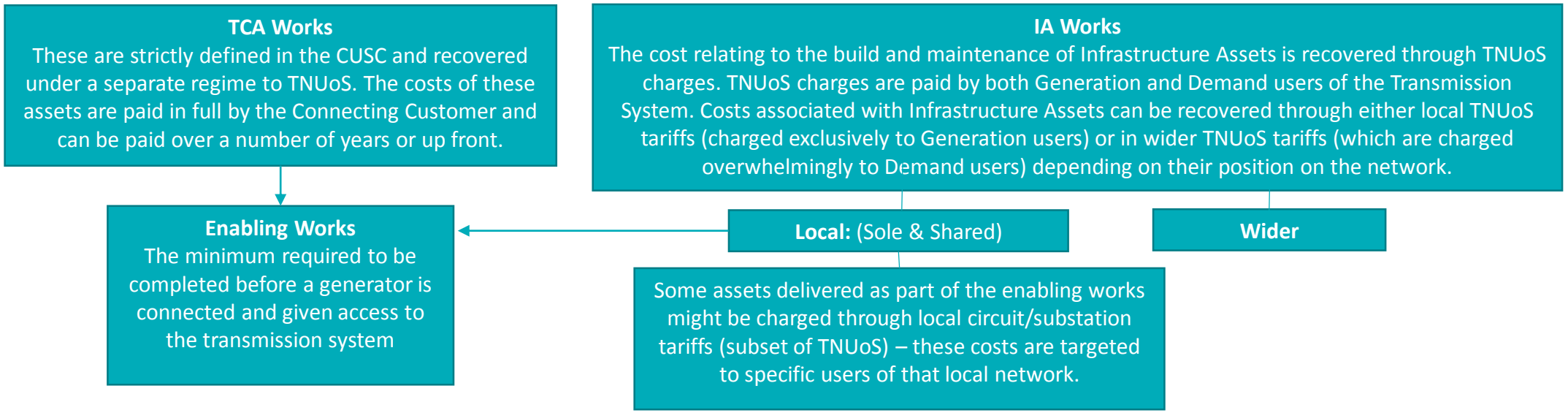
Current Distribution Connection Charging Arrangements

- The connection charging boundary is the extent to which the connecting customer has to pay for the costs of a given connection (with the rest being recovered through all customers via use of system charges).
- Where there is not enough spare capacity to facilitate a connection, the network operator may need to invest to reinforce the network to accommodate the new connection. The current connection charging boundary provides a signal to customers to connect where there is spare capacity on the network by recovering a proportion of the costs of reinforcement through the connection charge.
- All electricity distribution licensees have in place a methodology that describes how the charges for providing a new connection (or upgrading an existing connection) to the distributor's distribution system. Customers connecting to the distribution network in Great Britain face a **"shallow-ish"** connection charging boundary; that is the connecting customer:
  - Pays in full for the assets required to connect to the existing distribution network ("extension assets").
  - Contributes to reinforcement up to one voltage level above their point of connection. The level of contribution is calculated by the distributor using a **Cost Apportionment Factor** (eg, the capacity requested by the connecting user divided by the total new capacity being provided x 100%). This ensures the connecting user pays towards the network reinforcement they are driving. The remaining costs are recovered through distribution use of system charges.
  - Does not pay for the cost of any reinforcement at two voltage levels or more above the point of connection. Such costs are recovered by the distributor through distribution use of system charges to reflect the wider benefit such reinforcement provides.
- Connecting customers are required to pay in advance of their connection being provided.

Current arrangements

Current Transmission Charging Arrangements

> Transmission assets are classified as either Transmission Connection Assets (TCA), funded by the connecting user, or Infrastructure Assets (IA), recovered from TNUoS charges:



> Customers may be required to provide security against the value of works being carried out as part of their connection agreement. This is referred to as “user commitment” for generation customers and “final sums” for demand customers. This requirement places obligations on customers to provide financial security against the works required to connect them and in the event that the customer cancels or delays the provision of the connection, to bear the liability for the costs already sunk in providing the connection.

Current arrangements

Transmission & Distribution - Comparison Of Works Associated with Connections

There is not a direct read across between transmission and distribution arrangements. The table below seeks to show where there is (and is not) a degree of similarity in the definitions of work involved. A more detailed description is contained in the Excel spreadsheet provided with this report.

		Distribution				
	Works Category	Extension Assets	Reinforcement (at same voltage level plus one above)	Reinforcement (at two or more voltage levels above)	Enhanced Scheme (customer led)	Enhanced Scheme (DNO led)
Transmission	Connection Works	Works directly facilitate making of the connection				
	Enabling Works (sole)		At transmission, works may also include upgrades of the existing network			
	Enabling Works (shared)			Deeper system works with likely benefit to larger number of customers		Additional works initiated by network company over and above immediate connection requirements
	Wider Works					
	One-off Works				Additional works specifically requested by connectee	

Current arrangements

Size of the connections market

> Submissions by the DNOs as part of the RIIO price control regime provides an illustration of the size of the connections market. Figures exclude the cost of works undertaken by ICPs and IDNOs (**Source**: Ofgem)

	Reinforcement costs		Extension asset costs		
Year	**Customer funded (£m)**	**DUoS funded (£m)**	**Sole use demand (£m)**	**Sole use DG (£m)**	**Sole use unmetered (£m)**
2018	33.9	111.0	431.1	133.9	27.3
2019	32.9	97.1	442.8	75.8	23.3

> Extension assets are fully funded by the connecting customer, with reinforcement costs apportioned between the connecting customer and the DNO.

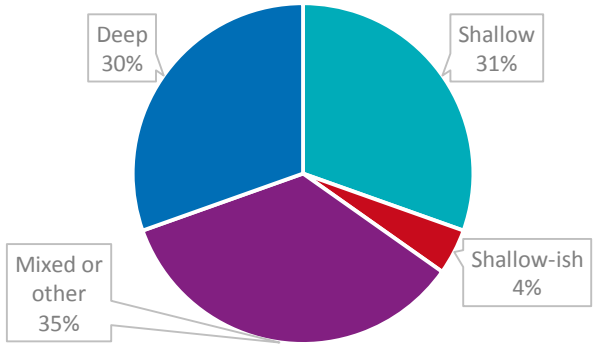
> Moving to a more shallow connection boundary will result in more reinforcement that is currently funded by the connecting customer being recovered through distribution use of system charges.

Connection charging current arrangements

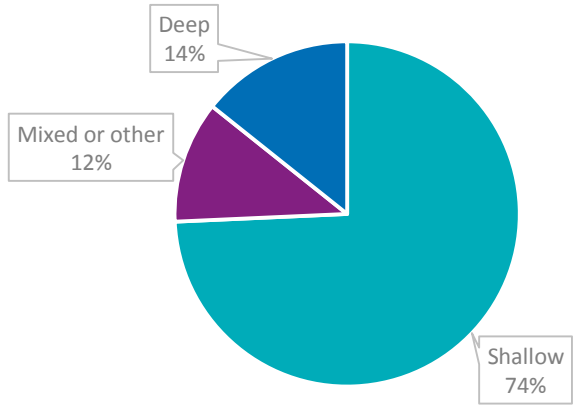
Current Charging Arrangements (Europe)

The working group looked at arrangements in other European countries. Recognising that there may be other factors influencing the choice it was noted that **there is no single consistent approach to setting the distribution connection charging boundary** and a clear preference for a shallow boundary at transmission.

Distribution connection charging boundary



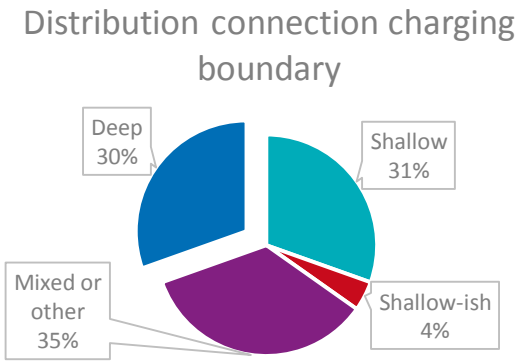
Transmission connection charging boundary



"There is no evolving international consensus practice concerning the optimal allocation of finance responsibility for the costs of connection. The differences in national policies for connection charges are substantial . They reflect the fact that different principles and policy considerations , each reasonable and valid, lead to different conclusions." **Source: Mercados**

Connection charging current arrangements

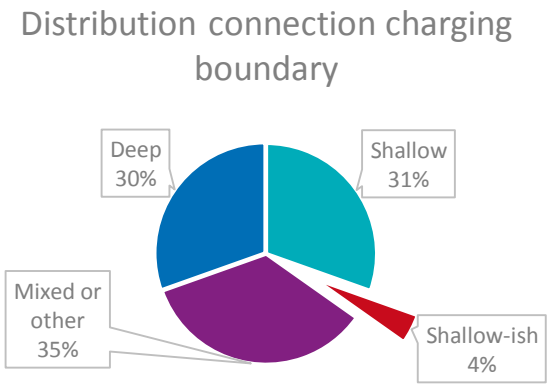
Current Distribution Charging Arrangements (Europe) – Deep



COUNTRY	APPROACH	NOTES
Austria	Deep	Admission charges are negotiated, while provision charges are regulated. Scope to refuse connection: lack of capacity
Croatia	Deep	Generators pay for all costs of connection. Demand users pay in accordance with a capacity based formula but will pay actual costs if real costs < or > 20%.
Germany	Deep	DSO estimates. For consumers and generators alike, the DSO may refuse connection only if it is impossible or if it would entail an unreasonable cost.
Lithuania	Deep	Two ways of determining connection charges public procurement and formula and commission approved fees.
Portugal	Deep	DG and large customers' connection costs are calculated on a case-by-case basis. For small users part opf the cost is shared with the DSO.
Slovak Republic	Deep	Different methodologies applied to different voltages.
Slovenia	Deep	Standard and actual costs applied.

Connection charging current arrangements

Current Distribution Charging Arrangements (Europe) – Shallowish

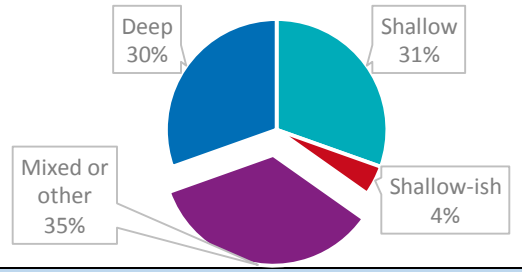


COUNTRY	APPROACH	NOTES
Greece	Shallowish	Customers pay the full cost for assets that will only be used by them or are not part of the minimum cost scheme. Customers also pay a proportion of wider network reinforcement cost where required.

Connection charging current arrangements

Current Distribution Charging Arrangements (Europe) – Mixed/Other

Distribution connection charging boundary

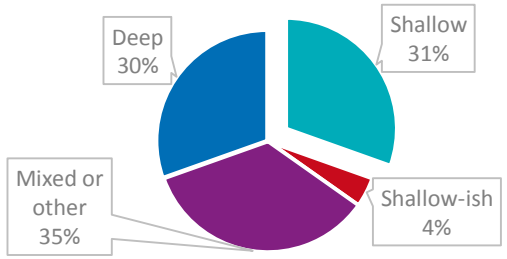


COUNTRY	APPROACH	NOTES
Cyprus	Shallow (deep on exceptional case)	Standard costs for distribution euipment and labour. Generalised cases based on simulations.
Finland	Shallow/Deep	Shallow charges for small consumers and small embedded generators. Deep charges for larger consumers and generators.
France	Shallow/Deep	Shallow for residential consumers and deep for generators. For the smallest connection works charges are approximated.
Ireland	Shallow/Deep	Charges are shallow for small connections. Larger connections are required to pay a contribution towards network reinforcements. A combination of standards costs and client specific connection fees are used.
Italy	Shallow/Deep	Shallow charges are used for consumers and embedded generators. Deeper charges are adopted for HV network users.
Luxembourg	Shallow/Deep	Shallow charges for small customers, deep(er) charges for larger customers.
Romania	Shallow/Deep	Small DG and consumers pay only extension costs. Larger customers pay all charges.
Sweden	Shallow/Deep	Connection costs are determined by the DSO. Customer can request a review if unsatisfied.
Czech Republic	Other (set fee)	Fee for connection which has no direct connection with real price of connection. The fee was determined to cover approximately half of the average connection cost.

Connection charging current arrangements

Current Distribution Charging Arrangements (Europe) - Shallow

Distribution connection charging boundary



COUNTRY	APPROACH	NOTES
Denmark	Shallow	For small consumers the connection cost is a standard cost. For larger consumers charges are based on a calculation covering the costs of building an average grid multiplied by the required capacity.
Hungary	Shallow	Standard charges and rules set by the regulator for smaller consumers (LV, MV). For larger consumers or generators the DSO makes an estimation based on its cost.
Netherlands	Shallow	Shallow charges applied to all users.
Poland	Shallow	Fees are calculated on the basis of costs incurred only in relation to the connection. A justified level of expenditures for connection to the network is set.
Spain	Shallow	A combination of Standard costs (approved by the Ministry) and connection costs calculated on a case-by-case basis is applied.

Connection charging current arrangements

Issues with the current arrangements

- A majority of respondents to the SCR launch consultation supported reviewing the distribution connection charging boundary, highlighting issues with the current arrangements falling largely into two categories:
  - Potential barriers to entry (eg, high upfront costs); and
  - Potential distortions or decisions caused by differences in transmission and distribution.

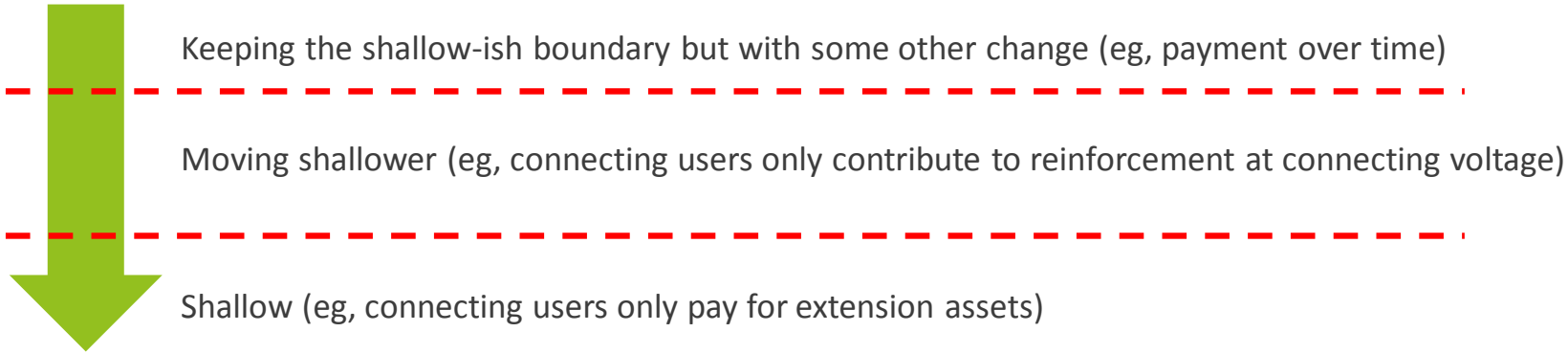
- An important part of Ofgem's assessment will be assessing evidence to support these arguments. Two key areas of work are underway:
  - A call for evidence has been issued to users to help understand quantitative evidence of any distortions and/or barriers to entry that exist because of the current arrangements; and
  - Scenario analysis of 'lifetime' network charges (for both connection and use of system) faced by a range of connection types (generation, demand and storage) across the GB transmission and distribution networks.

Connection Boundary

Options

Identification of options

- The scope of the working group has been based on the assumption that the current arrangements should provide the baseline, with potential options largely becoming more shallow. For example:



- The rest of this sections provides:
  - A **high level description of each approach (with more detail in the annex).** Detailed methodologies would need to be developed in the next stage of the SCR process.
  - An **initial assessment of how the different components of the connection charge would be funded** in each of the options.
  - An **initial view of possible combinations**. Some options could be combined with others. User segmentation might also be possible (eg, by voltage level). A more detailed assessment will form part of the next phase of analysis.
- The initial assessment of options does not include whether any liabilities or securities are required. These are covered in the section on 'Liabilities and Securities'.

Connection Boundary: options

Category	No	Title	Depth	Overview
Variation on current D arrangements	1.1	Base Case ie “do nothing”	Shallow-ish	Existing “Shallowish” connections boundary – reinforcement paid for based on Cost Apportionment Factor (CAF), two voltage level rule, High Cost Cap (HCC) for Distributed Generators (DG)
	1.2	Add cap on charges	Shallower	Base case with cap applied to reinforcement charges
	1.3	Remove HCC	Shallower	Base case with HCC removed
	1.4	Amend the ‘Voltage Rule’	Shallower	Base case with ‘Voltage Rule’ amended eg customers only pay for reinforcement at same voltage level as Point of Connection (POC)
	1.5	Amend CAF	Shallower	Base case with changes to CAF to reduce cost to connecting customer
	1.6	Recover T charges from D customers	Shallower	Base case with Transmission (T) reinforcement charges recovered from Distribution (D)
	1.7	Remove CAF	Shallow	Base case with CAF removed (shallow via CAF=0%)
	1.8	Remove CAF but with threshold	Shallower	Base case with CAF removed (shallow via CAF=0%) but pay for reinforcement over a threshold
Variation on current T arrangements	2.1	Adopting the T approach	Shallow	Change to adopt T approach, ie customers only pay for sole use assets up to 2km from the point of connection; sole use >2km, shared assets and all reinforcement recovered from DUoS customers
	2.2	Option 2.1 but without cap on length of sole use assets	Shallow	As 2.1 but with all sole use assets paid for by customer
	2.3	Option 2.1 but without cap on length of sole use assets and shared works approach	Shallow	As 2.1 but with all sole and shared use assets paid for by customer
Other approaches	3.1	Replace CAF with eg 25% rule	Shallower	Base case with change to what customer pays eg old 25% rule
	3.2	Replace CAF based on LRIC	Shallower	Base case but with CAF replaced with charge based on LRIC (Long Run Incremental Costs)
	3.3	Standard connection charges (reinforcement)	Shallower	Standard connection charges for reinforcement
	3.4	Standard connection charges (extension assets)	Shallow	Move beyond shallow and have standard connection charges
	3.5	Alternative payment options	Shallow-ish	Additional option to delay payment of the connection charge, paying on an annualised basis over an agreed period of time, following energisation

Connection Boundary: Initial Options – funding[1]

No	Title	Extension Assets	Reinforcement at same level	Reinforcement at one above	Reinforcement at two or more	Reinforcement above HCC	T charges to D
1.1	Base Case ie "do nothing"	Customer[2]	Apportioned[3]	Apportioned	DNO/DUoS	Customer	Customer
1.2	Add cap on charges	Customer	Apportioned	Apportioned	DNO/DUoS	**Apportioned**	Customer
1.3	Remove HCC	Customer	Apportioned	Apportioned	DNO/DUoS	**DNO/DUoS**	Customer
1.4	Amend the 'Voltage Rule'	Customer	Apportioned	**DNO/DUoS**	DNO/DUoS	Customer	Customer
1.5	Amend CAF	Customer	Apportioned	Apportioned	DNO/DUoS	Customer	Customer
1.6	Recover T charges from D	Customer	Apportioned	Apportioned	DNO/DUoS	Customer	**DNO/DUoS**
1.7	Remove CAF	Customer	**DNO/DUoS**	**DNO/DUoS**	DNO/DUoS	**DNO/DUoS**	Customer
1.8	Remove CAF but with threshold	Customer	Apportioned	Apportioned	**Apportioned**	**Apportioned**	Customer
2.1	Adopting the T approach	**Apportioned**	**DNO/DUoS**	**DNO/DUoS**	DNO/DUoS	**DNO/DUoS**	Customer
2.2	Option 2.1 but without cap on length of sole use assets	**Apportioned**	**DNO/DUoS**	**DNO/DUoS**	DNO/DUoS	**DNO/DUoS**	Customer
2.3	Option 2.1 but without cap on length of sole use assets and shared works approach	Customer	**DNO/DUoS**	**DNO/DUoS**	DNO/DUoS	**DNO/DUoS**	Customer
3.1	Replace CAF with eg 25% rule	Customer	Apportioned	Apportioned	**Apportioned**	**Apportioned**	Customer
3.2	Replace CAF based on LRIC	Customer	Apportioned	Apportioned	**Apportioned**	**Apportioned**	Customer
3.3	Standard connection charges – reinforcement	Customer	Apportioned	Apportioned	**Apportioned**	**Apportioned**	Customer
3.4	Standard connection charges – extension assets	**Apportioned**	Apportioned	Apportioned	**Apportioned**	**Apportioned**	**Apportioned**
3.5	Alternative payment options	Customer	Apportioned	Apportioned	DNO/DUoS	Customer	Customer

1. Entries in bold and a red box indicate a change from the current arrangements.
2. References to 'Customer' mean the connecting customer.
3. References to 'Apportioned' mean that the charge is funded by the connection customer and DNO/DUoS charges.

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Connection Boundary: some options could also be combined with others

		Base Case ie "do nothing"	Add cap on charges	Remove HCC	Amend the 'Voltage Rule'	Amend CAF	Socialise T charges to D	Remove CAF	Remove CAF but with threshold	Adopting the T approach	Option 2.1 but without cap on length of sole use assets	Option 2.1 but without cap on length of sole use assets and shared works approach	Replace CAF with eg 25% rule	Replace CAF based on LRIC	Standard connection charges – reinforcement	Standard connection charges – extension assets	Alternative payment options
1.1	**Base Case ie "do nothing"**																
1.2	Add cap on charges			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
1.3	Remove HCC				✓	✓	✓	✓	✓						✓	✓	✓
1.4	Amend the 'Voltage Rule'					✓	✓	✓	✓						✓	✓	✓
1.5	Amend CAF						✓									✓	✓
1.6	Socialise T charges to D												✓	✓	✓	✓	
1.7	Remove CAF															✓	
1.8	Remove CAF but with threshold															✓	✓
2.1	Adopting the T approach																✓
2.2	Option 2.1 but without cap on length of sole use assets																✓
2.3	Option 2.1 but without cap on length of sole use assets and shared works approach																✓
3.1	Replace CAF with eg 25% rule															✓	✓
3.2	Replace CAF based on LRIC															✓	✓
3.3	Standard connection charges – reinforcement															✓	✓
3.4	Standard connection charges – extension assets																✓
3.5	Alternative payment options																

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Connection Boundary

Approach to assessing the options

Assessing the options

Approach

- The working group considered the SCR guiding principles as a starting point:
  - Arrangements support efficient use and development of network capacity.
  - Arrangements reflect the needs of consumers as appropriate for an essential service.
  - Changes are practical and proportionate.
- The principles were then broken down into sub criteria for the purposes of the assessment. For example, the working group considered as part of the first principle:
  - The signals a particular option might give users in terms of location and or the amount of capacity requested as part of the connection; or
  - Whether an option would provide the network operator more flexibility in developing their network.
- These are described in more detail in the next few slides.
- The working group then completed a qualitative assessment of each option providing a rating and comments against each criteria.
- Some options will only benefit certain types of user (eg, removing the HCC will only benefit generation). Other approaches to user segmentation might also be driven by the extent to which the loss of locational signal can be mitigated by more locational use of system charges. This assessment considered the connection boundary in isolation. Further thinking will be needed to assess how options across the full Access SCR work together as a package.

Efficient use and development of network capacity

- The key considerations taken into account when assessing the connection charging options against this criterion were:
- **1. Efficient signals for network users.**
  - Moving to a shallower connection boundary removes the locational signal provided by the connection charge, reducing incentives for efficient use and development of network capacity. In many cases the connecting party and the final end user may also be different. The assessment was based on the DUoS arrangements as they are today but the final assessment needs to be assessed in the round with the scope for more locational DUoS charging.
  - The assessment considered the possible impacts on customers' requests for capacity (eg, whether there is an incentive to request more than is needed), responses to the loss of a locational signal in the connection charge and the attractiveness of flexible connections under each of the options.
- **2. Supporting efficient network development.**
  - Moving to a shallower boundary, where the distributor would be required to fund reinforcement in full, could mean that the distributor is better placed (incentivised) and has flexibility to choose:
    - an alternative solution to reinforcement if appropriate (eg procuring flexibility storages from storage/DSR provider).
    - the timing of when to do reinforcement.
    - reinforcement that has a wider strategic benefit.
  - The assessment considered the flexibility that each option might give to the network operator to determine the most efficient solution to meeting capacity needs and when developing the network.
  - Any potential benefits of a more shallow connection boundary need to be weighed about the effectiveness of the current regime where user willingness to pay the connection charge is a clear signal.

Efficient use and development of network capacity

…Continued from previous slide…

- **3. Addressing distortions between different types of users.**
  - Further work is required to validate (or otherwise) initial working assumptions that different connection charging approaches in transmission and distribution results in perverse locational signals that give undue influence as to where a customer should connect.
  - If the current different approaches to connection charging at transmission and distribution are shown to give perverse locational signals, then this might be mitigated by more closely aligning arrangements for distribution to those for transmission.
  - The working group has explored options for reconciling the different treatment of connection charges for transmission and distribution connections, as well as considering the risk of introducing new undue locational signals through different connection charging approaches.
- **4. Reducing barriers to entry.**
  - There is a concern that current connection charging arrangements may impose an undue barrier to entry for parties seeking connection. Further work/ evidence is required to validate this.
  - If evidence shows that high connection costs are a barrier to entry for some users, this could addressed by:
    - Moving to a more shallow connection charging boundary.
    - Offering-alternative payment options; e.g. deferred payment post connection.
  - The working group have considered alternative payment options as an option that could be applied in addition to the status quo or the options for changing the connection charging boundary.

Needs appropriate for an essential service

- For this assessment “essential services” is assumed to be the core energy requirements of domestic users in their homes.
- A move to a shallower connection boundary reduces the amount of money recovered directly through connection charges, leading to more money being recovered through DUoS charges, therefore increasing bills to customers.
- The working group are of the view that this principle is less relevant as the connection charging boundary principally affects the development of the network. However:
  - One of the consequences of moving to a shallower connection boundary is that a higher proportion of connection costs will need to be recovered through network charges for use of system.
  - This means that network charges for use of system (levied to suppliers) would increase and feed through to higher charges for consumers.
- Whilst the working group did consider the impact on charges faced by customers as well as competition in connections, this assessment has focused on the other two principles.
- A positive assessment against this principle will largely depend on the future design of use of system charges and any provisions made for small users.

Changes are practical and proportionate

- The working group's assessment under this principle focused on the ease of implementation and ongoing administration. Factors considered were:
  - Data availability, processing and accuracy
  - Time and cost required to implement changes
  - Ongoing administration
  - Usability for potential users
- The working group also considered, at a high level, whether any changes would be required to legislation, distribution licence, industry codes or charging methodologies. Furthermore, the working group assessed how feasible it would be to identify consumers that had paid for a connection under the existing regime.
- The assessment of options did not consider any transitional arrangements that might be required or the addition of a user commitment type mechanism. The working group did expect however that the addition of user commitment would increase complexity. This is discussed in more detail later in the report.

Connection Boundary

Summary of the assessment

Assessment of the options

Summary

- The options were assessed by the working group using the approach described in the previous chapter.
- The following slides provide a summary of the working group's findings. Where there is a common theme (ie, of moving to a more shallow boundary), this has been identified. However the actual impact on different types of user or distributor will vary between individual options.
- The current arrangements have been ranked as amber. Where an option is expected to be an improvement on the baseline, it is marked green. Where an option is expected be worse than the baseline, it is marked red.

Efficient use and development of network capacity

- All of the proposed options provide a weaker locational signal than the current connection charging arrangements since less of the upfront connection cost is borne by the connecting user. This locational signal becomes increasingly weaker as the connection charging boundary becomes more shallow. This could lead to less efficient investment signals for-development of the network, as there will be less of an incentive on customers to request connections where there is spare capacity and the costs to connect are lower. As an extreme example, all solar connections may seek to connect in the south of the country. However, the effect of this might be mitigated by the extent to which more locational DUoS can be achieved.
- A more shallow boundary could encourage potential connectees to oversize their capacity requests as they would not be liable for the reinforcement required to accommodate it. This could either reduce the confidence that distributors have in using requested capacity as a forecast of future requirements and/or lead to distributors needing to provide the ability for that requested capacity. The choice of charge design (eg, based on agreed capacity) might mitigate this – but cases where the connecting and enduring user are different would need to be considered in more detail.
- Where cost is a major driver, flexible connections may become less attractive by moving more shallow – at a point when they could offer most value to the network. This is because potential users could still receive a firm connection but face a lower upfront cost (as more of the cost of reinforcement is recovered from network charges for use of system). It is less clear what impact this would have when time or another factor takes precedence. This might potentially be mitigated though charge design (eg, discounts for flexible connections).
- Recovering more of the cost of reinforcement from network charges for use of system might provide distributors with more opportunity to consider alternatives to traditional reinforcement or to develop more overall efficient solutions, taking account of investment ahead of need. More work is required to understand whether this will happen in practice and if/how it interacts with the Minimum Scheme. Mechanisms to incentivise this would need to be developed as part of ED2.
- If evidence suggests that there is a distortion between transmission and distribution, and upfront cost is a significant barrier to entry, closer alignment between the two levels and recovering more of the cost from distribution charges may provide benefits in reducing or eliminating any of these barriers.

Efficient use and development of network capacity

		Base Case i.e. "do nothing" 1.1	Add cap on reinforcement charges 1.2	Remove HCC 1.3	Amend 'Voltage Rule' 1.4	Amend CAF 1.5	Socialised T charges to D 1.6	Remove CAF 1.7 ('Remove reinforcement costs')	Remove CAF but w/threshold 1.8	Adopt the T approach 2.1	T approach w/out cap on length of sole use assets 2.2	T approach w/out cap on length of sole use assets and shared works approach 2.3	Replace CAF - % rule 3.1	Replace CAF - LRIC 3.2	Standard connection charges - reinforcement 3.3	Standard connection charges - extension assets 3.4	Alternative payment options 3.5
Efficient signals for network users	1a) Risk that customers would request more capacity than they need leading to inefficient network design	3	4	3	4	4	4	4	4	5	5	4	4	3	4	5	3
	1b) Risk of loss of locational signal to connecting party leads to network party no longer being limiting factor.	3	4	3	4	4	4	4	4	5	5	4	4	3	4	5	3
Supporting efficient network development	1c) Risk that flexible connections would no longer be desirable choices for connecting customers .	3	4	3	4	4	3	4	4	5	5	4	4	5	4	5	3
	1d) Opportunity for the network operator to determine the most efficient solution to meeting the capacity/developing the network	3	3	3	2	2	3	1	1	1	1	1	2	1	1	1	3
Addressing distortions	1e) Opportunity to align D with T	3	3	3	3	3	4	2	2	1	2	2	3	3	4	5	2
Reducing barriers	2a) Opportunity to reduce connection charges for connecting customers	3	2	3	2	2	2	2	2	1	1	2	2	2	2	1	2

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Charging Futures

Needs appropriate for an essential service

- As set out previously, the assessment has focused mainly on the first and third SCR guiding principles.
- Other considerations were:
  - All options result in more of the cost of reinforcement being recovered through DUoS, with this increasing as options become more shallow.
  - The working group considered that a move towards the T approach or standard connection charges would negatively impact competition and connections.
  - The working group did not consider that amending the connection boundary would have a material impact on the time to connect – rather it simply shifts some of the burden of cost from connectee to wider consumers.

Needs appropriate for an essential service

		Base Case i.e. "do nothing" 1.1	Add cap on reinforcement charges 1.2	Remove HCC 1.3	Amend 'Voltage Rule' 1.4	Amend CAF 1.5	Socialised T charges to D 1.6	Remove CAF 1.7 ('Remove reinforcement costs')	Remove CAF but w/threshold 1.8	Adopt the T approach 2.1	T approach w/out cap on length of sole use assets 2.2	T approach w/out cap on length of sole use assets and shared works approach 2.3	Replace CAF - % rule 3.1	Replace CAF - LRIC 3.2	Standard connection charges - reinforcement 3.3	Standard connection charges - extension assets 3.4	Alternative payment options 3.5
Needs appropriate for an essential service	2b) Impact on DUoS charges for all customers	3	4	3	4	4	4	4	4	5	5	4	4	4	4	5	4
	2c) Risk to Competition in Connections	3	3	3	3	3	3	2	3	5	5	3	3	2	2	5	3
	2d) Opportunity to speed up time to connect	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Changes are practical and proportionate

- The working group considered a range of factors related to feasibility including whether new data, systems or processes would be required, how timely and costly this could be, and the complexity of administering a particular option in the future.
- A more shallow arrangement (but not fully shallow) could be achieved relatively easily. This is because the options are mainly variations on the current approach. More significant changes (including a shallow boundary) would be harder to implement.
- The working group thought it could be onerous to identify customers who paid under the existing regime (in the event that transitional arrangements or some other treatment were deemed necessary). The impact varied between options (linked to the number of customers concerned) and may need to be done on a case by case basis for some.
- An alternative payment scheme, while not changing the boundary, might be challenging to administer given the need to track this over time as well introducing a bad debt risk.

Changes are practical and proportionate

		Base Case i.e. "do nothing" 1.1	Add cap on reinforcement charges 1.2	Remove HCC 1.3	Amend 'Voltage Rule' 1.4	Amend CAF 1.5	Socialised T charges to D 1.6	Remove CAF 1.7 ('Remove reinforcement costs')	Remove CAF but w/threshold 1.8	Adopt the T approach 2.1	T approach w/out cap on length of sole use assets 2.2	T approach w/out cap on length of sole use assets and shared works approach 2.3	Replace CAF - % rule 3.1	Replace CAF - LRIC 3.2	Standard connection charges - reinforcement 3.3	Standard connection charges - extension assets 3.4	Alternative payment options 3.5
Practical and proportionate	3a) Ease of implementation (time, cost, complexity)	N/A	2	1	1	2	4	1	2	4	4	4	3	4	3	3	4
	3b) Ability to identify existing customers previously connected that could be impacted	3	4	3	5	5	3	4	5	5	5	5	5	4	4	4	3

User segmentation

- Some options are better suited to, or would only benefit, certain types of users. For example, the High Cost Cap only applies to Distributed Generation, so only those projects which exceed the current threshold would benefit.
- Other options, such as moving to a shallow boundary without any cap on the length of extension assets, might disproportionately affect users who connect further from existing distribution networks more than others (eg, consumers in more rural locations). This is due to the split of costs that will be borne by the connectee versus recovered through use of system charges.
- A final decision on user segmentation will depend on the interactions with other parts of the Access SCR. For example, how more locational DUoS can be and what the final DUoS charge design looks like.

Liabilities and Securities

Background and options

Current approach for transmission connections

Overview

- National Grid's charging methodologies result in only a small proportion of the costs of connection for both demand and generation customers being borne by the connecting party with the bulk of the costs recovered through TNUoS charges.
- The works required to connect are generally high in cost and with a long lead time and there is a risk of customers having to pick up these costs through use of system charges, if the connecting customers that require them terminate and don't connect.
- National Grid therefore place liabilities on the connecting parties for these investment works; this includes distributors where embedded generation causes an impact on the Transmission network. For some works these liabilities fall away on energisation; for some they continue after energisation.
  - For demand connections, the connecting party has to provide security for 100% of the liabilities. These are known as 'Final Sums'.
  - For generation connections, the connecting party only has to provide security for a proportion of the liability. These arrangements are known as 'User Commitments'.
- These two approaches are described further in Appendix 2.

Applying Liabilities and Securities at Distribution

Rationale

- The majority of the options for the connections boundary are likely to result in a higher proportion of costs being recovered through use of system charges. The scale of these costs will depend on the policy decided.
- However there is a risk that distributors could invest as a result of accepted schemes that fail to connect. Therefore it is appropriate to consider whether liabilities should be introduced for the connecting party to protect wider customers from these costs.
- Transmission arrangements for Wider Works also create an incentive for connecting parties to update their required connection date as generic liabilities start to apply working back four years from the connection date. This approach has not been considered at this stage due to the comparatively shorter timescales that typically apply to distribution reinforcement projects. Whilst it may be appropriate for 132kV reinforcement or in other specific circumstances, this aspect would need to be taken forward as a further piece of work.
- The principal intent of introducing Liabilities and Securities into distribution is therefore to protect existing customers from costs incurred by applicants that do not connect.

Options for Distribution

- There are two related but distinct aspects that need to be considered:
  - What **liabilities** will the connecting customer be exposed to if they apply and then do not connect?
  - If they are liable for some costs, what level of **securities** should they provide and what form can they take?

Liabilities

- Based on the approaches for transmission, a number of options have been identified to establish what level of any liabilities are appropriate. Each of the connection boundary options have then been considered and assessed. The general principle that has been applied is: if a connecting party is benefiting from a reduced charge that could result in inefficient investment by the distributor if they do not connect, that party should be liable for costs incurred.
- As introducing liabilities has the potential to undo one of the drivers for changing the connections boundary (ie to reduce barriers), a key assumption in the assessment is to not introduce liabilities where possible.
- It is assumed that introduction of liabilities to distribution would incorporate similar features to those at transmission but these have not been developed in detail at this stage of the work.
  - Liabilities would recover inefficient or stranded assets
  - Liabilities would be reduced if the assets can be utilised by other customers or the assets can be reused
- The assessment assumes that the approaches will apply consistently to demand and generation at distribution.

Options for Distribution

Securities

- The level and type of securities required has not been considered in this phase of the work and would need to be taken forward as a further piece of work
- The level of security required needs to balance the risk to existing customers with the potential to create new barriers to entry at distribution.
  - In some instances securitisation of 100% of the liabilities may be appropriate (similar to the 'Final Sums' approach in transmission). This results in very low level of risk to DUoS customers.
  - Alternatively a reduced level of securities may be appropriate but this has the potential to increase the risk to DUoS customers, either using:
    - a risk based approach (similar to the 'User Commitment' approach for attributable works in transmission); or
    - a time based approach (similar to the 'User Commitment' approach for Wider Works in transmission).
      - Note that the time based approach incentives customers to be realistic with their proposed connection date as they start to incur liabilities working back from this date.
- The type of security would also need further consideration as to what would be acceptable eg cash, parent company guarantees, etc.
- It is anticipated that any liabilities and or securities would fall away and or be returned to the connecting user on successful completion of the connection.

Liabilities and Securities – possible options

> There are a number of ways that a liabilities regime could be introduced at distribution.

Option	Description
Do nothing	• Not needed due to, eg, upfront payment from customer, acceptable level of risk to DUoS customers, not practical
Project specific	• Mirrors Attributable Works approach at Transmission • Liabilities based on project specific reinforcement (shared if multiple customers) • Liabilities apply to customers that trigger reinforcement but fall away on energisation • Level of securitisation TBC
Generic	• Mirrors Wider Works approach at Transmission • Zonal £/MVA calculated based on assessment of reinforcement • Liabilities apply to all customers connecting in that zone applied 4 years prior to connection date • Level of zone disaggregation (eg DNO, GSP, Primary) TBC • Level of securitisation TBC
Hybrid	• Create a new hybrid approach • Liabilities calculated on £/MVA basis for given specific planned reinforcement • Liabilities apply to customers that trigger or benefit from reinforcement but fall away on energisation • Could have a de minimis level below which it is not applied • Level of securitisation TBC

Liabilities and Securities

Initial assessment

Application of Liabilities and Securities to the options

Overview

- The application of liabilities has been considered for each of the connections boundary options.
- The assessment has been undertaken to consider whether liabilities should apply but has not considered in this phase of the work whether they would apply in all circumstances within that option. There is a balance to be considered between the financial exposure, the administrative costs and the risk of cancellation before connection.
  - For example the application of liabilities could be limited to where there is 132kV reinforcement required and project specific liabilities could be calculated. For these there is typically high costs of reinforcement with long lead times and therefore the extra administrative burden is worthwhile for the level of risk. If the liabilities were limited to 132kV work then this would result in more equitable treatment between the regimes in England and Wales and that in Scotland
- Where liabilities are considered appropriate, the level and type of security would need to be taken forward as a further piece of work.

Application of Liabilities and Securities to the options

No	Title	Liabilities appropriate	Comments (more detail is provided in Appendix 3)
1.1	Base Case ie “do nothing”	No	This options represents the status quo where there is no liability or security mechanism in place.
1.2	Add cap on charges	Yes	Might be required as the cost of any reinforcement above the cap would be borne by existing customers.
1.3	Remove HCC	Yes	Projects that breach the HCC are inherently expensive for the size of the connection and as such their cancellation would place a potentially large cost for unused/under utilised assets onto existing customers.
1.4	Amend the ‘Voltage Rule’	Yes	Customers benefit from not paying for reinforcement at the voltage level above which they connect to. If they cancel before they connect this could expose existing customers to costs.
1.5	Amend CAF	Maybe	Existing customers are exposed to more risk but this depends on level of CAF dilution
1.6	Recover T charges from D customers	Yes	Liabilities would be passed down from National Grid therefore could be appropriate to pass them through to the connection customer.
1.7	Remove CAF	Yes	Consistent with the transmission approach it would seem appropriate that connection customers are liable for any reinforcement costs if they cancel before they connect
1.8	Remove CAF but with threshold	Yes	As with option 1.7.
2.1	Adopting the T approach	Yes	As with option 1.7.
2.2	Option 2.1 but without cap on length of sole use assets	Yes	As with option 1.7.
2.3	Option 2.1 but without cap on length of sole use assets and shared works approach	Yes	As with option 1.7.
3.1	Replace CAF with eg 25% rule	No	The majority of the sub group considered that this was unlikely but would depend on approach. One sub group member considered that the cost of any connection works not paid via an upfront charge would require security.
3.2	Replace CAF based on LRIC	No	
3.3	Standard connection charges – reinforcement	No	
3.4	Standard connection charges – extension assets	No	
3.5	Alternative payment options	Yes	Some mechanism would be required to protect against default on deferred payment.

Liabilities and Securities – further work

More work is needed to develop the options as part of a further piece of work.

For example:

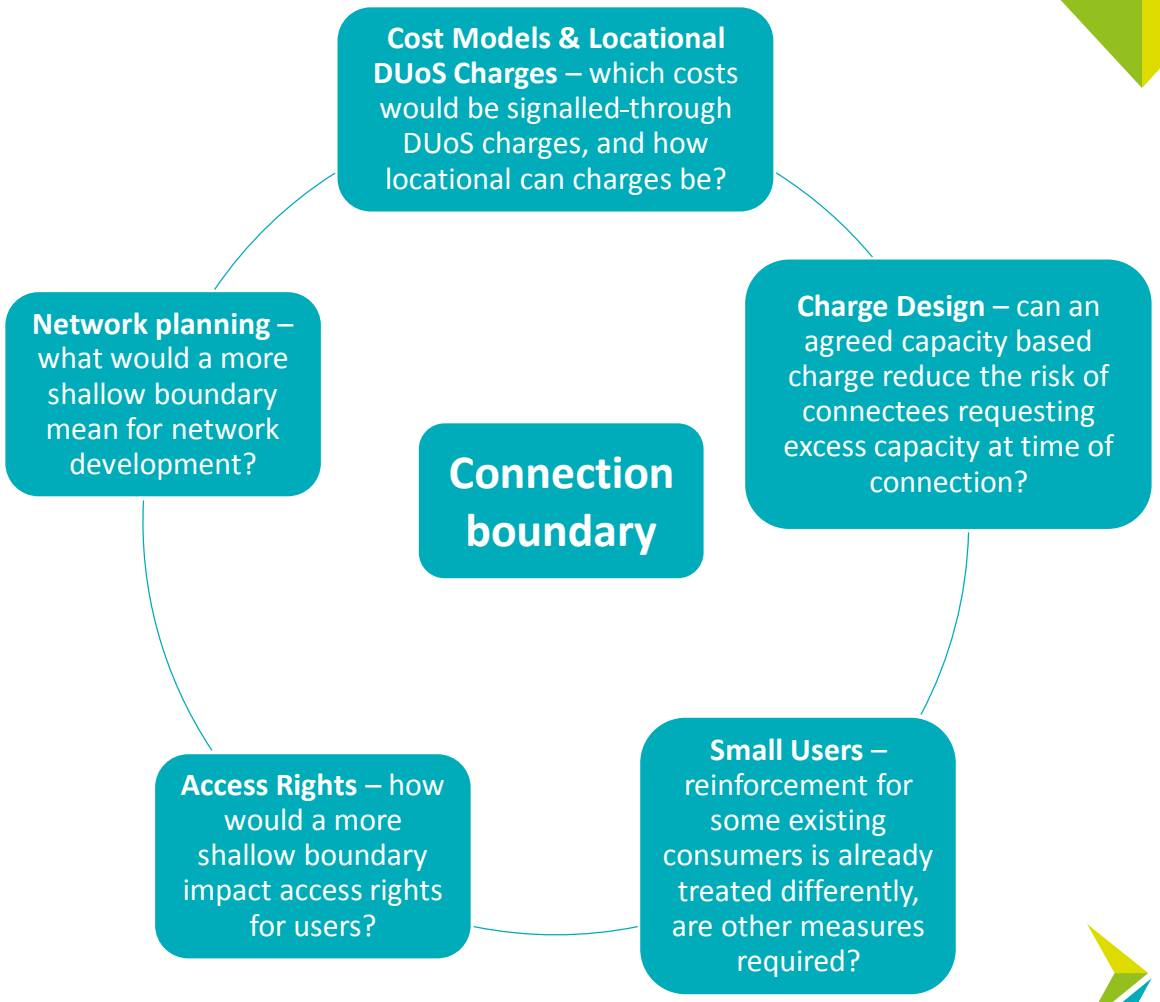
- Should we have a de minimis threshold to when securities are applied (eg, no security required if the reinforcement is, for example, less the £10k)?
- Do liabilities pass down voltage levels or should there be a 'voltage rule' to limit them (eg, if there is some 33kV reinforcement the who picks up liabilities)?
  - If you connect at 33kV?
  - If you are connecting at HV?
  - If you are connecting at LV?
- Will need to determine the level of security required and the balance of risk
- Will need to determine the type of security accepted
- Will need to consider section 20 of Electricity Act 1989

Linkages

Linkages

There are a number of linkages between the connection charging boundary and other parts of the SCR.

This is a non-exhaustive list of some of the cross-cutting issues that need to be considered further as part of the wider assessment.



Charging Futures

Appendix 1

Options for amending the connection boundary – further detail

Options – further detail and worked examples

The following slides describe each of the options in more detail.

These are split into three categories:

- Variations on the existing distribution arrangements.
- Variations on the existing transmission arrangements
- Other possible approaches.

A number of worked examples are then used to illustrate how the current and some of the proposed connection charging boundary options work in practice.

The examples are not intended to provide an accurate estimate of the charges which a person would become liable in respect of the provision of a connection, but to demonstrate how the apportionment of costs may differ under new arrangements.

- The examples do not take cognisance of the application of any liabilities and securities.
- An arbitrary cap and threshold value has been used for illustrative purposes.
- Extension assets will be charged in full to the customer for most of the proposed charging boundary options.

1.1. Base Case

Existing ‘shallowish’ connections boundary.

- Customers pay for 100% extension assets
- Customers pay proportion of reinforcement based on CAF
  - Security CAF – customer required capacity as proportion of new network capacity from reinforcement
  - Fault level CAF – 3 x customer fault level as proportion of new fault level capacity
  - ECCR applies and subsequent comers pay same proportion of costs
- A 'minimum scheme' applies. This is defined as the lowest capital cost (which isn't necessarily the lowest charge to the customer). Customers or Networks can choose to build an enhanced scheme but would be liable for additional cost.
- Key exceptions
  - High Cost Cap (HCC) applies to DG only; where costs of reinforcement >£200/kW then customer pays 100% over this threshold, would get rebates if more connect
  - Customers only charged for reinforcement at same voltage of connection plus one above, ie not charged for works at two voltage levels above

Current arrangements - demand

A customer requests a new 10MW connection that requires an existing 33kV substation with a capacity of 20MVA to be uprated to 40MVA.

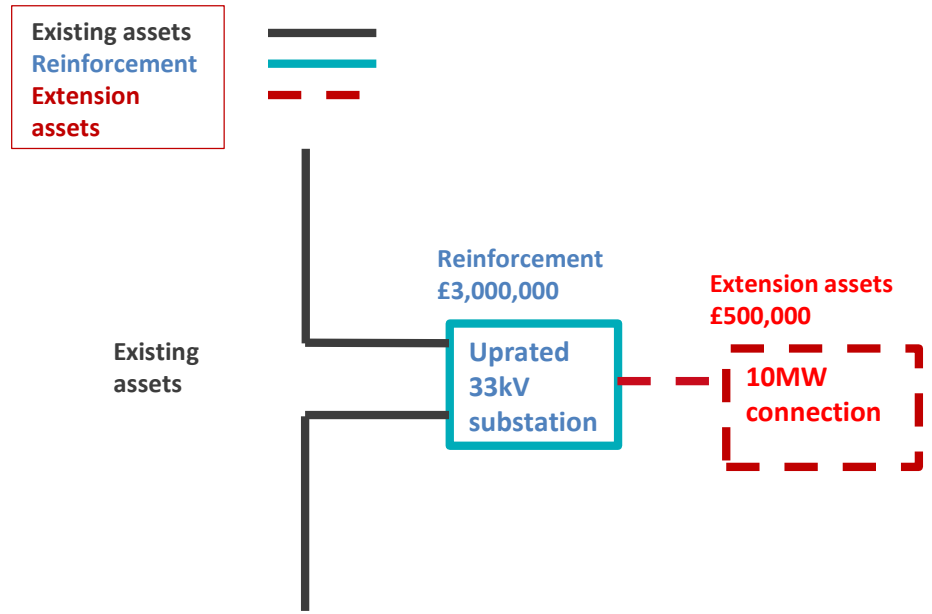
For all types of customer the Extension Assets would be paid in full by the connecting customer, say £500,000.

For a demand customer, the Reinforcement would be paid for using the CAF calculation. If we assume the Reinforcement creates 40MVA of capacity and costs £3,000,000 then the security CAF calculation would be:

$$\text{Security CAF} = \frac{\text{Required Capacity}}{\text{New Network Capacity}} \times 100\%$$

$$= \frac{10}{40} \quad \text{x £3,000,000}$$

	Customer Funded	DUoS Funded
Extension Assets	£500,000	
Reinforcement	£750,000	£2,250,000
Total	**£1,250,000**	**£2,250,000**



Current arrangements distributed generation

For a distributed generation customer, any costs over £200/kW are paid for by the connecting customer.

HCC = £200 x 10 x 1,000 = £2,000,000

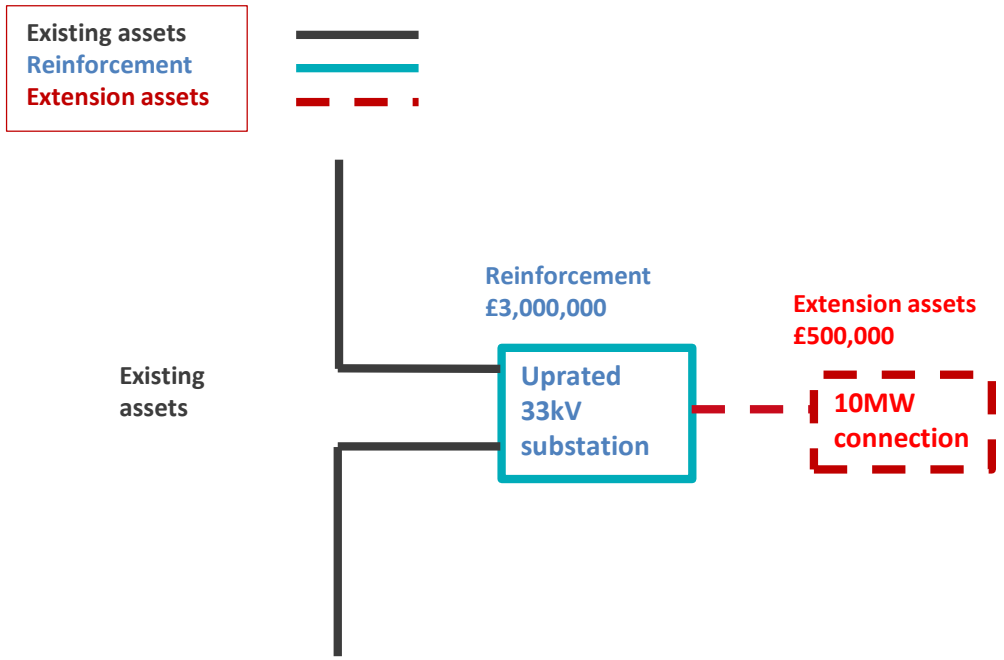
Costs above the HCC are paid ie £3,000,000-£2,000,000 = £1,000,000

Cost under the HCC are paid for using the CAF calculation. Therefore the security CAF calculation would be:

$$\text{Security CAF} = \frac{\text{Required Capacity}}{\text{New Network Capacity}} \times 100\%$$

$$= \frac{10}{40} \quad \text{x £2,000,000}$$

	Customer Funded	DUoS Funded
Extension Assets	£500,000	
Reinforcement above HCC	£1,000,000	
Reinforcement below HCC	£500,000	£1,500,000
Total	**£2,000,000**	**£1,500,000**



Variations on the Distribution approach

1.2. Add cap on charges

In this option this adds a cap to the base case methodology.

This could take the form of:

- An absolute cap – whereby a customer never pays more than £X
- A scaled cap – whereby a customer never pays more than £Y/kW (or per kVA)
- A voltage level cap – which could be absolute or scaled but different by voltage level

This would limit the amount of reinforcement paid for by the connecting customer.

- Would need to consider in conjunction with HCC
  - The HCC sets a threshold above which the customer pays all the costs
  - This cap would set an upper threshold on the costs the customer bears

1.3. Remove HCC

Currently the High Cost Cap (HCC) applies to DG only; where costs of reinforcement >£200/kW then customer pays 100% over this threshold, would get rebates if more connect.

In this option the HCC would be removed. DG customers would pay their proportion of reinforcement costs based on the relevant CAF, but the additional costs above the £200/kW threshold (that they would pay today) would be recovered through DUoS

This would equalise the treatment of demand and DG and would remove the extremes of charges to customers where there is high levels of reinforcement require to facilitate their connection.

1.4. Amend the ‘Voltage Rule’

In this option Customers would only be charged for reinforcement at same voltage as the point of connection but not charged for any reinforcement at any voltages above.

The table above shows the current arrangements and the proposed arrangements for this option for an HV Point of Connection.

Example for HV POC	Current	Proposed
132kV network	Funded by DNO/DUoS	Funded by DNO/DUoS
132kV/EHV substation	EHV circuit breakers only Apportioned	Funded by DNO/DUoS
EHV Network	Apportioned	Funded by DNO/DUoS
EHV/HV substation	Apportioned	HV circuit breakers only Apportioned
HV Network	Apportioned	Apportioned

The concept of the Minimum Scheme would still apply in assessing the Point of Connection.

1.5. Amend CAF

Currently the costs of Reinforcement are apportioned using one of two Cost Apportionment Factors (CAFs), dependent upon which factor is driving the requirement for Reinforcement:

$$\text{Security CAF} = \frac{\text{Required Capacity}}{\text{New Network Capacity}} \times 100\% \qquad \text{Fault Level CAF} = 3 \times \frac{\text{Fault Level Contribution from Connection}}{\text{New Fault Level Capacity}} \times 100\%$$

In this option the locational signal could be weakened (but not removed) by applying an arbitrary scaling factor eg 50%.

The extent of the scaling factor has not been be considered as part of this work.

1.6. Revised treatment of T charges

Currently the costs of T Attributable Works are passed through to specific D customers connecting that require the work via the distributor. If more that one customer then these are shared between those specific customers that are connecting.

In this option these T charges could be recovered from existing customers rather being paid for by the connecting customers.

1.7. Remove CAF

Currently the costs of Reinforcement are apportioned using one of two Cost Apportionment Factors (CAFs), dependent upon which factor is driving the requirement for Reinforcement:

$$\text{Security CAF} = \frac{\text{Required Capacity}}{\text{New Network Capacity}} \times 100\%$$

$$\text{Fault Level CAF} = 3 \times \frac{\text{Fault Level Contribution from Connection}}{\text{New Fault Level Capacity}} \times 100\%$$

In this option the approach of apportioning costs is removed and no reinforcement costs are paid for by the connecting party. The reinforcement costs would therefore become a costs paid for by existing DUoS customers.

There may need to be some exemptions to this eg where reinforcement is required at the request of the customer but these have not been considered in detail at this stage of the assessment.

1.8. Remove CAF but with threshold

In this option the approach of apportioning costs is removed and no reinforcement costs are paid for by the connecting party up to a threshold. Under the threshold the reinforcement costs would therefore become a cost paid for by existing DUoS customers. If the costs of the reinforcement are greater than the threshold then the incremental costs are paid for by the connecting customer.

This could be something similar to the HCC or the economic test in gas. The outcome is that within certain parameters the connecting customer doesn't pay and is funded by DUoS; outside those parameters the connecting customer does pay. This would act as locational signal for the extremes.

There may need to be some exemptions to this, eg where reinforcement is required at the request of the customer but these have not been considered in detail at this stage of the assessment.

Further thought would be needed whether the minimum scheme concept would still apply that could result in a POC further away and longer extension assets paid for by the connecting customer or more a ‘connect and manage’ approach.

Worked examples to show changes to reinforcement charges

Current arrangements

	Customer Funded	DUoS Funded
Reinforcement demand	£750,000	£2,250,000
Reinforcement DG	£1,500,00	£1,500,00

1.2 Add cap on charges

If we assumed an arbitrary cap of £500,000 to illustrate then the connecting customer's contribution would be capped at this limit and the residual paid for by connecting customers.

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement demand	£500,000	£2,500,000	+£250,000

1.3 Remove HCC

If the HCC was removed then the reinforcement costs would be the same for demand and DG

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement DG	£750,000	£2,250,000	+£750,000

1.4 Amend the 'Voltage Rule'

In this example, the reinforcement costs are at the voltage above the Point of Connection and therefore the customer would not pay any of the reinforcement charges.

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement demand	£0	£3,000,000	+£750,000

Worked examples

1.5 Amend CAF

If we assumed an arbitrary scaling factor of 50% to illustrate then the customers contribution toward the reinforcement would reduce to £62,500 (ie 50% of the base case contribution)

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement	£375,000	£2,625,000	+£375,000

1.6 Revised treatment of T charges

There are no transmissions charges in the example therefore no change.

1.7 Remove CAF

In this example, there would be no reinforcement costs charged to the connecting customer.

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement	£0	£3,000,000	+£750,000

1.8 Remove CAF but with threshold

If we assumed an arbitrary threshold of £500,000 to illustrate then the connecting customer's contribution would only pay the amount over the threshold.

	Customer Funded	DUoS Funded	Change to DUoS
Reinforcement	£250,000	£2,750,000	+£500,000

Variations on the Transmission approach

2.1. Adopting the T approach

In this option the approaches adopted by T would be applied and therefore in this approach all assets that are not single user assets would be recovered by use of system charges.

This would result in a number of changes:

- Distribution Extension Assets would only be paid for by the connecting customer where they were ‘sole use’. Costs of ‘shared assets’ would be recovered from existing customers
  - This option does not include changing how charges for connection assets are paid ie it assumes payments due by the connecting party are made in advance and that moving to payment in arrears post connection to align with T has not been included.
- Costs of ‘sole use’ assets >2km (where potential to be shared) would be recovered from existing customers
  - Effectively acts as a cap on charges paid for by the connecting customers
  - No work has been done to assess the equivalent of the 2km threshold in T at this stage of development.
- Costs of all reinforcement would be recovered from existing customers
  - This would replicate the Attributable Works and Strategic Wider Works approaches but need further work to define this categorisation. Would need to establish the equivalence of MITS for distribution to differentiate categories of reinforcement and the implications for who pays.
  - Might resolve the issue of minimum scheme ie a POC further away might be the most cost effective solution but the individual customer wouldn't pay for it

2.1 Worked example

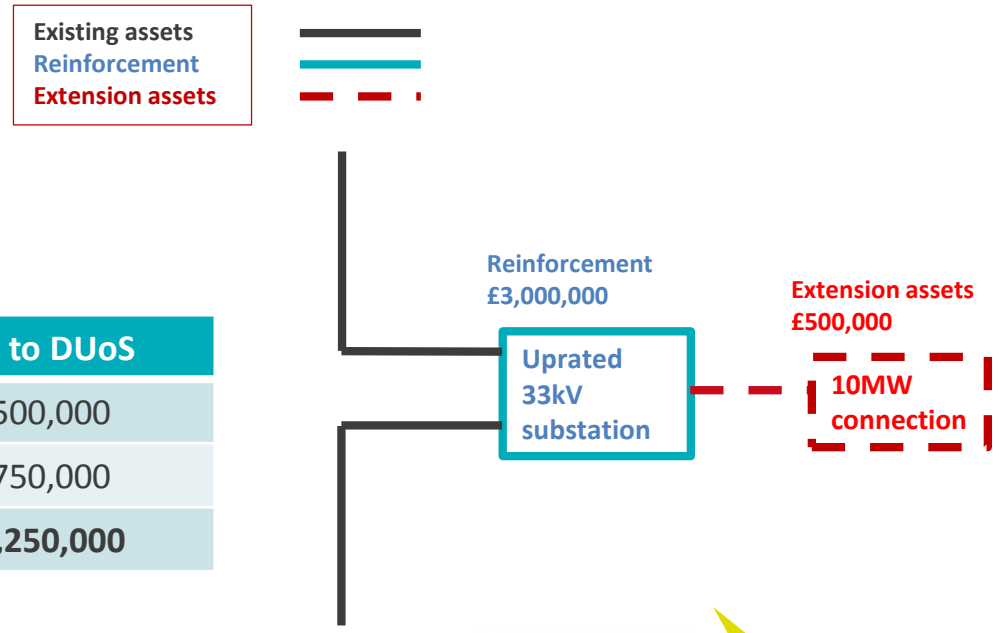
No reinforcement costs charged to the connecting customer.

If we assume that the Extension Assets are over 2km and potentially sharable then none of these costs will be charged as a connection charge. Note some of these costs may get charged as local TNUOS but is not considered here.

Current Distribution	Customer Funded	DUoS Funded
Extension Assets	£500,000	
Reinforcement	£750,000	£2,250,000
Total	**£1,250,000**	**£2,250,000**

	Customer Funded	DUoS Funded
Extension Assets	£0	£500,000
Reinforcement	£0	£3,000,000
Total	**£0**	**£3,500,000**

Change to DUoS
£500,000
£750,000
£1,250,000



2.2. Option 2.1 but without cap on length of sole use assets

In this option the T methodology principles outlined in 2.1 would apply apart from the cap on sole use assets, ie all sole use connection assets would be paid for by the customer irrespective of length.

Current Distribution	Customer Funded	DUoS Funded
Extension Assets	£500,000	
Reinforcement	£750,000	£2,250,000
Total	**£1,250,000**	**£2,250,000**

	Customer Funded	DUoS Funded	Change to DUoS
Extension Assets	£500,000	£0	£0
Reinforcement	£0	£3,000,000	£750,000
Total	**£500,000**	**£3,000,000**	**£750,000**

2.3. Option 2.1 but without cap on length of sole use assets and shared works approach

In this option the T methodology principles outlined in 2.1 for reinforcement would apply but not the treatment of shared assets and sole assets >2km.

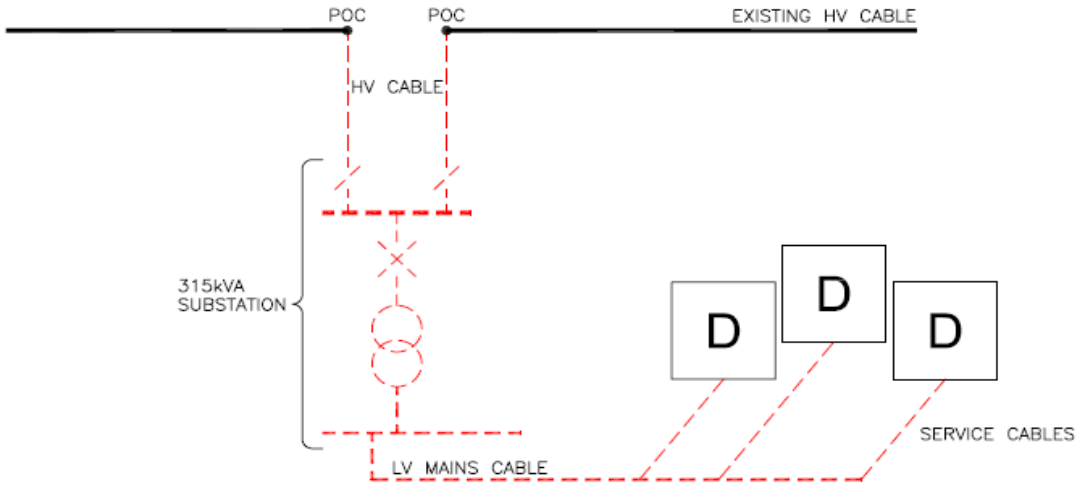
ie all shared and sole use connection assets would be paid for by customer irrespective of length.

- Costs of all reinforcement would be recovered from existing DUoS customers
  - This would replicate the Attributable Works and Strategic Wider Works approaches but need further work to define this categorisation. Would need to establish the equivalence of MITS for distribution to differentiate categories of reinforcement and the implications for who pays.

2.3 Worked example

In the example shown where say a housing developer has requested connections for 200 houses and the minimum scheme is to loop in a new distribution substation. Currently in Distribution all these new assets would be classified as Extension Assets and paid for by the connecting party.

In this option, the HV cables would be considered shared assets and therefore not chargeable to the connecting party



Current Distribution	Customer Funded	DUoS Funded
HV cables	£20,000	£0
Substation & LV cables	£200,000	£0
Total	**£220,000**	**£0**

	Customer Funded	DUoS Funded
HV cables	£0	£20,000
Substation & LV cables	£200,000	£0
Total	**£200,000**	**£20,000**

Change to DUoS
£20,000
£0
£20,000

Other approaches

3.1. Replace CAF with eg 25% rule

Currently the costs of Reinforcement are apportioned using one of two Cost Apportionment Factors (CAFs), dependent upon which factor is driving the requirement for Reinforcement.

In this option the CAF calculation is replaced with a different mechanism. For example it could be akin to the old “25%” rule so that customer does not pay for reinforcement if load is less than [25%] of the effective capacity of the equipment.

Extension assets would still be paid for by the connecting customer.

3.2. Replace CAF based on LRIC

In this option the LRIC (Long Run Incremental Cost) could be used as a basis of the charge

- The LRIC model calculates Nodal incremental costs. These costs represent the brought forward (or deferred) reinforcement costs caused by the addition of an increment of demand or generation at each network node. This method models the impact changes in users' behaviour have on network costs.
- When a customer connects and reinforcement is required then the LRIC reduces as capacity is created and this defers reinforcement costs. The reduction in the LRIC could be multiplied by X number of years to calculate a connection charge. This could annualised into a lump sum.
- When a customer connects and defers the need for future reinforcement eg demand connecting in a generation dominated area, then credits could be applied.

- Extension assets would still be paid for by the connecting customer.

3.3. Standard connection charges – reinforcement

In this option standard connection charges could be applied. These could vary by any of or combinations of the following

- Capacity requested
- Voltage of connection
- Where connection is eg based on nodes

Within the scope of changes to the connection boundary this would only apply to reinforcement costs. These changes would apply to all connections whether or not they were triggering reinforcement.

This has the effect of recovering the reinforcement costs across connecting customer rather than all customers (which are a mix of existing and connecting).

Extension assets would still be paid for by the connecting customer.

3.4. Standard connection charges – extension assets

In this option standard connection charges could be applied. These could vary by any of or combinations of the following:

- Capacity requested
- Voltage of connection
- Where connection is eg based on nodes

This option could go further and include extension assets and any Transmission charges in the standard connection charge. This would develop standard connection charges for different categories of connection. Ie any customer would pay the same irrespective of what extension assets, reinforcement costs or chargeable Transmission assets would be required.

This would go beyond the T shallow approach and dilutes the cost reflectivity of the charges.

3.5. Alternative payment options

In this option the charges for reinforcement could change from in advance/cash positive to either:

- Charge for reinforcement just prior to connection
- Charge post connection over X years (as per T approach)

Currently where reinforcement work is charged to the connecting customer there is no risk to DUoS customers. This option would introduce a bad debt risk that the distributor would seek to recover but would ultimately be underwritten by existing customers

This approach could be extended to the treatment of extension assets but considered beyond the scope of the workgroup at this stage as it is focusing on the connections boundary. Extension assets are currently outside of price control and therefore the distributor's commercial risk. Further consideration of how these risks would be underwritten would be required.

Appendix 2

Liabilities and securities - background

Overview of NGESO User Commitments

Extracts from User Commitments Methodology – Guidance and Implementation Document

National Grid and the other Transmission Owners (TOs) undertake investment works to accommodate the needs of generators already connected and those expected to connect in the future to the electricity transmission network. However, a generator may decide to cancel its project or reduce its capacity where the associated works have already begun. This may result in unnecessary costs to other network users which are ultimately borne by the end consumer. User commitment arrangements place liabilities on generators triggering particular investment works in order to financially secure the investment being undertaken on their behalf.

User commitment performs a vital function in ensuring adequate information is available to TOs to plan and develop the network in a manner that is economical and efficient and protects the interests of consumers and wider industry. User commitment signals are also financially underwritten to incentivise the provision of accurate and timely information and to ensure that the risk of stranded assets is placed on those parties best placed to mitigate and manage the risk.

Overview of NGESO User Commitments

Extracts from User Commitments Methodology – Guidance and Implementation Document

- The proposal was based on incentivising generation projects to provide notice of cancellation, closure and capacity reduction in a timely manner such that inefficient transmission investment by the transmission owners can be minimised, whilst reducing the barrier to new entrants that such arrangements represent.
- The arrangements are formally set out in section 15 of the CUSC and comprise of a generic liability to cover broad system investment (Wider), and a specific liability to cover local generator-driven investment (Attributable).
- All generation projects would be liable for a proportion of the wider amount, whilst only pre-commissioning generation projects would be liable for their particular attributable amount.
- In calculating the liabilities, the methodology includes a number of factors to more accurately reflect the risk of inefficient or stranded assets, and avoid over-securitisation of new investments.
- These factors cover sharing risk with consumers, potential for asset reuse by Transmission Owners (TO's), catch-up investment, etc.
- Security for this liability will reduce for pre-commissioning generation projects as their project progresses to completion, whilst no security will be required for post-commissioning users (as per current CUSC arrangements).

Overview of NGESO User Commitments

Extracts from User Commitments Methodology – Guidance and Implementation Document

The arrangements comprise of a **generic liability** to cover broad system investment (Wider), and a **specific liability** to cover local generator-driven investment (Attributable).

The aim of the arrangements is to incentivise future generation projects (pre commissioning) to provide notice of cancellation and for existing generation projects (post commissioning) to provide notice of closure or capacity reduction in a timely manner. This ensures that inefficient transmission investment by the transmission owners can be minimised.

- **All** generation projects would be liable for a proportion of the **wider** amount,
- whilst only pre-commissioning generation projects would be liable for their particular attributable, or local amount.

Sharing of Risk

- The liability for Attributable works is borne 100% by generation.
- The liability for Wider system investment is shared 50/50 between generation and consumers.

	Generation	Consumers
Attributable	100%	0%
Wider	50%	50%

The liability for pre-commissioning generation projects takes account of transmission investment for attributable and wider works; and
The liability for post-commissioning generation projects takes account of the investment for wider works only.

	Pre	Post
Attributable	Yes	No
Wider	Yes	Yes

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Overview of NGESO User Commitments

Extracts from User Commitments Methodology – Guidance and Implementation Document

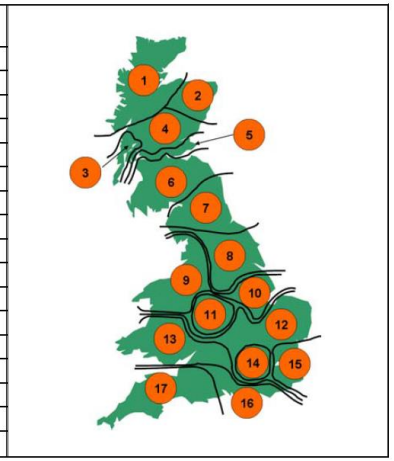
Wider Liability (generic)

The wider liability is a zonal £/MW charge. The charges are to be published annually and are calculated from the apportionment of wider load related and non load related Capex across system boundaries and then mapped to generation zones.

The Wider Liability is reduced by one factor:

> Global Asset Reuse Factor (GARF) set at 0.5 and shares the cost of wider investment equally between demand and generation customers

SYS Zone	Wider Zonal Unit Liability (£/MW)
Z1	£ 21,599.94
Z2	£ 15,691.57
Z3	£ 15,867.72
Z4	£ 11,762.73
Z5	£ 7,093.65
Z6	£ 6,366.92
Z7	£ 4,681.52
Z8	£ 2,785.21
Z9	£ 1,635.31
Z10	£ 1,316.08
Z11	£ 1,774.86
Z12	£ 822.75
Z13	£ 820.76
Z14	£ 822.75
Z15	£ 423.05
Z16	£ 2,447.00
Z17	£ 9,146.01



Attributable Liability (specific)

The Attributable liability will be calculated biannually and will be specific to the components that make up the attributable works. Components are considered to be substations or lengths of cable or overhead line between substations (and not the individual assets making up that component).

The Attributable Liability is reduced by three factors:

> Strategic Investment Factor (SIF) -limits the attributable liability to the proportion of the investment that the generator has triggered; ensures the generator isn't liable for more than their proportion should the TO build a component with greater capability.

> Local Asset Reuse Factor (LARF) - an estimate of what percentage of the component could be reused should the attributable generator cancel their project.

> Distance Factor- Where the nearest suitable MITS is not the connection MITS, the attributable works will be the pro rata share of the transmission capacity to connect the generation project to the nearest suitable MITS on the transmission network. This factor allows the TO to make design decisions without exposing the attributable generation project to more than the minimum Attributable works.

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Overview of NGESO User Commitments

Extracts from User Commitments Methodology – Guidance and Implementation Document

Security

The level of required security does not follow the same profile as the liability. Reductions based on an assessment of the likelihood of cancelation are applied.

Security is only utilised if the project cancels before connection; if any security is paid then it is returned on connection.

The trigger date is the 1 April of the financial year such that there is three full financial years to the financial year of connection.

Stage of generation project	Security as % of annual liability – directly connected	Security as % of annual liability – DNO connected
> 4 years from completion (Before trigger point)	100%	100%
Pre consents (between trigger point and consents)	42%	45%
Post consents	10%	26%
Post commissioning	0%	0%

Overview of NGESO Final Sums approach

The "Final Sums" Methodology

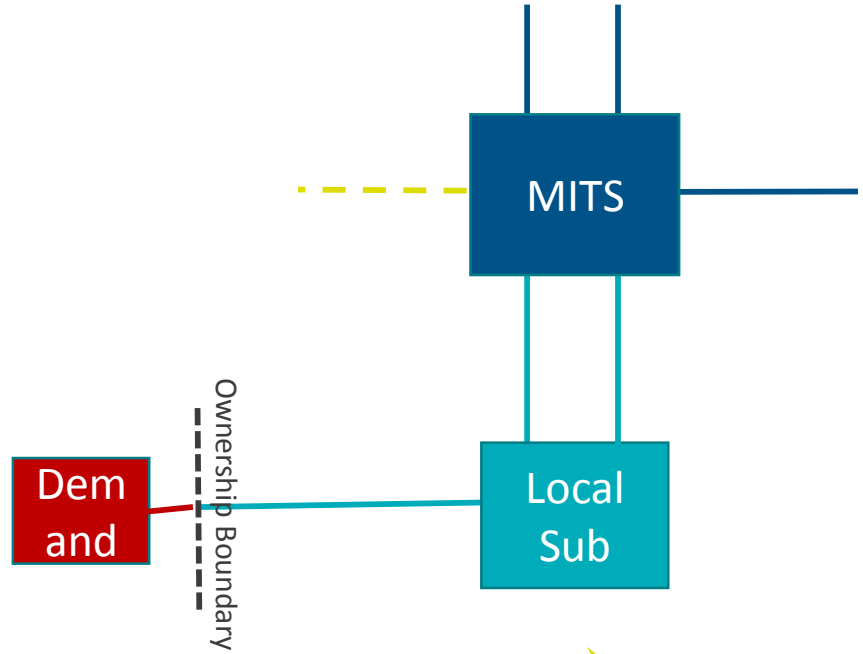
Transmission Connected Demand customers (DNOs, Rail electrification, Heavy industry requiring a transmission voltage connection, etc.) have a liability equivalent to 100% of all their enabling works from the point of TO expenditure until their connection date.

Demand Liability:

These might be new assets built to connect the demand customer to the MITS or upgrades to the existing local network. Demand secures against 100% of TO expenditure on these assets.

These are existing assets and no changes are required to enable the demand customers connection – the customer does not have a liability for any "circumstantial" (i.e. end of life) works that happen on these assets.

This line on the wider network (beyond the MITS) needs uprating to accommodate the demand customer – this is enabling works and the demand customer secures against 100% of TO expenditure on this asset



Appendix 3

Liabilities and securities - options

Application of Liabilities and Securities to Connections Boundary options

1.1. Base Case ie “do nothing”

- Currently Liabilities and Securities not generally used at distribution

1.2. Add cap on reinforcement charges

- This option introduces a threshold above which existing customers will fund any reinforcement; connecting customers would be contributing to any reinforcement up to the threshold
- Whilst the cap limits the contribution the connecting customer has to pay, existing customers would be exposed to costs above this level if the connecting party cancelled before they connected. It would therefore make sense to place liabilities on the connecting party.
- Project specific liabilities could be calculated to cover the costs above the cap that are currently funded by the connecting customer. These liabilities would fall away on energisation of the connection.

1.3. Remove HCC

- Projects that breach the HCC are inherently expensive for the size of the connection and as such their cancellation would place a potentially large cost for unused/under utilised assets onto the DUoS customer therefore it makes sense to place some liability on the connection customer.
- Project specific liabilities could be calculated as volumes are low to cover the costs above the HCC that are currently funded by the distributed generation customer. These liabilities would fall away on energisation of the connection.

Application of Liabilities and Securities to Connections Boundary options

1.4. Amend 'Voltage Rule'

- In this option connecting customers are benefiting from not paying for any reinforcement at the voltage level above which they connect to. If they cancel before they connect this could expose existing customers to costs and therefore feels appropriate that the connection customer should be liable for them.
- Project specific liabilities could be calculated where the reinforcement at the voltage level above was identified. It would seem appropriate to make the connecting customer liable for any costs incurred if they cancelled their connection. These liabilities would fall away once the connection is energised.

1.5. Amend CAF

- The application of liabilities in this option is likely to vary depend depending to the reduction applied to the CAF calculation.
  - If there is little dilution to the level of CAF then this would be similar to the current regime and therefore no liabilities required
  - If there is greater dilution and the level of contributions reduced then liabilities would be appropriate

Application of Liabilities and Securities to Connections Boundary options

1.6. Recover T charges from D customers

- Project specific liabilities could be calculated based on the capitalised charges from National Grid. Liabilities would be passed down from National Grid therefore would be appropriate to pass them through to the connecting customer. These liabilities would fall away on energisation of the connection(s).

1.7. Remove CAF

- Consistent with the transmission approach it would seem appropriate that connection customers are liable for any reinforcement costs if they cancel before they connect. Liabilities would apply to customers that trigger (or benefit from) reinforcement but fall away on energisation
- A new hybrid approach is proposed that would be calculated on a £/kVA basis for a given reinforcement; this would be similar to the current CAF calculation but would calculate the liability rather than the charge.
  - Could have a de minimis level below which liabilities are not applied to recognise that the extra administration may not be appropriate for the level of risk

1.8. Remove CAF but with threshold

- As the principle of the threshold is that connection customers pay for reinforcement above a threshold this protects existing customers from these costs.
- Below the threshold it would seem appropriate that connection customers are liable for any reinforcement costs if they cancel before they connect. This would be consistent with the approach described in 1.7

Application of Liabilities and Securities to Connections Boundary options

2.1. Adopting the T approach

- For this option to fully adopt the T approach then it would be logical to apply the same approaches to liabilities and securities used at transmission would be fully implemented too
  - Final Sums for demand
  - User commitments for generation
    - generic liability to cover broad system investment (Wider)
    - specific liability to cover local generator-driven investment (Attributable).

2.2. Adopting the T approach but without cap on length of sole use assets

- Securities as per current arrangements, see 2.1

2.3. Adopting the T approach but without shared works approach

- Securities as per current arrangements, see 2.1

Application of Liabilities and Securities to Connections Boundary options

3.1. Replace CAF with eg 25% rule

- The need for liabilities would be dependent on the actual approach developed.
- If it followed the principles of the old 25% rule then customers paid for any reinforcement if their requested capacity was over 25% of the capacity of the existing network. In these cases there would be no need for liabilities since the customer is paying for the reinforcement.
- If the requested capacity is less than 25% of the capacity of the existing network then the approach accepts that there would be no charge to the connecting customers.
  - In some cases they will be sufficient capacity and therefore no reinforcement costs
  - In some cases reinforcement will be required
- As it is an inherent feature of this option that DUoS customers would pay for any reinforcement in the situations it is needed it would follow that no liabilities would be appropriate.

3.2. Replace CAF based on LRIC

- The need for liabilities would be dependent on the actual approach developed. If this takes the form of a charge made to all connecting customers in a particular area then it would depend on whether these are paid before or after connection. If before then no liabilities would be required.

Application of Liabilities and Securities to Connections Boundary options

3.3. Standard connection charges – reinforcement

- In this option the costs of the reinforcement are socialised across connecting customers. As existing customers would not be picking up any costs of the reinforcement then there would be no need for any liabilities applied to the connecting customers

3.4 Standard connection charges – extension assets

- In this option the costs of the reinforcement are socialised across connecting customers. As existing customers would not be picking up any costs of the reinforcement then there would be no need for any liabilities applied to the connecting customers

3.5. Alternative payment options

- In this option liabilities would not fall away on energisation but would need to be in place post connection. The level of liability would reduce as progressively payments were made.
- Project specific liabilities could be calculated based on the specific reinforcement associated with the connection
- Level of securities would need to be determined in next phase of work

Appendix 4

Glossary

Distribution terms

Enhanced Scheme (DNO led)	When applying for a new connection, the network operator will provide an offer for the Minimum Cost Scheme, however there are circumstances where the network operator may elect to build a different or **Enhanced Scheme**, usually to provide other benefits to the general network. Where this is the case, the connectee is charged the lower of the connection charges applicable to the Minimum Scheme or the Enhanced Scheme.
Enhanced Scheme (customer led)	When applying for a new connection, the applicant may request that the network operator builds an **Enhanced Scheme**, requiring assets that are: 1. not required as part of the Minimum Scheme; 2. of a larger capacity than required by the Minimum Scheme; and/or 3. of a different specification than required by the Minimum Scheme. Where this is the case, the applicant will (in addition to the cost of any Extension Assets installed) be charged the full cost of any required Reinforcement plus the costs of any future operation and maintenance of the additional assets requested.
Extension Assets	These are assets which connect the existing distribution network to a customer's premises and will be charged to the applicant in full.
Minimum Scheme	In the context of a new distribution connection, the **Minimum Scheme** is the network design with the lowest overall cost which meets all technical, regulatory and safety requirements in order to provide the capacity required by the applicant.
Reinforcement	**Reinforcement** is defined as the work carried out and the assets installed that add capacity (network or fault level) to the existing shared use Transmission or Distribution System.

Transmission terms

Connection Assets	Assets solely required to connect an individual user to the transmission system and not deemed as shareable by any other party, e.g.: a) for Double Busbar connections, those single user assets connecting the user's assets and the first transmission owned substation, up to and including the Double Busbar Bay; b) for teed or mesh connections, those single user assets from the user's assets up to, but not including, the HV disconnector or equivalent point of isolation; c) for cable/overhead lines, those single user connection circuits connected at a transmission voltage =< 2km in length, not potentially shareable; and d) where customer choice influences the application of standard rules to the connection boundary, affected assets will be classed as connection assets.
Attributable Works	Means the works that are required to connect a customer's premises or other network to an existing MITS node. Such works are local to the MIS node and include: • Extension assets required to provide the connection to the MITS node; and • The works required to connect and integrate the extension assets with the MITS at the MITS node
Enabling Works	Means the minimum transmission works that are required before a premise can connect.
One Off Works	Means works on the transmission system that although directly attributable to the connection, may not give rise to additional connection assets. These works are defined as "one-offs". Liability for one-off charges is established with reference to the principles laid out below: • Where a cost cannot be capitalised into either a connection or infrastructure asset, typically a revenue cost. • Where a non-standard incremental cost is incurred as a result of a User's request, irrespective of whether the cost can be capitalised. • Termination Charges associated with the write-off of connection assets at the connection site.
Wider Works	Means works on the wider transmission system not falling within the definition of Enabling Works, which are not required specifically to facilitate a connection but are works for wider load related/non load related capex across system boundaries.
MITS Node	Means Grid Supply Point connections with two or more transmission circuits connecting at the site; or substation with more than four transmission circuits connecting at the site.

Transmission terms

User Commitment	Means the security that a generator has to provide to cover off the liabilities that the transmission system operator may incur in respect of such works should the user's connection not proceed. The User Commitment is calculated in accordance with the User Commitment Methodology set out in Section 15 of the CUSC and is derived from the **Cost of Attributable Works + relevant proportion of cost of Wider Works + Cost of one-off works.** User Commitment applies up and until the point that the connection to the generation connection is commissioned. Post connection any securities provided as User Commitment are refunded to the customer. Different security arrangements apply in respect of any deferred connection charges post connection, but such securities only apply in respect of Attributable works .
Final Sums	Similar in concept to User Commitment but relating to demand connections, It is the amount that a customer has to provide as security against the costs that the transmission operator may incur should the Construction Agreement be terminated before a connection is provided. The level of security required in respect of demand connections is set in the Final Sums Methodology. **Cost of Enabling Works + Cost of one-off works.** Security in respect of Final sums applies up and until the point that the connection to the NETS is commissioned. Post connection any securities provided under the Final Sums Methodology are refunded to the customer. Different security arrangements apply in respect of any deferred connection charges post connection, but such securities only apply in respect of Attributable works.