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Targeted Charging Review: update on approach to reviewing residual charging arrangements

Overview

Our energy system is undergoing a period of far-reaching change, driven by a combination of new technologies and new business models. The charging framework for recovering the costs of building, maintaining and operating our electricity networks was designed for a system with very different characteristics to that we have today. We now have more than a quarter of all generation capacity connected to distribution rather than transmission networks and an increasing proportion of that generation is intermittent.

In order to finance their activities, network companies need to recover the cost of building, operating and maintaining the distribution and transmission systems from network users. The way this is done will need to adapt to ensure that it continues to serve the best interests of consumers as circumstances change. This includes how residual and cost recovery charges are set, which is the subject of the Targeted Charging Review (TCR) Significant Code Review (SCR). This SCR will also keep under review the other 'embedded benefits', although that is not addressed here. [1]

Ongoing network charges include forward-looking charges that are designed to send signals to encourage efficient use of the networks, and residual charges that are designed to ensure the networks' allowed revenues are recovered. Residual charges are not intended to send signals or provide incentives to use networks in any particular way. However, they can create significant opportunities for some users to avoid paying them if they are not well designed. The response of some network users to the opportunities to avoid paying residual charges could lead to less efficient outcomes that are not in the best interests of consumers overall. It also affects the distribution of charges among network users. Hence, consumers who are less able to respond in ways which reduce their residual charges will end up paying a greater share of network costs.

In August of this year, we launched a SCR to address our concern that the current framework for residual and cost-recovery charging may result in inefficient use of the networks and unfair outcomes for consumers.[2] This paper sets out our latest thinking on how we will progress our work on residual and cost recovery charges so that our charging framework remains fit-for-purpose as the energy system changes.[3]

The principles we have proposed to use to assess potential changes are:

1. reducing distortions;
2. fairness; and
3. proportionality and practical considerations.

[1] This includes the embedded benefits remaining following our decision on CMP 264/265

[2] https://www.ofgem.gov.uk/system/files/docs/2017/08/tcr_scr_launch_letter.pdf

[3] This paper does not cover storage charging arrangements or 'other embedded benefits', which are also covered by the Targeted Charging Review. Our approach to these is explained in the launch document linked above.

We recognise that the allocation of residual charges will vary with users' investment or operational decisions, but we think this should not happen to the extent that users who cannot respond to the incentives created end up paying disproportionately towards the fixed and common costs of the networks.

Given the pace of change in the market, we have stated our ambition for the SCR to progress under a relatively fast timeline. In order to achieve this, we are undertaking a high-level principles-driven assessment of a broad set of residual recovery options based on the principles we have consulted on, in order to narrow down the potential options. We will then undertake detailed analysis of the shortlisted options and detailed policy implementation design phases on the project.

As an important first step, we have considered whether residual charges should be recovered from generation, from final demand (usually via suppliers), or from both. Based on our principles-driven assessment of this issue, we think that there are strong arguments to support recovering residual charges from demand, rather than from generators or a combination of demand and generators. We set out this analysis later in this paper.

We also set out our high-level assessment of how different charging structures could affect network user incentives and fairness. This work has identified the options that we think best fit the principles we have consulted on. Our principles-driven assessment of the short-listed options for residual charging structures will be supported by the quantitative analysis, including an impact assessment. Further assessment, and ultimately our decisions, will be informed by quantitative analysis based on more detailed design specifications and usage assumptions for the GB context. Getting this assessment right is key to supporting efficient development of the network charging framework.

This document provides more detail on how we propose to proceed with the SCR, with respect to residual charges, and is intended to inform discussions with stakeholders which have been planned through our forthcoming stakeholder events.[4] We invite any interested stakeholders to register for these events. It should be read alongside our 'Reform of electricity network access and forward-looking charges working paper' which has been published today and sets out how we will address cost-reflective signals.[5] We do not request stakeholders to formally respond to this working paper. If there are particular views you would like to share with us, please do so via the following email address: TCR@ofgem.gov.uk

[4] https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-workshop

1. Background

What are residual charges and how are they currently recovered?

1.1 Price controls determine the allowed revenues that network companies are permitted to earn for building, operating and maintaining their networks. These allowed revenues are recovered through use-of-system charges, with connection charges also being levied for new or expanded connections. The use-of-system charges include both forward-looking and residual charges (called scaling charges for distribution networks, and referred to as cost recovery charges in relation to BSUoS).[6] Forward-looking charges reflect the incremental costs and benefits that network users impose on the system. Residual charges exist to recover the allowed revenue left after these forward-looking charges are taken into account.

1.2 Network charges are set at a level that is forecast to recover the companies' revenue allowances. These are set out under price controls, which incentivise network operators to find new ways to improve efficiency and quality of service. As these allowed revenues are largely fixed within a given price control, if some users pay less, others will have to pay more to make up the difference. [7] [8]

1.3 Residual charges are intended to ensure revenue recovery and are not designed to incentivise specific actions by network users. Responses by network users to reduce their contribution towards residual charges can affect the overall development of the energy system, as well as the distribution of charges between network users. We think that making changes to residual charges could make them more likely to serve the interests of current and future consumers.

1.4 We have set out concerns with how residual charges are levied at present, which we think may be distorting competition between different network users and leading to unfair outcomes. This is illustrated in figure 1 below which outlines which network users currently pay residual and cost recovery charges.

[6] BSUoS charges recover the transmission system operators' costs in operating the system ie the short run marginal cost (SRMC). They are recovered on a socialised £/MWh basis from demand, TG and larger EG.
[7] The RIIO-T1 and ED1 price controls provide for a mid-period review of output requirements. This year we decided to reduce National Grid's Electricity Transmission allowances by £16.6 million. More information is available here: https://www.ofgem.gov.uk/system/files/docs/2017/02/mid-period_review_decision.pdf. Our proposed timetable and next steps for a potential RIIO-ED1 mid-period review is set out in our recent call for evidence: https://www.ofgem.gov.uk/system/files/docs/2017/07/riio-ed1_mpr_call_for_evidence_july_2017.pdf
[8] The current price controls will remain in place until 2021 for electricity transmission and 2023 for distribution.

Figure 1 Network users' current exposure to residual/cost recovery charges

		T Generation	T Final Demand	T Storage†	D Smaller EG*	D Larger EG**	D Smaller Storage*†	D Larger Storage**†	D Final Demand
Transmission residual	Generation (TGR)	✔		✔		✔		✔	
	Demand (TDR)		✔	✔	Paid††		Paid††	✔	✔
Distribution residual	Generation				Only EHV pay.#	Only EHV pay.#	Only EHV pay.#	Only EHV pay.#	
	Demand					✔	✔	✔	✔
Balancing	Generation	✔		✔		✔		✔	
	Demand		✔	✔	Paid		Paid	✔	✔

✔ - Pay the charge Paid – can get paid the inverse of the charge
* <100MW **>100MW
† - may be affected by ongoing storage modifications CMP280 & CMP281
†† - will be replaced by dedicated embedded export tariff following CMP264/5 WACM4 implementation
# - Only those connected at EHV level pay distribution demand residuals. All others are exempt

1.5 From the table above, it can be seen that there are a range of inconsistencies in how residual and cost recovery charges are currently levied.

- In terms of transmission residual charges:
  - only Transmission-connected Generation (TG) and storage, and larger Embedded Generation (EG) and storage, pay the TGR (which is now negative and functions as an adjustment mechanism for the €2.50/MWh cap)[9]; and
  - transmission-connected final demand, larger storage, and final distribution-connected demand pay TDR charges. Smaller EG and smaller storage can receive payments from helping suppliers to avoid TDR charges. From April 2018, this will be reduced to a payment to reflect the avoided GSP infrastructure costs, following CMP264/265 WACM4 implementation.
- In terms of distribution residual charges:
  - only demand users and EG and storage connected at Extra High Voltage (EHV) level pay distribution residuals; and

[9] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32010R0838

- all other EG does not pay distribution residual charges;

- In terms of BSUOS charges:
  - TG, T-connected storage, larger EG, larger storage and final demand all pay balancing charges; and
  - smaller EG and smaller storage don't pay BSUOS and can earn revenues from helping suppliers to avoid BSUOS charges.[10]

1.6 Under the current charging arrangements, residual charges can affect user decisions both on an operational level (dispatch) and at an investment level (including investment in generation, on-site generation, Demand Side Response (DSR) and bids into the capacity market). How network users respond to residual charges affects the development and use of the electricity system. Behaviour aimed at reducing exposure to residual charges, could even increase overall system costs.[11]

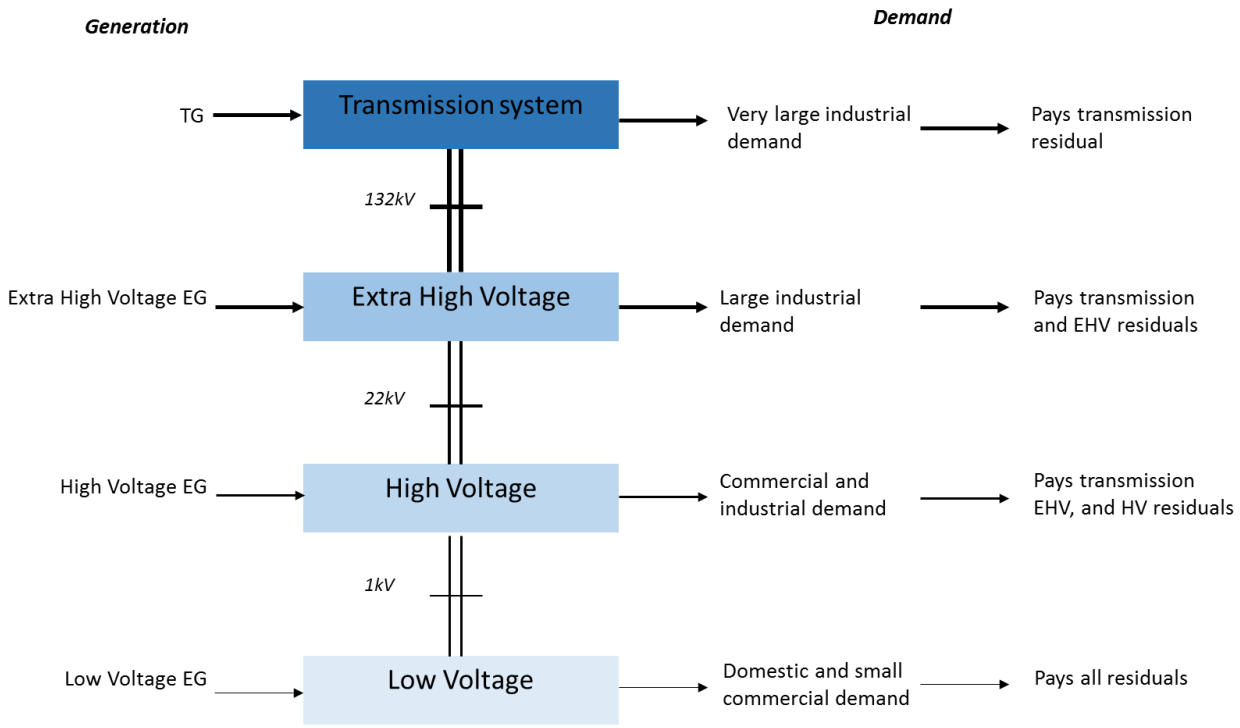
1.7 Further details on current charging arrangements, proposed modifications and the history of how charging arrangements have been developed are included in Annex 1, alongside a comparison with the approach taken to recover costs for other regulated UK networks (Annex 4).

1.8 An important difference between transmission and distribution charges is how differences in voltage levels are treated. For transmission, generation charges are set within generation zones and demand charges within demand zones, but all costs of the network are recovered together from all users of the network, irrespective of voltage level connected at. For distribution, there is an additional distinction that costs of the network are recovered differently, depending on the voltage level of connection. The costs at each voltage level are recovered from users connected at that voltage level and users connected at lower voltage levels, but not users connected at higher voltage levels. This means that users pay for costs associated with the voltage level they are connected at and at higher voltage levels, but not at lower voltage levels.

[10] This embedded benefit remains under review through the Targeted Charging Review.

[11] There may be overall efficiency losses due to uncoordinated investment decisions by reactive consumers, see: http://cadmus.eui.eu/bitstream/handle/1814/46044/RSCAS_2017_22.pdf?sequence=1&isAllowed=y

Figure 2 Network illustration



1.9 As part of our work on the Electricity network access project, we will assess the costs and benefits of connecting at different voltage levels of the network. If we find that users connected at higher levels are not benefiting from access to the lower voltage levels, this will provide insight as to whether the current system of residual charging where users only pay residuals related their connection voltage levels and above is in the best interest of consumers. When considering fair contributions to the residuals by those connected at higher voltages, we may also need to consider:

- whether these users are more likely to be able to respond to residual charges, or if it would significantly increase incentives to reduce usage of the network, potentially increasing the burden of costs on other consumers; and
- whether the residual charges that a user faces should be linked to the voltage level to which that user is connected.

Distribution of charges among network users

1.10 As a result of changes in technology and other factors, some network users are increasingly able to adjust the timing and volume of their production and/or consumption of electricity. This can reduce their exposure to residual charges, while potentially leaving fixed and common system costs at the same level. As a result, current residual charges will increasingly fall on those network users who are not able to do likewise, leaving those who are less able to adjust their consumption or afford any upfront investments in technology bearing more of the system costs. This is likely to include

household and small business consumers in general and certain more vulnerable consumers in particular.

Scope of the TCR

1.11 The overall objectives of this SCR are to:

- consider reform of residual charging for transmission and distribution, for both generation and demand, to ensure it meets the interests of consumers, both now and in future; and
- keep the other 'embedded benefits' related to transmission and BSUoS charging under review.[12]

1.12 In addition, we have set out our views about potential concerns with storage charges and encouraged industry to take these issues forward. We have also indicated that it may be appropriate to consider reforming BSUoS charges in line with transmission and distribution residual charges, if more fundamental reform of BSUoS is not undertaken, for example, through our Electricity network access project.

1.13 There are 3 separate dimensions which can be considered when designing a residual charge:

1) Who should pay – generation or final demand (usually via suppliers), or both;
2) What mechanism should be used to collect charges – for example, based on volumes used or another means such as a fixed or capacity charge; and
3) How those charges should be implemented – by voltage level or user group, by ability to respond to signals and whether a hybrid (either having different approaches for different users or combined approaches for the same user) approach would help facilitate our principles.

1.14 The focus of this paper is on the first two aspects, the aim being to narrow down the options to take forward for more detailed analysis.

Links between the TCR SCR and other Ofgem work areas

1.15 This work is part of a series of projects, which will assess how regulatory arrangements may need to change to support an efficient future energy system. We will ensure that all work is closely coordinated. Key other projects with links to the TCR are:

[12] This includes the embedded benefits remaining following our decision on CMP264/265.

- **The Electricity network access project:** our work on strategy for regulating the future energy system concluded that analysis and potential reform is required on the access and price signals received by network users.[13] Different approaches to valuing or allocating network access or setting forward-looking charges could affect the size of the residual charges in future. This will be considered in the sensitivity analysis for our quantitative work. A separate paper published sets out the scope of that work programme and launches a programme of work in conjunction with the Charging Futures Forum (CFF) to develop thinking on options for reform.

- **Electricity Settlement Reform SCR:** we have launched a separate SCR to develop and implement an enduring process to enable half-hourly settlement (HHS) of household and smaller business consumers' electricity usage.[14,15] Changes introduced under our TCR SCR may affect the potential costs and benefits of Electricity Settlement Reform. We are linking up our settlement reform work with our Electricity network access project reform and the TCR to ensure consumers can respond to signals that result in lower whole system costs, and to reduce distortions to these signals due to the recovery of residual charges.

- **RIIO-2 Programme:** we set price controls for the network companies, which determine the amount of revenue that they can recover for providing network services to their customers. The current set of price controls will end between 2021 and 2023 and the RIIO-2 programme is developing the new arrangements. A final framework decision on RIIO-2 will be published in the summer of 2018, and will set out how RIIO-2 will address the transitioning energy sector and associated uncertainty. Different approaches may affect the size of the residual network charges in the future.

- **Charging Futures Forum:** we have set up a new CFF to facilitate better co-ordination of changes to connection and charging arrangements.[16] We do not currently propose to set up a Task Force under the CFF for the TCR SCR work. However we will ensure that TCR updates are provided at the relevant forum and we will take into account other work done through the CFF.

[13] https://www.ofgem.gov.uk/publications-and-updates/our-strategy-regulating-future-energy-system

[14] Subject to an Impact Assessment, as part of the Electricity Settlement Reform SCR business case.

[15] https://www.ofgem.gov.uk/system/files/docs/2017/07/electricity_settlement_reform_significant_code_review_launch_statement.pdf

[16] The CFF aims to bring together the various ongoing and emerging electricity network charging reviews into a joined-up work programme, to meet Ofgem's and industry's electricity network charging reform aims and deliver better outcomes for current and future consumers. A description of the CFF arrangements is available here: https://www.ofgem.gov.uk/publications-and-updates/charging-futures-forum

2. Who should pay residual charges

2.1 This section sets out high-level considerations as to who should pay residual charges. Key aspects of the design framework are:

- Who should pay residual charges:
    - how to split residual cost recovery between generation and final demand; and
    - how to distribute residual charges amongst different kinds of users within those groups
- What is the basis for the charge (covered in section 3 of this report)

How to split residual charges between generation and demand

2.2 An important consideration in reviewing and developing residual charges is which network users should pay residual charges. We have undertaken an initial assessment of the arguments for levying residual charges on generation, demand or split across both, and a summary of these arguments are set out in the table below and discussed further in this section. We intend to undertake some sensitivity analysis during our quantitative assessment to confirm our views in this area.

2.3 Our views about the merits of levying residual charges assessed against the three principles underpinning the TCR are set out below.

2.4 **Reducing harmful distortions:** Residual charges may distort both investment and operational decisions, and so care should be taken to ensure that any distortion of competition between different kinds (and scales) of generation and demand response arising from residual charges is minimised, as it is likely to be detrimental to consumers. As residual charges do not relate to incremental costs caused by users' actions, action taken to avoid them does not result in a corresponding reduction in whole system costs, and so can lead to inefficiencies. Examples of this might include additional investment that was not needed, or the inefficient utilisation of existing assets. This is true for both generation and demand uses of the network. However, recovering residual charges from generators could also disadvantage GB generators compared to interconnected generators, who do not pay GB network charges. There is also a potential disadvantage to generation that is connected to the grid, relative to on-site generation (as it may be difficult to levy the same residual charges onto on-site generation).

2.5 **Fairness:** As we would expect charges on generation to be largely passed through to demand in the long run, from a fairness perspective we do not think there is a strong argument for residual charges to fall on either generation or demand, as both will lead to residual costs being ultimately paid by consumers/end users. We therefore consider reducing distortions to

be the more important issue. We also note below some of the practical barriers to generation charging.

2.6 Cost pass-through theory suggests that in the short-term, fixed costs may not factor into firms' variable pricing decisions.[17] Generator costs must be recoverable, if investment in generation is to be justifiable, and hence we would expect significant pass through of any fixed costs to consumers. There is relatively little empirical evidence on this particular issue, but studies at the wholesale level suggest cost pass-through rates, in excess of 80%, are likely.[18]

2.7 There may be potential short-term benefits to consumers in charging a proportion of residual charges onto generators. In particular, if generators are unable to pass through the full fixed charge onto consumers. Our initial work, however, indicates that it may be in consumers' longer-term interests to recover residual charges from suppliers only, as they ultimately pay all system costs. As such, this is a more transparent approach. We will work to ensure that non-active consumers do not shoulder an unfair portion of network costs and consider the way that residual charges are recovered across different voltage levels.

2.8 Under current market arrangements, this means that any proportion of fixed costs which are passed through to consumers is likely to be done so through the wholesale energy price or through Capacity Market (CM) payments (which are subsequently recovered from consumers via the Capacity Market Supplier Levy). Where a generator is a price-setter, fixed network charges could be taken into account when setting CM bids for future auctions. For existing CM contracts, and for price takers in future auctions, the ability to pass through generation charges may not be possible so they may seek to pass them through the wholesale prices where possible, but will otherwise bear the cost of these charges.

2.9 **Proportionality and practical considerations:** At present the majority of residual charges fall on final demand users via their suppliers.[19] Continuing to recover all residual charges from demand would involve less change than setting a new generation/demand split for recovery.

2.10 The changes needed to recover residual charges from generation with a level playing field for users connected at different voltage levels would be difficult to implement as this may require:

- establishing a framework for charging generators who are non-CUSC parties for use of the transmission system, including those who are licence-exempt, or on site at consumers' premises;

[17] Network costs may be recovered through fixed charges.

[18] RBB Economics (2014) *Cost pass-through: theory, measurement, and potential policy implications,* A Report prepared for the Office of Fair Trading.

[19] Currently, demand charges are paid by suppliers who are free to decide how they pass on these to customers. This may mean that some users may face more of these costs than others.

- addressing the issue of compliance with the EU cap on average generator charges for transmission-connected generators (which does not apply to EG); and

- addressing ongoing concerns about the competitiveness of GB based generation across interconnectors.

2.11 Recovering residual charges through generators could make regulated network costs look like a smaller portion of consumer bills – this may reduce transparency, affecting the quality of debate over payments to regulated companies and how these impact on the consumer's bill. Table 1 below sets out the factors we have considered in assessing whether residual charges should fall on generation or final demand.

Table 1: Assessment of options for recovering residual charges

Charging base	Advantages	Disadvantages
Generation only	• Generators may not be able to pass through all network charges in the short term if levied on a fixed/capacity basis, so consumers could realise some short term savings	• Could distort generation investment decisions • Could distort generation dispatch decisions • Currently only TG, larger EG and extra high voltage connected generation are exposed to residual charges, levying it on other EG would likely be difficult to implement • Potential to disadvantage grid-connected generation compared with on-site generation if comparable charges are not levied on on-site generation • Creates disadvantage for GB generators compared with interconnected generators who don't pay GB network charges
Final demand only	• Removes potential for distortions of generation investment and dispatch decisions • Addresses the distortions that only some generation currently faces generation residual charges • Consistent with removing intermediate demand charges from storage • Similar to current arrangements, so minimises disruption	

Recovering costs from final demand consumers

2.12 It can be seen from the above table that there are considerable benefits to levying residual charges on final demand, compared to generation. We will consider whether different categories of final demand users have significantly different levels of responsivity to changes in charges (often referred to as 'price elasticity') and whether this should be taken into account in setting residual charges.

3. How residual charges should be recovered

3.1 This section outlines our initial thinking on the types of potential recovery mechanisms which could be used to recover residual charges. This builds on the international case studies which we set out in our earlier consultation on the TCR and the responses to that consultation. There are broadly four ways that residual charges can be recovered:

1) Volumetric basis
2) Capacity basis
3) Fixed charges
4) A hybrid approach

3.2 For the purpose of this work we have split these options into a more granular set (outlined below) which focuses on the means of volumetric recovery, the period in time which a capacity allocation is set, and options to charge users on both import from the grid (via demand) and export to the grid (via generation).[20]

3.3 As part of our work under this SCR, we will assess which mechanism for recovery of residual charges will best meet our principles of:

- reducing distortions,
- fairness, and;
- proportionality and practical considerations.

3.4 Our initial analysis to date has shown that there are arguments for and against each of the potential mechanisms for recovering residual charges, with different approaches to the trade-offs between our principles resulting in different outcomes for the tariff structures.

3.5 In the section below, we set out the broad principles-driven assessment of the initial set of options we have considered in order to develop a short list of options which we propose to take forward for in-depth assessment.

3.6 Our more detailed assessment, and ultimately our decision, will be supported by our quantitative analysis based on more detailed design specifications and usage assumptions for the GB context, and our analysis of the practical considerations of reform.

3.7 The impacts, including the distributional impacts, of different distortions to incentives under each option may vary depending on the scale and speed of technology adoption. We will consider impacts under different likely scenarios.

[20] Although we think that residual charges should be recovered from final demand, we still assessed some options for demand and generation charges for completeness.

3.8 In our TCR consultation, we set out five broad options for setting residual charges and asked for views on this. Stakeholders provided arguments for and against each of these options. Many respondents stated that it would be premature to rule out any of the options. Respondents expressed a wide range of views, with several calling for a wider analysis of all available options. On this basis, we have taken forward a set of options for further work.

Approaches to residual recovery

3.9 We have undertaken a principles-driven assessment of the following mechanisms for setting residual charges:

- net volumetric demand charges
- fixed charges (per user)
- ex ante capacity demand charges
- ex post capacity demand charges
- gross consumption charges
- net volumetric import and export charges
- max import or export capacity charges

3.10 We assessed all of these options compared with the current baseline arrangements for transmission and distribution residual charges. The baseline arrangements include the current charging arrangements and modifications which have been approved by the Authority.

3.11 Our principles-based assessment is aimed at considering what approach to residual recovery will be most beneficial (or least harmful) from the perspective of consumer interest. This will be achieved by balancing our objective of reducing distortions to efficient use of the network, with fairness considerations, such as impact on vulnerable consumers. We acknowledge that any method of residual recovery is likely to leave in place some distortions. Further, we will ensure that any changes introduced are proportionate and take into account the practical considerations.

3.12 There may be significant advantages to hybrid approaches to recovering residual charges, which combine two or more residual recovery options. Hybrid approaches would facilitate adjustment over time as technology changes how the electricity networks are used. We will assess the combination of different recovery mechanisms as part of our work on implementation options. In addition, many of these options provide an opportunity for a tiered approach where initial units or blocks of capacity are offered, with these making a different contribution to residual charges than subsequent units or capacity.

Our preliminary views on how the different mechanisms for residual recovery affect network user incentives

Net (at meter) volumetric demand charges

- Volumetric charges are based on the units of electricity used in kWh. We currently recover residual network charges of the distribution system on a volumetric demand basis.
- Recovering residual network charges on the basis of volumetric demand charges may overly incentivise load reduction and mean that consumers ration their use of electricity networks beyond the extent to which it is efficient to do so, when the full social costs of use are considered. This could be achieved through reduced end-consumption or use of on-site generation.
- Technological developments are making it easier for some groups of users to reduce their loads. This means that if residual network charges are recovered on the basis of volumetric demand charges, the ability of some users to avoid paying them will mean that other users pay ever more, especially when actions they take to reduce charges do not lower the overall cost of the system.
- This goes against our objective of reducing distortions to efficient network use.
- Volumetric charges give little incentive for users to disconnect entirely from the network, because network users with on-site generation or storage can pay very little toward network costs, but still maintain a connection for backup, achieving a high level of reliability.
- It is possible that a tiered approach might be used with lower priced initial units to cover a 'basic' level of electricity network access, making a lower contribution to residual charges, followed by units in excess of this making higher contributions. This might address concerns about unfairness toward some users with very low demand.
- Volumetric charges would be straightforward to implement and may work well in a hybrid form with fixed or capacity charges.
- **In summary**, our initial view is that net volumetric demand charges would not be appropriate as the sole approach to recovery of residual charges, as they send signals to network users that are likely to result in inefficient network use.

Fixed demand charges (per user)

- Per user fixed charges, for example, could be based on user profile classes.
- A simple fixed charge, per network user should not distort operational decisions around network use. However, these charges could give an increased incentive for inefficient grid disconnection.
- It would be important to consider regressive effects in design of the charging framework.
- As a simple fixed charge design is not related to users' ability to access or use then network, they may not be seen as fair, though it is possible that

discounted fixed charges may be possible for certain user groups to address this.

- **In summary**, we see merit in taking forward fixed demand charge options for further assessment.

Ex ante capacity demand charges

- An ex ante capacity charge, based on a network user's agreed or connected capacity would be less distorting to operational decisions around network use than volumetric methods or on those based on maximum capacity usage.[21] However, these charges also give an increased incentive for inefficient grid disconnection.
- Ex ante capacity charges for household consumers may have some regressive distributional effects. It would be important to consider these in the design of the charging framework.
- Agreed capacity charges may also have positive effects in supporting efficient planning of the network, if consumers are incentivised to declare their capacity needs.
- As set out in the volumetric options above, it is possible that an initial capacity block (for some or all users) that makes a lower contribution to residual charges is possible, with capacity over this level subject to higher contributions.
- **In summary**, we see merit in taking forward ex ante capacity demand charge options for further assessment.

Ex post capacity demand charges

- An ex-post capacity charge is one which applies a measure of peak system use to individual system users. Residual charges do not relate to peak system use, but individual user peaks could be an option for recovering them. Our Electricity network access project will consider how to send cost reflective signals at peak.
- To achieve an ex-post capacity charge, a measure of peak use is required. As the residual component of the charges is not intended to reflect the costs imposed by individual network users, coincidence with system peak has limited benefits.
- A charge based on the average of a set number of each user's own highest usage half-hours over a defined period could create incentives that a smaller number of users are likely to respond to.[22]

[21] The effects of an ex ante capacity charge would depend on the thresholds involved. The vast majority of domestic premises have 'deemed' capacity much higher than most of them use, at 23kW. If we set the lowest charge at this level, it would not reflect the higher benefit that users who do use their capacity (eg for fast-charging an EV or running a heat pump) derive from being connected to the system, compared with the majority of users who currently do not. We could we set differential charges below that default level (say 0-4kW, 4-13kW, 14-23kW). However, some users could perceive this as introducing a charge for an option to access the network that was previously 'included in the price'. This might not be considered fair – although it would, like the other capacity charge detailed below, lead to higher residual charges for people who arguably derive more benefit from the network.

[22] We intend to carry out more analysis and modelling to understand the potential for response, related to the number of half-hourly periods measured. However, users who pay more under this would generally be seen to derive more benefit from the system than those who pay less.

- It has also been noted that any charges based on a user's historic usage would need to be well designed to prevent problems where a customer transfers from one supplier to another within a charging period. That there may be challenges ensuring a supplier is billed only for a customers use within their supply period and that reconciliations happen effectively.
- Lower residual contributions for an initial block of capacity might be appropriate.
- **In summary**, we see merit in taking forward ex post capacity demand charge options for further assessment.

Gross volumetric consumption charges

- The term 'gross charging' is used to refer to different types of charging arrangements. For this SCR, we are defining this as true gross charging, where all of a user's consumption is measured, including consumption of electricity generated on-site.
- In principle, this might not drive large responses to reduce charges, as gross consumption is relatively price insensitive for most users. To the extent that it would drive responses, these could be positive (energy efficiency) or negative for some users (not heating homes properly).
- The practical challenge of this option is considerable. Consumption from the network is metered, and for some on-site generation, gross generation is metered for Feed-in Tariff (FiT) purposes. There is currently no measurement of on-site consumption. Further, non-renewable behind the meter generation is not measured at all at present.
- Implementing this would require a new metering approach, and changes to the parties that can access information from the meters. This would increase costs and implementation time, and many people may not find this option acceptable on principle. It would require considerable change in our approach to what happens on-site and be extremely challenging to monitor and ensure compliance.
- **In summary**, we are not recommending further work on gross consumption charges, including that met by on-site generation, for household consumers. We do see merit in taking forward further analysis on gross consumption charge options for business consumers.

Net volumetric import and export charges

- Net volumetric import and export charges are effectively set on the sum of net import and net export. In the literature, this approach has been proposed for the setting of overall network charges (cost reflective and cost recovery elements), rather than for residual/cost recovery charges alone.
- This approach may have some advantages for setting new forward-looking charges. However, applied to residual charges it would incentivise some users to take action to adjust their network usage that would not be efficient in terms of overall system costs.
- **In summary**, because we propose that residual/cost recovery charges should be levied on final demand, and we will consider net volumetric demand charging within the base case scenario, we are not planning to proceed with 'net volumetric import and export' residual charges.

Max peak import or export capacity charges

- Similar to net import and export charges, a further option for capacity charges would be to charge users for the maximum import or export capacity requirement. Lower residual contributions for initial import blocks of capacity, might be possible.
- This would require a method of metering both maximum import and export use, or more feasibly requiring an ex-ante declaration of maximum system use. In principle, this would charge users a residual which was linked to their system requirements.
- There are a number of distortions that this approach may introduce. Firstly, it would dis-incentivise prosumers to have any export capacity. This could run counter to system needs, and could impact market flexibility. Secondly, it may lead prosumers to size any behind the meter assets simply to reduce their capacity requirements, leading to inefficient investment decisions.
- Lastly, placing residual charges on generators more widely would maintain at least to some degree a potentially distortive charge on producers.
- **In summary**, because we propose that residual/cost recovery charges should be levied on final demand we are not planning to proceed with 'Max peak import or export capacity' residual charges.

3.13 Owing to our initial views on charging residuals to suppliers rather than generators, we are proposing to narrow down our assessment of recovery mechanisms. This means not carrying forward for detailed assessment those options that require the application of residual charges to generators. In addition, we do not propose taking forward those options where the practical considerations underpinning the change to that type of charge are too great. As a result we do not propose to undertake a detailed assessment of net import and export charges, max import or export capacity charges, or applying gross metering to household consumers. However, in the next phase of work, we may undertake some sensitivity analysis of levying a proportion of residual charges on generation to provide further validation of our views.

Proposed approach

3.14 We propose to take forward the in-depth assessment of:

- fixed charges
- capacity demand charges – both on used (ex post) capacity, and on available (ex ante) capacity
- gross consumption charges (most likely for business consumers only)
- baseline arrangements for transmission and distribution residual charges.

3.15 Our work on strategy for regulating the future energy system concluded that work is also needed on the access and price signals received by network users. Different approaches to valuing or allocating network access or setting forward-looking charges would affect the size of the residual network

charges. While this will be considered in our sensitivity analysis for our quantitative work, it is possible that future work on access and price signals will result in a different framework for network charging.

3.16 There is a pressing need to reform residual charges based on known and increasing distortions, and it will not be possible to fully 'future-proof' arrangements so that no future changes will be needed. Some further revisions to residual charges may be needed with the emergence of new technologies, business models, policies and consumer preferences.

3.17 In undertaking further analysis on the options, we will be cognisant of this potential for future changes to affect how users respond to residual charges. We intend any reforms to residual charges to be robust to a range of plausible near term changes as possible.

4. Proposed approach to principle driven assessment of residual charging options for GB consumers

4.1 The principles we proposed in our consultation were:

- reducing distortions
- fairness
- proportionality and practical considerations.

4.2 Below we set out in greater detailed how we will assess the options set out in section 3, applying the principles, taking account of views raised by stakeholders.

4.3 In order to assess options for residual charges, we will undertake a principles-driven assessment taking account of the relevant code objectives, our regulatory stances and our wider duties. This principles-based assessment will be supported by quantitative assessment, as discussed in section 5 below.

Reducing distortions

4.4 Forward-looking charges are supposed to send signals so network users take account of the costs and benefits they cause to the network when deciding how to connect and use the network. Residual charges are supposed to 'top-up' these charges to ensure allowed revenues are recovered, but should not send signals which might amplify or dampen the forward-looking signals to inefficient levels. Instead, residual charges should attempt to collect revenue while leading to the minimum change in consumer behaviour from that guided by the forward-looking signals. To the extent that consumers are still likely to respond to the residual charges, we will give consideration to options which are likely to lead to beneficial changes for consumers.

4.5 In applying this principle, we consider that we are aiming to reduce the types of distortion, in particular:

- distortions to the signals created by the forward-looking charges (this may affect location of connection, and investment in, and use of, generation, storage or both); and
- distortions to competition between network users.

4.6 In assessing the potential impact of distortions, we propose to consider both i) responses that network users could take to reduce their charges and ii) the effect of such responses and whether they are likely to be harmful or beneficial to energy consumers.

4.7 In assessing the likelihood of distortions, we will consider:

- the degree to which a charge might vary depending on actions taken by users, including the likely cost of taking such an action and whether this would be outweighed by the reduction in charges;
- whether the residual charge would affect incentives or prices for dispatch of generation (including storage) or DSR; and
- whether the residual charge would drive changes in investment, including investment to enable disconnection from the grid.[23]

4.8 In considering how a varying charge may affect behaviour, it is important to note that the detailed design of a charge will affect this. For example, an ex post capacity charge that relates to one period of use, or to a small number of predictable periods, may be quite easy to avoid paying by taking a small number of actions. This can happen now, in relation to TNUoS charges for half-hourly settled customers. However, a charge that is based on (for example) a user's own peak periods, and that has a reasonably large number of reference periods, is likely to drive a smaller response.

4.9 We will also consider the potential for inefficient grid disconnection and any other resulting distortions.

Fairness

4.10 We consider 'fairness' is relevant as it applies to, and between, end-consumers. However, network charges are either levied directly on suppliers or borne by suppliers through transactions with other network users. We will give careful consideration to the impacts on vulnerable consumers.

4.11 Our analysis of this aspect will have a particular focus on financial vulnerability, as the SCR covers network charges borne by users, but not wider aspects of consumers' interaction with industry parties, in which other types of vulnerability may put some consumers at a disadvantage.

4.12 Electricity networks are natural monopolies that provide an essential service. This makes it crucial that we have regard to distributional effects when considering changes to our network charging framework. Given that overall residual charges are broadly fixed in the short to medium term, any changes are likely to reduce bills for some network users and increase bills for others. Our assessment of potential new tariff structures will include consideration of the likely effects on users. We will take into consideration whether expected outcomes from a new tariff design would be distributionally regressive.

4.13 While some respondents to the consultation suggested we should include a principle of fairness to other network users (such as generators), we think that reasonable treatment of these parties is appropriately covered under our 'reducing distortions' principle, and under proportionality and practical considerations, such as the value of regulatory predictability. We are

[23] Ofgem is not aiming to prevent or penalise those who wish to disconnect from the grid, but considers that incentives to disconnect from the grid in order to avoid residual charges may lead to inefficient investment decisions.

therefore focusing in the TCR on fairness to, and between, end users of electricity.

4.14 We should seek to avoid undue discrimination among network users and investors due to the recovery of residual charges. We will explore the principle that the same use of the network should result in the same network tariff under the same circumstances. This is important, because residual charges which do not provide undue advantages to any particular set of network users will best facilitate efficient use of the network. We will therefore consider effects on passive consumers, active consumers, storage providers and generation at times when they are using the network, or providing services over it, in the same way.

4.15 We consider that to be accepted as fair, any differences in residual charges between users should have a clear reason. Our current view is that geographical variation in charges is acceptable if based on underlying variations in cost.

4.16 We think that to the extent that residual charges vary between users, and/or with users' behaviour, there should be an understandable link from those variances to the benefits the user receives from being connected to the network. These benefits may be linked to total use, or to the 'insurance' benefit of having access to power and associated power management that comes with being connected to the grid.

Proportionality and practical considerations

4.17 When considering changes to how the residual element is recovered we have to consider:

4.18 **Proportionality**: implementing changes in itself causes costs, and takes Ofgem and stakeholder resource away from other priorities. We will consider whether the impacts on some users, and the scale of work required to make changes, are justified by the likely reduction in distortions and the benefits of charges being set more fairly. This consideration will include the question of whether charges for all users should be changed, or if keeping the current system for some groups of users would be appropriate at least for some period of time.

4.19 **Predictability**: we may need to consider the case for transitional arrangements where changes for individual network users would be significant. However, given we have clearly signalled the need for a review of residual charging well in advance of any changes likely to come into effect, we will only consider implementing transitional arrangements if clearly justified.

4.20 **Practical considerations**: it is important to consider practicalities in designing a charging methodology, including the availability of the required metering information, implementation cost and simplicity. Smart meters are required for half hourly settlement options so their role out is a key practical consideration.

4.21 Table 2 below sets out a high level view of some of the practical implications of the four options that we outlined previously. We intend to carry out a full review of the practical considerations.

Table 2: Assessment of practical implications of the four shortlisted options

Type of charge	Fixed	Gross consumption	Ex-post capacity	Ex-ante capacity
Metering	Can utilise current metering arrangements. May require additional MPAN data access for National Grid.	Requires additional metering (HH) to be installed for most users and for HH metering for all users.	Can utilise the current HH metering for larger HH users but likely additional and HH metering required for household users	Can utilise the current HH metering for larger HH users but likely additional and HH metering required for household users
Data flows	HH data not necessarily required	Additional HH data collection and pass through required. HH data accessibility a possible issue.	Historical data available for some users. HH data required for smaller users unless profile used.	Historical data and agreed capacity available for some larger users. HH data required for smaller users, unless profile used. Accessibility to the HH data a possible issue.
Cost	Likely lowest cost. Can utilise current data, metering and systems.	Likely highest cost due to additional metering and data collection required. System and consumer cost.	Dependent on smart meter roll out for household users. Likely lower cost than gross metering. Aggregating the data may have lower cost. Historical data required for some users.	Dependent on smart meter roll out for household users. Likely lower cost than gross metering. Aggregating the data may have lower cost. Likely administration costs in agreement of capacity.

4.22 In Annex 2 we set out a more detailed summary of the practical considerations we will have to consider for the four options.

5. Proposed approach to quantitative assessment of options

5.1 In our TCR launch document, we noted that the way that network users respond to residual charges may affect the development and use of the energy system if those charges distort forward-looking incentives or encourage users to reduce their exposure to the residual charges. This could increase overall system costs and may lead to those who are less able to reduce their residual charges paying a greater share of network costs.

5.2 We think that three distinct questions need to answered through our quantitative assessment:

- What are the residual charges and associated incentives faced by individual users due to the existing arrangements, and how are theyaffected by a change in the method by which residual charges are collected?
- What aggregate (whole system) changes might be expected from a change in the method by which residual charges are collected, and would such changes benefit consumers when compared to those that might be expected from the existing arrangements?
- What are the practical implications of changes, and assuming change is feasible, how do the costs of change compare to the quantified benefits of any change?

5.3 Our first task will be to gain a more detailed understanding of how different user groups are affected by the existing residual charging arrangements and the actions that those groups can take to reduce their exposure to these perceived costs. We are keen to understand user incentives that relate to the broader system shift away from passive consumption and toward active consumption and self-generation. To supplement this analysis, we hope to gain a better understand if certain user groups are particularly likely to respond to incentives.

5.4 With a better understanding of these issues, and insight into how these groups relate to the energy system as a whole, we hope to identify whether significant shifts in residual charges between user groups are likely, and how this is expected to change over time. Further work will assess whether these incentives and the resulting shifts in residual exposure would change under different methods of collecting the residual charges.

5.5 We think that this work is needed to determine whether methods of recovering residual charges are likely to drive particular user responses and to provide some insight into whether a response could lead to broader changes in the use of the system. Residual charges that lead to inefficient signals, but are demonstrated to be of a magnitude that does not lead to a significant change in behaviours, may be of lower concern than those that are significant enough to incentivise large-scale inefficient investments and so drive wider system changes.

5.6 From this analysis, we hope to be able to draw broader conclusions about the likely aggregate responses of system users to different methods for recovering residual charges. We recognise that there are a number of factors that will influence the robustness of this analysis, such as:

- the characteristics of the user group segments or archetypes, their representativeness as part of the wider system, and their associated behavioural responses;
- the costs of technologies or behaviours that might be adopted to reduce exposure to residual charges, and the increased or decreased costs of networks, generation or balancing that may arise from particular changes in user behaviour; and
- the approach by which we take account of other policy developments that may overlap, such as Ofgem's Electricity network access project or changes to the size or charging mechanisms of other costs recovered from energy users.

5.1 We will assess the overall benefit to consumers for each option when compared to the baseline arrangements, and may look at the following issues, among others:

- Whether it is financially beneficial for network users to install their own on-site generation or storage in order to reduce residual charges;
- The contribution that responses related to residual charging could make efforts to encourage energy efficiency, smart energy use or demand-side response;
- The interactions between behavioural responses and any investment they drive and other wider policy aims, in particular facilitating effective decarbonisation of the energy system at the lowest cost to all consumers but possibly also around innovation or sustainable development; and

5.2 We are not committing to model or simulate these costs in all cases but consider that assessment of these elements will provide useful insight. With this analysis, we will consider how the distribution of the residual charges and the incentives they can provide combine to build a picture that enables our principles-driven assessment. We expect to make use of external expertise for some of these work areas.

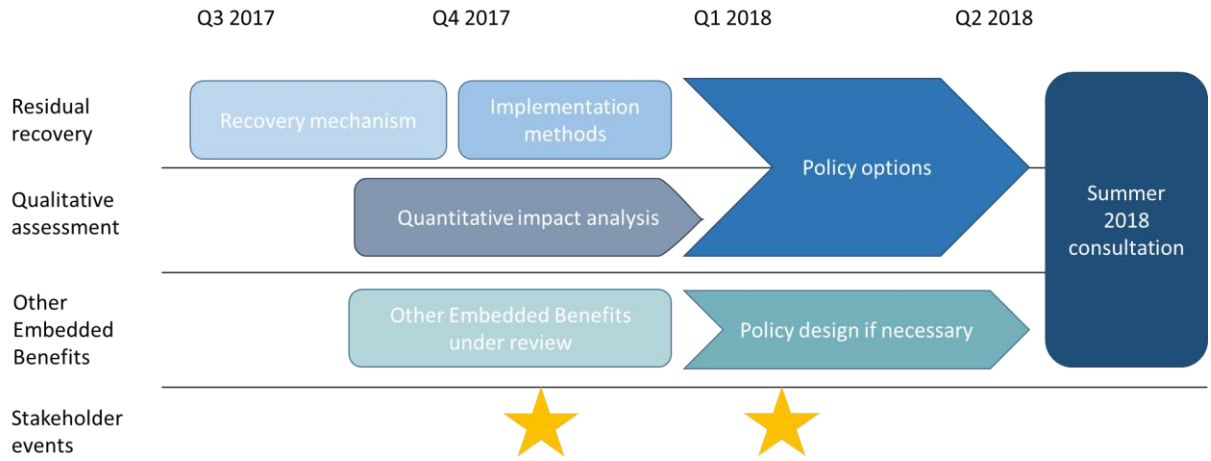
5.3 We recognise that there are likely to be trade-offs between the various factors we will assess different residual charging options against. For example, some residual collection methods may be more efficient, and so lead to aggregate consumer benefits, but may not be considered fair by energy consumers. For example, if they significantly increase the share of residual charges paid by vulnerable consumers. Similarly, options that appear fair but would result in significant levels of harmful distortions to investment or operational signals, would be difficult to justify.

5.4 In addition to the options we have detailed previously, we intend to understand more about how the incentives provided by the different approaches vary if hybrid approaches were adopted. We think there may be benefits to hybrid approaches if they can be shown likely to reduce a undue focus on one type of residual charge avoidance behaviour.

6. Next steps

5.5 This document outlines our current thinking on narrowing down the potential residual recovery options and expected timelines. The diagram below sets out the Ofgem-led policy development phase of the significant code review. Our review is split into four key work packages followed by a policy evaluation stage. We plan to hold two rounds of stakeholder events followed by a consultation on a minded-to decision in summer 2018.

Figure 3: expected timeline of the Ofgem-led policy development phase of the SCR



Recovery mechanisms

5.6 This paper has set out our initial thinking on recovery mechanisms, and sets out the four high level options we will take forward for detailed quantitative assessment. We will be looking to better understand industry views at our stakeholder events in November.

Quantitative assessment

5.7 We will be commissioning external support to help our understanding in two key areas of analysis; the distributional analysis of any changes to residual charges and the whole system impacts. There are links to our Electricity network access project, and we will ensure any modelling undertaken as part of the TCR are aligned with this work.

Implementation options

5.8 Once we have assessed the likely impacts of our short list of residual recovery mechanisms, we will assess the options for implementation of the recovery mechanisms.

5.9 It remains a potential outcome that different charge types for different users may be appropriate given the objectives we have set out, or indeed that a combination of the charge structures set out in this paper are combined for individual users.

Other Embedded Benefits

5.10 The other embedded benefits that relate to transmission and BSUOS charges remain under review during the SCR. If evidence emerges that these may be leading to significant distortions and consumer dis-benefits, we will consider whether action, ahead of the conclusion of the SCR, would be in consumers' interests. We do not plan to engage further on these particular issues at this time.

Stakeholder events

5.11 We want to engage with industry throughout the process. We do not intend to launch a Task Force under the CFF for the TCR. However, we plan to hold two rounds of stakeholder engagement ahead of our formal consultation in summer next year. The focus of the first session will be on the thinking we have set out in this working paper.

5.12 The first round of stakeholder sessions have been scheduled for 15 November in Glasgow and 30 November in London. Please register at the link below or contact us at TCR@ofgem.gov.uk if you would like to attend one of these events.[24]

5.13 We do not expect stakeholders to formally respond to this working paper. However, if there are particular views you would like to share with us, please do so via the following email address: TCR@ofgem.gov.uk

[24] You can also register via the following link: https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-workshop

ANNEX 1: Current charging arrangements and proposed modifications

Current framework for recovery of transmission residual charges

For transmission, charges have historically been first split between generation and final demand (usually charged via suppliers) on a fixed proportion, and then between forward-looking and residual charges. Due to an EU cap on average overall TNUoS charges for generation, this is no longer possible and the split between transmission charges for generation and demand is determined by the EU cap. In addition, the average forward-looking charges for generation now exceed the EU cap, which means the transmission generation residual (TGR) charge is now functioning as an adjustment mechanism to ensure average generation charges stay within the cap, and is currently negative. The transmission demand residual (TDR) charge remains a charge to ensure overall allowed revenues are recovered and remains positive.

Household and smaller business consumers are currently settled largely on a non half-hourly basis. This means that they are charged for use of the energy networks based on a combination of the kWh they have consumed and the estimated consumption patterns for their 'Profile Class'.[25], [26] Consumers in different demand zone areas are charged at different rates reflecting the different price controls of the 14 DNO regions. Residual charges recovered in this way incentivises potentially inefficient load reduction measures, for example through on-site generation.[27] These measures are considered inefficient when they do not lead to significant network cost savings, with benefits to these users not reflecting benefits (or costs) they provide to the system.

Larger industrial and commercial consumers are generally settled on a half-hourly basis. They pay both forward-looking and residual charges based on their net demand during the three half-hours of highest demand on the GB electricity transmission system over the winter period.[28] This provides strong incentives for changes in the timing and level of network use, which is appropriate for the forward-looking charges which are designed to encourage efficient use of the network. However, levying residual charges on the same basis means that some customers who take action to reduce net consumption during these periods are contributing less towards residual charges.[29]

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[25] Suppliers are charged for consumers' use of the network and are free to decide how they reflect this cost when billing their customers.

[26] Profile Classes are allocated depending on whether: the Metering System Identifier is Import or Export; meter usage is Domestic or Non-Domestic; the meter has 'switched load' capabilities; and if Maximum Demand is recorded. More information on the allocation of Profile Classes is available from: https://www.elexon.co.uk/csd/bscp516-allocation-of-profile-classes-and-sscs-for-non-half-hourly-sva-metering-systems-registered-in-smrs/

[27] On site generation is also frequently referred to as Behind the Meter (BTM) generation

[28] eg 2016/17 transmission charges use the three system peaks between Nov-16 and Feb-17 (inclusive)

[29] 'Net consumption' is used to explain the aggregate demand (total demand minus generation) at a given point in the network. This can be either taken at different voltage levels of the network such as at the GSP group level (where generation can be netted off from demand) or down to household consumer level (where generation, such as solar PV output can be netted off from consumer demand). It can also be monitored over different time horizons, such as on a half hourly basis (for large users) up to an annual meter reading.

Prior to our decision on CMP264/265, TDR charges were based on net demand in a Grid Supply Point (GSP) group during peak 'triad' periods, where net demand is the gross or total customer demand on the distribution network, less any generation output from smaller EG, within each GSP group.[30] This arrangement historically generated significant revenues for smaller EG. Those customers with onsite generation, or the ability to reduce their demand at specific times are still able to reduce their exposure to residual charges.

TGR charges are levied on transmission-connected generation (TG) and larger embedded generation (EG), but not on smaller EG or on interconnected generation. This is not currently a major distortion as TGR charges are currently small, but could become a larger issue in future.

Current framework for recovery of distribution residual charges

On the distribution side, residual charges are recovered through Distribution Use of System (DUOS) 'scaling' charges which are added onto the DUOS forward-looking charges and almost entirely recovered from suppliers.[31] Although residual charges are currently levied based on peak consumption, for consumers connected at low and high voltages, they will be applied as a 'fixed adder' to the forward-looking charges from April 2018. [32],[33] Following the implementation of DCP228 in April 2018, the fixed adder previously in £/kW/year applied at the transmission exit level (which primarily scales the on peak usage) will be replaced with a fixed p/kWh adder applied to the calculated pre-scaled unit rates. This will mean that all unit rates will face the same absolute p/kWh adjustment (except where any unit rates are subject to a floor price).

This approach allocates the distribution residual charges among the distribution voltage levels, while maintaining the cost-signal differential for consumption at different times. Residual charges are recovered from customers based on the kWh they have consumed. As with non half-hourly transmission charges, residual charges recovered in this way incentivise potentially inefficient measures to reduce overall consumption in kWh. This could mean that network users reduce their usage and/or run on-site generation which is not justified by the savings in marginal system costs.

Industry proposals

There have been a number of proposals raised by industry participants which look to reform the residual charges, both for transmission and distribution users.

Three CUSC modifications were raised in 2016/17 which have a high degree of overlap with both our Electricity network access and TCR work: CMP271,

[30] https://www.ofgem.gov.uk/publications-and-updates/embedded-benefits-impact-assessment-and-decision-industry-proposals-cmp264-and-cmp265-change-electricity-transmission-charging-arrangements-embedded-generators

[31] Generation connected at the Extra-High Voltage level does contribute towards residual charges. Generation connected at lower voltage levels will remain exempt from scaling charges when DCP228 comes into effect in April 2018.

[32] Adds fixed amounts to the unit rate element of the DUoS charge.

[33] https://www.ofgem.gov.uk/system/files/docs/2016/09/dcp228_decison_letter.pdf

CMP274 and CMP276. These modifications were run in joint work groups, due to the intersections in scope between them. All three modifications propose changes to the residual and forward looking charges. It was recognised in the workgroup that the modifications are likely to have significant overlap with our internal work on both Access, and the TCR. The modifications provide a range of different approaches to residual recovery, which will feed into our thinking as we progress through the SCR process. As such, a decision was taken by the workgroup to pause the modifications whilst the TCR/Access work is ongoing. Below we provide a brief overview of the three modifications and highlight how this relates to our work on residual recovery.

CMP271

The CMP271 proposal would revise the current charging arrangements by introducing three separate tariffs for demand users, bringing demand charges more in line with current transmission generator charges. A key change for CMP271 is that it splits out the 'peak' and 'year round' demand tariffs, which are currently recovered over the same demand base. The proposed changes are:

- A locational peak tariff derived from the Transport Model in £/kW and applied to suppliers based on "Triad" Peak Demand;

- A locational year round tariff charge derived from the Transport Model in £/kW and applied to a suppliers annual demand as a £/MWh commodity charge (this would resemble the current arrangements for BSUoS charging); and

- A residual tariff that ensures revenue recovery which is applied to a suppliers annual demand as a £/MWh commodity charge (this would resemble the current arrangements for BSUoS charging).

CMP274

The CMP274 proposal would change how the demand residual is recovered only, with the locational demand tariff recovered over triad and over the same charging base (triad), as is currently done.

The demand residual will be charged on a newly created winter baseline (not triad), calculated across 06:30-10:30 and 16:30-20:30 between Monday - Saturday. This will be calculated only across calendar days, excluding Sundays and bank holidays over the period of November to February. This would effectively be a net volumetric charge, with the inclusion of a broad time of use implementation to coincide with transmission system peak demand.

CMP276

CMP276 proposes to make broader changes to both the locational and residual elements of the demand tariffs which are summarised, in short, below:

- an adjustment is made to the demand locational tariffs to reduce the residual element of the tariff. The change prevents any negative

locational tariffs by adding the greatest negative locational value to all demand zones. This results in all locational tariffs being positive.

- the generator 'cap' on transmission generators is set at or close to €0/MWh so that transmission generators pay no transmission charges overall (when averaged).

- the remaining residual component of the charge is split over both a flat charge per Meter Point Administration Number (MPAN) and a kWh charge. This would effectively be a hybrid option combining of a fixed charge and a net volumetric charge.

The extent of overlap between the three CUSC modifications and our work on residual recovery is evident, with the modifications altering either the charging base, or the recovery mechanism, some in ways similar to that suggested within this working paper. These modifications are currently on hold, however, the working groups will be meeting in early November to assess the impact our work has on the modifications. We encourage those that have participated in the working groups set out above to attend our TCR stakeholder events to ensure full account of the progress made in those session can be considered as part of our detailed policy design process.

In 2017, two related mods were raised and subsequently withdrawn, partly due to their overlap with the TCR.[34]

[34] These mods were DCP274 'The Application of Export Capacity Charges in the EDCM' and DCP284 'The application of scaling to generation credits in the CDCM'

Annex 2: Practical considerations assessment

Metering and data flows

Fixed charges

In terms of metering and data flows, fixed charges are likely to be the easiest to implement as they can utilise current systems used for charging. It is likely that the fixed charge options could be facilitated with existing metering and data available, with little change in the underlying contractual/trading arrangements necessary. This option could be based on a per MPAN basis, or per site basis for customers with multiple feeders. The DNOs already have access to MPAN data for their customers, for the purpose of network charging, so this would require little change.

Further consideration will be required for 'sized' options, where different fixed charges are applied to different sizes of users, as it is unlikely to be accepted that a household consumer pay the same as a large industrial user. The number or granularity of those 'sized' options could match the current measurement brackets (e.g. measurement classes/MPAN) or be new.

An example could be banding according to the current profile classes with household users (profile classes 1 and 2) in one band, non-domestics (classes 3 and 4) and half hourly metered users (classes 5-8) being in another. The half hourly metered users could be allocated into bands according to their max demand over a specific time period (e.g. 2-5 years) using historic data

Gross charges

Gross charging appears to be the most challenging option from a metering perspective, with the data not currently existing to provide 'true gross' data for household and most business consumers. It is also the most challenging from an operational perspective, requiring a process to collect all data and derive a gross peak demand estimate, where the data exists to do so.

Our initial view is that this option would likely focus on business consumers. The Advanced Meter roll out was completed in 2014, and required all large non-domestic consumers (consumers in profile classes 5-8) to have 'advanced meters' installed. These advanced meters have the functionality to deliver remote half hourly consumption data to a supplier, however, the meters are not generally capable of metering export and do not meter any onsite generation, meaning additional onsite metering would be required for any generation.

On the household consumer side, whilst smart meters are capable of metering a sites import and export, users are not required to register sub 30kW exports under current arrangements and many domestic users do not have half hourly metering for their renewable generators. Under some of the renewable schemes (Feed-in Tariff for instance), exports on an installation under 30kW is 'deemed' at 50% (75% for micro-hydros). This is an approach that could be taken for household consumers if a profile could be established for the different user types (eg with onsite generation, under 30kW). It is likely that a true 'gross' option for

household users would be difficult to implement and may not provide the benefits when assessed against the cost of implementation.

Ex-post capacity charges

Ex-post charging (on a user's individual peak, for example) would likely rely on the roll out of half hourly smart metering, or for roll out to reach a minimum level to allow a profile for those not enrolled. At the point of implementation, there may also be a lack of historical half hourly smart meter data to calculate charges. The ex-ante capacity charging option could possibly be used as an interim measure.

Currently data flows tend to be aggregated into totals per supplier ('supercustomer') for charging purposes. If this process was still to be used, it is likely that data changes to the central systems could allow the data to be flagged to indicate a user's maximum demand, with this then being aggregated on the supplier level. Maximum demand data is already extractable for some metered customers and for users in profile classes 5-8. SMETS2 meters have the ability to measure maximum demand.

Ex-ante charges

This option would involve charges being set on a forecast of capacity, an agreed capacity or capacity of a user's current connection (for instance, fuse size).

In current charging arrangements, specifically DUoS charges, demand users tend to have an agreed capacity, especially for recently connected sites or for larger sites, with the DNOs having access to this data. For household consumers an agreed capacity would have to be recorded, or a proxy, such as fuse size, used.

This may fail to differentiate between large and small domestic users and could therefore score badly when assessed under our fairness principle. One possibility would be to apply the class profiles to the annual consumption recorded for individual MPANs, to determine the peak demand for that site.

If a consumer wanted to be moved between different assumed capacities, then there would also need to be an established system and process to record this, as well as suppliers being informed of the agreed capacities.

Consumer impact and cost

Fixed charges

In terms of implementation cost, it is likely that fixed charges would have both the lowest consumer and implementation cost. There would be little change required to the current metering or billing arrangements.

Whilst implementation of an approach, where the same residual charge is applied to all users, could be seen as the easiest to implement, fixed charges may require banding for different levels of users, with the next consideration

being the granularity of the banding. It is likely that the more granular options would lead to higher cost in implementation and administration.

Gross charges

If consumers were required to install meters for onsite generation, this would lead to an increased cost to those users and a requirement to declare all onsite generation. There could be an incentive not to declare onsite generation unless specific requirements and checks were in place. The cost of installing additional metering would fall on users, as well as additional data collection being required, the cost of which would ultimately fall on consumers.

This option may also provide an incentive for 'off grid' installations which are not metered, if the residual charges are high enough. This is not a cost effective or efficient outcome.

Ex-post and ex-ante

For the ex-post and ex-ante charging options, as stated previously, the cost is reliant on the smart meter roll out. For ex-ante capacity charging, additional costs may be realised by the DNOs and suppliers if they are required to administer capacity records or changes in capacity.

Contractual implications and transition period

Any change in charging may have an impact on contractual arrangements and it is important to consider whether a transition period could be in the interests of consumers.

As previously stated, if the benefit of implementing the changes was to be seen a significant benefit to consumers, then we would consider derogating against the 15 month notice period, ensuring that parties were significantly engaged and weighing it up against the significant support of publishing charges in advance.

ANNEX 3: History of charging

How we got to here

Transmission

The original split of annual TNUoS revenue between demand and generation was set in 1990 and has been a feature of National Grid Company's (now NGET) Investment Cost Related Pricing (ICRP) charging methodology since then.

The split was set as 75% payable by demand and 25% payable by generation. This revenue split was developed through consideration of alternative pricing models and the perceived inequity of the broad revenue divisions available (eg 0:100 or 50:50). A charging review undertaken by NGET in 1992 allowed OFFER to confirm the principles and methods underlying the ICRP methodology. The outcome of this review was a decision to retain the same split of revenue. In October 1996, the then Director General of Electricity Supply proposed that NGET adopt a modified approach to the identification of the appropriate connection boundary whereby spurs that served only generation should remain connection assets, i.e. retaining but slightly modifying the treatment of generation only spurs within the connection charging methodology based on a set of defining criteria.

NGET's acceptance of the 1996 transmission price control proposals resulted in a small change to the application of connection charges and a shifting in the overall balance of revenue collected from total transmission (TNUoS) charges. As a result, the application of a TNUoS revenue split between generation and demand of 25% and 75% respectively recovered from TNUoS charges was adjusted slightly to 27:73 in order to maintain the 1996/97 balance of overall transmission revenue. This ratio has applied since then although there have been subsequent suggestions from NGET and Industry to change it.

In 2003, NGET began a consultation process regarding changes to their charging methodologies with their Initial Proposals document. In this context NGET initially proposed changing the G:D split from 27:73 to 10:90, mainly to address a perceived problem of negative demand charges. The proposed change to the G:D split submitted by NGET in September 2003 were rejected by Ofgem in December 2004.

In 2014 Ofgem accepted a CUSC mod (CMP224) to set generator charges to the lower of either 27% or the maximum amount recoverable under the EC Regulation that sets a EUR2.5/MWh cap on generator charges. [35]

Distribution

After privatisation, the introduction of price controls replaced the concept of financial targets and DNOs used a variety of ways to model costs and to apply

[35] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/CUSC/Modifications/CMP224/

revenue matching in order to set DUoS charges that comply with the price control.

In October 2008, the development process to deliver a common charging methodology for HV and LV users started as a voluntary collective initiative by the seven DNO groups. In 2009, we proposed a collective licence modification to formalise the Common Distribution Charging Methodology (CDCM) development process with a specific set of legal obligations on DNOs. This licence modification was accepted by all DNOs and came into force on 1 July 2009. In April 2010, the CDCM was implemented and came into effect as the basis for most of the DUoS.

In 2011, the DNOs and the Energy Networks Association (ENA) jointly developed proposals for a new use of system charging methodology for higher voltage network users (the Extra high voltage Distribution Charging Methodology, or EDCM). The EDCM applies to customers connected at extra high voltage (EHV), or connected at high voltage (HV) and metered at a primary substation. In April 2012 EDCM was implemented for demand customers and April 2013 for generation customers.

The CDCM is the average charging model used to set charges for HV and LV end users whereas the EDCM aims to generate cost-reflective and site specific charges for import and export.

ANNEX 4: How this problem is approached in other regulated sectors in GB – telecoms and water

Recovery of residual charges in GB Networks

Economic theory indicates that users make more efficient decisions about where, when and how to use the network when they are facing the incremental or marginal cost of their behaviour. Network tariffs based on long-run marginal costs (LRMC) can provide end-users appropriate signals to encourage them to use the network efficiently, ie to minimise the costs that result from their network usage.[36]

Infrastructure networks operating as natural monopolies typically have marginal costs that are lower than average costs owing to significant joint and common costs that cannot be attributed to specific user(s). Consequently, a tariff based only on LRMC would not recover the total cost (equivalently, the total approved revenue) of the network. The difference between the total approved revenue and the revenue that would be raised through LRMC-based tariffs is termed the 'residual' charge. Below we explore the ways in which residual charges are being recovered under the network charging arrangements in the water and telecoms sectors in GB.

GB Telecoms

In GB, the telecom network provides a combination of voice, data and television services. While retail and the core networks are 'competitive', the so-called 'last mile' connections to customers – the portion of the telecoms network that physically reaches the end-user premises – are natural monopolies. The incumbent, BT Openreach is required under UK law to provide access to other service providers on an equivalent basis. Communications providers that use BT's copper network pay BT Openreach a fee to access the network for the provision of various wholesale telecoms services.

As the communications regulator in the UK, Ofcom establishes the principles for setting these cost-based access charges, and have primarily relied on two key approaches:

- Current Cost Accounting for Fully Allocated Costs (CCA FAC): The FAC of a service is calculated as the sum of: 1) direct costs: costs that can be directly attributed to the service; and 2) indirect costs: common costs that are allocated to the service based on rules determined by BT and overseen by Ofcom. Under CCA FAC, a number of different approaches have been

[36] While there has general been a long standing agreement amongst economists that economic efficiency is best achieved through marginal cost pricing, there are differences in opinion regarding whether short-run or long-run marginal costs are more appropriate. See for example, Nelson, J. R. (editor). Marginal Cost Pricing in Practice. Prentice-Hall Inc., 1964.

used to allocate indirect costs, for example, profit-weighted net replacement costs.[37]

- LRIC+: This approach estimates the forward-looking long-run incremental costs (LRIC) of a service plus an allocation of common costs (the '+'). Under LRIC+, the allocation of common cost between service groups (for example, between copper services and fibre services) typically follows the equi-proportional mark-up (EPMU) approach where common costs are allocated on the basis of the relative LRICs of different services, i.e. the higher the relative LRIC the greater the proportion of common costs allocated to that service.[38]

  Within service groups, common costs are typically allocated in a way that sets price differentials between substitutes equal to the absolute differences in their incremental costs (eg, between copper services). Alternatively, the differentials may be based on current observed price difference between services (eg, services offering different speeds of superfast broadband-SFBB).[39]

In the past, Ofcom have preferred to rely on the more transparent CCA FAC approach. The CCA FAC for each regulated service is reported by BT in their Regulatory Financial Statements (RFS) which are externally audited. Where LRIC estimates are used, these are produced by BT's models that and are less transparent. Ofcom has in the past pointed to the similarities in principles between the CCA FAC and LRIC+ approaches, noting that "on efficiency grounds, there is little to differentiate between CCA FAC and LRIC + EPMU."[40]

In summary, in the GB telecoms network the residual charges – more specifically the fixed and common costs of the network – are distributed across network services based on cost allocation rules that may or may not reflect the underlying incremental costs. The GB telecom network provides a good analogy to the electricity network given that in both situations the marginal/incremental costs of the network are quite small while fixed and common costs are material. The fixed adder approach for recovering residual charges in the electricity distribution network (See 1.10 above) is similar in principle to the approach being currently used to allocate common costs in the telecoms network within service groups, i.e. a fixed amount of residual charge is added to the incremental cost based charges of services that are substitutes to ensure that price differential between substitutes equal the absolute differences in their incremental costs. In both instances, this approach has been motivated by a desire to ensure that incremental cost based signals are preserved to the extent possible.

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[37] This methodology distributes costs to activity and plant groups in proportion to the profit that the rateable assets are able to generate, and is calculated by weighting the net replacement costs (NRC) by the average return on capital employed for each rateable asset.

[38] Ofcom has in the past considered Ramsey pricing as a potential approach to allocating common costs but has not deployed it on account of difficulties associated with assessment of the elasticity of demand.

[39] Ofcom. Wholesale Local Access Market Review – Volume 2. 31 March 2017. https://www.ofcom.org.uk/__data/assets/pdf_file/0034/99637/Vol2-Charge-control.pdf

[40] Ofcom. Charge control review for LLU and WLR services. 2012 Section 3, https://www.ofcom.org.uk/__data/assets/pdf_file/0024/53808/statementmarch12.pdf.

GB Water

In the water (and wastewater) sector in GB, the supply activities in many jurisdictions remain vertically integrated and access sought between network operators and network users has historically been limited. The general principle guiding charging arrangements has been that volumetric rates for measured customers should relate to estimates of long-run incremental costs (LRIC). GB water companies have typically relied on the fully allocated cost (FAC) approach, albeit with a forward-looking view, to inform the basis of revenue recovery within the regulatory price controls.[41] Companies have the responsibility for deciding how much revenue is recovered from each customer group and are obligated to be non-discriminatory in striking the balance between these groups.

Ofwat's focus in regulating (wholesale) tariffs has been to ensure that tariffs are set to recover the company's existing total cost base and that revenue recovered from any particular customer group is proportional (roughly) to the costs incurred in serving it. Consequently, the average tariff has recovered the expected average accounting cost for providing the service.

Going forward, developing appropriate upstream competition will require an access regime that facilitates efficient entry in water resources. Third party water resource providers will need to access the water distribution networks and treatment facilities of incumbents who will need to set prices for providing access to their facilities. It is likely that the cost of developing new water resource will differ markedly from the average cost for existing resources as a result of the RCV discount at privatisation, and also because new resources are likely to be more expensive assuming companies have developed lower cost resources first.

Ofwat are in the process of reforming the access charging regime to encourage efficient new entry in water resources. The current proposal calls for an 'equalisation payment' in addition to the average cost-based charges that will (as before) remunerate the incumbents for the costs of providing network plus water services. The equalisation payment would be set to reflect the difference between the average price or charge of water resources and the cost of developing new water resources (ie, the LRIC of new resources), enabling third parties to compete with incumbents on a more equal footing.

In summary, the recovery of residual charges has historically not been an issue in the water sector. This is because on average tariffs have roughly equalled the average costs of service given that long-run incremental costs are broadly similar to average costs of the network. In this regard, the GB water sector is different from both the GB electricity and telecoms sectors.

[41] Anglian Water Services. Potential approaches to Access Pricing in the UK Water Sector. 17 July 2015. https://www.anglianwater.co.uk/_assets/media/Access_Pricing_-_Issues_paper_-_Main_report_-_FINAL.PDF