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Delivery Group – 17 Jan 2020

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Objectives

Objective of today's session:

- Update you on each workstream's progress with assessing options and recommending for shortlisting
- Present CEPA TENI's approach to the impact assessment to be carried out on the shortlisted options
- Get feedback on our plan for 2020/21
- Inform you of our initial thinking on packaging of options

Delivery Group meeting agenda

Item	Timing
Introduction and overview	10:00 - 10:15
Update on assessment / initial shortlisting sessions:	
Access right definition and choice	10:15 – 10:35
Improved locational DUoS signals	10:35 – 11:05
DUoS charge design	11:05 – 11:35
TNUoS	11:35 – 11:50
Connection charging boundary	11:50 – 12:05
Small users	12:05 – 12:20
Lunch	12:20 – 12:50
Initial thinking on packaging of options	12:50 – 13:15
CEPA/TNEI presentation approach to impact assessment	13:15 – 14:00
The plan for 2020/21	14:00 – 14:35
Non SCR update	14:35 – 14:45
Next steps	14:45 – 15:00

Re-cap on last year

Last year we published two working papers. The 2nd working paper was published at the start of December.

1st working paper - published in the summer

- An initial overview and assessment of options for access rights, better locational DUoS signals and charge design.
- The links between access, charging and procurement of flexibility.

2nd working paper – published in December 2019

- Small user treatment
- Distribution connection charging
- Focused transmission charging reforms

We held a Charging Futures Forum (CFF) on 18 December 2019 to gather feedback on our second working paper. Generally the response has been positive. Stakeholders have welcomed our transparent approach to option development and assessment.

Shortlisting

We are now focused on shortlisting options across all of the policy areas of the SCR, to enable us to focus our further development and in depth impact assessment. This will be based on a largely qualitative assessment of the long-list of options against our guiding principles:

Principle 1: Arrangements support efficient use and development of system capacity

- Access arrangements support network capacity in allocation to users' needs and value to network usage
- Signals reflect costs and benefits of using network at different times and places
- Signals support efficient use of capacity
- Signals ensure no undue cross-subsidisation between users
- Effective signals for justified new network capacity
- Reduce barriers to entry
- Enable new business models

Principle 2: Arrangements reflect the needs of consumers as appropriate for an essential service.

- Avoid inappropriate outcomes or unacceptable impacts for small users
- Users are able to understand arrangements
- Users have sufficient information to predict their future access and charges

Principle 3: Any changes are practical and proportionate.

- Impact on existing data collection, processing and analysis requirements
- Impact on existing systems, assets and equipment, potential requirement for new IT/operational systems (eg billing systems)
- Modifications to charge calculation and settlement methodologies
- Adaptions to engineering or planning standards
- Impact on customer engagement or commercial agreements
- Ease of implementation

The next slides take you through the high-level options we have been considering within each workstream and give an *indication* of our current thinking on which options might be shortlisted. This is subject to change.

We plan to publish an open letter in March confirming which options we have shortlisted. Our consultation/draft impact assessment over the summer will explain our reasoning for not shortlisting options at a high-level but a key reason for our ongoing engagement is to flush out any evidence that questions this shortlisting as early as possible.

Red dashes indicates an option we currently envisage shortlisting.
A **?** indicates where we are still ensure about an option.

Update on assessment:
Options for better definition and choice of access rights

Access rights assessment – options

We have identified three key options and several cross-cutting considerations

Firmness of rights	This is the extent to which a user's access to the network can be restricted (physical firmness) and their eligibility for compensation (financial firmness) if it is restricted.
Time-profiled rights	This would provide choices other than continuous, year-round access rights (eg 'peak' or 'off-peak' access).
Shared access rights	Users across multiple sites in the same broad area obtain access to the whole network, up to a jointly agreed level.
Bespoke vs standard	The extent to which access choices should be standard or bespoke
Small users	Whether we should better define levels of access for small users

Access rights assessment – evidence

We have assessed each of the options and their variants against our three Guiding Principles. To support our assessment, we have used information collated through RFIs, an ongoing academic literature review and a workshop with the DNOs.

Access subgroup – we formed a subgroup to:

- Gather data and info on the benefits of "flexible connections".
- Assess feasibility of different access choices.
- Assess impact on ability of user's to sell service to different markets.
- Assess impact on monitoring and enforcement of access rights.
- Assess the impact of better defining access rights for small users.
- Develop and assess options for distribution access to the transmission system.

Network planners

We held a workshop with the network planners to understand how the DNOs plan their networks and incur costs (eg whether shared access leads to more efficient use of network than inherent network diversity).

Challenge Group and CFF feedback

We have engaged with the CG (eg survey) and CFF to get their feedback on the access options under consideration.

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Access rights assessment

Firmness of rights	Defined by physical assets	• Could lead to more efficient use and development of system capacity. Data from “flexible connection” demonstrates the potential benefits. • CFF and CG stakeholders have stated that they would value this choice and “flexible connections” demonstrates that there is demand for this type of access. • Firmness defined by consumer outcomes, may be easier for users to understand likely level of curtailment. • No obvious feasibility issues identified – all DNOs offering flexible connections. We need to consider further how we charge for this access choice
	Defined by user experience	
	Financial firmness	• Could help support more efficient and use of system capacity. • However distribution-connected parties with non-financially firm access can already take action to mitigate against the risk of curtailment (eg storage). If a DNO wants to curtail a user with “standard connection”, then the DNO must pay the user (ie flexibility contract). • Many stakeholders consider that this could be valuable (ensures reliable revenue stream). • Financially firm access requires the development of agreed planning and security standards. There is insufficient time to develop and implement these in time for 2023.
Time-profiled rights	Static time-profiled access rights	• Could lead to more efficient use and development of system capacity. • Network conditions change will change over time. This would need to be taken into account by the network or system operator when offering this access type. • Some stakeholders have highlighted that this may be very useful for them. • No obvious feasibility issues identified. Some DNOs already offering this type of access. We need to consider further how we charge for this access choice. • However, network and system operators have signalled that it would be more challenging to offer dynamic time-profiled access.
	Dynamic time-profiled access rights	

Access rights assessment

Shared access rights

Local shared access

Wider shared access

- Could lead to more efficient use and development of system capacity behind a network constraint.
- However, could have a negative impact on system diversity, especially when access is shared by a large number of users over a wider area.
- Some stakeholders have highlighted that this may be very useful for them. Other stakeholders do not consider that this access right would be useful.
- Difficult to charge for wider shared access (eg users at different voltage levels).
- Practical issues may create additional challenges (eg monitoring and enforcement, sharing access at different sites may require "exchange rates, sharing access between multiple suppliers). These challenges are exacerbated for "wider shared access".

Small users

Defined access for small users

?

- May incentivise users to take action to reduce access requirements and reduce need for network reinforcement. It could also provide better information about where new network capacity is required.
- Individual users' access unlikely to drive need for wider network reinforcement at LV.
- May be difficult for small users (or their suppliers) to understand and accurately identify access requirements. Risk that users choose insufficient levels of access
- May be difficult to reflect different access options in charging.

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Access rights assessment

Bespoke vs standard	Bespoke	• Bespoke access right choices could provide greater efficiency of network utilisation. • However may require more work to administer and provide. • May better meet individual users' needs and may help facilitate innovation. However, could be more challenging for some users to understand, compare and trade. May be more suited to larger users. • It may be difficult to administer and charge for bespoke access rights. Bespoke access rights may also make it harder to operate the system.
	Hybrid	• Hybrid options could support efficient network (eg tailoring access choices to reflect local network conditions). • Could provide access choices that are easy to understand, with the ability to tailor meet individual user needs. Facilitate innovation, whilst maintaining degree of commonality. • This would still increase complexity (Eg administration, charging and system operability), but could be easier to implement than bespoke access rights.
	Standardised	• There is a risk that standardised options may result in less efficient utilisation of the network. • There is a risk that standardised options may not meet individual users' needs and may reduce ability to innovate. However, they may be simpler for users to understand, compare and trade. May be more suited to small users. • Standardised options may be simpler to administer and charge for. They may also make it easier to operate the system.

Access rights – our next steps & further considerations

We need to continue our quantitative analysis to better understand:

- How developing access options could support efficient use and development of system capacity
- The rate of uptake of access options and the potential impact on the electricity system
- The cost of offering and operating these access right options.

We believe further work is needed to identify:

- How we would charge for each of these access choices
- How each of these access rights choices would be defined and would work in practice (eg shared access)
- Initial thinking on hybrid options.

We expect that the Access Right subgroup will continue to support the quantitative work and develop our understanding of the options.

Update on assessment:
Options for improved DUoS locational signals

DUoS locational signals – options for change

Network cost model methodology

Model

Short-run marginal costs
Charges based on estimates of how short-run marginal costs of network (ie costs of congestion in terms of opportunity cost forsaken).

Incremental model
Models that take into account spare capacity - where model suggests that an area of a network will need additional capacity in a given timeframe, then charges based on the marginal cost of that capacity.

Ultra long-run / allocative model
Models that do not take into account spare capacity – can be seen as cost-reflective allocation of network costs or of marginal cost of expanding/replacing the network over a longer-term.

Who should signals be sent to?

Generation and demand receive equal and opposite charges / credits, with signals covering upstream costs only

Users pay charges for either upstream of downstream flows they are contributing to, with no opposing credits

+ still considering precise methodology for incremental approach (eg LRIC vs FCP)

DUoS locational signals – options for change

Locational granularity

Treatment of EHV costs for HV/LV customers

- **All the way model**: HV and LV connected customers are charged based on a generic allocative/ultra long-run model per DNO region, while EHV connected customers have highly locational incremental charges
- **Pancaking / layering**: HV and LV connected customers face equivalent charges for EHV costs as EHV connected customers, and then additional charge for HV/LV costs

HV/LV baseline

Extent of locational granularity for HV/LV customers

Extent of variation	**Varying by secondary substation / secondary groupings**	**Varying by primary substation / primary groupings**	**DNO region charges**
Basis for variation	**Urban / rural or population density archetypes**	**Cost of existing network assets**	**Extent of spare capacity**	**Reflecting dominant flows**

(HV/LV baseline)

+ still considering options for locational granularity for EHV-connected customers (zonal vs nodal, treatment where generation dominant flows)

Cost models assessment – evidence

We have assessed each of the options and their variants against our 3 Guiding Principles. To support our assessment, we have used information collated through RFIs, discussions with academics and an ongoing academic literature review, and a workshop with the DNOs.

Cost Models subgroup

We established a subgroup to identify and support qualitative assessment of the cost model options, gather data and carry out analysis. Key activities have included:

- Considering whether there is evidence to support allocating customers to different archetypes
- Assessing whether it is possible to identify generation dominated areas
- Developing a reference network model
- Gathering cost data (based on RIIO-ED1 “expert costs”) and network assets for the different DNO regions

Network planners

- We held a workshop with the network planners to understand how the DNOs plan their networks and incur costs (e.g. whether the engineering standards mean they do not plan to secure generation at all).

Request for information

- We issued an RFI seeking data on the cost and time to apply a nodal pricing approach at HV
- We have also asked the DNOs for a high level estimate of the impact of implementing at LV and evidence of whether it would be a cost reflective option.

Challenge Group and CFF feedback

- We have engaged with the CG and CFF to get feedback on the cost models policy questions we are considering.

DUoS locational signals – options assessment

Network cost model methodology

Likely only possible for EHV costs

Model

Short-run marginal costs
Charges based on estimates of how short-run marginal costs of network (ie costs of congestion in terms of opportunity cost forsaken).

Incremental model
Models that take into account spare capacity - where model suggests that an area of a network will need additional capacity in a given timeframe, then charges based on the marginal cost of that capacity.

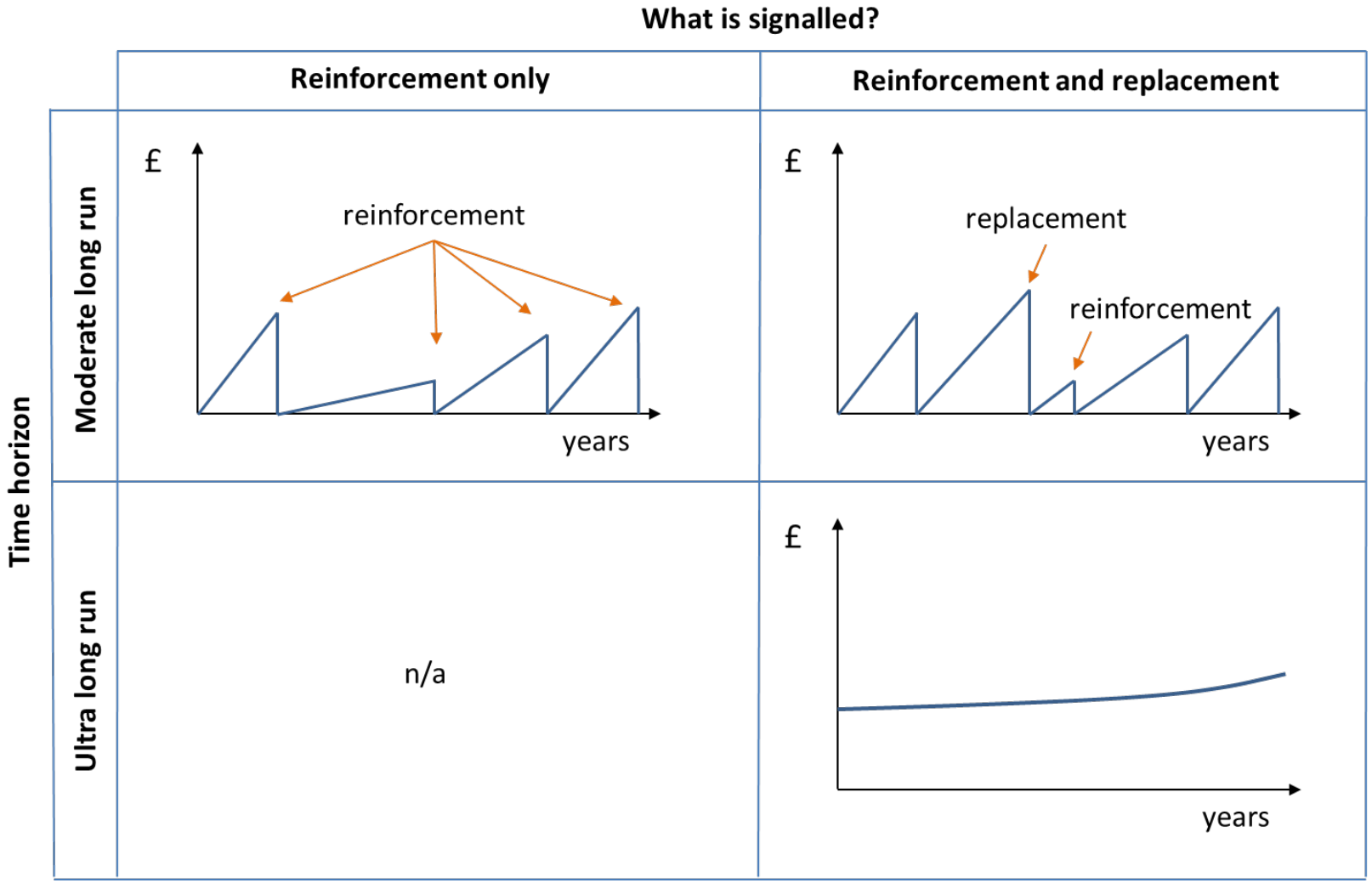
Ultra long-run / allocative model
Models that do not take into account spare capacity – can be seen as cost-reflective allocation of network costs or of marginal cost of expanding/replacing the network over a longer-term.

Who should signals be sent to?

Generation and demand receive equal and opposite charges / credits, with signals covering upstream costs only

Users pay charges for either upstream of downstream flows they are contributing to, with no opposing credits

Re-cap on different long-run marginal cost model options



DUoS locational signals – options assessment

Charging cost model

Option	Initial assessment
Short-run marginal cost charging model (nb part of real-time pricing)	• **Efficiency:** in theory very efficient, but lack of market to reveal price means administratively set price likely to be inaccurate • **Essential service:** scope to contribute to spikier and more locationally varying prices for consumers *if* passed through • **Practicality / proportionality:** insufficient network monitoring/forecasting capability and ability to forecast users' opportunity costs within implementation timeframes
Incremental long-run marginal cost model	• **Efficiency:** by focusing higher charges on areas where reinforcement need is foreseen, can encourage behaviours where they can bring most savings. But needs to be sufficiently predictable to influence behaviours. • **Essential service:** lack of predictability brings uncertainty; could lead to higher charges in some areas with potential detriment for those in high charge areas • **Practicality / proportionality:** this is viable for EHV-related costs but our present assessment (tbc) is that it will not be for HV/LV costs within implementation timeframes
Allocative/ultra long-run marginal cost model	• **Efficiency:** more predictable and can support cost-reflective charging and identifying willingness to pay. However, could encourage flexibility behaviours even in areas where lots of spare capacity - works best where is a reasonable assumption that network will need to expand over time. • **Essential service:** reduced locational variation between areas • **Practicality / proportionality:** viable/in use in some form at all voltages

DUoS locational signals – options assessment

Who faces signals?

Option	Initial assessment
Generation and demand receive equal and opposite charges/credits, with signals covering upstream costs only	• **Efficiency:** users can have right relative signals about how their impact varies at different locations of the network; those who benefit the network can readily access the value they provide • **Essential service:** limited direct impact • **Practicality / proportionality:** is current approach across both transmission and distribution charging, albeit that in some cases methodologies do not fully account for direction of dominant flow
Users pay charges for either upstream of downstream flows they are contributing to, with no opposing credits	• **Efficiency:** users can have the right absolute signal about the cost they impose on the network (where they do so), but not clear that those who bring benefits to the network would be able to readily access that value • **Essential service:** limited direct impact • **Practicality / proportionality:** this would involve a major change in how charging models are set up, with new/more sophisticated network models.

DUoS locational signals – options assessment

Locational granularity

Treatment of EHV costs for HV/LV customers

All the way model
HV and LV connected customers are charged based on a generic allocative/ultra long-run model per DNO region, while EHV connected customers have highly locational incremental charges

HV/LV baseline

Pancaking / layering
HV and LV connected customers face equivalent charges for EHV costs as EHV connected customers, and then additional charge for HV/LV costs

Extent of locational granularity for HV/LV customers

Extent of variation

Varying by secondary substation / secondary groupings

Varying by primary substation / primary groupings

DNO region charges

(HV/LV baseline)

Basis for variation

Urban / rural or population density archetypes

Cost of existing network assets

Extent of spare capacity

Reflecting dominant flows

?

DUoS locational signals – options assessment

Treatment of EHV costs for HV/LV customers

Option	Initial assessment
All the way model (baseline)	• **Efficiency:** doesn't feed through differences in EHV costs (including proximity of reinforcement need) through to HV/LV customers; can lead to cliff edge in charges for users connecting either side of a primary substation • **Essential service:** limits locational variation in charges • **Practicality / proportionality:** current approach
Pancaking/layering of EDCM produced EHV charges with HV/LV	• **Efficiency:** can provide better signals about how LV/HV customers' behaviours can reduce EHV costs; reduce distortions between LV/HV and EHV connections • **Essential service:** would increase locational variation, some users may not be able to respond. However, EHV cost variation likely to be limited relative to total bill • **Practicality / proportionality:** Would increase admin burden as introduces new tariffs – extent of this is dependent on extent of zoning of primaries. Need to consider whether change is proportionate. Incremental cost reduced if coupled with introduction of zoning for HV/LV charges.

DUoS locational signals – options assessment

Locational granularity for HV/LV costs – extent of specificity

Option	Initial assessment
Zonal – secondary substation(s)	• **Efficiency:** while can help increase cost reflectivity, if cannot be coupled with sufficient modelling of network flows/future cost drivers then approach will lead to higher charges/credits even in areas where no reinforcement needed. Could also lead to higher volatility. • **Essential service:** would lead to significant locational differences, with potential detriment for those in high charge areas • **Practicality / proportionality:** not feasible due to lack of sufficient network data; number of tariffs would be extremely high
Zonal – primary substation(s)	• **Efficiency:** as described on next slide, more scope for network data to provide reasonably accurate basis for how there is locational variation in users' impact on future network costs. Higher degree of averaging should reduce volatility • **Essential service:** some increase in locational differences could potentially create detriment in higher charge areas • **Practicality / proportionality:** as described on next slide, is adequate network data for some differentiation between primaries. Increase in number of tariffs would involve some increased administrative costs

DUoS locational signals – assessing the options

Locational granularity for HV/LV costs – basis for variation

Option	Initial assessment
Urban/rural or population density archetypes	• **Efficiency:** analysis of DNO data suggests that these are not reliable indicators of differences in network costs across locations. • **Essential service:** could lead to significant locational differences and issues with post code lottery, with potential detriment for those in high charge areas • **Practicality / proportionality:** technically viable at primary level but unlikely to be proportionate
Cost of existing asset mix	• **Efficiency:** Increased locational specificity could improve cost reflectivity but could lead to distortions if not reflective of how future cost drivers vary • **Essential service:** could lead to significant locational differences and issues with post code lottery, with potential detriment for those in high charge areas • **Practicality / proportionality:** while not readily available for all DNOs, drawing this information together seems feasible with SCR implementation timelines
Extent of spare capacity	• **Efficiency:** spare capacity at primary substation could be used as indicator for need for reinforcement below that level, but this is likely to be poor proxy • **Essential service:** could lead to more locational variation but effect would be to turn down some demand charges in some areas relative to status quo • **Practicality / proportionality:** feasible for primary substation loading only
Reflecting dominant flows	• **Efficiency:** reflecting where generation is not saving/demand not contributing to possible reinforcement should increase efficiency • **Essential service:** could lead to more locational variation but effect would be to turn down some demand charges in some areas relative to status quo • **Practicality / proportionality:** possible to determine at primary level whether flows are generation or demand-dominated but not below

Cost models – our next steps & further considerations

We need to continue our quantitative analysis:

- Understanding extent of locational variation between primaries for both EHV and HV/LV cost drivers and considering different options for grouping primaries for charging purposes
- Understanding the potential administrative costs of introducing new tariffs

We believe further work to determine our policy positions is needed to address:

- Considering the best incremental model methodology and level of zoning for EHV customers/costs, including considering if/how replacement costs should be factored in
- Considering the role for and approach to allocating some charges alongside incremental charges for reinforcement
- Developing the detailed option(s) to address generation-dominated areas
- Develop the approach to allocating MPANs to different charging zones
- Ahead of shortlisting, finalising our views on whether:
  - An incremental will be possible or not for high voltage costs by 2023
  - There would be any value in reflecting the cost of existing network assets

Update on assessment DUoS charge design options

DUoS charge design – options for change

We've previously outlined 6 core options for change, each with potential variants:

Timebands differ within DNO region

Charges differ across seasons

Static	Dynamic
Volumetric ToU: • Based on actual consumption • Different unit rates (£/kWh) are assigned to time bands	**Real time pricing:** • Based on actual usage • Rates (£/kWh or £/kW) determine dynamically reflecting network conditions • Customers notified in advance • Time periods that a rate applies could vary
Actual capacity: • Based on actual capacity • Charges (£/kW or £/kVA) reflect maximum capacity during a designated time period • Could be calculated annually, weekly, daily, at "peak" times, etc	**Critical peak pricing:** • Based on actual usage • Small number of peak periods during which high charges apply (£/kW or £/kVA) • Low or no charges during other periods • Peak periods could be ex-post or ex-ante
Agreed capacity: • Based on agreed capacity (individual, deemed or menu based) and does not vary to reflect usage below the agreed level • Calculated in £/kW or £/kVA • Could have time bands applied	**Critical peak rebates:** • Based on actual usage • Small number of peak periods during which rebates apply (£/kW or £/kVA) • Low or no charges during other periods • Baseline would need to be identified

There are two broad category of charge type – static (charges set in advance to be applied to consumption or capacity at pre-defined times) and dynamic (charges could change, as could the times at which charges/credits apply depending on network conditions)

There are multiple degrees of investment and operational signals available through these options, with potential options around season, time and ex ante/ex post approaches

DUoS Charge Design – our approach to shortlisting

We have assessed each of the options and their variants against our 3 Guiding Principles. To support our assessment, we have used information collated through RFIs, an ongoing academic literature review and a workshop with the DNOs.

The RFIs and workshop:

- Aiming to gather information on:
  - Cost drivers;
  - Constraints;
  - Current network monitoring capability;
  - Network connectivity data;
  - How networks are planned; and
  - Approach to forecasting

Use:

- If a network charging option requires levels of monitoring or connectivity data which are not available, that option is unlikely to meet our 'practical and proportionate' Principle;
- Once cost drivers and existing constraints are understood, it's possible to consider how best to relay those messages to network users and to ensure that costs are borne by those driving them, to the extent possible

Literature Review & Academic Discussions:

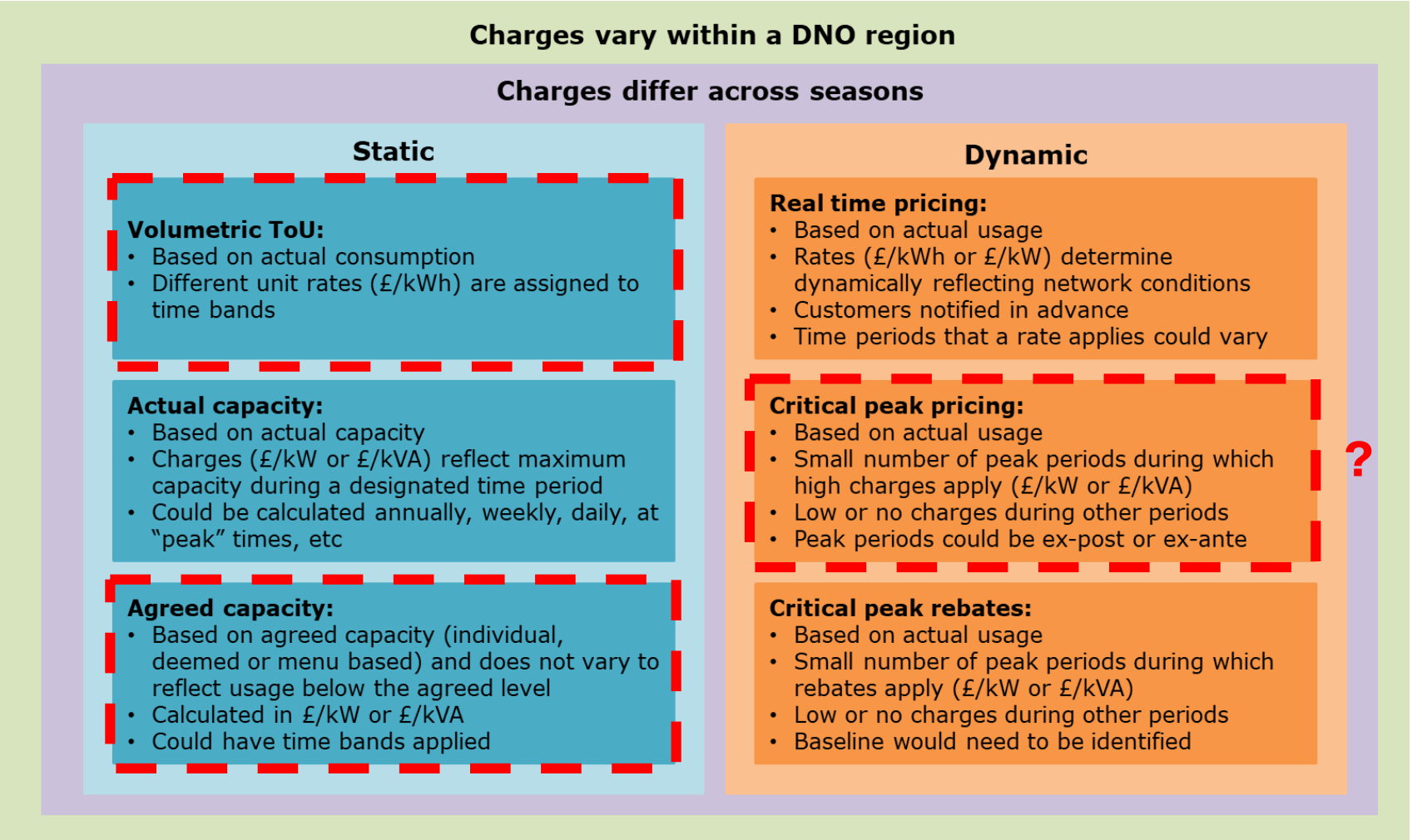
- Conducting a literature review to identify:
  - Merits/demerits of each option, including economic theory;
  - Examples of where they have been implemented in other countries and, if they were considered but not chosen, the reasons for not choosing them
  - Evidence of the behavioural response to different options identified in trials or actual implementation

Academic key messages included:

- A dynamic option (with sharp operational signals) only works well where there is high confidence that an operational response is needed during those periods (i.e. the charging model reflects proximity of reinforcement need in sufficiently locationally accurate detail)

DUoS charge design – options assessment

Having considered all 6 core options, and their variants against our 3 Guiding Principles, our current thinking is to **shortlist** both **Volumetric ToU** and **Agreed Capacity**. We believe further consideration of **Critical Peak Pricing** is needed before it can be ruled in or out



Principle 1 - arrangements support efficient use and development of system capacity

Static Option	Initial assessment
Volumetric ToU	• Users are already familiar with the concept of 'use less, pay less' and where they fully understand this option, they may be more likely to engage with their energy usage, resulting in more efficient network usage over time if response leads to consistently lower peaks; • If the timebands or their application are based on profiled data there may be a dampened incentive to change behaviour • Consideration of alignment of timebands to network conditions required
Actual Capacity	• Very similar to ToU and as such the incremental network efficiency benefits of measuring actual capacity during peaks are unclear;
Agreed Capacity	• Close alignment to network planning/build for DNOs – especially at higher voltages - therefore close alignment to cost drivers; • Encourages users to reduce their maximum capacity requirements but in itself • Could also complement some network access right choices (flexible/interruptible connections; off-peak access); • Actual Capacity still needs to be measured for exceedance

Principle 1 - arrangements support efficient use and development of system capacity

Dynamic Option	Initial assessment
Real-time pricing	• Would be the best alignment of signals and network conditions if it can be delivered; • May not be predictable enough to be a strong investment signal
Critical Peak Pricing	• Would provide a better alignment of operational signals and network conditions if charging model is locationally accurate; • Could send signals that conflict with other market messages (flexibility procurement/BM etc); • May result in peak shifting rather than load flattening, which may not reduce network costs significantly if next biggest peaks still high; • Does not provide a long-term investment signal
Critical Peak Rebates	• Similar to CPP but may not drive behaviour to a greater – or more accurate - extent than flexibility procurement or Access options could; • Uncertainty as to whether this would prompt a greater user response than a CPP high charge (i.e. charge avoidance vs. credit receipt) • Does not provide a long-term investment signal

Principle 2 - **arrangements reflect the needs of consumers as appropriate for an essential service**

Static Option	Initial assessment
Volumetric ToU	• Users only pay charges for their actual usage; • With charges and timebands known in advance, users are better able to plan their energy spend; • Network users who cannot respond to signals risk incurring higher charges – particular consideration of effect on vulnerable/fuel poor and other small users needed
Actual Capacity	• Similar to Volumetric ToU, although consumers without agreed capacity today may not be as familiar with the concept of being charged based on kW/kVA rather than kWh
Agreed Capacity	• The charge is effectively fixed if the customer does not exceed their agreed capacity • If defining small users' access was shortlisted, small users with high, inflexible capacity requirements could face higher charges – particular consideration of effect on vulnerable/fuel poor and other small users needed • Small consumers may find it difficult to understand their capacity requirements

Principle 2 - **arrangements reflect the needs of consumers as appropriate for an essential service**

Dynamic Option	Initial assessment
Real Time or Critical Peak Pricing	• Network users who cannot respond to signals risk incurring high charges – particular consideration of effect on vulnerable/fuel poor and other small users needed. Bill shock risk of consuming during high charge periods higher due to sharper signals.
Critical Peak Rebates	• Consumers may prefer to receive a credit under the rebate option than to avoid paying a high charge under the pricing option;

Principle 3 - **any changes should be practical and proportionate**

Static Option	Initial assessment
Volumetric ToU	• Likely to be relatively simple to implement, as it is similar to the current approach – more complex for disaggregated billing solutions or supplier-specific profiling; • We recognise that many market participants including Suppliers and DNOs may need to undertake IT upgrades to manage disaggregated billing or more locational/seasonal granularity in charges, but these variants are not unique to this option
Actual Capacity	• If this option is not used to recover all forward-looking charges, it could still be used in conjunction with any Agreed Capacity approach for the purposes of exceedance charges
Agreed Capacity	• Some HH sites already have agreed capacity, so implementation is an upscaling of the current arrangements rather than a new structure to implement; • For small users (who aren't CT metered), the DNO or Supplier would need to agree capacities with every network user which would be administratively burdensome and may drive costs, both for DNOs/suppliers and for consumers if agreed contractually – if do shortlist this option for small users will need to explore ways to mitigate

Principle 3 - **any changes should be practical and proportionate**

Dynamic Option	Initial assessment
Real-time pricing	• There would be no market for price-discovery – charges (mix of SR and LR costs) would be administratively set by DNO. This would require same monitoring/forecasting as for CPP *plus* ability to forecast how users' marginal (opportunity) costs in different time periods; • Could lead to over-/under-recovery of DNO allowed revenues or increase in Residual; • Suppliers would need to invest in new systems/system upgrades to send notifications to customers if passing charges through;
Critical Peak Pricing	• Would require network monitoring at all voltages to identify and relay messages regarding network/asset conditions; • Over-/under-recovery risks to DNOs through variable charges with unknown response rates; • Suppliers may be less likely to pass through signals – the relatively high cost of implementation of these options may therefore not be proportionate to the benefits that would be derived. However, would still work for other automation-based service offerings • Suppliers would need to invest in new systems/system upgrades to send notifications to customers if passing charges through;
Critical Peak Rebates	• Similar to CPP, but in addition, a 'base' level of usage would have to be established so as to identify the incremental load reduction/shift; • Suppliers may be less likely to pass through signals – the relatively high cost of implementation should be assessed against the incremental benefits

DUoS charge design – our next steps & further considerations

We need to continue our quantitative analysis:

- We are analysing the **seasonal and daily peaking patterns** on a per primary substation basis, particularly to determine the extent of variation that exists in (and between) DNO regions and whether there may be a case for considering differing network backgrounds (eg year-round and peak) in setting charges; and
- We are looking to **determine whether peaks align at different voltage levels**, and whether sending one signal at one voltage level would drive undesired user behaviour at other another

We believe further work is needed on:

- The network benefits of an agreed capacity option for **small users**;
- The relative merits of **hybrids** of some options, for instance capacity and volumetric ToU;
- The extent to which **Critical Peak Pricing** is feasible once we better understand the relative costs and timing of this option

DUoS charge design – our next steps & further considerations

Delivery group input

- We do not intend to set up a separate sub-group for this
- We continue to analyse the primary data collected by the cost models sub-group and may have follow ups on this
- We envisage that we will discuss charge design issues with the cost-model sub-group on an ad hoc basis, with that group making sense given the high levels of interactions between charge design and cost models
- We are also working with CEPA-TNEI under their DCUSA contract to develop greater detail on how different charge design options could be implemented

Update on assessment TNUoS Reforms

TNUoS – Charge Design

TNUoS charge design – options

In our working paper we set out 4 broad options:

Static charging options

Actual capacity / Volumetric ToU

- Based on use of capacity within specific time bands or consumption of energy within time bands.
- Bands priced differently to reflect the expected cost of using the system at that point in time.

Agreed Capacity

- Based on a users' agreed capacity of a user (in some cases could be deemed).
- Charges are not time-banded and there are no peak periods, so users do not face day-to-day signals, except to stay within their capacity.
- Consistent charge for a charging period e.g. per month or per day.

Dynamic charging options

Ex-post critical peak (Improved Triad)

- Based on use of capacity in peak periods which are not known in advance.
- Charges only within peak periods, with relatively sharp signal to manage usage during those periods.
- Users required to predict charging periods, or manage their use of the system in periods that could turn out to be a peak period.
- Improvements could include moving to regional peaks and removal of non-peak costs.

Ex-ante critical peak

- Based on use of capacity in specified periods forecast by system operator.
- Users notified of peak periods, and so are not required to predict peak periods.
- Charges only within those specified peak periods, with relatively sharp signal to manage usage during those periods.

Static charging options provide visibility of charges to users ahead of time, often months ahead, which do not change within a charging period.

Dynamic charging options require more user engagement and users do not have full information about the cost of using the system in different periods until closer to the time or after the fact.

Charges provide different levels of investment and operational signals. In the case of Agreed Capacity charges, no operational signals are provided at all.

TNUoS charge design – options assessment

Having considered the options against our three guiding principles, we consider volumetric ToU and agreed capacity should be shortlisted for assessment against the status quo. We are still considering whether a reformed ex-post critical peak approach should also be taken forward.

Static charging options

Actual capacity / Volumetric ToU

- Based on use of capacity within specific time bands or consumption of energy within time bands.
- £/kW or £/kWh.
- Bands priced differently to reflect the expected cost of using the system at that point in time.

Agreed Capacity

- Based on a users' agreed capacity of a user (in some cases could be deemed).
- £/kW or £/kVA.
- Charges are not time-banded and there are no peak periods, so users do not face day-to-day signals, except to stay within their capacity.
- Consistent charge for a charging period e.g. per month or per day.

Dynamic charging options

Ex-post critical peak (Improved Triad)

- Based on use of capacity in peak periods which are not known in advance.
- Charges only within peak periods, generally with relatively sharp signal to manage usage at that time.
- Users required to predict charging periods, or manage their use of the system in periods that could turn out to be a peak period.
- £/kW or £/kVA.

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Ex-ante critical peak

- Based on use of capacity in specified periods forecast by system operator.
- Users notified of peak periods, and so are not required to predict peak periods.
- Charges only within those specified peak periods, generally with relatively high prices and sharp signal to manage capacity use.
- £/kW or £/kVA.

TNUoS charge design – assessing the options

Principle 1 - arrangements support efficient use and development of system capacity

Charge Type	Option	Initial assessment
Static	Actual capacity / Volumetric ToU	• Good engagement from users is likely. If periods of high cost are well understood, charges should provide signals for flexibility and lead to more efficient use of the system. • Less sharp signals than critical peak, so response may be less pronounced. • Can work well if high number of similar peaks and can allow for more than just peak costs to be signalled to users. • Access or option value not reflected, as charge related to use. • Response may overlap or clash with other flexibility signals.
	Agreed Capacity	• Can reflect key transmission cost drivers and both Peak and Year Round impacts. • Incentivises users to manage capacity • Reflects access and option value, can work well with different options for different access and firmness levels. • Reliant on access right choices or flexibility markets to provide signals for operational flexibility
Dynamic	Ex-post critical peak (Improved Triad)	• In use currently, with good record of engagement. • If charging periods aligns with national and/or local network flows, can support reduced network costs. • Year Round costs not dealt with appropriately, potentially undervaluing flexibility during non-peak periods. • Response may overlap or clash with other flexibility signals. • Access or option value not reflected, as charge related to use.
	Ex-ante critical peak	• If forecasted periods are accurate, aligns well to system conditions and users sufficiently engaged, peak demand should be reduced. However, may not suit GB profile with many similar peaks. • Year Round costs not dealt with appropriately, potentially undervaluing flexibility during non-peak periods. • Access or option value not reflected, as charge related to use. • Response may overlap or clash with other flexibility signals.

TNUoS charge design – assessing the options

Principle 2 - **arrangements reflect the needs of consumers as appropriate for an essential service**

Charge Type	Option	Initial assessment
Static	Actual capacity / Volumetric ToU	• Users pay charges related to their actual usage, and periods of high charges are known well in advance. • Risk that inflexible users or those who are not engaged may find usage in expensive periods costly, potentially impacting vulnerable/fuel poor and small users, if they are on pass-through tariffs.
	Agreed Capacity	• Charge more or less fixed in advance. • Greater impact on users who have high usage at times, even if usage is low for most of the time or this usage does not coincide with periods of high cost. • Risk that users who do not understand their capacity requirements may pay more, either through excess capacity charges or oversizing of agreed capacity.
Dynamic	Ex-post critical peak (Improved Triad)	• Status quo for many users already, though refinements could impact predictability. • Risk that inflexible users or those who are not engaged may find usage in expensive periods very costly, potentially impacting vulnerable/fuel poor and small users, if on pass-through tariffs.
	Ex-ante critical peak	• More predictable than ex-post approach • Risk that inflexible users or those who are not engaged may find usage in expensive periods very costly, potentially impacting vulnerable/fuel poor and small users, if on pass-through tariffs.

TNUoS charge design – assessing the options

Principle 3 - **any changes should be practical and proportionate**

Charge Type	Option	Initial assessment
Static	Actual capacity / Volumetric ToU	• Would require changes, but reasonably simple in principle. Depending on the design of the charge, there could be significant settlement requirements to match usage with charging periods. • Does not require agreed capacity for users that don't currently have this. • New revenue forecasts would be needed, as engagement unknown. • Supplier pricing and billing models will probably need significant change
	Agreed Capacity	• Sites that don't currently have agreed capacity will require this to be set – potentially many users. • Simple for ESO to predict revenues, reducing risk. • Supplier pricing and billing models will need to change, but simple in principle
Dynamic	Ex-post critical peak (Improved Triad)	• Status quo option for most users. Expansion to smaller users may not be proportional or practical. • If refinement is needed to better reflect local peaks, significant change may be needed as well as new forecasting capability for industry. • Revenue forecasts exist currently, though may need updates if changes are made.
	Ex-ante critical peak	• Would require new revenue forecast as engagement unknown. • Would require means of forecasting and communicating peaks to users. • Supplier pricing and billing models will probably need significant change

TNUoS – Distributed Generation charges

SDG charge design – options

In our working paper we set out three options to treat SDG on a more equivalent basis to larger generators:

We would expect to pursue one of these two options

Remove cap and maintain inverse demand charges for SDG

- Remove cap at zero for SDG wider locational charges, so that those in zones where generation contributes to network flows would face a signal to reflect this
- SDG would face signals equal to the inverse of the relevant demand charge.
- If Triad is retained, this would be based on the SDG output during triad periods
- If another demand charging option is chosen, SDG would be charged on the inverse of the demand charge.

Remove cap and move to generation charges for SDG

- Remove cap at zero for SDG wider locational charges, so that those in zones where generation contributes to network flows would face a signal to reflect this
- SDG charges would be on equivalent basis as larger generators, ie based on capacity and with adjustments for intermittency and peak/year-round
- Very small generators may need to retain inverse demand charging for practical reasons.

Could be applied alongside the other options

Distributed generation contribution to local assets

- DG (smaller and larger) make contributions to local circuit charges where relevant
- This would prevent a situation where certain parts of the network would have higher charges for TG as SDG not required to contribute to local assets that they use.

SDG charge design – options assessment

We propose to take all options forward, though we think inverse demand charging has some weaknesses

We would expect to pursue one of these two options

Remove cap and maintain inverse demand charges for SDG

- More cost-reflective than existing regime
- Will increase charges for some generators.
- Could lead to dispatch impacts under some charging models such as Triad, though this could be mitigated under some demand charging options.
- Practical issues surrounding charging these users if they a) avoid charging periods or b) don't have formal relationships with ESO
- SDG face different charges (higher or lower) than TG as technology and load factor not accounted for.

Remove cap and move to generation charges for SDG

- More likely to lead to efficient outcomes as cost-reflectivity improved.
- Should lead to non-discriminatory investment regime.
- Allows demand charges to be designed for demand only, rather than additionally to manage SDG charges and incentives.
- Will increase charges for some generators.
- Potential for expansion of TG charging administration.
- May require changes to generators relationships with other industry parties.

Could be applied to one of the other options

Distributed generation contribution to local assets

- More likely to lead to efficient outcomes as cost-reflectivity improved.
- Distortion between TG and SDG removed

SDG access options and assessment

Our thinking has not advanced significantly in this area, though we have taken on board webinar / menti feedback on the possibility of further options in this area. We intend to continue our assessment of the possible access options.

Working paper options

No change

- No changes to Access Right definitions.
- Less likely to lead to efficient outcomes
- Status quo
- May prevent some charging options.
- May include changes to developer capacity regime to allow SDG choose financially firm

Explicit rights via agreement

- Requires users to agree explicit access to the transmission system
- More likely to lead to efficient outcomes, clarity around rights
- Requires users to enter into agreements

Explicit rights via third party

- DNOs or suppliers could obtain access on behalf of customers
- More likely to give efficient outcomes, cost reflectivity improved, clarity around rights
- Requires users to engage with DNO/supplier to obtain access
- Could include changes to the National Terms of connection with rights to access transmission added to NTCs for generators over a certain size

TNUoS – options for changes to the Transport model's existing reference node approach

Changes to the distributed reference node – options

In our working paper we set out a number of options, including retaining the existing arrangements:

There are multiple options for the treatment of the 'distributed reference node', which is used in TNUoS to set the Locational element for Generation and Demand

We need to understand more about whether the current arrangements are distortive, what those distortions are and whether material changes to the TNUoS transport model are the best way to resolve them

If our assessment leads us to believe that there are distortions arising from the use of a demand-weighted distributed reference node, we will consider the options outlined in our recent working paper

This is an inherently complex topic which – we think – needs a more dedicated discussion for those interested. We propose to set up a call to discuss this area in more detail.

We would welcome expressions of interest to join a specific discussion on the reference node: FutureChargingandAccess@ofgem.gov.uk.

TNUoS – our next steps & further considerations

We need to continue our quantitative analysis to provide:

- Evidence of key drivers of transmission network costs and how they could be best reflected in different charge designs, eg considering the case for year-round tariffs and regional variations
- Evidence of the impact of SDG on transmission network costs

We believe further work is needed on:

- How options for charging SDG could be implemented, including how to determine agreed capacities and other factors (eg load factor) relevant to apply TG charging principles
- Whether there are relevant issues to be addressed through reference node options, and if so the extent to which the options would deliver the expected effects
- The implementation costs of different options

We are working with the ESO to support this work and also envisage needing input from others, eg on implementation costs.

TNUoS – our next steps & further considerations

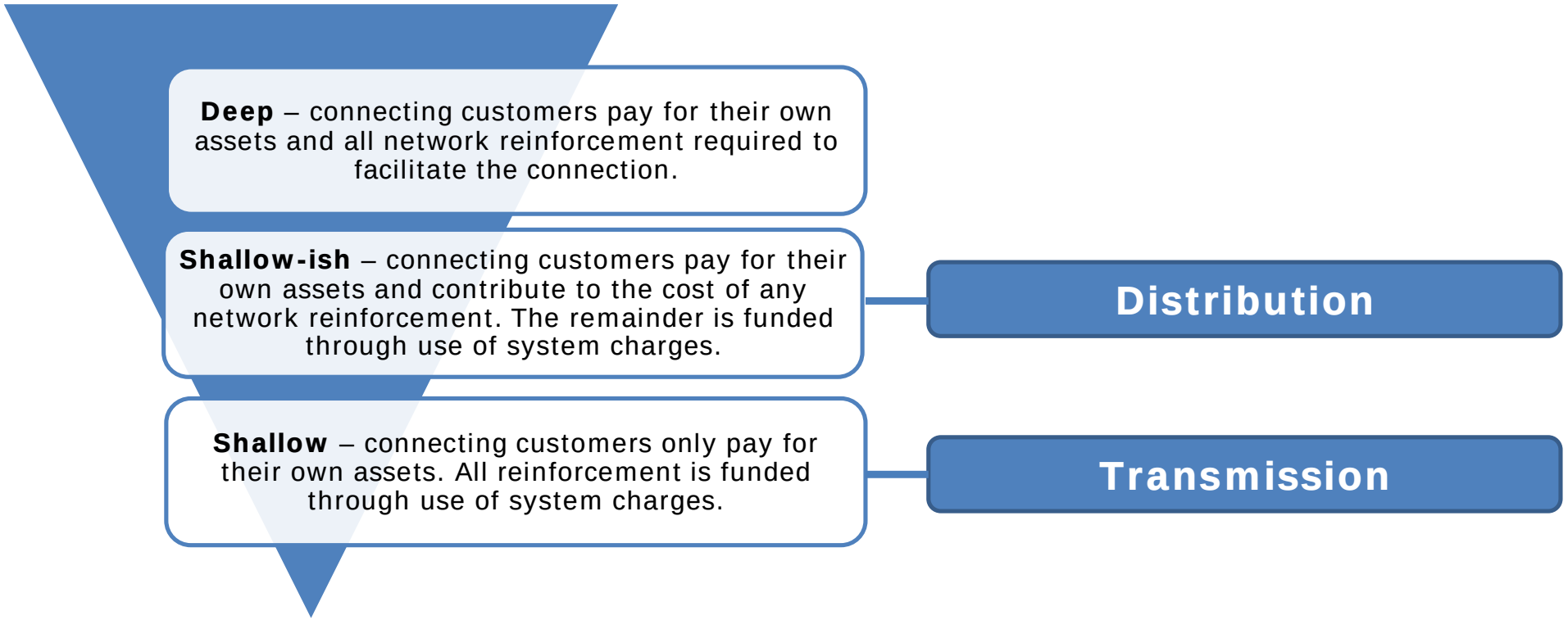
Delivery group input

- We do not envisage setting up a sub-group on this
- We will need significant input from the ESO and are engaging with them bilaterally on this
- We may also need ad hoc input from TOs to support understanding of cost drivers
- We envisage we will need delivery group input on the options for defining SDG's transmission access and collecting charges from them
- We also note the need to consider consistency with DUoS reforms (esp. on demand charging design) and so will keep the delivery group updated on our analysis

Update on assessment
Connection charging boundary options

Connection charging boundary – current arrangements

The connection boundary is the extent to which customers pay for a new connection and is currently referred to as **“shallow-ish”** at distribution.



Stakeholders have told us the current arrangements could be creating undue barriers to entry and or distorting investment decisions. When we launched the SCR we said we would look for evidence of this and explore a range of options for the distribution connecting charging boundary.

Connection boundary – our approach to shortlisting

While being cognisant of the other principles, our initial assessment has mainly focused on Guiding Principle 1 – "**arrangements support efficient use and development of system capacity**". To support our shortlisting, we have used information from a range of sources.

Connection boundary sub group:

- A sub group made up of DNOs, IDNOs, TOs and ESO developed and assessed a long list of options for change.
- This work was shared with the Delivery and Challenge Groups and the Charging Futures Forum for feedback.

Charging scenarios:

- The ENA led work on scenario analyses, comparing the lifetime costs of connections based on different voltages and locations.
- This work seeks to test the hypothesis that the current difference in arrangements at T and D are causing distortions.

Literature Review & Academic Discussions:

- We have conducted a literature review of relevant academic material.
- We have also engaged with a number of academics through Ofgem's Academic Panel.

Other data:

- We have examined data submitted by the DNOs as part of the annual reporting process. This provides data on the cost of connections, in the context of wider reinforcement, and the overall and relative cost of accepted and rejected offers.
- We held a workshop with network planners to better understand how DNOs plan their networks and what the changes might mean in the future.

Gathering evidence of issues with the current arrangements is a crucial part of our assessment. While we think there may be some evidence to suggest upfront cost might be a barrier to some, we have not yet seen compelling evidence to support more fundamental change. We would welcome any further insights being sent to **FutureChargingandAccess@ofgem.gov.uk**.

Connection boundary – options for change

We have identified a number of options grouped under different depths. We do not think we can rule out any high level options at this stage – but, based on the assessment and evidence so far, do not propose taking forward all variants.

There are also other changes we could make regardless of the connection boundary depth such as alternative payment terms and or introducing liabilities and securities.

Shallow-ish

- Status quo but could be modified to include, for example, alternative payment terms.
- Connecting customers pay for their own assets and contribute to the cost of any network reinforcement.
- The remainder is funded through use of system charges

Shallower

- Connecting customers pay for their own assets.
- Connecting customers make some contribute to the cost of any network reinforcement, but less than they do today.
- The remainder is funded by all customers through use of system charges.

Shallow

- Connecting customers pay for their own assets.
- All reinforcement costs is funded through use of system charges.
- Could go even further with some or all of the cost of extension assets through use of system charges.

Alternative payment terms

Liabilities and securities

Connection boundary – shallower variants

We propose to take forward three possible variants of a shallower connection boundary.

Variant	Initial assessment	Proposal
Remove High Cost Cap (HCC)	• Would align treatment of demand and generation. • Would reduce cost barrier for some DG users that otherwise might choose not to connect. • May encourage connection in areas where high level of reinforcement is needed pushing up costs for all.	**Shortlist**
Amend the voltage rule	• Could keep some locational signal (although not as strong as with a shallowish boundary). • Could encourage DNOs to consider flexible alternatives to traditional reinforcement/ more strategic approach(es) to support more efficient network development. • Potential for issues when customer requesting the connection is different from the ongoing customer.	**Shortlist**
Amend or replace the Cost Apportionment Factor (CAF)	• Similar pros and cons to amending the voltage rule. • Need to consider risk of creating a target capacity that breaching would trigger costs for the connecting user. • Would need to consider what the amended calculation would look like in practice.	**Shortlist**
Cap connection charges	• Could introduce cross-subsidies between users. • Could be challenging to set a cap without being, at least partly, arbitrary. • May have unintended consequences for competition in connections.	Do not shortlist
Recover the cost of transmission reinforcement through use of system charges	• Could introduce new distortions if transmission connectees are still liable. • Could be difficult to target the users driving these costs through use of system charges. • Potential for different consequences in Scotland versus England and Wales.	Do not shortlist

Connection boundary – shallow variants

We think the evidence received so far for moving to a shallow boundary is inconclusive, but we cannot completely rule it out at this stage.

Variant	Initial assessment	Proposal
Recover only extension assets costs though connection charges	• Removes scope for different treatment at transmission and distribution (depending on further evidence gathering). • Maximum scope (of the proposed options) for DUoS funded reinforcement and considering alternatives/ more strategic approach(es) to support more efficient network development. • Potential for issues when customer requesting the connection is different from the ongoing customer.	**Shortlist**
Recover extension asset costs through connection and use of system charges	• Removes scope for different treatment at transmission and distribution (depending on further evidence gathering). • Maximum scope (of the proposed options) for DUoS funded reinforcement and considering alternatives/ more strategic approach(es) to support more efficient network development. • Potential for issues when customer requesting the connection is different from the ongoing customer. • Could be complex to implement as may need the introduction of a local circuit/ MITS type distinction.	Do not shortlist
Standard connection charges	• Would introduce cross-subsidies between users and reduce locational signal in high cost areas, leading to more expensive networks overall. • Could be challenging to set a cap without being, at least partly, arbitrary. • May have unintended consequences for competition in connections.	Do not shortlist

Cross-cutting considerations

We are continuing to look at a number of cross-cutting considerations.

Alternative payment terms	• Regardless of boundary depth, we think alternative payment terms could address some of the concerns raised. • Based on the work so far, we think this is most likely to take the form of payment over time. • More work is needed to consider whether this would be for extension assets, reinforcement or both – and what this would mean for networks and customers.
Liabilities and securities	• We continue to think it is prudent to consider whether some mechanism of liabilities and securities would be required at distribution to protect existing customers from the cost of connections that do not proceed. • However, we will consider what is practical and proportionate. • More work is also required to understand what form of L&S would be required, whether obligations would continue post-energisation and whether it risks creating new barriers.
User segmentation	• We need to consider user segmentation further, including assessing the approach of doing it by voltage level alongside alternative options. • This could be informed by looking at arrangements in other countries and a more detailed comparison of the connections at transmission and at different distribution voltage levels. • We will work closely with the charge design and cost models work streams to inform our thinking.
Treatment of existing small users under RIIO-ED1	• From April 2015, where reinforcement of the network is caused by existing domestic or small business customers connecting new appliances, these costs are funded by all customers (through use of system charges). • We do not propose to recommend any changes to this rule as part of the Access and Forward Looking Charges SCR.

Connection charging boundary – our next steps & further considerations

We will continue further evidence gathering and analysis to better understand the issues with the current system, including the extent to which the current arrangements are:

- Supporting effective investment decisions, or creating an undue barrier to investment.
- Distorting the connections playing field between distribution and transmission.
- Preventing efficient DNO actions to support network development (strategic/anticipatory investment and flexible procurement).

We also believe further work is needed on:

- Refinement of the proposed options, in particular alternative payment terms and liabilities and securities.
- User segmentation including links with other work streams.

We are grateful for the input from the sub group so far and expect it to continue to help inform our work. We think this will involve at least two meetings on the above topics but may also involve requests for information, pieces of analysis and comments on our developed thinking as required.

Update on assessment
Small Users

Small users adaptations and protections – options for change

Our small users work considers whether access and charging reforms should apply to all network users and whether adaptations or protections may be required to protect domestic and small business consumers, as we transition to a smarter, more flexible and low carbon energy system. We want to understand where they may be at risk of undue detriment, and what options can ensure consumers overall benefit from the reforms.

This workstream so far has been thinking about how the different policy areas could work for small users and indeed the working paper covered assessment against all three guiding principles. **Going forward** we intend the respective policy workstreams will pick up their options for small users and this workstream to focus predominately on:

1. **Feeding in on the Principle 2 assessment** ("Arrangements reflect the needs of consumers as appropriate for an essential service") and
2. **Considering the potential need for adaptations / protections** for small users or particular groups of them

Retail-focused approaches

Retail regulation, including our principles-based supply licence framework

- Changes to the current or introduce new obligations
- Approaches for DNOs and non-licensed parties
- Measures for multiple parties involved

Access and charging adaptations

Access adaptations

- Defining a minimum guaranteed access level
- Limiting choices of access options or approach to setting access limits
- Standardised access options and automated increases in access levels
- Opt-in only access level definition

Use of system charging adaptations

- A basic usage tier for small users
- General limits on locational granularity for small users or at LV
- Restricting certain charge design options for small users

Connection charging adaptations

- Averaged or standardised connection charges
- Reducing the voltage threshold above which connection customers contribute to wider network capacity increases
- Changes to timing such as payments over time

Small users – suitability of options and potential adaptations and protections for shortlisting

Retail options

- In general, retail-based measures could have an important role in managing the potential risks. Existing obligations – such as our supply licence principles - potentially with some further more specific guidance or additions, could address a range of potential concerns. In particular, some aspects which rely on consistency, standardisation or coordination across or among parties may require more specific regulation or provisions.

Access options

Standardised, tiered access options with automatic increases in access on exceedance appear most likely to have potential for small users, balancing potential for efficiency benefits with simplicity. A “basic” minimum access level could form part of this, essentially forming the first tier in any set of access level options.

We may alternatively not to further define access rights for small users, or introduce greater definition and choice of access options as an “opt-in” variants.

Charging options

Suppliers and our and government’s wider retail and vulnerability policy will play a key role in managing potential risks for small users. Should the potential distributional effects of the changes to charges suggest significant risk of adverse outcomes for some small users (especially the vulnerable) then this could support the case for a basic charging tier in addition to these wider measures.

Connection charging boundary options

In general, the risks for small users associated with the options we are considering for connection charges are less significant. There may be a case for an amended approach to any requirement for financial commitment for small users, or for not extending such a requirement to them for proportionality reasons.

One approach across both access and charging options would be to try to identify **consumers in vulnerable situations** and tailor the approach to them specifically. We consider this would be challenging, given vulnerability can be hard to measure precisely and can be transient in nature. In addition, some vulnerable consumers may benefit from being able to offer flexibility. It is likely therefore that any mitigations within the access and charging framework would need to **apply generally**, eg to all domestic consumers.

Small users – our next steps & further considerations

Role of subgroup

We envisage we will continue want to engage with the Small Users subgroup but see the approach and the type of engagement changing:

- Going forward, we expect to request stakeholders' input through a **"virtual" standing group** that will include members from the previous subgroup.
- We do not plan to have recurring meetings. We expect that we may send **remote requests** for comments and views to test our thinking in more depth than the Challenge Group as required. There could be also **ad-hoc teleconferences** (only if needed).
- Given this approach, we don't think it will be necessary to have different groups within the subgroup focusing on specific aspects: everyone will have the opportunity and will be welcomed to contribute.
- We expect this group to cover access and charging aspects around adaptations (in coordination with the relevant workstreams) as well as retail market aspects.

Small users – our next steps & further considerations

We intend to undertake further analysis as we progress through the shortlisting and our impact assessment to better understand:

- The distributional impacts of our proposed options and the level of behavioural response which might be anticipated under different approaches
- We will consider in further depth in qualitative terms what the impact of shortlisted options could be, the relative benefits of different option variants and how any potential risks may be mitigated through adaptations to those options or through future retail market provisions
- Depending on the options we decide to shortlist, we would expect a different level of analysis. For example if we take forward the agreed capacity or access rights for small users, compared to other options we would expect further work to be done and more input around levels of capacity, responsibilities of parties involved, exceedance charges etc.

Do you agree with our initial views on shortlisting for small users?
Is there anything that we have missed in our further analysis?

Lunch

Packaging options

The role / need for option packaging

Ultimately, we will need to take decisions on the individual aspects of each policy workstream. But it will be important to consider different packages of options for two key reasons:

Reason	Timing
Different sub-elements need to work together coherently/as a logical package	There may be some options which work particularly well together, or approaches which are less compatible. This could mainly be determined on a **qualitative basis at the point of draft conclusions**, though will be relevant for shortlisting decisions.
Our consultants' distributional/ behavioural/ system impacts analysis needs to consider the combined effects of options	**We need to agree options packages for modelling is at the end of Feb. However, there may flexibility in the approach to modelling** – eg the models could be relatively "plug and play" in design, or we could define some initial packages we want modelled but leave scope to specify other aspects later.

What analysis do we need to do?

Our assessment will require a mix of modelling the potential impacts and “off-model” quantitative and qualitative analysis. Our initial thinking is:

Modelling

- Likely to be of more value for **assessing impact of high-level options**
- Insights on distributional and system impacts will be vital in order to justify major change
- Supports picking up combined impact of options

Off-model

- Often more suitable for **assessment of detailed sub-options**
- Principles-based assessment of high-level options also important given modelling uncertainty
- Can help inform modelling assumptions for high-level options
- Needed to help identify option interdependencies

Context and discussion questions

We are considering different approaches to packages of options, which will address the key issues we have identified in different ways:

Reminder of key issues - current arrangements:

A. Don't reflect the costs of using the network at **different locations**	B. Don't reflect the costs of using the network at **different times**	C. May pose barriers for connection to the network	D. Distortions due to **differences by voltage** and **user types**

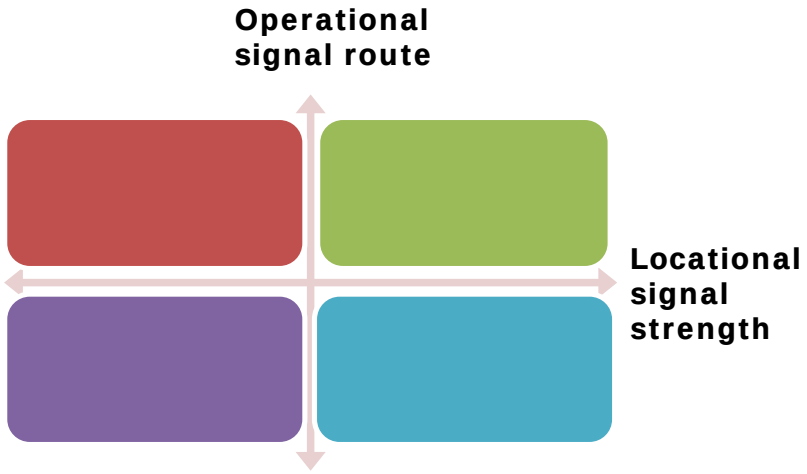
In formulating packages of options, we are considering:

- **Substitutability**: Alternative approaches with lead option in different policy areas may be taken to addressing the key issues in different ways. Different options may imply a different balance between key outcomes.
- **Compatibility and enablers of options to address key issues**: A key basis for packaging would be whether options in different areas are clearly dependent on options in other areas, or incompatible. Our initial view of shortlisting suggests this is unlikely to be a major driver
- **Proportionality and interdependencies:** There is a need to balance proportionality with number of options modelled as a standalone package. Sensitivities or different 'off-model' quantitative or qualitative approaches can help assess variants. We will need to consider the extent of interdependencies between these variables in determining the suitability of this approach.
- **Modelling approach:** We are considering options which would look similar or particularly different from a modelling functionality perspective, including any which might be more readily combined or collapsed, eg due to similarities in impact or challenges in resolving differences in modelling approach.

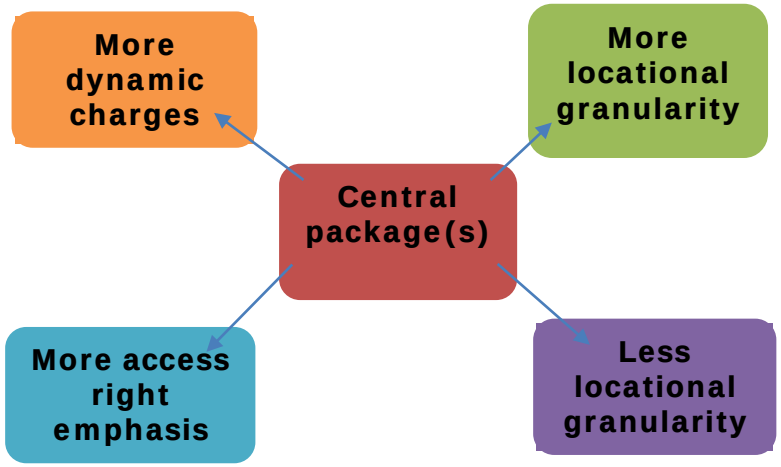
Key questions across policy options

We are considering different potential approaches we could take to creating packages for modelling, based on shortlisted options and key enablers.

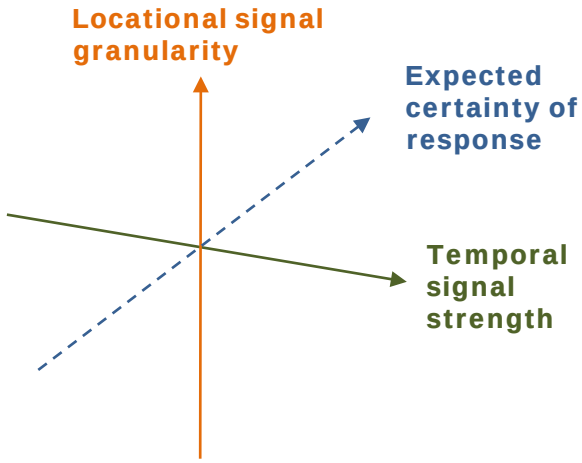
Simple matrix + variants: Mapping options to a simple matrix eg locational granularity vs route to sending operational signals, with variants



Central package + variants: Identifying 'central' package(s) based around key alternative options, with most promising combination of other options and varying key aspects variants



Variable-based scenarios: Structuring potential scenarios around key variables, focused on higher / lower granularity, certainty or simplicity, mapping options to these



A **hybrid approach** may have value - a promising approach could involve **central packages structured around the shortlisted charge design options**, with a promising package of wider options based around these options, and **sensitivities in other areas**, eg cost model variations, connection boundary depth or user segmentation. **Case studies** may also have a role.

The **most suitable approach may depend on our final option shortlisting decision of individual policy options**. We will need to consider the approach to sensitivities in particular, and there may be more **combinations that makes this more complex**.

Discussion questions

What are your views on the potential packaging structures above, and our potential hybrid approach?

In particular:

- Are there particular options / packages you think are particularly key to model as separate packages?
- Can you identify lead / central options, or alternative packaging approaches we should be focusing on?
- Which aspects do you see as more suitable to build into a central model vs assessing more quantitatively?

We will update you on our further thinking in February / March

CEPA TNEI approach to impact assessment

Access and Forward Looking SCR

Impact Assessment Modelling Approach

17/01/2020

Agenda

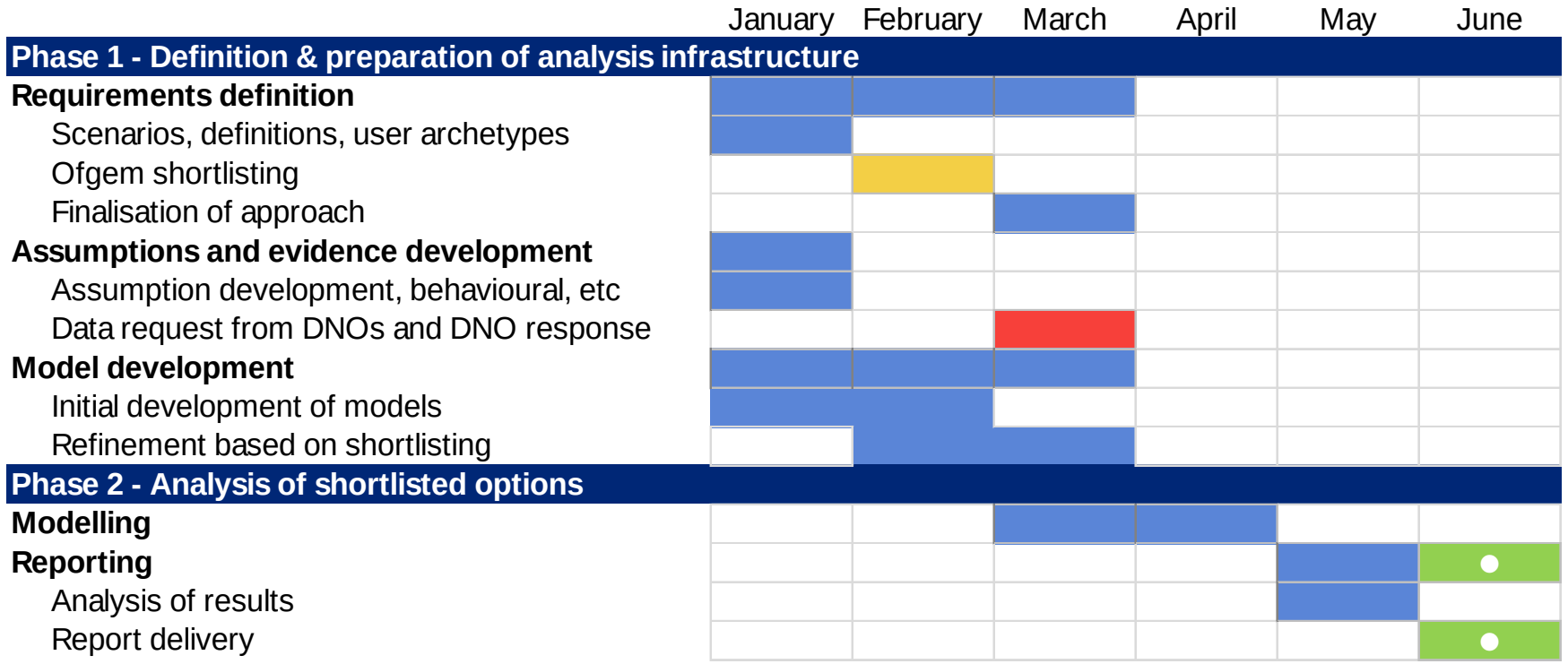
- Project timeframes and touchpoints
- Summary of developing high-level approach
- Requests from Delivery and Challenge Group
- Questions/comments

Project timeframes and touchpoints

Project scope

- The scope of the project is to carry out an impact assessment of Ofgem's shortlisted options
- This will combine several models built under this contract with outputs from models owned/developed by others:
  - DUoS charges
  - TNUoS charges
  - Outputs from ESO transport model for transmission reinforcement costs
- Given the complexity and range of options, we will adopt the principles adopted for DUoS modelling of the options. I.e.:
  - *Simplifying* assumptions will be required
  - Focus will be on *impactful* options
  - *Transparent* where possible
  - *Replicable* where possible
  - *Consolidation* of options to streamline modelling where reasonable

Project timeframes



Touch points with Delivery and Challenge Groups

Today

- Initial discussion of high-level approach
- Request Delivery/Challenge group input in some key areas

February/March

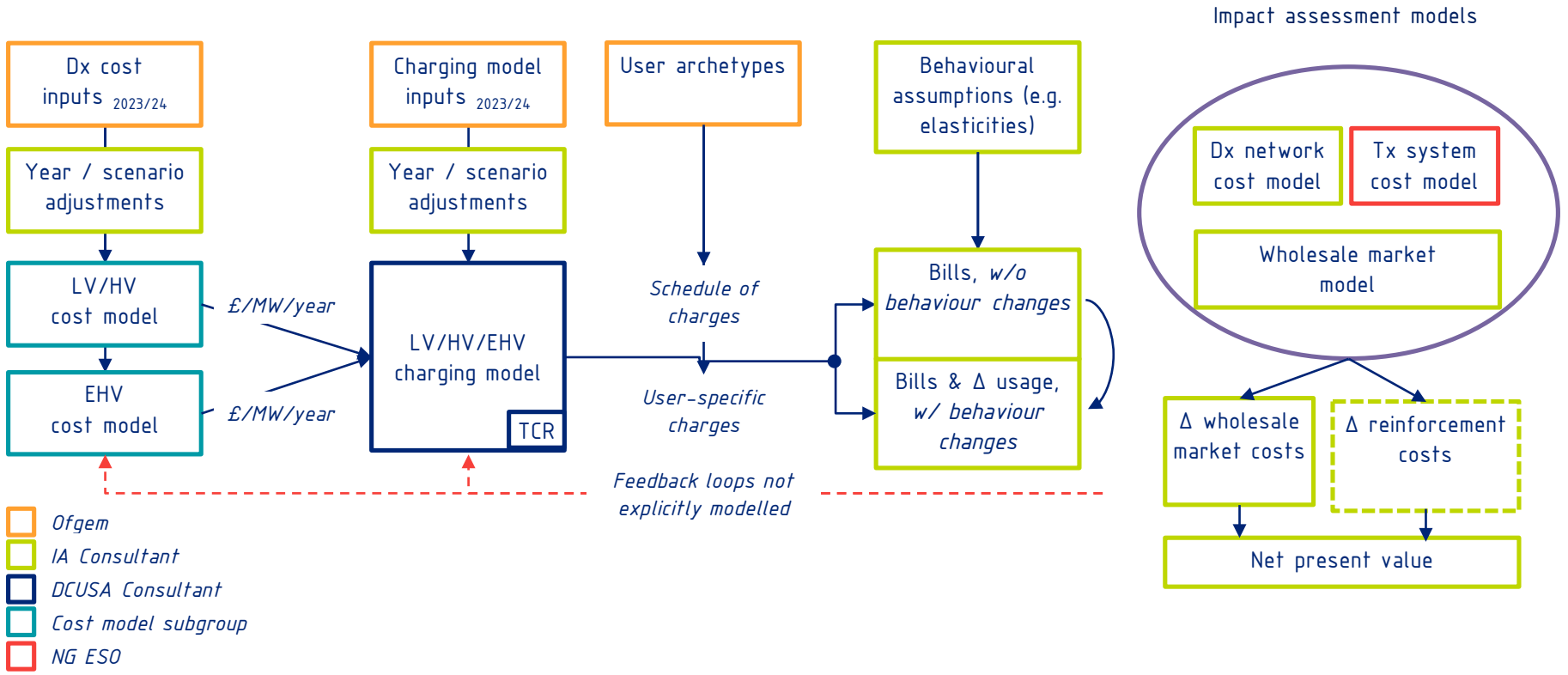
- Discussion of detailed modelling approach
  - Key features of options modelling
  - Key assumptions
  - Behavioural analysis
- Data requirements

May/June

- Discussion of results and initial conclusions

Summary of developing high-level approach

Overview of IA approach



Charging models

The Charging models are not being developed under this contract but are intended to provide outputs which are used in analysis

Distribution Use of System

- *Development contracted by DCUSA*
- *Models EHV, HV and LV network charges*
- *Includes 500 locations/primaries per DNO*
- *Allow for definition of a range of user archetypes based on consumption and capacity assumptions*
- *Allows for analysis of (static) distributional impacts of charging options*
- *Provides outputs for market and network reinforcement analysis*

Transmission Use of System

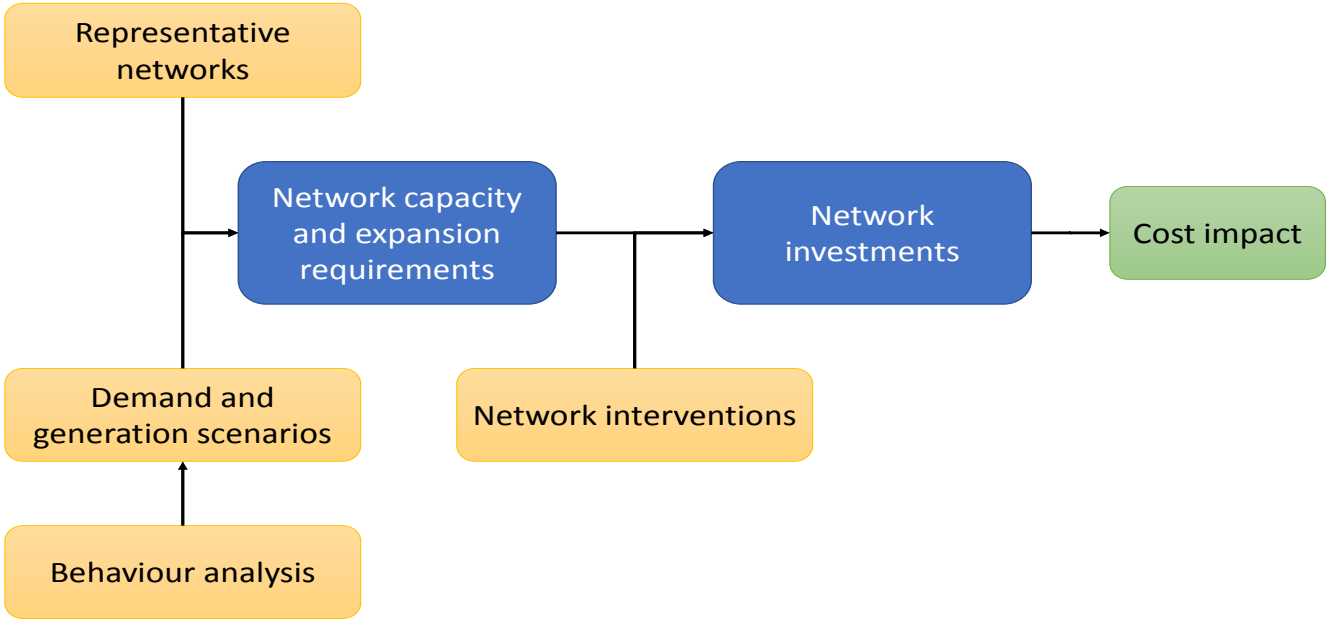
- *Owned by National Grid ESO*
- *Models options which include changes to TNUoS charges*
- *Allows for analysis of (static) distributional impacts of TNUoS charging options*
- *Provides outputs for market and network reinforcement analysis*

Distribution reinforcement model

We plan to develop an excel based model for estimating distribution network reinforcement costs. The model would follow a four-step process:

1. Model baseline network capacity under relevant scenario (exogenous)
2. Calculate network capacity requirements
3. Identify need for reinforcement
4. Optimise solutions to meet capacity needs at lowest cost

We are planning to request data from DNOs to populate the model

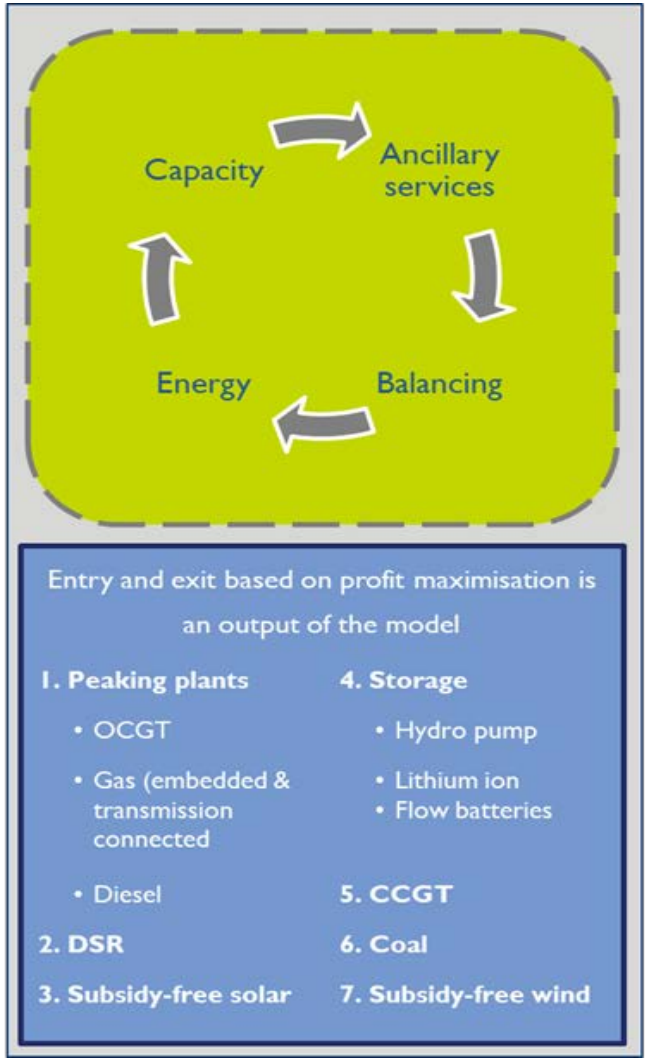


Wholesale Market model

Input assumptions

- Technology (capex, performance, learning rates)
- Policy (changes to existing regulation, renewables build out, nuclear build out)
- Fuel & carbon prices

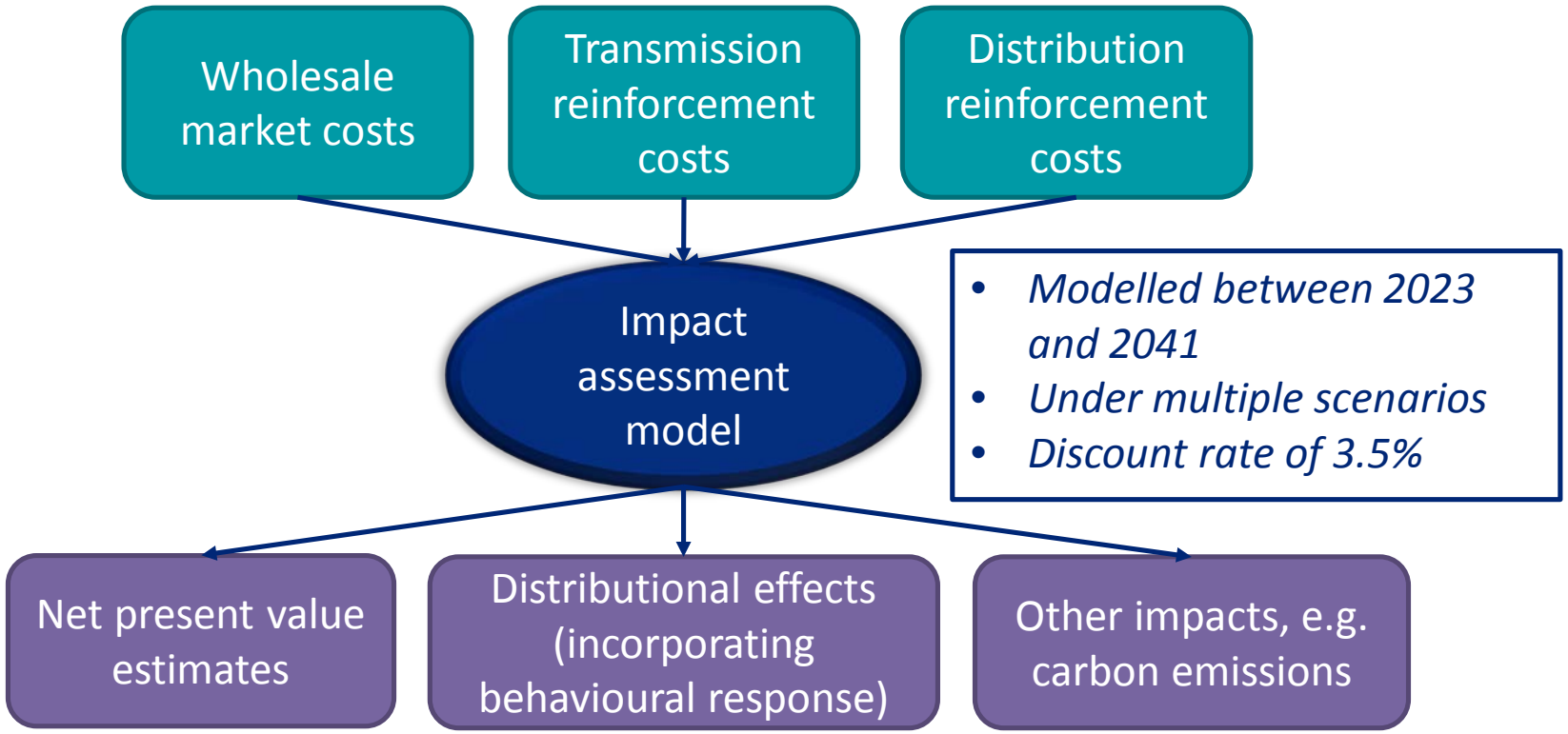
Consumption profiles and price elasticities of different user archetypes will be informed by our behavioural analysis



Market outcomes

- New build entry and exit decision
- DA hourly dispatch
- BM actions
- Hourly electricity, balancing & reserve prices
- Plant-level revenues

Impact Assessment model



We are considering the most appropriate scenarios to consider in light of the Government's net zero targets. Net zero scenarios will require assumptions which extrapolate from those included in FES 2019.

Behavioural modelling

- There is a mixed depth of literature in relation to potential behavioural response
- We propose to develop assumed levels (0-3) of behavioural response for each consumer archetype, considering how they may respond to changes to £/MW and £/MWh signals
- We would consider the potential extent of behavioural response from consumers in the following ways:
  - *How much energy to consume (and when)?*
  - *How much capacity is needed?*
  - *Where to locate and consume?*
  - *What technologies to install?*
  - *Whether to disconnect from/ connect to the system?*
- To do this, we would combine evidence from the literature, trials and judgement
- We would justify these assumed levels of response and test them with the Challenge and Delivery Groups

Behavioural modelling

Example of behavioural response matrix

- We would assume that non-domestic consumers respond rationally to price signals unless there is strong evidence to suggest a material non-rational response
- 0 = no behavioural change, 3 = maximum behavioural change

where scores (1-3) are mapped to percentage changes based on our analysis

- Our behavioural analysis (combination of evidence and judgement) will allow us to deviate from a baseline assumption that domestic consumption is inflexible

Stylized example behavioural response matrix

Consumer archetype	**Energy consumption (and when)** *Assumed strength of response*	**Capacity requirement** *Assumed strength of response*	**Location** *Assumed strength of response*	**Disconnection** *Assumed strength of response*
Domestic – low consumption	1	0	0	0
Domestic – Electric Vehicles	2	1	0	0
…	…	…	…	…

Behavioural modelling

Differentiating between charging options

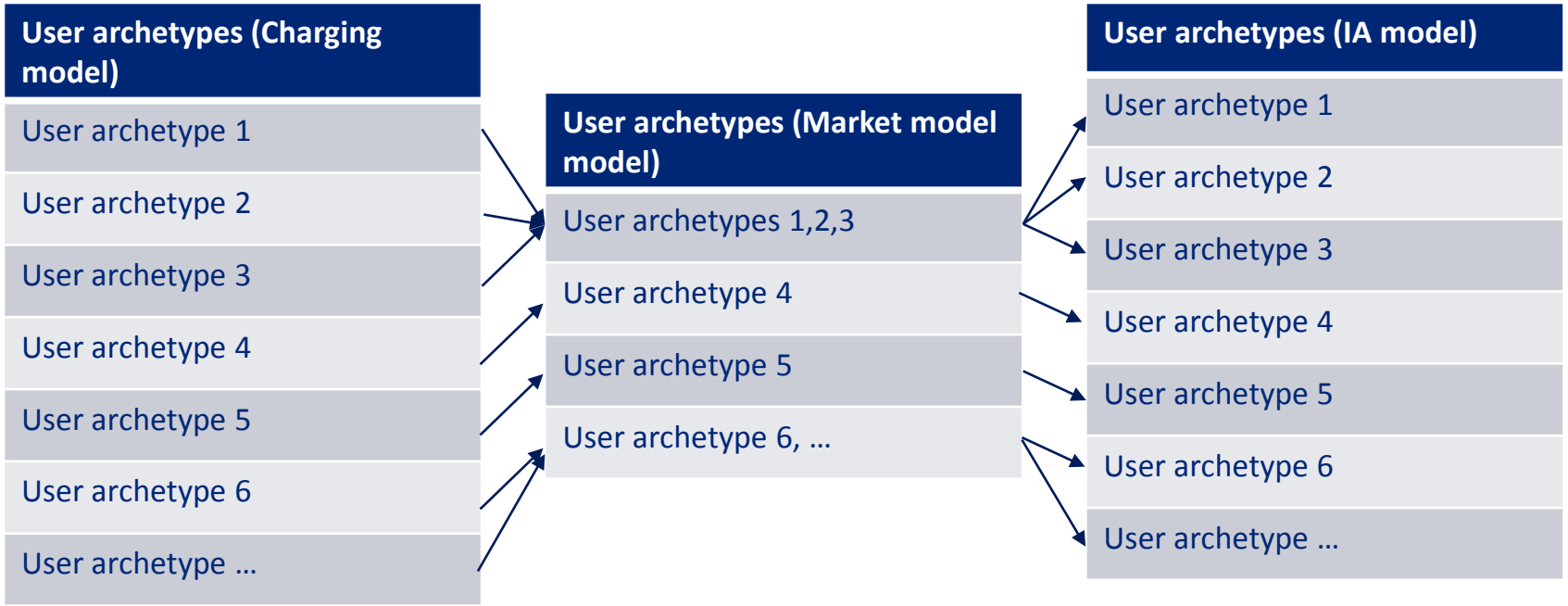
- The behavioural response score assigned to each user archetype will remain constant across options – i.e. assume that relative change in response between archetypes is constant
- However, the percentage change in response assigned to each score may change depending on the strength of signal
- Under some options, the behavioural response may not be 'switched on'. I.e.

Stylized example mapping of behavioural response

Behavioural response score (Capacity)	Option package 1 (% change)	Option package 2 (% change)	Option package 3 (% change) – *Behavioural response not 'switched on'*
0	0	0	0
1	5	2.5	0
2	10	5	0
3	20	10	0

User archetypes

- We will model impacts across a number of user archetypes
- User archetypes will need to be aggregated in some models where behavioural responses and tariffs are expected to be similar
- However, the Charging model and IA model would be designed to estimate impacts on a wider range of user archetypes (data allowing)
- Where full dynamic modelling in the market model is not possible, we may only provide distributional analysis from the Charging model



User archetypes

- The user groups modelled under the TCR were as follows:

Domestic classes	Commercial classes	Industrial classes
Domestic – Low consumption	Commercial – Low Consumption	Industrial – EHV-connected without onsite generation / demand management
Domestic – Medium consumption	Commercial – High with onsite generation / storage	Industrial – EHV-connected with peak generation / demand management
Domestic – High consumption	Commercial – High without onsite generation / storage	T-connected with peak generation / demand management
Domestic – Economy 7	Commercial – Light industrial HV-connected	T-connected without onsite generation / demand management
Domestic – Solar PV		
Domestic – Solar PV with storage		
Domestic – Electric Vehicles		
Domestic – Heat Pumps		

Ofgem is updating its domestic user archetypes. This work may feed into those which we include in our modelling where possible.

User archetypes

- We have proposed the following changes to user archetypes:
  - Inclusion of generation users
  - Removal of Domestic – Economy 7 tariff class
  - Potential new tariff splits (e.g. HV/LV tariff types) depending on shortlisted options
  - Inclusion of analysis of vulnerable customers
    - Vulnerable customers are very heterogenous. We will consider:
      - financial vulnerability and;
      - vulnerability which may impact on a consumer's propensity to respond to certain signals where relevant

Ofgem is updating its user archetypes. This work may feed into those which we include in our modelling where possible.

Requests from Delivery and Challenge Group

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- We would appreciate your input in the following areas:
  - **Any general comments on our developing approach**
  - **Behavioural analysis**: *Have you carried out any trials or other research which may help to inform our behavioural assumptions?*
    - *We are particularly interested in any research relating to behavioural responses to:*
      - *Capacity charging*
      - *Critical peak pricing*
      - *Access rights*
  - **User archetypes:** *Do you have any views on user archetypes which should be included in the analysis (noting Ofgem's ongoing work to update domestic consumer archetypes)? And the ability to gather data which allows us to observe impacts on them – e.g. consumption and capacity profiles.*

We request input from Delivery/Challenge Group by 27th January to allow us to incorporate into analysis.
We will come back to you in February/March to discuss our data request.

Questions/comments

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Planning for 2020/21

2020/21 planning
Reminder of key dates

- The focus of our planning is on “Options assessment and modelling” to inform our draft decision in late Summer 2020.
- Our key activities during this period will be:
  - Ongoing development and assessment of shortlisted options under individual workstreams
  - Analysis of packaged options
  - Impact assessment modelling

2020/21 planning

Delivery Group and sub-group input

We continue to be committed to undertaking this significant code review (SCR) in an open and transparent manner. The Delivery Group will continue to provide knowledge and experience of how the networks are planned and operated, to help develop and assess options. It

The Delivery Group will continue to meet approx every 5 weeks. Until late Summer, the focus of the Delivery Group will be:

- Developing and further assessing shortlisted options.
- Shaping the packaging of shortlisted options.
- Inputting into the impact assessment modelling;
- Helping to inform our minded to decision and draft SCR direction.
- Beginning detailed implementation scoping

The subgroups will continue to exist. The previous slides should provide more info on what each of these subgroups should be doing:

- Cost models – continue
- Connection boundary – continue
- Access Rights – continue
- Small users – continue on ad hoc basis in virtual form to provide insight on specific issues.

Non-SCR update

The Voice of the Networks

Energy Networks Association

Industry-led Update

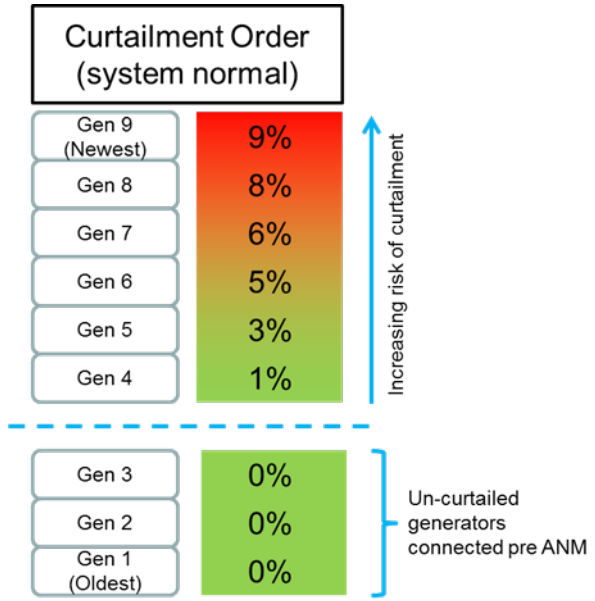
Trading of Curtailment Obligations/Exchange of Access Rights

Paul McGimpsey
January 2020

Non-SCR Industry-led Access

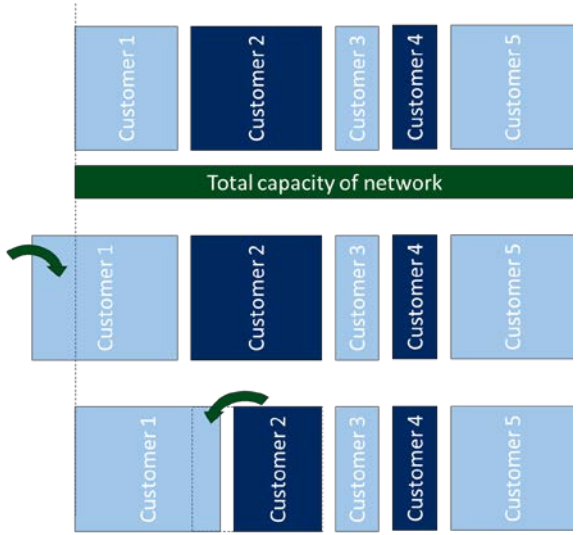
Product 1: Trading of non-firm curtailment obligations

Facilitating: Customers who wish to reduce the likelihood of curtailment through trade(s) with other party(ies).



Product 2: Exchange of access rights

Facilitating: Customers who wish to increase their capacity through exchanges of access rights with other party(ies).



Trading of Curtailment Obligations / Exchange of Access Rights

Broad Support from Stakeholder Engagement:

- TRANSITION/LEO innovation projects
- BEIS
- Ofgem Access SCR Challenge Group
- Ofgem Charging Futures
- The Association for Renewable Energy & Clean Technology (REA)

Trading of Curtailment Obligations / Exchange of Access Rights

Stakeholder Feedback:

- Majority agreement with principles developed
- Support for bringing products to market
  - Charging Futures webinar – majority interest in future use
  - REA expressing strong desire to participate in trials (particularly Product 2)

Some concerns:

- Impact on non-trading parties
- Potential that trading could cause a 'new constraint'
- Network management - Operational risk, need to ensure transparency & visibility
- Product 2 may result in increased reservation of capacity – monetary value
- Consequences of non-performance

Other thoughts:

- Extension of product availability to parties seeking connection
- Products should cater for multiple party trades

Next steps

- Handover to ENA Open Networks (complete)
- Publish report
- Test principles/rules against planned market simulations
- Identify trial opportunities
- Validate pre and post-transaction datasets utilising trials

Next steps and close

Next steps and close

- We welcome any comments or feedback on our initial assessment and proposed shortlisting - **FutureChargingandAccess@ofgem.gov.uk**
- We have the next Challenge Group session on Monday 20 January. As a reminder, we are keen to increase the presence of the network companies as those meetings.
- To keep up to date with all our work on Future Charging and Access – make sure you are added to the Charging Futures distribution list at: http://www.chargingfutures.com/sign-up/sign-up-and-future-events/