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Potential Impacts of Changes to the Connection Boundary

A Report for Citizens' Advice

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1 Executive Summary

This report looks at the impact of potential changes to the connection boundary proposed by Ofgem in their Minded-to consultation on their Access and Forward-looking Charges Significant Code Review (Access SCR). The purpose of the report is to assist Citizens' Advice in preparing its response to the consultation.

The report uses the worked examples of the application of the Common Connection Charging Methodology (CCCM) to examine the potential effects of the proposals. Whilst the proposals have the potential to be fairer to customers who face higher connection charges when they trigger network reinforcement, as the costs will be borne by demand customers in general, they could have an adverse effect on demand customers' use of system charges.

Whilst it is not possible to quantify the effects these changes may have; the report provides recommendations of changes which could mitigate the effects of very high reinforcement costs in advance of the wider reforms to Distribution Use of System (DUoS) charges which are expected to follow. These changes to the Minded-to proposals could be implemented in April 2023 at the same time as the change to the connection boundary is due to take effect.

2 Document purpose

Ofgem are consulting on their minded to positions for three key areas of their Access SCR: distribution connection charging, the definition and choice and choice of access rights, and transmission charges for small distributed generators.

Citizens' Advice have asked EPC to advise on the potential impacts of the proposals for distribution connection charging to inform its response to the Ofgem consultation.

2.1 Scope of work

EPC propose to take examples from the CCCM and to extrapolate them to identify potential extreme cases where high reinforcement costs are avoided by connectees under the proposed connection policy. These micro examples will be used as a basis to show the potential impact across a range of scenarios. The deliverable will be a report that explains the modelling work undertaken and the assumptions made. The report will also capture the arguments for other measures which could mitigate any adverse outcomes from these proposals. These include the potential for introducing a high-cost cap for demand, links between connection charges and DUoS (particularly the capacity charge), and the impact of changes to the connection policy for generation.

3 Background – Ofgem's Access SCR

Ofgem launched their Access SCR in December 2018 with the following scope:

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

In late 2020, it launched its Full Chain Flexibility programme to look at incentivising flexible network usage and the role that each might play. As a result of linkages between this programme and the Access SCR, it decided to pause assessing DUoS options. However, it did not think that there were the same dependencies on other aspects of the Access SCR and the consultation covers the areas which Ofgem believes can be progressed.

Under a SCR process, Ofgem are unable to provide a final decision on some parts in advance of others. It has therefore stated that it will not issue its final decision and Impact Assessment for these reforms, until it is also ready to issue a decision regarding DUoS options. However, it is thought unlikely that DUoS reforms will have progressed enough in 2021 for any substantive reforms. It is therefore expected that Ofgem will decide on these aspects and decide not to progress DUoS reforms as part of this SCR.

4 Connection Boundary Proposals

4.1 Current Approach

Connecting customers are currently charged under a 'shallowish' approach to connection charging which is set out in the Common Connection Charging Methodology (CCCM). Under this approach the connecting customer pays for:

- All of the costs for the extension assets required as part of their connection; and
- Some of the costs for any network reinforcement required to facilitate their connection.

Extension assets are the new assets to extend the existing network to the customer and reinforcement is the work needed to upgrade or expand the capacity of the existing shared network assets to facilitate the new connection. Costs for reinforcement are limited to one voltage level above the point of connection (POC) and are apportioned in accordance with rules set out in the CCCM. The exception to this one voltage rule is where costs are incurred on the transmission system. In these circumstances costs are charged to the connecting customer.

In the CCCM, the costs of reinforcement are apportioned using one of two Cost Apportionment Factors (CAFs), dependent upon which factor is driving the requirement for reinforcement. These are the 'Security CAF' which is applied where the costs are driven by either thermal capacity or voltage (or both); and the 'Fault Level CAF' which is applied where the costs are driven by Fault Level restrictions. The formulae for these factors are: -

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

$$\text{Fault Level CAF} = 3 \times \frac{\text{Fault Level Contribution}}{\text{New Fault Level Capacity}} \times 100\% \quad \text{(max 100\%)}$$

Where: -

- Fault Level Contribution is the assessment of the fault level contribution from the equipment to be connected or for an existing customer the incremental increase in fault level.
- New Fault Level Capacity is the Fault Level rating following reinforcement.
- New Network Capacity is the capacity of the Relevant Section of Network (RSN) following Reinforcement. There may be more than one RSN.
- Required Capacity is the maximum capacity agreed with the customer or for an existing customer the increase above their existing capacity.

For generation there is also a High-Cost Cap (HCC) where reinforcement costs (up to one voltage level above the POC) greater than £200/kVA are charged to the connecting customer.

The intention behind this approach is to share the cost of reinforcement between the connecting customer and the wider user base connected to the distribution system as both contribute to and benefit from the additional network capacity created by reinforcement.

4.2 Ofgem's view on shortcomings in the current arrangements

Ofgem have concerns that the current connection arrangements do not work in the best interests of customers, in particular whether they continue to provide effective signals and whether they may actually hinder the achievement of Net Zero. It summarises its issues as: -

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- *The current arrangements do not give an effective locational signal in many cases. Whilst some types of customer may have some geographic elasticity on where they customer locate (e.g. some types of generation), for most customers (typically demand) the location is driven by many factors other than the connection cost. In some cases, a high connection cost signal could result in a connection not proceeding rather than the connecting customer seeking to locate elsewhere on the network, whilst in other locations users may receive no locational pricing signal at all. For example, the location of electric vehicle charging infrastructure will be largely driven by the national road networks and the points at which consumers will need to charge their vehicles prohibitively high connection costs may inhibit the investment and therefore the deployment of electric vehicle charging infrastructure in some parts of the country. Similarly, arguments apply to industrial processes that may seek to convert from gas fired to electric power and require additional distribution network capacity. These arrangements could therefore slow down our attempts to achieve Net Zero.*
- *The current arrangements hinder the efficient development and investment in distribution networks. While other factors such as uncertainty around the ability to recover sunk investment will also have an influence, they contribute to DNOs taking an incremental and reactive approach to reinforcement as the means of facilitating new connections, rather than investing in light of anticipated wider network needs. Additionally, the current arrangements make using already connected flexible resources to offset reinforcement and facilitate new connections unattractive to customers and DNOs. If DNOs were more (or fully) responsible for funding such work, they would be better placed to consider alternative options other than reinforcement for meeting the capacity requirements of their customers. This could in turn reduce the overall requirement for traditional network investment while providing the capacity needed to facilitate new and modified connections in an efficient and timely way.*
- *Differences between current connection charging arrangements at distribution and transmission may be creating distortions and/or impacting competition between generators connecting to the different networks. Aligning the connection charging arrangements to the extent possible may help address these issues.*
- *In order to meet targets for the electrification of heat and transport, the use of heat pumps and EVs will play an important role. Installing this technology in new and existing homes will increase pressure on distribution networks. While the current arrangements mean that reinforcement triggered by a change to an existing connection is already fully funded by the DNO (subject to certain conditions), customers will face these costs if, for example, they exceed a 100A fuse size or need to move from a single to three phase connection. The cost for*

reinforcement also falls only on the customer whose connection directly results in the available network capacity being exceeded, despite earlier connections contributing to the need for reinforcement. Current arrangements therefore mean consumers could face significantly different costs depending on when they are able to connect.

4.3 Ofgem's Minded-to proposals

Ofgem's Minded-to proposals are to modify the connection boundary are as follows: -

4.3.1 Reducing the contribution to reinforcement for generation

The proposal is to reduce the contribution towards the cost of reinforcement for generation connections by amending the voltage rule so that connection customers only contribute to reinforcement at the same voltage as their point of connection. Reinforcement above the voltage level of the point of connection will be fully funded by the DNO. This will reduce the upfront cost of connection (especially where work is needed at higher voltages) but keep some signal within the upfront charge. Ofgem believe this is important given DUoS, in the absence of further reform, will not provide any signal of the costs these users place on the system (generation customers receive credits and do not face DUoS charges under the current DUoS charging methodology).

Ofgem proposes to keep the HCC but are considering the interaction with the voltage rule. It is considering two options:

- HCC only applies at the voltage of connection (i.e., the voltage rule takes precedence);
- HCC applies at the same voltage level as connection, plus one above (i.e., the HCC takes precedence).

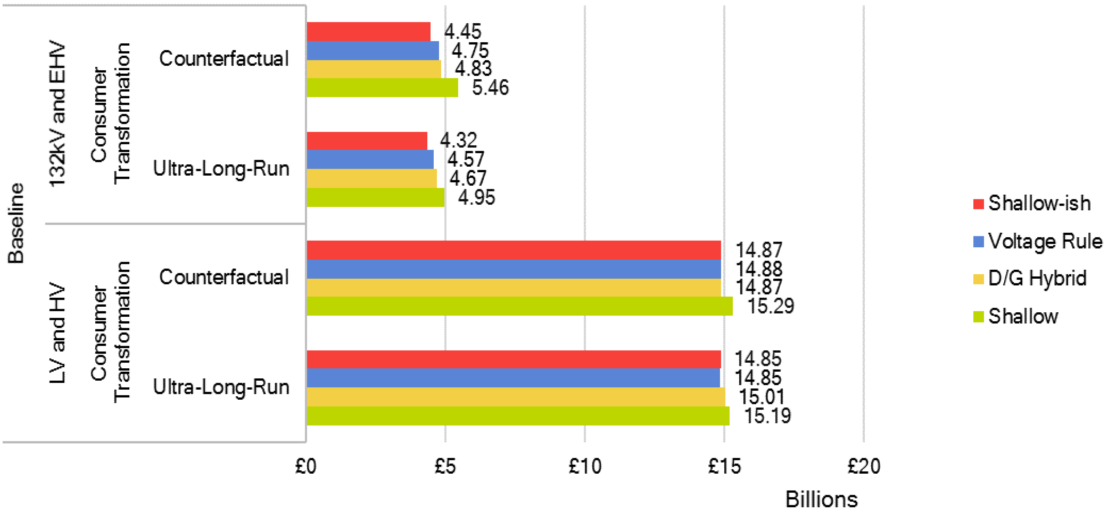
The choice of option depends on whether future DUoS charges can provide an accurate signal in high-cost areas. If not, Ofgem thinks there may be a case for the HCC taking precedence given the otherwise dampened signal that will be provided to users. Either option could be complemented by a review of the level of the HCC to ensure this is still appropriate. It is not considering whether the HCC should apply at all voltages as this would effectively be a deeper connection charge than they face today.

4.3.2 Removing the contribution to reinforcement for demand

The proposal is for DNOs to fully fund all reinforcement for demand connections. In this case, the voltage rule and CAFs would no longer be applicable. A rule such as the HCC does not apply to demand today and Ofgem has not seen any compelling evidence that suggest a strong case for introducing one at this time. However, analysis in this report does suggest that it probably is justified introducing a high-cost cap for demand if these changes are introduced.

5 Ofgem's Impact Assessment on the proposals

Ofgem has primarily made a principle-based assessment to reach its preferred assessment but also commissioned CEPA-TNEI to undertake analysis to quantify the costs or benefits of the proposals. This analysis indicates that there are likely to be additional network costs due to the changes as illustrated in the chart below. For its preferred option for the reforms, it would introduce a present value cost of £380m over 17 years relative to the status quo in the Consumer Transformation scenario. This cost is likely to be reduced if DUoS reforms were introduced. Similar outcomes were expected under different scenarios.



However, Ofgem acknowledges that the CEPA-TNEI modelling, whilst sophisticated, does not capture any benefits that different boundary depths would have for new generation or LCT uptake. To build such a model would require assumptions about elasticity of connection date and connection date where there is insufficient data.

6 Analysis of CCCM Worked Examples

The CCCM includes worked examples which demonstrate how the methodology should be applied in various scenarios. These are real life scenarios in order to better explain how the methodology would operate in practice. The worked examples that include reinforcement have been recalculated to show how the Minded-to proposals would affect the connection charge payable by new connectees. For reference, the CCCM Worked Examples that include a reinforcement component are included in Appendix 1. An additional example, 14X, has been included which applies the HCC to Example 14.

The calculations of the revised connections charges are given in Appendix 2. The output of the analysis is summarised in the table below: -

Analysis of CCCM Worked Examples with reinforcement

			Current CCCM Methodology				Minded-to Methodology				
CCCM Worked Example	**Type of Connection**	**Total Scheme Cost**	**Extension Asset Cost**	**Customer Funded Reinforcement**	**DNO Funded Reinforcement**	**Current Connection Charge**	**Customer Funded Reinforcement**	**DNO Funded Reinforcement**	**Proposed Connection Charge**	**Change in Customer Contribution**	**Change in DNO Funding**
Example 2B: New connections on a domestic housing development with interconnection b) The LV interconnection is requested by us in order to create additional network capacity (No exception).	Demand	£255,000	£207,000	£29,365	£18,635	£236,365	£0	£48,000	£207,000	-12%	158%
Example 4: Additional load application for commercial Premises (requiring a new connection from the HV network)	Demand	£177,600	£52,800	£10,140	£114,660	£62,940	£0	£124,800	£52,800	-16%	9%
Example 5: Connection of a new embedded generator that requires Reinforcement involving Security and Fault Level CAFs.	Generation	£647,400	£58,400	£84,142	£504,858	£142,542	£84,142	£504,858	£142,542	0%	0%
Example 6: Connection of Mixed Housing and Commercial Development	Demand	£10,705,000	£9,205,000	£300,000	£1,200,000	£9,505,000	£0	£1,500,000	£9,205,000	-3%	25%
Example 7A: New 3MVA Generation Connection, Fault Level Triggered Reinforcement	Generation	£575,000	£125,000	£102,857	£347,143	£227,857	£102,857	£347,143	£227,857	0%	0%
Example 8A: Connection of housing development with network Reinforcement	Demand	£783,000	£605,000	£23,117	£154,883	£628,117	£0	£178,000	£605,000	-4%	15%
Example 8B: Connection of housing development	Demand	£722,000	£542,000	£23,376	£156,624	£565,376	£0	£180,000	£542,000	-4%	15%
Example 8C: Connection of housing development with remote network Reinforcement	Demand	£715,000	£610,000	£13,644	£91,356	£623,644	£0	£105,000	£610,000	-2%	15%
Example 9: a) Minimum Scheme	Demand	£12,000	£2,000	£2,000	£8,000	£4,000	£0	£10,000	£2,000	-50%	25%
Example 9: b) Enhanced Scheme 1	Demand	£17,000	£2,000	£1,500	£13,500	£3,500	£0	£15,000	£2,000	-43%	11%
Example 9: c) Enhanced Scheme 2	Demand	£27,000	£2,000	£2,500	£22,500	£4,000	£0	£25,000	£2,000	-50%	11%
Example 10: A new connection application for commercial Premises on a meshed 11kV distribution system requiring Reinforcement.	Demand	£1,449,000	£135,000	£298,771	£1,015,229	£433,771	£0	£1,314,000	£135,000	-69%	29%
Example 11: Non-Secure Connection With Non-Secure Reinforcement	Generation	£780,000	£280,000	£52,000	£448,000	£332,000	£52,000	£448,000	£332,000	0%	0%
Example 12: Non-Secure Connection With Secure Reinforcement	Demand	£1,630,000	£130,000	£500,000	£1,000,000	£630,000	£0	£1,500,000	£130,000	-79%	50%
Example 13: Secure Connection With Secure Reinforcement	Demand	£365,000	£115,000	£69,500	£180,500	£184,500	£0	£250,000	£115,000	-38%	39%
Example 14: New 25kVA Generation Connection, Voltage Rise Triggered Reinforcement	Generation	£17,000	£2,000	£9,375	£5,625	£11,375	£0	£15,000	£2,000	-82%	167%
Example 14X: New 25kVA Generation Connection, Voltage Rise Triggered Reinforcement (with HCC applied)	Generation	£17,000	£2,000	£13,125	£1,875	£15,125	£10,000	£5,000	£12,000	-21%	167%
Example 15: New 2MVA Generation Connection, Voltage Rise Triggered	Generation	£245,000	£45,000	£66,666	£133,334	£111,666	£66,666	£133,334	£111,666	0%	0%
Example 16: New 250kVA Generation Connection, Voltage Rise Triggered Reinforcement	Generation	£76,000	£51,000	£25,000	£0	£76,000	£25,000	£0	£76,000	0%	0%

In broad terms this analysis supports the findings from the Ofgem analysis which show that historically a large proportion (over 90% for both demand and generation) of current connection charges are from the extension assets, the treatment of which is unchanged by the proposals. This could imply that the Minded-to proposal would have little impact on the cost paid by customers in general.

Whilst this may be the case historically, it may not be true in the future. Quotations which included much higher levels of reinforcement may not have been accepted and hence are excluded from the historical data. As networks become more fully utilised due to decarbonisation, the reinforcement component may become larger.

To get a better understanding of the impact of the changes, it is worth looking in more detail at a few of the examples.

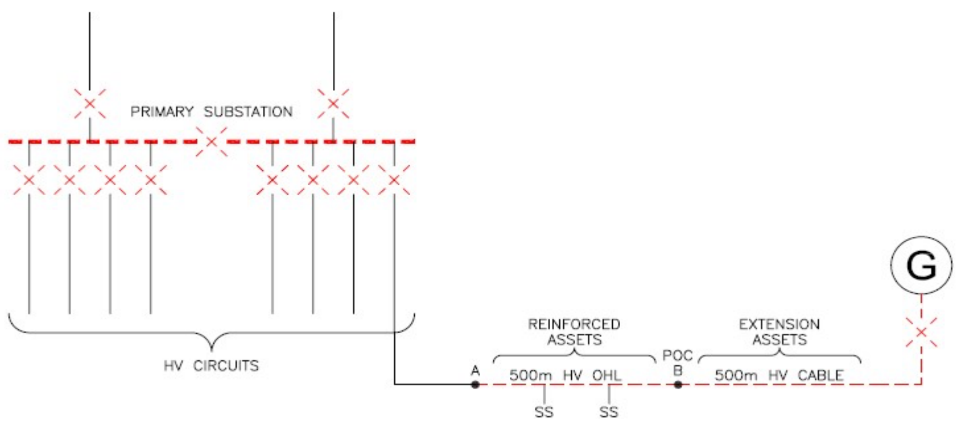
6.1 Example 5: Connection of a new embedded generator that requires Reinforcement involving Security and Fault Level CAFs.

6.1.1 Example Description

A Customer requests a connection to a generator with a Required Capacity for export purposes of 3MVA. The Fault Level contribution at the primary substation from the generation connection is 10MVA.

The POC is to the existing HV network at point B and it is proposed to install 500m of HV underground cable from the POC to the Customer's installation. This is a non-secure connection that requires reinforcement of a non-secure network.

The connection requires the Reinforcement of 500m of HV overhead line between points A and B for a thermal capacity requirement and replacement of the existing 11 panel HV switchboard at the primary substation in order to increase its fault level rating from 150MVA to 350MVA. However, the new fault level will be limited by the fault level rating of the local network of 250MVA.



Reinforcement:

The RSN is the HV network from the primary substation to Point B.

Security CAF calculation: the numerator in the CAF calculation is based upon the Required Capacity of the Customer, i.e. 3MVA. The denominator is based on the New Network Capacity following Reinforcement, which is 7.6MVA, i.e. after Reinforcement, in this particular case, the section of cable with the lowest rating.

The RSN is the 11kV switchboard at the primary substation.

Fault Level CAF calculation: The numerator in the CAF calculation is based upon the Fault

Level contribution from the Customer's new generator connection, in this Example 10MVA. The denominator is based upon the New Fault Level Capacity, which is the lower of the Fault Level capacity of the new HV switchboard, 350MVA or of the local system, 250MVA in this Example.

The Connection Charge for this Scheme under the current CCCM rules is calculated as follows:

Example 5: Connection charge calculation under both current CCCM Rules and the Minded-to proposals GENERATION

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	3/7.6 x 100% = 39.50% Security CAF	£19,342	£29,658
Replacement of existing 11 panel 11kV switchgear	£540,000	3 x (10/250) x 100% = 12.0% Fault Level CAF	£64,800	£475,200
Total Reinforcement Cost	**£589,000**		**£84,142**	**£504,858**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£142,542**	

6.1.2 Example Commentary

With this example the connection charge payable by the generator would be the same under the minded-to proposals as under the current methodology. The reinforcement cost per kVA is £196.33 (£589,000/3000kVA) which is just under the £200/kVA HCC and all the reinforcement is at the same voltage as the POC of the new generator.

Most of the cost of the reinforcement would be borne by demand customers whilst it provides no new demand capacity. As demand customers are paying for the reinforcement it is probably more appropriate to calculate the cost in terms of the cost of capacity for demand customers. This is more difficult for fault-level driven reinforcement where it is unlikely to provide additional demand capacity, hence it may be necessary to continue to calculate this in terms of generation capacity.

This example can be expanded to illustrate other potential effects of the proposals. If works had been required to upgrade the primary transformers to say 24MVA firm at a cost of £1.5 million (using illustrative costs from example 12), then the revised connection charge would have been as shown in the table below: -

Example 5: Connection charge calculation with additional reinforcement under current CCCM Rules GENERATION

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	3/7.6 x 100% = 39.50% Security CAF	£19,355	£29,645
Replacement of existing 11 panel 11kV switchgear	£540,000	3 x (10/250) x 100% = 12.00% Fault Level CAF	£64,800	£75,200
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£11,000	3.0 / 24.0 x 100% = 12.50% Security CAF	£1,375	£9,625
Reinforcement in Excess of HCC	£1,489,000		£1,489,000	£0
Total Reinforcement Cost	**£2,089,000**		**£1,574,530**	**£514,470**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£1,632,930**	

Under the Minded-to proposals, with the HCC applied using the one voltage rule then the customer contribution would reduce by £1,375 as the bulk of the contribution to the transformer upgrade would be covered by the HCC. This calculation is shown in the table below-

Example 5: Connection charge calculation with additional reinforcement under Minded-to proposals using one voltage rule HCC GENERATION

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	3/7.6 x 100% = 39.50% Security CAF	£19,355	£29,645
Replacement of existing 11 panel 11kV switchgear	£540,000	3 x (10/250) x 100% = 12.00% Fault Level CAF	£64,800	£75,200
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£11,000	n/a	£0	£11,000
Reinforcement in Excess of HCC	£1,489,000		£1,489,000	£0
Total Reinforcement Cost	**£2,089,000**		**£1,573,155**	**£515,845**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£1,631,555**	

If the HCC were applied to the same voltage only, then none of the transformer upgrade costs would be borne by the connecting generator but would be borne by demand customers. This calculation is shown in the table below: -

Example 5: Connection charge calculation with additional reinforcement under Minded-to proposals using same voltage rule HCC GENERATION

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	3/7.6 x 100% = 39.50% Security CAF	£19,355	£29,645

Replacement of existing 11 panel 11kV switchgear	£540,000	3 x (10/250) x 100% = 12.00% Fault Level CAF	£64,800	£75,200
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£11,000	n/a	£0	£11,000
Reinforcement in Excess of HCC	£1,489,000		£0	£1,489,000
Total Reinforcement Cost	**£2,089,000**		**£84,155**	**£2,004,845**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£142,555**	

Finally, the operation of the HCC under the current methodology is illustrated by increasing the size of the generator to 5MVA (assuming the fault level contribution increases proportionately to 16.7MVA). Under the current CCCM methodology, the customer contribution to the reinforcement would be reduced to £1,314,862 from £1,574,530 for a 3MVA connection. This reduction, by £260k, is shown in the calculation below: -

Example 5: Connection charge calculation with additional reinforcement and higher generation capacity under current CCCM Rules GENERATION

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	5/7.6 x 100% = 65.79% Security CAF	£32,237	£16,763
Replacement of existing 11 panel 11kV switchgear	£540,000	3x(16.7/250) x 100% = 20.00% Fault Level CAF	£108,000	£432,000
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£411,000	5.0 / 24.0 x 100% = 20.83%	£85,265	£325,375
Reinforcement in Excess of HCC]	£1,089,000		£1,089,000	£0
Total Reinforcement Cost	**£2,089,000**		**£1,314,862**	**£774,128**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	

HV circuit breaker at Customer's substation	£10,000	n/a	£10,000
Non-Contestable Work			
HV pole top termination	£1,400	n/a	£1,400
Total Extension Asset Cost	£58,400		**£58,400**
Total Customer Contribution			**£1,373,262**

In this case, under the Minded-to proposals, with the HCC applied using the one voltage rule then the customer contribution would reduce by £85,625 as the bulk of the contribution to the transformer upgrade would be covered by the HCC.

Example 5: Connection charge calculation with additional reinforcement and higher generation capacity under Minded-to proposals and one voltage rule HCC GENERATION

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	5/7.6 x 100% = 65.79% Security CAF	£32,237	£16,763
Replacement of existing 11 panel 11kV switchgear	£540,000	3x(16.7/250) x 100% = 20.00% Fault Level CAF	£108,000	£432,000
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£411,000	n/a	£0	£411,000
Reinforcement in Excess of HCC]	£1,089,000		£1,089,000	£0
Total Reinforcement Cost	**£2,089,000**		**£1,229,237**	**£859,763**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£1,287,637**	

Again, if the HCC were applied to the same voltage only, then none of the transformer upgrade costs would be borne by demand but would be borne by demand customers. This results in the connection charge being £1,174,625 lower under the Minded-to proposals.

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Example 5: Connection charge calculation with additional reinforcement and higher generation capacity under Minded-to proposals and same voltage rule HCC GENERATION

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Re-conductor of 500m of HV overhead line	£49,000	5/7.6 x 100% = 65.79% Security CAF	£32,237	£16,763
Replacement of existing 11 panel 11kV switchgear	£540,000	3x(16.7/250) x 100% = 20.00% Fault Level CAF	£108,000	£432,000
Installation of 2 x 24 MVA 33/11 kV transformers (within HCC)	£411,000	n/a	£0	£411,000
Reinforcement in Excess of HCC]	£1,089,000		£0	£1,089,000
Total Reinforcement Cost	**£2,089,000**		**£140,237**	**£1.948,763**
Extension Assets:				
Contestable Work				
Installation of 500m HV cable	£47,000	n/a	£47,000	
HV circuit breaker at Customer's substation	£10,000	n/a	£10,000	
Non-Contestable Work				
HV pole top termination	£1,400	n/a	£1,400	
Total Extension Asset Cost	£58,400		**£58,400**	
Total Customer Contribution			**£198,637**	

6.1.3 Example Conclusions

The original CCCM Example shows the potential issues with the current CCCM and the Minded-to proposals. The generator connection requires significant reinforcement of over £500k which is funded by demand customers. However, as the bulk of the reinforcement cost is driven by fault level, this reinforcement is unlikely to benefit demand customers. As the generator is connected at HV it would also receive credits, again paid for by demand customers, whilst it is increasing not reducing costs.

The additional scenario, where reinforcement of the primary substation is required, demonstrates that this could be exacerbated unless an HCC applies to one voltage level above the POC, and the cap is triggered. It is doubtful whether an HCC operating solely at the same voltage level would have any meaningful effect.

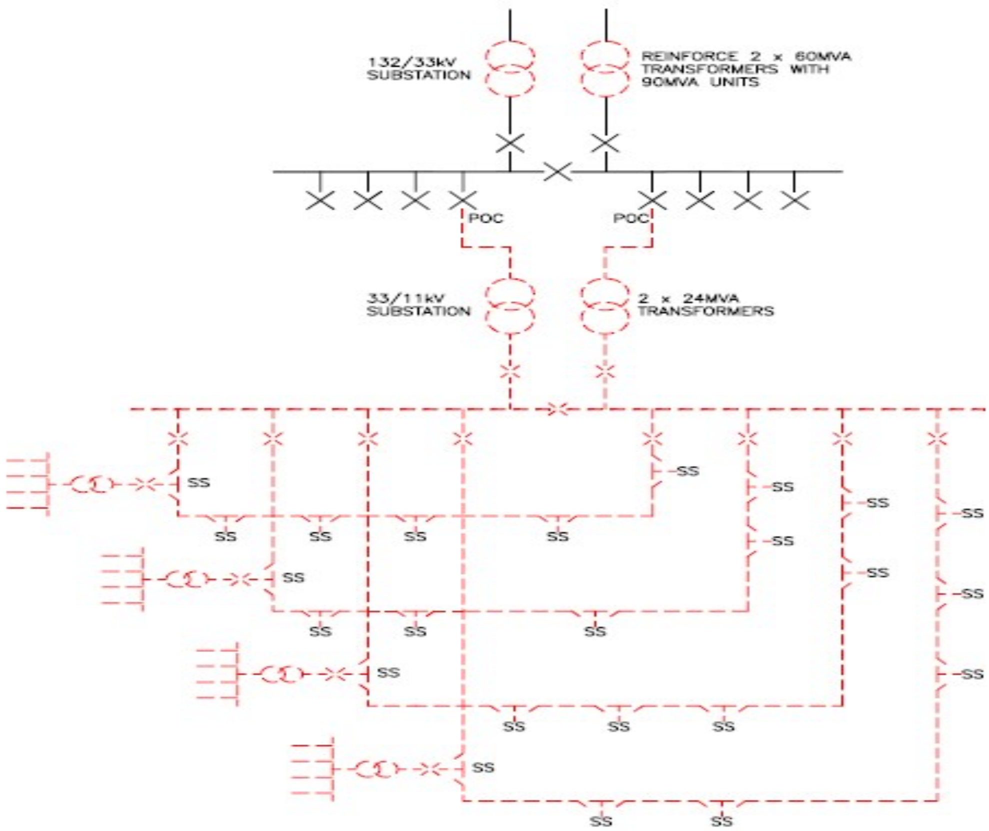
The effect of increasing the size of generator would mean even more costs being borne by demand customers and more credits being paid to generators from demand customers too. This is because the HCC is calculated in respect of the size of the generator rather than the amount of capacity created, due to the HCC being a mechanism derived for the distributed generation incentive scheme which operated in Distribution Price Control 5.

This analysis indicates that Ofgem should: -

- Reconsider whether it is appropriate for the Minded-to proposals to make the connection charge boundary shallower for generation as this has the potential for increasing costs to demand customers
- If Ofgem decides to proceed with the proposals it should consider the following mitigations to maintain some cost signals on generators in the absence of DUoS reforms
- Retain the HCC to apply at one voltage level above the POC
- Apply the HCC based on the cost additional demand capacity created. Consideration needs to be given on how the cap should apply to fault level reinforcement. This would require the current £200/kVA to be recalculated.
- Remove generator DUoS credits in the CDCM at locations where generator reinforcement has occurred or is likely to occur.

6.2 Example 6: Connection of Mixed Housing and Commercial Development

6.2.1 Example Description



The Customer requests 18MVA for a new mixed housing & commercial development site which comprises of 7,000 plots and a mixture of small commercial Premises. The POC on the network will be at the two existing 33kV circuit breakers located at the 132/33kV substation approximately 600m from the site boundary. In order to accommodate the Required Capacity, it will be necessary to reinforce the two 60MVA, 132/33kV, transformers with 90MVA transformers. It will then be necessary to extend the network and establish a 2 by 24MVA transformer 33/11kV substation on site with an extendable HV board in this new substation. The HV board will comprise of 2 incomer circuit breakers, 1 bus section and 8 outgoing circuit breakers. From this substation there will be 3km of HV cable required to supply 24 substations. From each of these 24 substations there will be associated LV cable and services as required.

Reinforcement:

The RSN for the Reinforcement is the transformers at the existing 132/33kV substation

Security CAF calculation: the numerator in the CAF calculation is based upon the Required Capacity of the Customer, i.e. 18MVA. The denominator is based on the secure New Network Capacity following Reinforcement, i.e. 90MVA.

Fault Level CAF calculation: This Scheme does not have any significant Fault Level contribution to the existing shared use distribution network and Fault Level CAF is therefore not applicable here.

The Current Connection Charge for this Scheme is calculated as follows:

Example 6 Connection charge calculation under current CCCM Rules DEMAND

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Replace two 60MVA, 132/33kV transformers with two 90MVA transformers.	£1,500,000	18/90 X 100% 0.2	£300,000	£1,200,000
Total Reinforcement Cost	£1,500,000		**£300,000**	**£1,200,000**
Extension Assets:				
Contestable Work				
600m of 2 by 33kV cable	£180,000	n/a	£180,000	
3000m of HV circuits, 24 HV/LV substations, LV cable and services	£7,000,000	n/a	£7,000,000	
2 by 24MVA transformer substation	£2,000,000	n/a	£2,000,000	
Non-Contestable Work				
Terminate two 33kV cables on to two existing 33kV circuit breakers.	£25,000	n/a	£25,000	

Total Extension Asset Cost	£9,205,000		**£9,205,000**
Total Customer Contribution			**£9,505,000**

6.2.2 Example Commentary

Under Ofgem's proposals, there would no longer be a contribution to the 132/33kV reinforcement costs. As the overall scheme costs are high, this reduction has a modest impact on the overall connection charge reducing the charge by £300k to £9,205k (or £43 per plot).

Example 6: Connection charge calculation under Minded-to proposals DEMAND

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Replace two 60MVA, 132/33kV transformers with two 90MVA transformers.	£1,500,000	n/a	£0	£1,500,000
Total Reinforcement Cost	£1,500,000		**£0**	**£1,500,000**
Extension Assets:				
Contestable Work				
600m of 2 by 33kV cable	£180,000	n/a	£180,000	
3000m of HV circuits, 24 HV/LV substations, LV cable and services	£7,000,000	n/a	£7,000,000	
2 by 24MVA transformer substation	£2,000,000	n/a	£2,000,000	
Non-Contestable Work				
Terminate two 33kV cables on to two existing 33kV circuit breakers.	£25,000	n/a	£25,000	
Total Extension Asset Cost	£9,205,000		**£9,205,000**	
Total Customer Contribution			**£9,205,000**	

This type of scheme could become more common and could apply to developments with much smaller number of plots if the developments need to accommodate electric vehicle charging and other low carbon technologies such as heat pumps. It is unlikely any of these savings will be passed through to end customers though nor do they seem significant enough to affect a location decision. Whilst in theory, retaining the signal could encourage developers to invest in technologies such as storage to reduce the impact on the upstream network, it is unlikely to be large enough for developers to deploy such complexity.

This is an example of the features of the existing approach. With such a large scheme with most end users point of supply at low voltage, the developer and by extension the end users, will be required to fund the full capital cost up to the 33kV network and a contribution to the 132/33kV transformers as well. These customers will also contribute to these costs through their ongoing use of system charges.

6.2.3 Example Conclusions

In the current CCCM, some customers (through the developer) could fund significant parts of the network though their connection charge (both the extension asset component and the reinforcement comment) whilst paying the same use of system charges as customers who have made far smaller contributions, e.g. just the service cable for a single connection.

The removal of the contribution to reinforcement is unlikely to influence location decisions as there are many other factors that the developer would have to take into consideration and extension asset charges are likely to remain significant in any case.

This example indicates that the Ofgem proposals for demand should be supported. Costs are shared currently as all users pay the same charges irrespective of the assets that were funded at the time of connection. Costs being shared increases fairness and removes the lottery of where people are connected and the specific status of the network at the time the connection application is made. If there is spare capacity at the time of connection then the customer would not have to pay, if there is not the customer would be required to pay a contribution though both would pay the same DUoS charges.

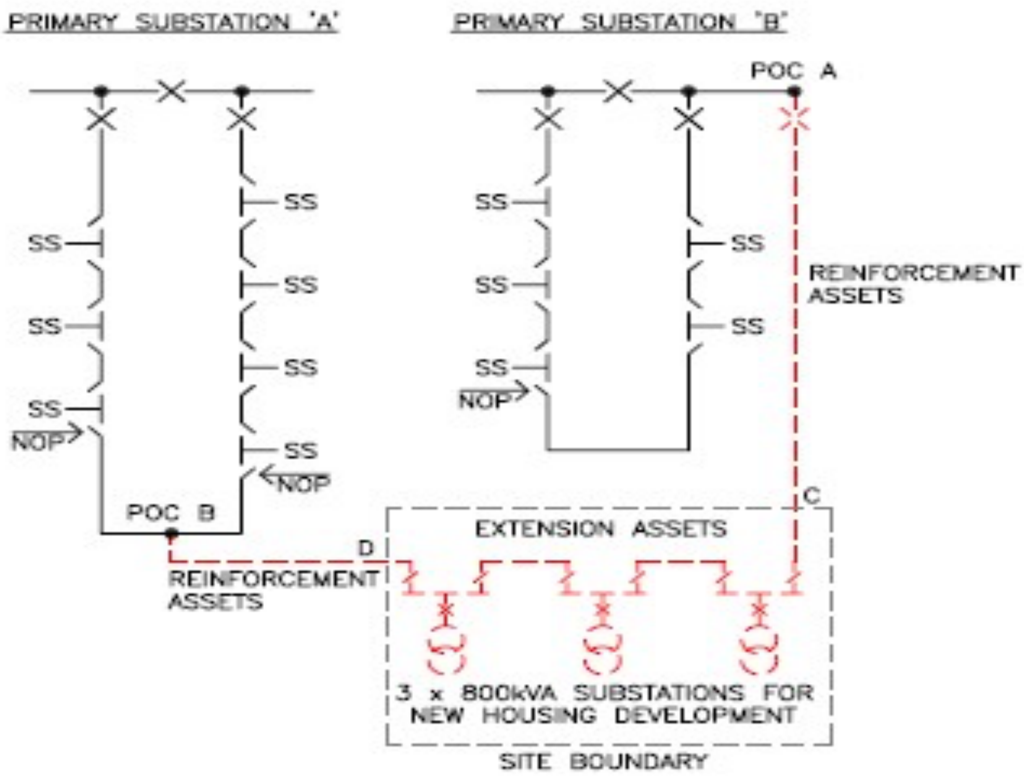
It is noted however, that in examples like this where connection charges are paid by a developer and not the end user there is no guarantee that any reductions will be passed on. This may be particularly true for housing developments where any savings form part of a much larger cost base.

6.3 Example 8B: Connection of housing development

6.3.1 Example Description

A new housing development has a Required Capacity of 2MVA to serve 900 plots. The local 11kV feeder has a network capacity of 7.7MVA based upon the limitation of the existing 400 Amp circuit breakers at Primary Substation A. The existing load on the circuit is 7.6MVA. It is therefore not possible to connect the new load to this circuit without Reinforcement works. The Minimum Scheme is to connect the new load to the new 11kV feeder from Primary Substation B and provide interconnection to an existing secure 11kV feeder from Primary Substation A. In this Example 600m of 11kV cable on site (between Points C and D) is required to provide connectivity within the development and is considered to be Extension Assets.

The figure below shows the proposed network.



The assets connecting POC A and POC B add capacity to the existing network, so would normally be treated as Reinforcement. These comprise –

- the assets between the Customer's site and POC A (POC A to point C);
- the assets between the Customer's site and POC B (POC B to point D); and
- the 600m of 11kV cable on site.

The three 800kVA substations are not considered to provide connection between POC A and POC B. The 600m of 11kV cable on site is additional network length to provide connectivity between multiple exit points on the Customer's site. Therefore, Exception 5 applies and the 600m of 11kV cable on site will be treated as Extension Assets and its costs will charged in full to the customer. No exceptions apply to the assets between POC A and point C and POC B and point D. Therefore, these will be treated as Reinforcement and their costs will be apportioned.

Reinforcement:

The RSN for the Reinforcement

The RSN is considered to be the secure three feeder 11kV network comprising the two feeders from Primary Substation A and the new feeder from Primary Substation B. As in the above example the numerator in the CAF calculation is based upon the Required Capacity of the new development, i.e., 2MVA. In this case, however the work to provide the connection will increase the capacity of the existing shared use

Distribution System from 7.7MVA to 15.4MVA. The New Network Capacity (under secure N -1 conditions) following the Reinforcement works is equal to (3 – 1) x 7.7MVA = 15.4MVA

The Connection Charge for this Scheme is calculated as follows:

Example 8B: Connection charge calculation under current CCCM Rules DEMAND

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Works				
1 new 11kV Circuit Breaker tailed out from primary substation B	£45,000	2/15.4 x 100% = 13.00%	£5,844	£39,156
2 by 11kV closing joints	£5,000	As above	£649	£4,351
700m of 11kV cable from primary B to site	£70,000	As above	£9,091	£60,909
600m of 11kV cable from POC B to site	£60,000	As above	£7,792	£52,208
Total Reinforcement Cost	**£180,000**		**£23,376**	**£156,624**
Extension Assets:				
Contestable Works				
600m of 11kV cable on site	£60,000	n/a	£60,000	
3 by 800KVA unit Substation	£150,000	n/a	£150,000	
On site LV mains and services	£330,000	n/a	£330,000	
Non-Contestable Work				
2 by 11kV cable box terminations	£2,000	n/a	£2,000	
Total Extension Asset Cost	**£542,000**		**£542,000**	
Total Customer Contribution			**£565,376**	

6.3.2 Example Commentary

Again, under Ofgem's Minded-to proposals, there would no longer be a contribution to the 11kV reinforcement costs. This reduction has a modest impact on the overall connection charge reducing the charge by £23k to £542k (or £26 per plot).

Example 8B: Connection charge calculation under Minded-to proposals DEMAND

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Works				
1 new 11kV Circuit Breaker tailed out from primary substation B	£45,000	n/a	£0	£45,000
2 by 11kV closing joints	£5,000	n/a	£0	£5,000
700m of 11kV cable from primary B to site	£70,000	n/a	£0	£70,000
600m of 11kV cable from POC B to site	£60,000	n/a	£0	£60,000

Total Reinforcement Cost	**£180,000**		**£0**	**£180,000**
Extension Assets:				
Contestable Works				
600m of 11kV cable on site	£60,000	n/a	£60,000	
3 by 800KVA unit Substation	£150,000	n/a	£150,000	
On site LV mains and services	£330,000	n/a	£330,000	
Non-Contestable Work				
2 by 11kV cable box terminations	£2,000	n/a	£2,000	
Total Extension Asset Cost	**£542,000**		**£542,000**	
Total Customer Contribution			**£542,000**	

With this is example, where most end users point of supply is at low voltage, the developer (and therefore by extension the end users) will be required to fund the full capital cost up to the 11kV network through the Extension Asset component of their connection charge. In the previous example the end users were also funding the 33kV network and primary transformers supplying them though all these customers pay the same ongoing use of system charges.

Again, this type of reinforcement could be needed for much smaller developments in future due to the need to accommodate low carbon technologies.

6.3.3 Example Conclusions

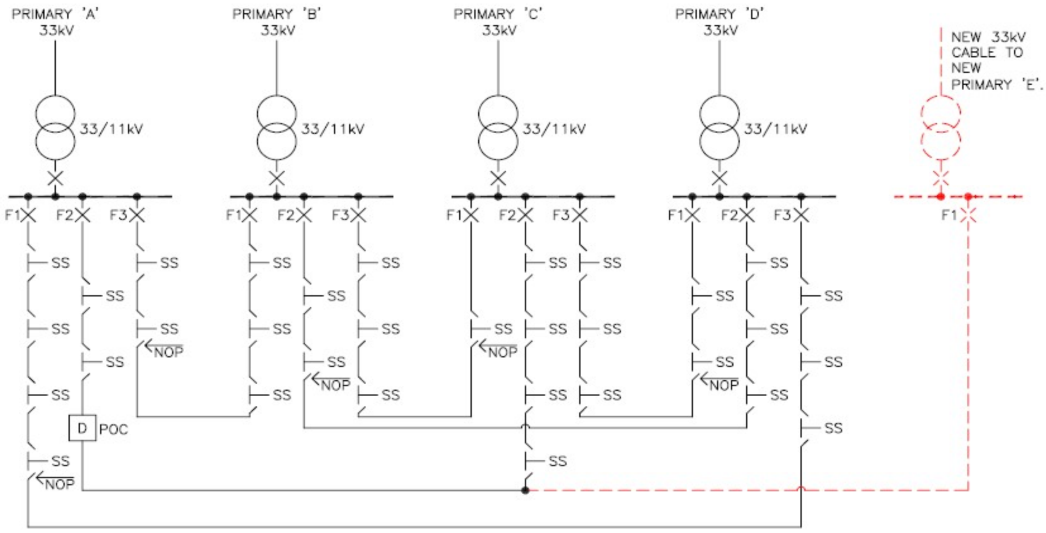
This example further supports the conclusions above that the Minded-to proposals increase fairness and even with these proposals customers will still be required to make contributions to the costs of different parts of the network whilst paying the same use of system charges.

Again, it is noted however, that in examples like this there is no guarantee that any reductions will be passed on to customers.

6.4 Example 10: A new connection application for commercial Premises on a meshed 11kV distribution system requiring Reinforcement.

6.4.1 Example Description

A Customer requests a new connection to a commercial premise requiring a 4MVA HV metered connection. The local 11kV network is of a meshed design whereby the 11kV network is supplied from single 33/11kV primary transformers via 33kV radial feeds as shown below.



The existing network consists of four 10MVA primary transformer substations and associated 11kV switchgear. A new connection of 4MVA has been requested in the vicinity of F2 from Primary A.

The existing relevant primary transformer group is loaded to its secure capacity so the primary transformer group will require Reinforcement to enable the new connection to progress.

To provide the Required Capacity, the 11kV network will be reinforced by the installation of a new primary substation connected to the nearest 33kV circuit. The new primary substation (Primary E) will contain a 10MVA transformer, associated 11kV switchgear and a new 11kV (7.7 MVA) cable installed to interconnect into the existing 11kV network (from F2 at Primary A to F2 at Primary C).

Reinforcement:

Security CAF calculation: In this example there are two different security CAFs applied. This is because the RSN is different when considering the new network capacity in respect of different elements of the Reinforcement works.

The RSN for the Reinforcement comprising the 11kV Cable Works:

For the 11kV cable assets the RSN is considered to be the secure three feeder 11kV network from Primary A (Feeder 2), Primary C (Feeder 2) and Primary E (Feeder 1). In this case the New Network Capacity (under secure N -1 conditions) following the Reinforcement works is equal to

(3 – 1) x 7.7MVA = 15.4MVA

This is due to the fact that following the Reinforcement work both of the existing circuits; Primary A, Feeder 2 and Primary C, Feeder 2 can be loaded to their full capacity and will have the newly installed clean feeder from Primary E to act as a back feed to meet the requirements of P2/6.

The security CAF for these assets will therefore be 4/15.4 X 100% = 26.0%

<u>The RSN for the Reinforcement comprising the Primary substation assets:</u>

In this instance the RSN comprises Primary A, C and E within the group that can be used to supply the customer. The New Network Capacity of this RSN (under secure N -1 conditions) following the Reinforcement works is equal to 17.7MVA. (10MVA from either Primary A or Primary C and 7.7MVA from Primary E which is limited by the single 11kV cable connected to it.

The security CAF for these assets will therefore be 4/17.7 X 100% = 22.6%

Fault Level CAF calculation: This Scheme does not have any significant Fault Level contribution to the existing shared use distribution network and Fault Level CAF is therefore not applicable here.

The Connection Charge for this Scheme is calculated as follows:

<u>Example 10: Connection charge calculation under current CCCM Rules DEMAND</u>

<u>Reinforcement</u>:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Works				
500m 11kV cable from new primary substation E	£50,000	4/15.4 X 100% 0.26	£12,987	£37,013
1 by 11kV closing joints	£4,000	As above	£1,039	£2,961
11kV switchgear at new Primary E	£80,000	4/17.7 X 100% 0.226	£18,079	£61,921
Primary transformer	£600,000	As above	£135,593	£464,407
2.5km of 33kV cable installation	£500,000	As above	£112,994	£387,006
33kV Circuit Breaker	£70,000	As above	£15,819	£54,181
33kV Terminations	£10,000	As above	£2,260	£7,740
Total Reinforcement Cost	£1,314,000		**£298,771**	**£1,015,229**
Extension Assets:				
Contestable Work				
HV ring main unit	£20,000	n/a	£20,000	
HV metering unit	£10,000	n/a	£10,000	
500m of 11kV cable	£100,000	n/a	£100,000	
Non-Contestable Work				
2 by 11kV closing joints	£5,000	n/a	£5,000	
Total Extension Asset Cost	£135,000		**£135,000**	
Total Customer Contribution			**£433,771**	

6.4.2 Example Commentary

Again, under Ofgem's Minded-to proposals, there would no longer be a contribution to the reinforcement costs. The calculation of the connection charge under the Minded-to proposals is shown in the table below.

Example 10: Connection charge calculation under the Minded-to proposals DEMAND

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Works				
500m 11kV cable from new primary substation E	£50,000	n/a	£0	£50,000
1 by 11kV closing joints	£4,000	n/a	£0	£4,000
11kV switchgear at new Primary E	£80,000	n/a	£0	£80,000
Primary transformer	£600,000	n/a	£0	£600,000
2.5km of 33kV cable installation	£500,000	n/a	£0	£500,000
33kV Circuit Breaker	£70,000	n/a	£0	£70,000
33kV Terminations	£10,000	n/a	£0	£10,000
Total Reinforcement Cost	£1,314,000		**£0**	**£1,314,000**
Extension Assets:				
Contestable Work				
HV ring main unit	£20,000	n/a	£20,000	
HV metering unit	£10,000	n/a	£10,000	
500m of 11kV cable	£100,000	n/a	£100,000	
Non-Contestable Work				
2 by 11kV closing joints	£5,000	n/a	£5,000	
Total Extension Asset Cost	£135,000		**£135,000**	
Total Customer Contribution			**£135,000**	

In this example the customer sees a significant reduction in the connection charge from £433,371 to £135,000 (69%) or around £75k/MVA. The Ofgem impact assessment acknowledged that there was little evidence on the price elasticity of demand customers and other non-electricity costs are likely to play a larger part in deciding where to request a new connection.

Such large reductions would also apply to existing customers wanting to increase their capacity requirements, for example to decarbonise their processes, which is the intention of the Ofgem proposal. However, these customers may be able to increase their capacity without the need to strengthen their connection assets and therefore such increases would effectively be free of charge. Whilst customers would make some contribution to this increased capacity through their DUoS charges, an unintended consequence of the proposals could be that customers ask for more capacity than they actually need as there are limited costs in doing this.

If the cost of the reinforcement is calculated relative to the capacity requested, this works out at £328.5/kVA (Reinforcement cost £1,314k divided by 4MVA capacity) which would be deemed excessive for a generation customer. This would indicate that it is probably justified to protect customers generally from excessive reinforcement costs by introducing an HCC for demand. How this is calculated needs further consideration and is probably more appropriate if the costs are relative to the capacity created.

6.4.3 Example Conclusions

For new connections the Minded-to proposals are likely to work as intended and the connection charge from the extension assets will still provide some signal to customers. However, the above example indicates that for existing customers there is effectively a minimal pricing signal, and an unintended consequence could be to encourage users to request more capacity than is needed.

There is also the potential that customers generally could be asked to fund very expensive reinforcements that benefit few users.

This analysis indicates that Ofgem should: -

- Enhance the signal in DUoS faced by existing (and new customers) by increasing capacity charges and reducing usage charges. This is a relatively simple change and could be introduced as a tactical change, at the same time as these changes, in advance of wider DUoS reforms.
- Introduce a HHC for demand to protect customers in general from excessive reinforcement costs.

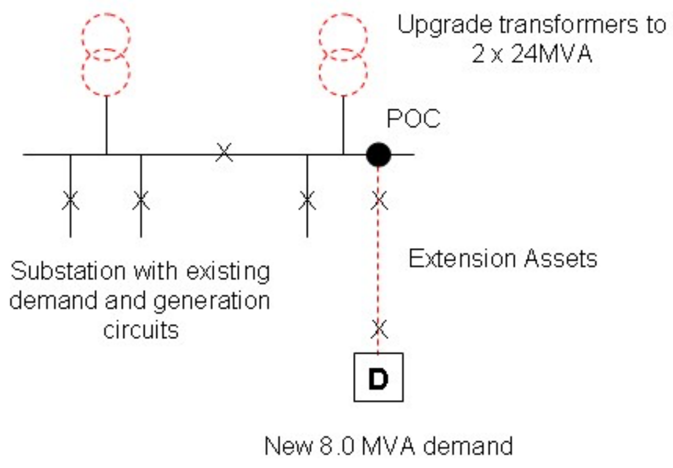
6.5 Example 12: Non-Secure Connection With Secure Reinforcement

6.5.1 Example Description

A Customer requests a new connection to industrial premises requiring an 8 MVA metered demand connection. In this case, the Customer has exercised their option to request non-secure Extension Assets in the provision of the connection.

The existing network comprises a substation which has 2 x 15 MVA transformers. The Minimum Scheme to provide the connection is to install 750m of 11 kV cable from the substation to the industrial premises, as Extension Assets. As there is insufficient capacity available from the existing 2 x 15 MVA transformers to provide the new connection, it will be necessary to upgrade the transformers to 2 x 24 MVA units. Both transformers at the substation must be upgraded to ensure the 11kV network load can be maintained during planned or unplanned outages of one of the transformers.

Although the Customer wishes to accept a nonsecure connection, the substation must provide secure capacity to its Group Demand (which includes the Customer) to comply with the requirements of Engineering Recommendation P2/6. As the Extension Assets will be provided solely for the Customer, these can be provided on the basis of a single circuit to provide a non-secure connection, at the Customer's request.



Reinforcement:

The numerator in the CAF calculation is the Required Capacity of the new demand, which is 8.0 MVA.

The Relevant Section of Network in this case is the transformers at the substation. The New Network Capacity is the secure capacity of the transformers, which is 24 MVA. This is the denominator in the CAF calculation.

The Connection Charge for this Scheme is calculated as follows:

Example 12: Connection charge calculation under current CCCM Rules DEMAND

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Installation of 2 x 24 MVA 33/11 kV transformers	£1,500,000	8.0 / 24.0 x 100% = 33.33%	£500,000	£1,000,000
Total Reinforcement Cost	**£1,500,000**		**£500,000**	**£1,000,000**
Extension Assets:				
Contestable Work				
Installation of 750m 11kV cable	£75,000	n/a	£75,000	
Installation of 11kV metering circuit breaker	£50,000	n/a	£50,000	
Non-Contestable Work				

Joints to 11kV network	£5,000	n/a	£5,000
Total Extension Asset Cost	**£130,000**		**£130,000**
Total Customer Contribution			**£630,000**

6.5.2 Example Commentary

Again, under Ofgem's Minded-to proposals, there would no longer be a contribution to the reinforcement costs. The calculation of the connection charge under the Minded-to proposals is shown in the table below.

Example 12: Connection charge calculation under the Minded-to proposals DEMAND

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Installation of 2 x 24 MVA 33/11 kV transformers	£1,500,000	n/a	£0	£1,500,000
Total Reinforcement Cost	**£1,500,000**		**£0**	**£1,500,000**
Extension Assets:				
Contestable Work				
Installation of 750m 11kV cable	£75,000	n/a	£75,000	
Installation of 11kV metering circuit breaker	£50,000	n/a	£50,000	
Non-Contestable Work				
Joints to 11kV network	£5,000	n/a	£5,000	
Total Extension Asset Cost	**£130,000**		**£130,000**	
Total Customer Contribution			**£130,000**	

Again, this example illustrates that commercial customers could see significant reductions in their connection charge from £630k to £130k, in this example 79% or around £63k/MVA. This may or may not be sufficient to influence a location choice for a new connection but may encourage existing customers to increase their requirements up to the capacity of their connection assets as this would be at zero cost to the customer, other than through their DUoS charges.

In this example, using the same approach that is currently used for generation, the cost per kVA of the reinforcement in £187.5, just below the threshold that is considered excessive in generation.

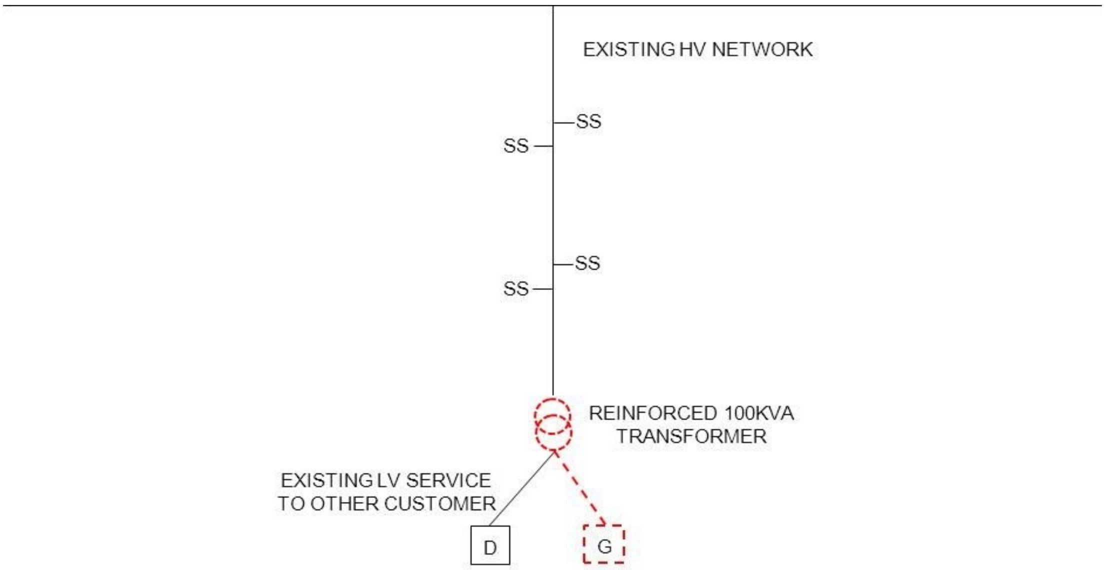
6.5.3 Example Conclusions

This example supports the conclusions in the previous example that for existing customers the proposals remove most price signals and could lead to some customers requesting more capacity than they require. Increasing capacity charges in DUoS tariffs could help mitigate against this.

6.6 Example 14X: New 25kVA Generation Connection, Voltage Rise Triggered Reinforcement (with HCC applied)

6.6.1 Example Description

An existing Customer wishes to connect a new generator with a Required Capacity for export of 25kVA. The Minimum Scheme for connection of the generator requires the local 25kVA pole mounted transformer to be reinforced with a 100kVA split phase transformer in order to keep voltage rise within acceptable limits. A new 95mm^2 service cable is to be installed to the premises.



Reinforcement:

<u>The RSN for the Reinforcement is the HV/LV transformer.</u>

Security CAF calculation: the numerator in the CAF calculation is the Required Capacity of the Customer, i.e. 25kVA. The denominator is the New Network Capacity following Reinforcement, this being the maximum generation output that could be connected whilst keeping the voltage rise within acceptable limits, i.e. 40kVA in this case.

Fault Level CAF calculation: this scheme does not have any significant Fault Level contribution to the existing shared use distribution network and Fault Level CAF is therefore not applicable here.

The Connection Charge for this Scheme is calculated as follows:

Example 14X: Connection charge calculation under current CCCM Rules GENERATION

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Replacement 100kVA transformer (capped at HCC)	£5,000	25/40 x 100% = 62.50%	£3,125	£1,875
In excess of HCC (25kVA x £200/kVA)	£10,000		£10,000	£0
Total Reinforcement Cost	**£15,000**		**£13,125**	**£1,875**
Extension Assets:				
Contestable Work				
Provision and installation of LV service cable	£1,500	n/a	£1,500	
Non-Contestable Work				
LV Joints to network	£500	n/a	£500	
Total Extension Asset Cost	**£2,000**		**£2,000**	
Total Customer Contribution			**£15,125**	

In the CCCM Example, the HCC is ignored which reduces the connection charge payable by the customer. The calculations for the CCCM example with the HCC applied is shown in the table above.

6.6.2 Example Commentary

In this generator example, the HCC is an important factor and ensures most of the cost of the reinforcement is funded by the generator.

If in Ofgem's proposed approach the HCC continues to reflect the one voltage rule but the same voltage rule applies for reinforcement, then the cost of replacing the transformer below the HCC would not be levied as a connection charge. This would reduce the connection charge from £15,125 to 12,000 or by 21% as shown in the table below: -

Example 14X: Connection charge calculation under Minded-to proposals with one voltage rule HCC GENERATION

Reinforcement:	Cost	Apportionment	Customer Contribution	DNO Contribution
Non-Contestable Work				
Replacement 100kVA transformer (capped at HCC)	£5,000	n/a	£0	£5,000
In excess of HCC (25kVA x £200/kVA)	£10,000		£10,000	£0
Total Reinforcement Cost	**£15,000**		**£10,000**	**£5,000**
Extension Assets:				

Contestable Work			
Provision and installation of LV service cable	£1,500	n/a	£1,500
Non-Contestable Work			
LV Joints to network	£500	n/a	£500
Total Extension Asset Cost	**£2,000**		**£2,000**
Total Customer Contribution			**£12,000**

If the HCC was only applied to reinforcement at the same voltage, then the connection charge would be £2,000, a reduction of 87% as shown in the table below.

<u>Example 14X: Connection charge calculation under Minded-to proposals with same voltage rule HCC GENERATION</u>

Reinforcement:	**Cost**	**Apportionment**	**Customer Contribution**	**DNO Contribution**
Non-Contestable Work				
Replacement 100kVA transformer (capped at HCC)	£15,000	n/a	£0	£5,000
In excess of HCC (25kVA x £200/kVA)	£10,000		£0	£10,000
Total Reinforcement Cost	**£15,000**		**£0**	**£15,000**
Extension Assets:				
Contestable Work				
Provision and installation of LV service cable	£1,500	n/a	£1,500	
Non-Contestable Work				
LV Joints to network	£500	n/a	£500	
Total Extension Asset Cost	**£2,000**		**£2,000**	
Total Customer Contribution			**£2,000**	

In summary, the connection charge,

- under current CCCM rules £15,125
- under Minded-to Proposals with one voltage HCC £12,000
- under Minded-to Proposals with same voltage HCC £2,000

As stated in previous examples, for generation, any reinforcements costs are funded by demand customers and generators connected to the HV network and below will receive DUoS credits under the CDCM methodology.

6.6.3 Example Conclusions

This example supports the findings and recommendations given in example 6.1 as it demonstrates the importance of the HCC to protect demand customers from excessive costs the need to remove DUoS credits to generators in areas where generation is driving network reinforcement.

7 Conclusions

The full impacts of the Minded-to proposals are difficult to model as they are dependent on customer behaviour and the specific status of networks when connection applications are made. However, with the lack of DUoS reforms, there is a potential for adverse outcomes for demand customers in general, who under the current charging methodology will pick up the cost of these reforms.

7.1 Demand proposals

In general, the demand proposals do increase fairness and remove the lottery of where people are connected and the specific status of the network at the time the connection application is made. If there is spare capacity at the time of connection then the customer would not have to pay, if there isn't the customer would be required to pay a contribution though both would pay the same DUoS charges.

It is unlikely that the changes would influence where a new demand customer would locate as there are many other factors that the customer would have to take into consideration and extension asset charges are likely to remain significant in any case.

Example 10 (refer to section 6.4 above) shows it may however be appropriate to introduce an HCC for demand to protect demand customers in general from excessive reinforcement costs. In these situations, this could encourage customers to adopt approaches to minimise the level of reinforcement needed. If the DNO is obliged to fund the reinforcement regardless of the cost, there is no need for the customer to consider any actions they could take.

Examples 10 and 12 (refer to 6.4 and 6.5 above) show that there is a potential issue with these proposals for existing customers. Unless capacity increases are particularly large then it is unlikely that there would be any extension asset costs at all if a demand customer requested an incremental increase in the Maximum Import Capacity (MIC). Customers could therefore request increases in their capacity without facing any customer contributions at all, though they would see their Distribution Use of System (DUoS) charges increase. To mitigate against this, it is recommended that capacity charges in DUoS are increased, and usage charges reduced for tariffs with an MIC, to encourage customers to keep their MIC at the level they require. This is a fairly simple change to the current methodology and can be an interim measure whilst wider DUoS reforms are being considered.

7.2 Generation proposals

The review of the CCCM Worked Examples has indicated that the Minded-to proposals would have no effect on many of the examples as the reinforcement is at the same voltage of connection. It cannot be certain how representative these examples are now or how they will be in the future. If a new generator did trigger reinforcement at the voltage level above the point of connection, then under the Minded-to proposals the generator would not pick up the additional costs. This is illustrated by reviewing Example 5 (refer to 6.1 above). In a situation where reinforcement of the transformers is required, under the current CCCM rules the generator would pay a connection charge of £1,633k as the HCC would apply. In the Minded-to proposals, with the HCC applying at the same voltage only, the connection charge would reduce to £143k with the balance being funded by demand customers.

What is not clear is how many applications of this type of scheme do not progress currently due to the high connection charges making the project unviable. If these costs were excluded from the connection charge, then these projects and more could become viable increasing the costs to demand customers. Where generation is connected to the HV network and below, the generators would also receive generator credits regardless of whether the generation provided benefits or not. These credits will also be paid for by demand customers.

The analysis in 6.1 also shows the problem with the working of the HCC. The HCC was devised when the DNO price control had a separative Distributed Generation Incentive. The HCC is calculated relative to the installed generation and the analysis in 6.1 highlights that the generator can potentially reduce their contribution by artificially increasing the generation capacity, regardless of whether it is installed or not. An HCC that is limited to the voltage of connection is unlikely to have any significant impact in protecting demand customers from excessive costs. It is therefore recommended that an HCC is retained and looks at costs up to one voltage level above but is calculated relative to the additional demand capacity that is created. Consideration needs to be given as to how fault level reinforcements are treated as these are unlikely to provide additional demand capacity.

Generation connections also created additional costs for demand customer through the payment of credits. In these absence of wider DUoS reforms, it would be recommended that generations credits are removed in areas with large amounts of generation or where there has been generator driven reinforcement.

Appendix 1 – CCCM Worked Examples with Reinforcement

See separate excel workbook

Appendix 2 – CCCM Worked Examples Analysis

See separate extract from CCCM