

FUTURE FLEX: IDEAS FOR TRIAL

A REPORT FOR WESTERN POWER DISTRIBUTION



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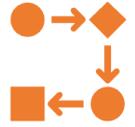
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VERSION HISTORY

A	Initial Draft	9 March 2020
B	Complete Draft	12 March 2020
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0. EXECUTIVE SUMMARY

FUTURE FLEX: ENABLING HOMES TO SUPPORT THE DSO – UNLOCKING GRID CITIZENSHIP

PARTICIPANT FEEDBACK		FUTUREFLEX RESPONSE				
PRINCIPLES	SPECIFICS	IDEA	GOAL	APPROACH	PARTNERS	PRINCIPLES
<p>User-centric: Framed around customer journey</p> <p>Coordinated: Aligned with ESO and wider market activity</p> <p>Holistic: Inclusive of flex and energy efficiency</p>	<ul style="list-style-type: none"> Critique of DSO service lifecycle being timed and framed to suit DSO only Barriers flagged on consumer engagement, interest, unclear standards and low roll-out of flex assets 	<h3>1. DSO-READY HOMES</h3> <p>What if ... we make homes DSO-ready to suit the home, rather than to suit the DSO?</p>	 <p>Homes activated to provide DSO services</p>	<p>Use INTERVENTIONS in the customer journey to futureproof homes for DSO services</p> <ol style="list-style-type: none"> Define what a DSO-ready home looks like: in building fabric, assets, people and proposition Identify intervention points in customer journey of home decisionmakers Test how the intervention points can be leveraged to make homes DSO-ready E.g. an intervention point for a housing developer is applying for a grid connection – how might an alternative connection process incentivize DSO-ready homes? 	<p>3-4 housing decisionmakers, e.g. housing developer(s), local authority, mortgage provider</p>	<ul style="list-style-type: none"> Customer journey focus Activate for ESO services too Whole house approach
	<ul style="list-style-type: none"> Data quality issues raised as priority concern at workshops Strong interest amongst suppliers to engage in trial 	<h3>2. SUPPLIER TRIAL</h3> <p>What if ... we trial a DSO service accessible to domestic flexibility and energy efficiency, with data optionality at its heart – rather than asking domestic solutions to fit current requirements?</p>	 <p>DSO procurement requirements appropriate to domestic data characteristics</p>	<p>Implement TRIAL with different data options with energy supplier(s), using Sustain service as a test case</p> <ol style="list-style-type: none"> Identify energy supplier(s) with portfolios suitable for Sustain (Scheduled Constraint Management) service – co-creating an approach Scrutinise existing datasets (e.g. Electric Nation) to quantify benefits of portfolio approach Work with suppliers & Flexible Power team to procure services, trialling multiple different data options – with associated different remuneration levels Capture lessons learned 	<p>1-2 energy supplier partners, Flexible Power team</p>	<ul style="list-style-type: none"> Supplier-led Review by ESO team: Residential Response Sustain is selected as accessible to heat pumps
	<ul style="list-style-type: none"> Concern that externality of carbon is not priced – and this disadvantages domestic flex Strong interest in 'pump-priming' the domestic flex market to meet net zero 	<h3>3. PRO LOW CARBON</h3> <p>What if ... we design DSO markets to actively promote lower carbon solutions like domestic flex, rather than being carbon-agnostic?</p>	 <p>Competitive advantage to low carbon solutions like domestic flex in DSO markets</p>	<p>Implement TRIAL of DSO service procurement which factors in carbon, supporting Ofgem/BEIS</p> <ol style="list-style-type: none"> Audit and categorize sources of flexibility, using existing methodologies Explore options to price carbon into DSO service procurement Explore who might pay for the carbon premium Trial options in real procurement of DSO services for a defined CMZ, working closely with Ofgem/BEIS 	<p>Ofgem / BEIS, Specialist carbon auditor, Specialist carbon economist</p>	<ul style="list-style-type: none"> Minimize user inputs Close working with Ofgem / BEIS Inclusive of energy efficiency



I. INTRODUCTION

Background

FutureFlex is a participant led trial of second-generation DSO services, deploying step change innovations for procurement, testing and delivery suitable for domestic scale assets. It is a joint project delivered by Western Power Distribution, Everoze and Smart Grid Consultancy (SGC), funded by the Network Innovation Allowance (NIA).

Purpose

This document presents shortlisted ideas for consideration by WPD. These ideas are all grounded in participant feedback, and have been developed into scopes of work by Everoze in discussion with WPD and SGC. A detailed scope of work is included for each idea, to inform the FutureFlex project change request form.

The shortlisted ideas are as follows:

1. DSO-ready homes
2. Supplier trial
3. Pro low carbon

In addition, for completeness the document provides the original longlist of ideas, summarising the process by which these ideas were filtered down to a shortlist.

2. SHORTLISTED IDEAS

This chapter describes the project plan.

1. DSO-ready homes
2. Supplier trial
 - a. This includes a nested idea of Aggregated Datasets
3. Pro low carbon.

DSO-READY HOMES

Making homes DSO-ready when it suits the home, rather than when it suits the DSO.

Participant feedback

At present, DSO procurement timelines and processes are framed around DSO needs. For instance, services are advertised most heavily when needed by the DSO and are largely communicated in a technocratic fashion. Flex providers are targeted when they are based within a CMZ.

At the same time, consumer interest in domestic flexibility is generally low (albeit varying by segment). Workshop participants commented on the challenges of consumer activation, both in terms of awareness (14 comments) and trust (14 comments), with specific feedback citing the public's "lack of knowledge of problems and opportunities" and customers' "suspicion of big energy motives".

So workshop participants challenged DSOs to start with customers, rather than with DSOs. Specific quotes included: "mindset and consumer led business models", and "start at the consumer end – not the DNO end!" Workshop participants also critiqued the workshop approach of framing barriers according to the DSO services lifecycle, which was commented as not being truly user-led and indicative of implicit bias.

"Domestic flexibility should be bottom up. We need to rethink the concept for the long term"

– Workshop participant

As a result, this trial idea puts the consumer first – seeking to make homes DSO-ready by targeting natural intervention points. The trial would put the activities of home developers, occupiers and owners centre stage by identifying events where these players are most open to making the changes required to become DSO-ready, even if DSO services are not currently required in the area.

DSOs are well-placed to target intervention points because their interests are aligned with consumers. Unlike energy suppliers, they do not have the conflict of interest of a financial incentive to sell more energy. Unlike the ESO, they have direct contact with customers (e.g. vulnerable customer register, or during blackouts). Unlike BEIS and Ofgem, they are local actors, who understand best where domestic flexibility should be targeted.

Objective

The objective of DSO-ready homes is to *deliver a set of proven, costed interventions to make homes DSO-ready, through adopting a customer-centric approach.*

Scope of Work

The proposed scope of work is as follows:

- I. **Define what it means for a home to be DSO-ready.** The first step is to define the nature of a home that is ready to provide DSO services from the perspective of the DSO.
 - a. **To illustrate this, the definition of 'DSO-ready homes' is likely to span:**
 - i. **Mindset:** An awareness of and openness to engage with new energy supply and flexibility propositions from home developers, occupiers and owners.
 - ii. **Assets:** The minimum requirements for metering, data provision and flexibility to enable a DSO-ready home to provide DSO services.

- iii. **Building fabric:** The level of energy efficiency measures that are required.
 - b. **Consideration will be given to ESO requirements:** To be truly customer-centric, the project will also seek to identify wider flex-readiness criteria needed to participate in ESO services.
 - c. **Note:** The most complex aspect of defining DSO-readiness is the 'Assets' criterion, specifically whether it is possible to identify appropriate minimum standard. This is challenging due to the number of live developments in this area, such as by BSI and BEIS, and also due to the nascency of the sector. FutureFlex will not seek to define definitive standards; instead, the project will engage with relevant stakeholders to align with current thinking, and also seek to apply pragmatic requirements in real life, to help inform future development of standards.
2. **Identify the players which control the DSO-readiness of a home.** Multiple stakeholders influence whether a home, be it existing or new-build, is DSO-ready. Identifying them will require a degree of market segmentation.
- a. **As an illustration, stakeholders might be expected to include:**
 - i. New-build housing developers
 - ii. Local authorities and planning teams
 - iii. Live-in homeowners
 - iv. Tenants
 - v. Social landlords
 - vi. Private landlords
 - vii. Mortgage providers
 - viii. Energy efficiency, heat pump and EV chargepoint installers.
 - b. **However, rather than focusing on all stakeholders, the project will focus on 2-4 priority targets.**
 - i. We will downselect to focus on stakeholders who influence multiple homes, as these are the 'low hanging fruit' for the DSO. This is likely to lead to a focus on housing developers, social landlords and mortgage providers.
 - ii. However, one target group might represent a segment of consumer homeowners. The reason for doing this is twofold. Firstly, because so much of the participant feedback was around the challenges of motivating consumers themselves. Secondly, due to the size of the retrofit market.
 - iii. Specific partners will be identified within each shortlisted stakeholder group.
3. **Map the intervention points for each category of stakeholder.** Stakeholders are likely to be most receptive to increasing the DSO readiness of a home if they are incentivised to act at a time that is convenient to them; not one that is only convenient to the DSO. Thus, this project takes the customer-centric approach of focusing on 'intervention points'.
- a. **Defining intervention points.** An intervention point is an event or point in time when a stakeholder has increased capacity and/or has increased openness to enact changes that make a home more DSO-ready. For example:
 - i. For a housing developer, an intervention point might be when applying for a grid connection, or when finalising the house design.
 - ii. For a live-in homeowner an intervention point might be installing a heat pump, moving house, embarking on a significant home improvement project, or perhaps a psychological change such as a decision to live a lower-emission lifestyle; for instance, as a response to awareness of climate emergency.
 - b. **Engagement with stakeholders is needed.** This task is to be done in conjunction with the decision makers, adopting their view.
 - c. **Consider demographic and psychographic factors.** These factors are likely to be especially significant in identifying intervention points for the retrofit market in particular. Workshop participants and interviewees expressed the view that *consumer motivations are not just about money, so we would be wrong to focus narrowly on value as a pound sign*. Understanding these motivations and recognising when they can be capitalised on to support DSO-ready homes will be key to the success of this idea. For instance, it may be important to sell the wider vision (facilitation of low carbon future) rather than the details (reduction of DNO reinforcement spend),
4. **Scope out how the DSO can act at each intervention point.** Explore and scope-out, for each intervention point that has been identified, the intervention options for a DSO.

- a. Intervention options will be wide-ranging.** Potentially spanning new DSO processes provision of targeted advice, lobbying, information provision or direct financial incentives, if feasible. For example:
 - i. Amending the grid connection process for housing developers
 - ii. Including DSO-readiness in known measures, such as the Energy Performance Certificate (EPC)
 - b. Again, engagement with stakeholders is critical.** We will form ideas in collaboration with decisionmakers, who best understand their own process and mindset.
- 5. Test intervention options.** Run a trial of the most promising intervention options to test how successful they are when deployed in the field.
 - a. Focus on communication.** The trial will not just focus on the timing of the intervention to align with the identified intervention point, but also the suitability of communication, which will need to be tailored to each market segment. It will likely be necessary to employ a specialist comms agency.
- 6. Assess results.** Analyse the results of the trial and consider, if successful, how best to move from trial to business as usual (BaU).
 - a. Gather feedback.** Seek out feedback from all actors involved, and especially from the decision makers. Find out what works and what doesn't, and what recommendations there are for transitioning to BaU.
 - b. Estimate costs.** Estimate the financial cost of each type of intervention.
 - c. Form recommendations.** Develop recommendations for the transition to BaU, based on a cost-benefit analysis.
 - d. Consider follow on work.** Contemplate whether there is benefit in taking a more holistic approach which treats the home as flexibility-ready, not just DSO-ready.
- 7. Dissemination:**
 - a. 2 presentations/webinars
 - b. 2 blogs.

Deliverables

The outputs of this work are:

- 1. A report.** Containing the findings and recommendation of scope of work items 1 to 4. This is to include a clear definition of exactly what it means for a home to be DSO-ready, and an explanation of: the stakeholders who control the DSO readiness of a home; the intervention points where they are most open to change, and; the actions that the DSO could take at each intervention point.
- 2. Real-world interventions.** Testing out the most promising intervention options identified.
- 3. An analysis of intervention results.** Including feedback, costs and recommendation for how to transition from trial to BaU.

In addition, there will be project dissemination deliverables; for instance social media activity and webinar/presentation. Such project dissemination requirements apply to all ideas in this report, and are not specifically itemised.

Partners required

The vast majority of this work can be delivered by the FutureFlex consortium. The Project Manager will be Freya Espir, with close support from Felicity Jones. Nithin Rajavelu will assist in the definition of DSO-ready Homes.

Some support may be required at the intervention stage. From a comms agency adept at tailoring communication to the different market segments involved in the trial, as described in scope item 5a.

SGC input will be:

- Review throughout
- Targeted input to scoping out what a DSO-ready home is, and also supporting some WPD-related interventions (e.g. revision to connection process).

Call with BEIS

The FutureFlex team had a call with BEIS on 2 April 2020. Their feedback was:

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- Very supportive of trial idea.
- Recommend speaking to the DSR team at BEIS
- Recommend reviewing the Future Homes Standard
- Recommend reviewing the London Energy Transformation Initiative's Climate Energy Design Guide, which includes KPIs for designing buildings.

We will follow-up on these recommendations during the first phase of the scope of work.

Key benefits and risks

Benefits

- **Ability to integrate with other home energy developments.** By tackling the problem from the point of view of the home, this idea is able to integrate with other domestic energy developments such as energy efficiency and electrified heating. It takes a holistic view – which is what is needed for the net zero journey.
- **Building trust.** Workshop participants identified a lack of trust and understanding of domestic flexibility as a key barrier. By trialling approaches that work for the home, rather than imposing measures designed for the DSO, this idea is able to build trust and understanding amongst the key stakeholders in the provision of DSO services.

Risks

- **Being able to define DSO-readiness for Assets.** Defining what it means to be DSO-ready means for assets taking a long term outlook, both on what DSO-services will look like in the future and on how domestic energy technology will evolve. There is a risk of getting 'bogged down' in discussions of standards. We will mitigate this risk by being focused on the project end-goal, and aligning with other stakeholders working in this space.
- **Large scale.** This idea has the potential to expand beyond its defined horizons and incorporate many other work areas. Strict scoping and an understanding of what is being addressed elsewhere will help keep the work focussed.

SUPPLIER TRIAL

Trialing a DSO service accessible to domestic flexibility and energy efficiency, with data optionality at its heart – rather than asking domestic solutions to fit current requirements.

Note: this idea should be read alongside Aggregated Datasets.

Participant feedback

Participants find current data requirements either unclear or unduly prescriptive. 18 comments/barriers were logged on Data by participants in the workshops; others flagged '*High transaction costs*' and similar. This is elaborated further in *Aggregated Datasets* below.

In addition, workshop participants – and particularly interviewees – emphasized the importance of DSO services being accessible to both flexibility and energy efficiency. Participants in the London workshop emphasised that DSO services should be '*Holistic: accessible to both flex and energy efficiency*', a theme that was continued in subsequent interviews. For instance, a trade association talked of the need to view the retrofit market and DSR community together, asking '*how can we achieve a joined-up view through a trial?*'.

Participants were also eager to explore actual provision of DSO services from domestic flex through a trial. Multiple suppliers expressed interest in participating in a trial. There was openness to pursuing different commercial mechanisms within this. Most interestingly, one participant advocated strongly for a service which allows for a "drop to a value" rather than a "drop by a value", which is believed to be easier to achieve for DSR.

Discussion with the Flexible Power team has flagged that the Sustain Service may be an appropriate vehicle to pursue the themes of (a) Data and (b) Holistic Flex+Efficiency further. Sustain has been historically

referred to as Scheduled Constraint Management within Open Networks. It is a service whereby ‘the DSO procures, ahead of time, a pre-agreed change in input or output over a defined time period to prevent a network going beyond its firm capacity (thereby ensuring all load remains secure following the next fault). For example, a reduction in demand is procured over an evening peak period to mitigate risk of overload that might result should a fault occur on one of two in-feeds to a group’. The service is considered appropriate because, with adjustments, as a scheduled service it is fulfillable by both domestic flexibility (where 4 workshop participants raised concerns about slow response times) and energy efficiency (which cannot be ‘dispatched’). Sustain is a hybrid of time-of-use tariffs and DSO services; key characteristics are summarized in the table below.¹

Service Characteristics	Scheduled Constraint Management
When to act	Pre-fault
Triggering action	Time
Certainty of utilisation	Very certain
Efficiency of utilisation	Low
Risk to network assets	Low
Frequency of use	High

TABLE 1: OVERVIEW OF SCHEDULED CONSTRAINT MANAGEMENT, FROM OPEN NETWORKS

Objective

The objective is to *trial/demonstrate the provision of a DSO service suitable to domestic flex, which:*

- *Is accessible to both flexibility and energy efficiency; and*
- *Gives options on data provision, rather than being prescriptive.*

Discussion with Flexible Power team

The FutureFlex team shared participant feedback with WPD’s Flexible Power team to inform trial design.

Specifically, we shared the feedback that participants request a trial which:

- Is accessible to both flexibility and energy efficiency solutions in the home; and
- Gives options on data provision, rather than being prescriptive.

We sought the Flexible Power team’s advice on how participant feedback could be best explored in a trial. A call was held with Ben Godfrey to discuss which DSO ‘technical problems’ might be the most appropriate vehicle for a trial to explore participant feedback. We were seeking a good test case to pioneer solutions. Ben described the technical problem of new EVs, heat pumps and smart hot water controllers threatening the Diversity Model, and SGC provided further elaboration. This is outlined below.

The distribution network is modelled on a set of behaviours known as the Diversity Model. Upstream infrastructure is sized with the assumption that this maximum is not required by all customers at the same time – that there is diversity within the population. The Diversity Model approach has historically served the sector well: overloading on the low voltage network is rare.

Profiles tailored to the type of new technology in the homes are used in the Diversity Model. New technology in the home for electrified heating and transport risks increasing import during peak hours of network usage. The added demand contributions that we could see from EVs, heating and other new customer loads could overly stress the existing distribution infrastructure. This consumer behaviour is factored into the tailored profiles used in the Diversity Model.

¹ <https://www.energynetworks.org/assets/files/ON-WSI-P2%20DSO%20Service%20Requirements%20-%20Definitions%20-%20PUBLISHED.pdf>

The new technologies with most material impact on the network are: EVs, battery storage (with or without co-located solar PV), heat pumps and to a lesser extent, controllable hot water.

Sufficient incentives and price signals can be used to achieve improved network outcomes compared to the Diversity Model profiles. The technologies identified above have the potential to have a material impact on network usage during peak hours. A suitable incentive structure with appropriate price signals coupled with smart control strategies for the new technologies can help unlock flexibility and add value to the network by driving desired consumer behavior and consumption patterns improved from the profiles used in the Diversity Model.

The Diversity Model problem was identified as a suitable vehicle to explore participant feedback due to four features:

1. **Suitable technology focus:** The problem spans both flexibility (EVs, battery storage, controllable hot water) and energy efficiency (heat pumps). These are also technologies which are receiving significant supplier focus at present.
2. **Suitable to explore data:** Addressing the problem requires scrutiny of data requirements and techniques – and hence is a good opportunity to probe the data issues raised by participants.
3. **Simplicity:** The problem can be addressed through a scheduled DSO service, which is simpler to deliver than more dynamic services – hence more straightforward and cost-effective to trial. No complex dispatch mechanism needs to be developed.
4. **Baselining practicality:** The problem elegantly dodges the difficult issue of baselining, which 16 participant comments raised as being complicated, and which an interviewee advised us to avoid due to risk of duplicating Elexon activity.

The highly diversified profile in the Diversity Model used for HV distribution network modelling shall be used as the baseline. As constraints in the low voltage distribution network are rare, WPD has suggested using the Diversity Model profile used for the high voltage distribution network as the basis to assess network benefits and calculate participant payments. This is based on a highly diversified profile – includes a variety of consumers with different combinations of new technologies. Any reference to the Diversity Model profile in the subsequent sections of this document shall refer to this highly diversified profile.

Call with BEIS

The FutureFlex team had a call with BEIS on 2 April 2020. Their feedback was:

- Eager to follow the trial.
- Keen to see progress made on energy efficiency and are open to how this looks. It would be good for the trial to explore whether energy efficiency can be made to work in existing flexibility tender processes, or if it might be too hard, requiring separate mechanisms. BEIS are eager for energy efficiency to be valued in some form.
- Recommend exploring SSEN's SAVE project on energy efficiency, and to build on that.

Project idea

We will trial a DSO service targeted at homes with new energy technologies, which incentivises the management of these technologies to minimise network impact. We will specifically focus on homes that have installed new technologies that increase peak loads on the network and have adverse effects compared to the Diversity Model profile. This is expected to be limited to EVs, battery storage and heat pumps. The trial will be open to households that have already adopted, or are just about to adopt, these technologies.

The service will reward householders who adopt these new technologies and demonstrate desired consumer behaviour away from the Diversity Model profile. For instance, a household that has installed an EV chargepoint would be rewarded if its EV was charged outside peak demand periods on the network hours, whereas the Diversity Model profile includes consumption patterns during peak hours. In doing so WPD can pre-emptively take action that is seen to be positive and incentive based rather than punitive.

The DSO service will be a variant of Sustain, also called Scheduled Constraint Management. The service is scheduled and pre-fault, targeted in specific locations of constraint. This scheduled service is recommended as a starting point for the incentive structure to be used in the trial to ensure alignment with the product suite within the ENA's Open Networks project – hence responding to participant feedback that there is a *'lack of standardization across DNO processes,*

contracts and requirements'. A further benefit of using Sustain as a starting point is to avoid any overlap with the close-to-real-time services being developed under the Intraflex project. As a starting point for the trial, the tariff used for payment shall be the tariffs currently offered under Flexible Power for DSO services. This shall be reviewed as part of the validation exercise at the end of the trial.

The trial will be run through market intermediaries such as energy suppliers, rather than directly with homes. WPD will contract with parties who aggregate >20 households within the defined area, rather than contracting directly with each household. The expectation is that suppliers will be able to mobilise households already within their portfolio which already have in-home flexibility, rather than recruiting new customers as part of the trial. This approach will reduce trial costs and accelerate timeframes.

Suppliers will have discretion to package up the incentive as they wish to domestic participants. Suppliers may wish to reward their customers through direct financial reward, or through alternative non-financial mechanisms. This might for instance be wrapped into the time-of-use-tariff, or potentially some other incentive mechanism. WPD will collect data during the trial on how the reward is packaged, but will not seek to influence its design.

There are two core datasets that will be required from energy suppliers prior to be eligible for a reward. Specifically:

1. **Proof of qualifying asset:** e.g. proof of installation of EV chargepoint and/or heat pump – and potentially associated technical specification.
2. **Proof of outcome:** Evidence that households in aggregate are delivering the required response volumes and maintaining desired load limits. Household and asset level data sets will also be required to be provided by suppliers.

Given the multiplicity of metering solutions at both a home and asset-level, the trial will give suppliers reasonable flexibility to specify what data they provide to evidence the outcome. The trial will be flexible to receipt of data from SMETS1 meters, SMETS2 meters, asset-meters and any other metering sources to evidence network behaviour – offering reasonable flexibility on resolution, accuracy, upload frequency or completeness of dataset. This is discussed further as part of the Aggregated Datasets nested project.

Reward levels will be determined through reference to (a) local network benefit, (b) performance and (c) data quality. The trial will quantify the network benefit for provision of service in the area, and define what constitutes acceptable performance. The payment formula will also include a Data Quality score (de-rating factor), whereby WPD adjust payments to reflect data quality. At first, the trial will adopt a simplified approach with a very approximate de-rating approach. This will be refined through the trial, and informed by a parallel workstream of FutureFlex, which will probe how this Data Quality Score should be more accurately calculated. The calculation approach will be entirely transparent to participants, so that they can make informed decisions to submit alternative datasets throughout the trial to maximise their return.

The Diversity Model profile is used as the baseline to calculate the network benefit and corresponding payment. As noted above, WPD's Diversity Model profile used for HV distribution network modelling shall be used as the baseline for the aggregated supplier portfolios. This shall be used as the basis for quantifying the network benefit and the supplier payments under the trial. The challenges and limitations for using this baselining approach is recognized, however is proposed to be used to move to the trial phase in an agile manner. The lessons learnt focused on participant feedback from the trial on the benefits and limitations of baselining approach adopted shall be reviewed at the end of the trial

The trial will also address secondary participant feedback areas: A number of secondary feedback areas raised during workshops will be considered in design – for instance around contracting, payment mechanism development and procurement. These secondary feedback items will be considered in project design. This will aim to build on existing Flexible Power mechanisms and procedures as opposed to development from scratch to avoid 'reinventing the wheel' where appropriate. The Flexible Power team's input and expertise shall be sought and utilised where appropriate to ensure efficient use of resources.

The trial seeks to adopt the three principles of being holistic, coordinated and user-centric:

- **Coordinated:** The trial will seek alignment with the ENA by taking the Sustain service as a starting point for design. The trial will also align with WPD's Flexible Power team to ensure alignment with existing DSO service procurement processes, where this does not impede innovation.
- **Holistic:** The trial is inclusive of both EV and heat pump solutions.

- **User-centric:** The trial gives participants optionality on data to be provided, to be truly user-centric in approach. In addition, the details of the trial will be worked up alongside market intermediaries.

The success of the Supplier Trial project is reliant on being able to demonstrate network benefit to the DSO whilst ensuring participant interests are maintained. To this extent, the trial shall:

1. **Quantify network benefit:** As an outcome of the supplier trial, the network benefit offered by the behavioural change of the aggregated portfolio of homes under the incentive structure used as compared to the Diversity Model profile shall be quantified. The core metrics for quantification shall be i) proportional reduction in loads during the peak demand periods, and ii) proportional reduction in daily peak loads (if this is outside of peak demand periods).
2. **Quantify the value of the service:** A validation exercise shall be undertaken to benchmark the value of the price signal used in the trial against the benefits to the DSOs from these services. The methodology of this validation exercise shall be based off methodologies previously developed as part of the Flexible Power project and input from WPD/Flexible Power team and SGC shall be sought. This shall include i) value of the network benefit offered by the households (input from Flexible Power team shall be sought to quantify this benefit), ii) reliability scoring to reflect over-procurement (input from Flexible Power team shall be sought to quantify this metric). The metric quantified shall be to show the share of the reliability-adjusted benefits to the DSO that is passed through to the suppliers for the flexibility service provided.

Clarifications:

- **The energy efficiency solution targeted under the project will be heat pumps, rather than wider amendments to building fabric:** We discussed whether it was possible to be inclusive of other energy efficiency measures such as home insulation or LEDs. This was discarded as (a) they do not address the Diversity Model challenge, and (b) can be addressed more thoroughly under the DSO-ready Homes workstream.
- **The project will initially target homes that risk causing network challenge rather than those that might bring a network benefit.** The project targets an intervention at the market segment who might otherwise exacerbate peak network usage – for instance, households with EVs. We considered extending the reward to network ‘superusers’, whose behaviour is even more positive than the Diversity Model predicts; for instance, perhaps they are a PassivHaus with exceptionally low usage during peak hours. We decided to exclude such superusers to avoid undue complexity in mechanism design.

Scope of Work

The proposed scope of work is as follows:

I. Scope out trial idea:

- a. **Review latest ENA Open Networks guidance:** The project begins by ensuring a fully current view on the latest status of Sustain. This is ensured by liaising with (i) ENA and with (ii) WPD Flexible Power team.
 - i. On (i), we will review latest Open Networks guidelines and schedule a videoconference with relevant ENA lead.
 - ii. On (ii), we will liaise with internal WPD BaU team to understand latest status of integrating Sustain into Flexible Power.
- b. **Host internal workshop (Everoze, WPD, SGC) to sketch out trial basics further:** The output of which will be a briefing paper from which suppliers can be engaged.
- c. **Engage with 5-6 suppliers to co-create/refine idea:** Co-create idea further, ensuring that the trial is user-led in design. Give consideration to consumer archetypes and seek to be inclusive of both flexibility and energy efficiency. Note that Future Flex will leave suppliers to package the product as they wish for their customers.
- d. **Establish KPIs.** For instance, these might include:
 - i. Uptake by suppliers
 - ii. Uptake by customers
 - iii. Data integrity

- iv. Network impact
- v. Financial viability
- 2. **Secure commitment from up to 3 suppliers to engage with project:** Ensure that they understand and agree to the scope, participant payments, timeframe and engagement. This will be formally written down and agreed.
- 3. **Work with Flexible Power team to ready the platform and processes for trial implementation:**
For instance, this will include but not be limited to liaising with Sharon, legal counsel and procurement team to:
 - a. Agreeing division of labour between Future Flex team and Flexible Power team – including defining interfaces and integration required
 - b. Selecting an appropriate CMZ – this will be driven by i) the geographical distribution of homes in the supplier's portfolio, and ii) constraints and service requirements in that CMZ
 - c. Revising contractual terms, including developing payment mechanics
 - d. Confirming with WPD on the Diversity Model profile to be used for baselining
 - e. Defining process for qualifying sites
 - f. Defining process for data collation and analysis → to be aligned with Aggregated Datasets idea below.
 - g. Confirming timeframe for trial
 - h. Registering suppliers on WPD's procurement system and planning for payment administration
 - i. As noted elsewhere in the Supplier Trial project description, it is assumed we can build off existing Flexible Power processes and documentation.
- 4. **Run trial:** Test the service procurement through a trial over a period of 9 months, including administering payments to flex providers. It is assumed payments will be made via Flexible Power.
 - a. This will include working with suppliers at the start to set up and keep updated data exchanges that are necessary to facilitate the analysis that will help determine the veracity and efficacy of the different propositions offered.
 - b. In addition, the Future Flex team will provide ongoing support and operation of data analysis and payment calculations. Extensive support for data quality and integration issues has not been assumed to be required, and where required, it is assumed the project contingency budget shall be used.
 - c. The trial will include monthly review cycles of data and payment calculations to maximise learning. It is assumed both supplier trials will run concurrently with single monthly review rounds for both suppliers.
- 5. **Explore application to network 'superusers':** Explore how the service might be developed to be inclusive of other energy efficiency solutions, such as amendments to building fabric – and in particular the approach for rewarding network 'superusers' whose peak network usage is significantly below expected behaviour. Probe how the approach would need to change – for instance, regarding baselining, payment, commercial terms etc – including longevity of support required given the permanency of some energy efficiency solutions. Liaise with the Association for Decentralized Energy (ADE) to capture industry input.
- 6. **Review trial success and form recommendations:**
 - a. **Seek feedback from stakeholders and participants:** Systematically gather feedback, likely through workshop or semi-structured interviews. This shall include feedback on the baselining approach used.
 - b. **Quantify network benefit and value of service:** As per that set out in the Project Idea section above
 - c. **Synthesise and recommend:** Summarise key lessons learned, and form recommendations for next steps – so that the trial has long-term impact and legacy. In doing so, work closely with Flexible Power team to ensure recommendations are well-framed for BaU implementation. For instance, some of the trial functions will likely be conducted manually, whereas automation may be appropriate for future roll-out.
- 7. **Dissemination:**
 - a. 2 presentations/webinars (one during 2020 and the other during 2021).
 - b. 2 blogs (one during 2020 and the other during 2021).

Deliverables

The outputs of this work are:

- 1. **A short concept note to share with suppliers:** A paper outlining the trial proposition to share with suppliers for early feedback and co-creation.

2. **A design paper outlining detailed trial design.** This paper follows on from supplier engagement and co-creation. In particular, the paper will outline the specificity of how domestic flex providers will participate.
3. **Updated contracts and flowcharts mapping processes:** These documents can be used again for future service procurement, if the trial proves successful.
4. **A report reviewing extension to network ‘superusers’:** Describing how the project might be extended to other market segments in future.
5. **A report reviewing trial results:** A report systematically capturing feedback from all relevant stakeholders/participants, synthesising lessons learned and forming recommendations for next steps and future BaU implementation (if appropriate).

Dissemination deliverables are logged above.

Partners required

The Future Flex consortium can deliver this inhouse, in particular leaning on SGC’s pioneering experience in the development of DSO services and existing relationships with suppliers. Strong collaboration with WPD’s Flexible Power team will also be essential.

The Project Manager for this workstream will be Nithin Rajavelu. Nithin will also be responsible for the interface with the Aggregated Datasets workstream.

SGC’s input will be as follows:

- Review role throughout the project
- Active contribution during scoping phase
- Framing of Payment mechanism
- Support on data format and standards (Paul Charleston)
- Support to supplier mobilization and signup (if existing 5 suppliers engaged via workshops do not signup).

Key benefits and risks

Benefits

- **Aligned with Future Flex’s original objectives for a physical trial engaging suppliers:** We originally envisaged (and communicated) intentions for a trial engaging 2+ suppliers/aggregators; this trial idea honours that intention.
- **Aligned with ENA Open Networks activity:** The trial is aligned with ENA plans for the Sustain / Scheduled Constraint Management service – but takes this further by futureproofing it to domestic flex. There is a great opportunity to influence ENA DSO service design and have real impact across DSOs.

Risks

- **Ensuring the trial is genuinely participant-led:** A core principle of Future Flex is being participant-led, and workshop activity strongly endorsed the agile, user-led approach proposed. For instance, one participant praised the fact that we have ‘started to push against the ‘linear’ R&D approach to network innovation – a more open/agile approach’. A challenge will be balancing ongoing ‘linear’ ENA Open Networks activity with a genuinely participant-led, agile trial. This is especially important given that the trial idea has not originated with participants. Everoze sees this as being the primary risk.
- **Securing supplier engagement:** A key risk is securing sufficient supplier engagement. We expect to be able to mitigate this based on (a) strong level of interest from suppliers during workshop in engaging with Future Flex, and (b) leveraging existing SGC/Everoze contacts.

AGGREGATED DATASETS (SUBSET OF SUPPLIER TRIAL)

Note: this idea should be read alongside Supplier Trial above. It is proposed that Aggregated Datasets is a supporting project workstream which feeds into the Supplier Trial.

Quantifying how aggregation improves overall accuracy of data, rather than assessing data quality at an individual household/asset level

Participant feedback

Data quality issues were raised as a priority concern for domestic flex at the workshops. There were 18 comments on data barriers at the workshops, often linked to metering, for instance “Is my metering granular enough?”. As this participant question suggests, there was concern both about data quality requirements being (a) unclear, and (b) too onerous.

Domestic properties tend to produce lower quality of data for flex services than larger assets. Specifically, the technical concerns for a DSO are four-fold:

1. **Resolution:** The regularity of recording data. For instance, second-by-second is more granular than minute-by-minute. Sample participant comment on barriers: “Granularity of data”.
2. **Accuracy:** The measurement tolerance and specificity of each datapoint. For instance, measuring energy (kWh) with an accuracy of +/- 1% is more accurate than measuring to an accuracy of +/- 5%. Sample participant comment on barriers: “Is there too much noise in the data to pinpoint the delivery of the service?”.
3. **Upload frequency:** The regularity of providing data to the DSO. For instance, upload every minute is more frequent than upload once per month. Sample participant comment on barriers: “Communications – how to get reliable data?”
4. **Completeness:** The wholeness of a dataset. For instance, a dataset with full data is more complete than a dataset with missing datapoints. Sample participant comment on barriers: “Data Quality”. This could be a matter of missing or erroneous data from a given property or, more likely, periods of loss of data from a variety of properties in an aggregated portfolio (e.g. due to connectivity issues).

Domestic flex participants were concerned about the cost and administrative implications of improving data quality. A sample participant comment was “Quality of data (demanding/expensive)”. For instance, there is a concern around the capital costs of installing high quality metering at a large number of small installations (i.e. properties), and – to a lesser extent – concern around the burden/cost of managing large data volumes.

Reflecting high level of participant concern, a subgroup picked up this theme in the afternoon session of the Bristol workshop – adopting an aggregation focus. They framed the barrier as ‘Achievability of DSO data requirements for domestic aggregation’ and focused on exploring how aggregation of multiple homes might address data concerns. Their hypothesis was that when adopting an aggregated view of datasets, many of the data challenges at individual home level become less significant. The hope is then that DSO requirements can be clarified and ideally avoid being unduly onerous.

Objective

The objective of the *Aggregated Datasets* trial idea is to *quantify to what extent aggregation might address data quality challenges at domestic level – and to establish the implications for DSO service procurement*. Put another way, the trial tests whether DSO data requirements might be too stringent for domestic flex, explores to what extent aggregation can help, and probes the resulting commercial implications. The output will be tested directly within the Supplier Trial, including as an input to the payment formula.

Scope of Work

During the Bristol workshop, participants sketched an idea for a physical trial. This was staged as follows:

1. **Recruit homes/suppliers/aggregators for a trial:** Engage intermediaries to secure homes for trial.
2. **Install kit:** Perform a test of an aggregated portfolio of domestic DSO assets with additional high-quality metering installed with local data recording alongside a lower-cost, basic metering solution.
3. **Analyse data:** After the trial has run for a few months, compare the basic data as recorded remotely by the aggregator, against the high-quality data recorded locally at the premises.
4. **Assess implications:** How do the datasets compare, has the aggregation improved accuracy overall and can any disparities be resolved by e.g. application of an offset or multiplier or other adjustment?

However, upon reflection it is considered both possible and more cost-effective to conduct the trial with existing datasets. As a result, the proposed scope of work is as follows.

1. Obtain relevant datasets:

- a. Specify the core parameters that are required from a dataset for it to be appropriate for analysis.
- b. Establish what datasets are available for assessment, using the Smarter Networks Portal. Known WPD datasets include Electric Nation and MADE. WPD will support this phase, noting that the output of the project is dependent on securing appropriate datasets.
- c. Everoze will review datasets, with the objective of assessing their appropriateness and recommending and selecting datasets for application in the next stage. Considerations will include size of portfolio, time period, required asset granularity, metering, etc.

2. Develop and document a methodology to test for the benefits of aggregated approach: This methodology is likely to require a different approach for each type of the four technical concerns listed above.

- a. **Resolution:** This is expected to entail taking one or more 'high quality' datasets, and then re-averaging these to a lower resolution. The lower resolution data will then be aggregated and compared to the same aggregation of the original 'high quality' data. For example, 1-minute data may be re-averaged to a half hourly resolution leading to 30 identical 1-minute values². Decisions on re-averaged data resolution will be informed by what can be provided by current metering solutions (for instance, historic, SMETS1, SMETS2 and appliance metering). Measurement equipment specifications and performance will be required.
- b. **Accuracy:** Most smart meters and appliance meters are likely to have a reasonable degree of accuracy as it stands and whilst specifications for these devices are likely to give an error range, those specifications are very unlikely to provide any detail as to any biases or distribution of accuracy across that range, making it hard to estimate the impact of inaccuracy on aggregated data sets without purpose-made trials as originally envisaged. On the basis of this, Everoze will review whether it is appropriate to further investigate the potential for improvements in accuracy through large aggregated data sets.
- c. **Upload frequency:** The ideal frequency of data upload is currently higher for flexibility services than is currently provided under regular domestic energy supply. When aggregating multiple properties, the ability to aggregate and upload data from multiple sources within the required timeframes will be investigated. The strength of the requirement for rapid upload will also be reviewed. Upload frequency is closely linked with 'Completeness' below.
- d. **Completeness:** This will involve reviewing the number of missing data periods within the existing datasets and using this to attempt to inform an availability multiplier to account for probabilistic communications or other outages. The base assumption for this analysis is that periods of no data are concurrent with periods of non-performance (since without data, performance can never be proven). However, alternative methods for accounting for short data gaps that take a more balanced approach on actual asset performance could also be considered. The data analysis should cover different times of day and week to capture periods when, for example, communications may be more or less constrained. It should also investigate variation in data loss between the different existing data sets to test for any device or location-specific issues.³
This phase will be conducted alongside the Supplier Trial, so that the methodology is shaped in a way that is actionable, and informed by the latest discussions with suppliers on what data are available.

3. Conduct analysis of the benefits of an aggregated approach:

- a. Everoze will additionally explore and quantify to what extent aggregation is affected by other variables: For instance:
 - i. Different technology/asset types (thermal solutions are expected to be particularly complex). There will be a specific focus on EVs and heat pumps, to reflect the emphasis of the Supplier Trial.
 - ii. Different times of the year / week / day

4. Form recommendations for DSO services measurement and procurement:

- a. Outline the implications and options of the above technical analysis for DSO service procurement. For instance, options might include:
 - a. Introducing de-rating/multiplier factors for portfolios, to be used in procurement

² Current requirements under Flexible Power are minute by minute data.

³ At present, WPD treat a missing data point as 0 in delivery.

- b. Minimum data requirements, to include comment on requirements for asset metering (aligned with Elexon)
 - c. Option to reduce payments to reflect data quality and/or portfolio size
 - d. Recommendations for natural minimum portfolio sizes which are viable for future procurement of hyperlocal services, at <1 kV level
- b. Evaluate these options, including consideration of practical challenges such as auditability.
 - c. Implement preferred options within the Supplier Trial, to test through learning by doing.
 - d. Disseminate preliminary findings and secure review of draft findings from industry. This will include an open exchange of findings with the ESO's *Residential Response* project, reflecting participant feedback that it is helpful to align approaches between DSO and ESO where possible.

Deliverables

The outputs of this work are:

1. **A technical report quantifying to what extent an aggregated approach can address data quality issues:** This will document methodology and findings, clearly quantified.
2. **A commercial report forming recommendations for DSO procurement.** A short paper outlining the implications of the technical findings for DSO service procurement from aggregated portfolios – to include specific recommendations for inclusion in the Supplier Trial.

Partners required

No additional project partners are required. Everoze's team of data analysts are able to deliver this inhouse. For instance, Everoze regularly analyses battery test data for National Grid ESO as Independent Technical Expert, including providing feedback on the ESO's tool design. More generally, Everoze regularly analyses SCADA data for renewables projects, for instance through conducting bankable Energy Performance Assessments. In particular:

- The Project Director for this workstream will be Dan Bacon, selected due to his systems engineering and analytical expertise. Dan will be especially closely involved in the scoping and methodology-framing stage.
- The Project Manager will be Freya Espir, with support from Nithin Rajavelu.
- Work on the payment formula will be led by Nithin Rajavelu.

The input required from SGC is to review all deliverables, and to provide targeted support on metering.

Key benefits and risks

Benefits

- **Responds to a high priority barrier raised by participants.** Ensuring that the cost of participation by domestic flex is clear and manageable, whilst also avoiding excessive conservatism by DSO in procurement.
- **Improves DSO understanding of domestic flex data.** Develop enhanced understanding of statistical characteristics of domestic flex portfolios – from which practical procurement recommendations are then derived.

Risks

- **Securing appropriate datasets:** A risk is securing sufficiently large datasets; this is mitigated by the fact that even if for some reason other DSO datasets cannot be obtained, WPD's Electric Nation dataset is deep and rich. In addition, the Smarter Network Portal should assist in securing wider datasets.
- **Project is too 'academic':** A risk is being too 'academic', failing to deliver actionable findings. This is mitigated by input and challenge from project partner SGC, who will ensure that the analysis is scoped and framed in a commercially relevant and targeted way. In addition, the project outcomes will be used to directly inform the payment formula in the Supplier Trial.

Designing markets for DSO services that are not agnostic to carbon, but which actively promote lower carbon sources of flexibility.

Participant feedback

During the workshops, the idea of developing low carbon incentives originated in discussion of two barriers:

1. **At present, DSO services do not price in the externality of carbon.** There were 20 comments in the workshops which touched on the uncertainty, volume and, most importantly low value of DSO services. In particular, participants commented that there were a number of externalities not currently priced – most notably carbon. For instance, one participant recommended that “All externalities should be captured: carbon, air quality and more”.
2. **There is no coordinated action in ‘pump-priming’ the domestic flex market for net zero.** In the Bristol workshop, participants discussed the challenge of catalysing domestic flex to meet decarbonisation targets. They concluded that this requires market stimulation and termed this intervention ‘pump-priming’. They observed that there is no actor in the energy sector providing this pump-priming, and suggested that, although this was not the sole responsibility of the DSO, that the DSO had a valuable contribution to make. They argued that it was a barrier to domestic flex roll-out that no actor was proactively taking a long-term view to stimulating market development. This led to wider commentary about the need for DSOs to take a more assertive position in their own decarbonisation.

As a result, this trial idea seeks to amend the design of DSO markets to actively reflect the negative externality of carbon and enable the net zero journey. The idea was framed as part of the ‘Value’ subgroup session at the Bristol workshop. The idea entails a step away from technology neutrality in procurement, and towards DSOs adopting a more assertive role in energy system decarbonisation; an idea alluded to in Ofgem’s recent decarbonisation action plan. This will enable domestic flexibility solutions to access more value, as they are comparatively low carbon options for flexibility provision.

Objective

The objective is to *include consideration of carbon within DSO service procurement, so that the positive externalities of low carbon sources of flexibility are fairly accounted for in competitive procurement.*

This objective has been discussed by Everoze, WPD and SGC. It was noted in discussion that the carbon intensity in the provision of DSO services may be relatively low; therefore, pricing carbon as an externality may not materially increase the value (£) delivered to domestic flex providers. Instead, it is suggested that this trial idea is framed in terms of low carbon sources *gaining competitive advantage* in DSO markets – as an essential part of the DSO’s wider decarbonisation journey.

Call with BEIS

The FutureFlex team had a call with BEIS on 2 April 2020. Their feedback was:

- They are very supportive of the trial idea.
- The strong alignment with the BEIS ‘carbon in flexibility markets’ workstream was noted, albeit recognising that the BEIS work is at an early stage of development.
- BEIS’ core challenge is securing data on carbon emissions from flexibility (spanning both the manufacturing/development and operational phases). There is no continual data transparency. BEIS are interested in how these data, if it was available, might be tied into procurement, and in what a dynamic reporting process would look like.
- Ofgem agree that carbon needs to be valued but are cautious about DNOs leading this; Ofgem want to tie it into an existing mechanism (e.g. the ETS or Defra methodology) rather than developing a parallel mechanism.
- They believe that this is an interesting and exciting area to explore, but recommend conferring with Ofgem on how a trial might develop.
- BEIS believe there may be mileage in a trial which works with a council who have an ambitious target for carbon reductions and a mandate to act on this. This would help make the trial accountable.
- It was agreed that it is very important to establish the effectiveness of existing policies, and the gaps therein.
- Engagement with Patrick Kassels at Ofgem was recommended.

Scope of Work

The proposed scope of work is as follows:

- 1. Audit and categorise the sources of flexibility.** Establish how the carbon emissions of various forms of low carbon flexibility can be categorised and audited.
 - a. Establishing boundaries.** This will include precise definition of the boundaries of carbon assessment, such as defining whether embodied carbon and emissions from asset manufacturing processes are to be included in the final assessment.
 - b. Use existing methodologies.** Techniques and frameworks for auditing carbon are well established. For instance, there is an existing methodology for assessing carbon intensity of electricity generation, which informs Ofgem's Cost-Benefit Analysis. However, such methodologies require specialist knowledge – it will be necessary to contract this element of work out to a specialist in carbon auditing methodology. Input from DSOs will be needed on the likely utilisation of assets providing DSO services – as this determines operational carbon emissions.
 - c. Share findings:** Share findings with BEIS, to explore how this might support their 'carbon in flexibility markets' workstream.
- 2. Embed carbon data transparency into DSO markets:**
 - a. Form recommendations** on how to embed continued visibility of carbon emissions into DSO markets, both internally and externally.
 - i. Data capture:** Address what additional data (if any) should be captured as part of the procurement and/or delivery process.
 - ii. Internally:** Address how carbon accounting might be made more transparent internally during Flexible Power procurement and dispatch so that it is readily available, continually monitored and always at front-of-mind.
 - iii. Externally:** Address how carbon data might be shared externally. This is important both to provide the correct signals to current and prospective market participants, and to provide radical transparency on the carbon impact of WPD's services. For instance, solutions might range from an API in WPD's Energy Data Hub through to embedding within WPD's Flexible Power platform. The goal will be to make data readily accessible, visible, and continually updated, as suggested by BEIS.
 - b. Liaise with Flexible Power team to implement 'quick win' recommendations:** Seek to implement quick-win recommendations; if more substantial change is required, additional budget may be sought.

STAGE-GATE: Seek agreement with Ofgem before proceeding to next phase. Upon completion of the first two phases, it is expected the BEIS/Ofgem's 'carbon in flexibility markets' workstream will have progressed. At this point, Everoze will approach Ofgem with a more detailed plan for the next phase of the workstream. This will consider whether a regulatory sandbox approach is needed, and also explore whether Future Flex might be considered an action within Ofgem's Decarbonisation Plan. The following phases will only be pursued if Ofgem agreement has been secured.

- 3. Explore options to price carbon into DSO service procurement.**
 - a. Probe mechanisms for valuing carbon financially.** There are numerous ways that negative externalities can be priced into procurement mechanisms. Carbon floor prices, carbon de-rating factors or an emissions performance standard (EPS) are all options. It may be necessary to employ the services of a specialist in carbon market design and economics for this stage. It will be necessary to prove that the value of carbon is sufficiently material to have an impact on competitive DSO procurement.
 - b. Explore how carbon is currently priced:** The project will explore how carbon is already priced into the market (MCPD, other levies etc), to ensure no double-counting.
 - c. Map the options onto service design.** Determine how the different options for carbon valuation will work with the existing and likely future design of DSO service procurement mechanisms.
 - i.** This will involve identifying which procurement stage – for example qualification, tendering, or payment – at which carbon will be accounted for.
 - ii.** Considerations will be made of the contractual changes that might be required.

- iii. The stage at which carbon is accounted for also has implications for how carbon is measured. For example, if utilisation payments are made, then operation carbon emissions must be taken into account at the payment stage.
 - d. **Evaluate the options.** The different options for how carbon is to be incorporated into DSO-procurement will be evaluated according the clearly defined criteria, including the consideration of unintended consequences on the wider market.
 - e. **Seek stakeholder feedback.** A consultation document will be published, seeking feedback from all stakeholders (especially Ofgem) on the preferred options previously identified.
4. **Explore who might pay for the carbon premium.**
 - a. **Options could include:**
 - i. **Willing consumers.** Analogous to green tariffs in the energy supply market, some consumers may be willing to pay to reduce the level of carbon emissions associated with their supply of electricity.
 - ii. **Local authorities.** Many local authorities have declared a climate emergency. They may be willing to make financial contributions that help ensure low carbon electricity supply within their area.
 - iii. **DSOs themselves.** Payment by DSO would be ultimately distributed across all consumers. This would be linked to the RIIO-ED2 business plan.
 - b. **Develop the details of the mechanism.** For each viable option, determine how it would work in practice. This would include considerations of fairness, e.g. ensuring than vulnerable customers are not bearing unwarranted costs.
 - c. **Seek stakeholder feedback.** Publish a consultation document seeking feedback from stakeholders, combined with the consultation document for scope item 3, as described above.
5. **Trial options.** If possible run a trial of one or more options, integrating carbon into procurement under Flexible Power.
6. **Dissemination and interface with policymakers:**
 - a. 1 presentation/webinar
 - b. 2 blogs
 - c. 3 meetings/calls with BEIS/Ofgem, including engaging with their Flexibility Markets workstream to ensure continued alignment with the policy/regulatory context.

Deliverables

The outputs of this work are:

1. **Report on carbon impact of WPD's DSO services:** Auditing the carbon emissions implied by WPD services to date.
2. **Brief paper probing options for carbon data transparency:** Including detailed recommendations for delivery.
3. **Thought leadership.** A thought leadership piece summarising the findings of the work and exploring the best methods for valuing carbon in DSO market design. This will incorporate stakeholder feedback received from the phase 3 and 4 consultations.
4. **Physical trial.** If possible, a physical trial of integrating carbon into DSO service procurement under Flexible Power.

Dissemination deliverables are logged above.

Partners required

The Everoze Project Manager will be Benjamin Lock. The majority of this work can be delivered by the FutureFlex consortium. However, the following contractors will be sought:

- A carbon auditing specialist to support the carbon auditing and categorisation of different sources of flexibility.
- A carbon market design economist to support the exploration of how negative externalities can be priced into DSO service design.

SGC input will consist of:

- Advice on carbon auditing approaches.
- Review throughout.

Key benefits and risks

Benefits

- **Important signal to domestic flex market.** The signal sent may be as important as the actual value (£) delivered – tapping into wider consumer political interests and motivations: mapping a way to net zero.
- **Support delivery of Ofgem’s action plan:** Ofgem’s decarbonisation action plan states that they will consider how “distribution network companies can most appropriately take into account the carbon intensity of the flexibility services they procure”. This idea would explore and trial how this might work in practice.

Risks

- **Going beyond the remit of a DSO.** Discussions of ‘who should pay’ for a carbon premium is essentially a question of politics and distributive justice. It is important to liaise with Ofgem on whether it is appropriate for a DSO to pursue item 3 of the scope of work, and to avoid duplication of activity.

3. LONGLIST OF IDEAS

3.1 PROCESS

The participant feedback document⁴ was screened to pull out a list of project ideas raised by participants.

WPD, SGC and Everoze then used the following criteria to screen the longlist of project ideas:

Criteria
Cost: What will the trial cost?
Impact: <ul style="list-style-type: none"> How material is the barrier that is addressed? (according to participant feedback) To what extent will the trial address key barriers? (as flagged by participant feedback)
Additionality: To what extent is this being addressed elsewhere?
DSO fit: To what extent is it appropriate for a DSO to lead this trial?

3.2 SCREENING RESULTS

The following table logs the screening process.

TRIAL IDEAS	DESCRIPTION	EVALUATION
Test reliability of aggregated datasets	Perform a test of an aggregated portfolio of domestic DSO assets with additional high-quality metering installed with local data recording alongside a lower-cost, basic metering solution. After the trial has run for a few months, compare the basic data as recorded remotely by the aggregator, against the high-quality data recorded locally at the premises. How do the datasets compare, has the aggregation improved accuracy overall and can any disparities be resolved by e.g. application of an offset or multiplier or other adjustment?	Proceed, but instead explore utilizing existing datasets to ensure this passes the Cost criterion.
Create market for 11kV	Provide visibility of service need and later manifestation into a market and price signal for active power services across lower voltage levels. At the moment, WPD only procuring services at 33kV level; if needed at 11kV level, have the option to provide this, creating a market for those services.	Fails on Impact criterion: Previous WPD investigation suggests that the premium value is low.
Value low carbon	Premium payment or derating factor for non no/low carbon assets	Proceed (bonus: well-aligned with recent Ofgem direction of travel).
Standardise qualification/procurement for ESO & DSO services.	Make the contracting process simpler/tidier for multi-asset portfolios Common set of rules and contracts across ESO/DSO services?	Fails on DSO fit criterion. Better led by Energy Network Association's Open Networks.
Compile data requirements for provision of DSO&ESO services	Research and list out data / measurement requirements from existing DSO/ESO service definitions. Identify what's common across them, what's not common and what new data are needed currently or likely to be in the future. Include review of requirements for resolution / accuracy (which should be considered in light of any benefits from mass data aggregation). Use this to compile comprehensive set of standards for data requirements.	Fails on DSO fit criterion. Better led by Energy Network Association's Open Networks or other similar coordinating body.
Standardise existing comms protocols	Research and potentially test existing smart appliance / EV / metering standards / protocols and produce a league table of what works and what doesn't against DSO and ESO service requirements. Use this to further inform data requirements standards (extension to idea 1 above).	Fails on DSO fit criterion. Better led by BEIS, BSI and Open Networks.

⁴ WESTERN002-R-01-C: FutureFlex participant feedback, February 2020.

FUTURE FLEX: IDEAS FOR TRIAL

Refine baselining	<p>Tech specific baselines (inc smart appliances) Historic v near time + hybrid Geographical baseline Calibrated site methodology testing Future visibility needs – ready for tomorrow Use existing installed technology (low integration cost) Trials for system to system integration Near real-time baseline around existing constraints Who should define 'the standards'? Who should operate and enforce the baselining methodologies?</p>	Fails on Impact criterion – it is higher impact to address Data requirements first; baselining follows afterwards. In addition, needs more specificity to be compelling.
Create & use flexibility register	<p>Focus on improving visibility of where flex exists, rather than where current DSO needs are.</p>	Fails on additionality – this is addressed by Electron's Recorder project.
Trial joined-up approach to value (beyond elec)	<p>Unlike other flex assets, domestic flex can offer a range of local social benefits: this should be recognised. E.g. top-ups to DSO payments from local authorities where domestic flex also supports fuel poverty or climate emergency initiatives. DSO collaborates with local actors to pump-prime domestic flex market – holistically pricing in ALL externalities. In addition to the value of network investment deferral, work with other actors to price in all externalities such as: - Long-term market development: [alongside ESO etc] - Low-carbon (local authority may offer premium? premium due by WPD due to RII0-ED2 environment commitments??) - Value of community - Clean air. This framing of wider benefits should also engage consumers more fully too. Find existing/planned activity for retrofit and heating electrification, and intervene to ensure that this is futureproof for DSO services</p>	Proceed – but requires further research to be confident of additionality (possible duplication of SSEN work). Some discussion of whether it might fail the DSO fit criterion, but ultimately seen as a Pass for this given strength of stakeholder feedback that this was within scope.
Trial short-duration services (HH)	<p>Analogous to DS3 products in Island of Ireland. WPD services currently require min 1hr duration requirements. But domestic flex wants more modular durations, e.g. heat pumps might not be able to provide 1hr duration. Bring it down to 5 min granularity [aligned with ESO].</p>	Fail due to insufficient Impact – concern that it is too premature to have high impact.
Trial DSO services for energy efficiency	<p>Develop an approach for energy efficiency to participate in DSO services Develop a combined approach to retrofit (energy efficiency) and DSR in providing DSO services. An incentive mechanism that promotes a holistic view on both.</p>	Some concern around additionality criterion (see SSEN project SAVE). Decision to research further and consider alongside new Sustain service.
Info campaign for non-specialists	<p>Giving suppliers & aggregators the tools and information to help them engage their customer base/related stakeholders. How DSOs approach & engage with non-specialist stakeholders to improve awareness/education.</p>	<p>Proceed as low hanging fruit; however, consider merging with other trial ideas to ensure material Impact, due to small overall scale. Some discussion around DSO fit criterion and whether better led by ENA; decision that it was appropriate for DSO to trial enhanced information.</p>
Price premium for long-term benefit	<p>Pump prime the market for flex - price in long-term benefit</p>	Some discussion on DSO fit, and appropriateness of DSO leading this. Decision to consider alongside idea for low carbon procurement.
Leverage intervention points to make homes DSO-ready	<p>- Develop a joined-up value proposition where grid services play a part but are not dominant: exploring how the DSO can fit its services into existing social/environmental initiatives. -Find the market segments which are already committed to major home upgrades due to other reasons, unrelated to the DSO. For instance, homes planning deep retrofit, oil-heating replacement, or which are yet to be built and so are open to different designs. These are the DSO's intervention points. - For these segments, provide targeted advice and/or incentive, so that those major home activities to be implemented in a way that is DSO-ready. Trial providing this advice/incentive to multiple audiences (e.g. new build housing, different homeowner archetypes, social housing providers etc). - This is an appropriate approach because the DSO is 'piggybacking' on existing activity in the home, providing targeted interventions that leverage opportunities that occur once-in-a-few-decades per household.</p>	Proceed.
Alternative data sources: Investigate supplementing low-grade metered data with data from other sources	<p>As part of the trial proposed in idea 1 above, look at improving accuracy and quality of data through other sources of data (e.g. OLEV EV usage etc.)</p>	Fail on Impact, due to insufficient confidence that this will deliver material benefits relative to other ideas. Electric Nation trials already provide confidence on prequalification; and alternative methods are considered more appropriate for assessing performance.
Test devices and comms protocols: Set up interoperability lab	<p>Set up specialist lab to test devices and comms protocols at all levels between household and DSO / ESO. Compare interactions against simulations.</p>	Fails on DSO fit.
Enhanced long-term map of DSO need	<p>DSO giving visibility on grid needs in the future (certainty).</p>	Fails on impact – recommend to pursue as BaU tweak instead (pass onto Flexible Power team).
Coordinate an industry level project to agree and test standards	<p>Bring together the different parties who may wish to connect to domestic dwellings and EVs and establish a set of standards that meet all their needs which could then be published so that we could do everything we can to enable revenue stacking at a domestic level, which in turn helps address the main concern expressed, that there needs to be increased value to attract widespread participation.</p>	Fails on additionality – standardization work already ongoing (BEIS, BSI, Open Networks).
Build a single market to reduce overall costs	<p>Metering, qualification, admin, stackability, revenue hopping</p>	Fails on additionality and DSO fit criterion – see ongoing work by BEIS and Ofgem.
Reformed network charging	<p>Different approaches to network charging and consumer reaction. Pull together all work already done first (network charging signals)</p>	Fails on additionality and DSO fit criterion – see ongoing work under SCR.

Consumer testing	Consumer reaction to 'flexing' by tech type. Consumer attitude to third party ownership and kit Consumer attitude to what 'flex' is.	Fails on additionality – already explored under MADE and ElectricNation, plus BEIS-funded domestic flex innovation projects.
Reboot ECO to include domestic flex	ECO money for electric heating controls for local flex Make it open-to-all	Fails on DSO fit – currently ECO is supplier led.
Local authority collaboration	Support vulnerable consumers and electric heating. Develop flexible places not constraint zones. Make this proactive and planning-based not cost-based (local authorities can take the risk) View homes within the community, not as atomised buildings.	Decision to consider alongside Joined-Up Value idea above.
Allow aggregators to bid without portfolio in place.	Rely upon incentive/penalty structures to provide commercial comfort to DSO. Adopt a de-rating factor for reliability, applying a lower reliability weighting to virtual portfolios. E.g. portfolios with high levels of physical assets, rather than virtual ones, are chosen first.	Fails on Impact, particularly given ESO's STOR experience.
Run a procurement trial mirroring the wholesale market	More options for procurement horizon, giving a level of optionality analogous to wholesale market. Long-term/medium/close-to-real-time procurement horizons	Fails on additionality criterion; covered in Intraflex.
Develop Framework/smart contracts	Including secondary trading) with standard terms. Common framework across DSOs & ESO – entirely standardised	Fails on Impact criterion: premature.

3.3 FURTHER REFINEMENT

The following logs a meeting between FutureFlex team and Flexible Power team on 17 03 2020, during which ideas were further downselected and refined.

DSO-ready homes:

➔ MINDED TO PROCEED

➔ Advice:

- Clarification: Distinguish clearly between decisionmakers and recipients; be open to working with local authorities.
- Definition of 'trial': Be clearer on what success looks like; it could be to change an outcome or decision.
- DSO-ready v flex-ready: Make Scope item 1 flex-ready, but focus on interventions which DSO can deliver.
- Standards: Recognise that these are not yet mature.

Industry-led data:

➔ EAGER.

➔ Advice:

- Context: On the 33kV network and above, through EDCN Charging methodology, WPD can contact any large customer and ask them to take a DSM contract to reduce their import for a fixed period, and thereby reduce their DUoS. This is funded from the DUoS pot. It would be very helpful to have a similar mechanism for domestic customers. One possibility is to come up with average profiles, and then aggregate this (with some derating/delta).
- Sustain: This is equivalent to Scheduled Constraint Management. EDCM contracts are a Sustain product. Future Flex could help widen the pool of participants that use the Sustain product.
- Payments: BaU able to fund customer payments. Recommend approaching a friendly supplier with good dataset, examine their customer archetypes and then co-create an expected delta per participant.
- Tech: Eager to engage both EVs and EE. For EVs, we could use a normalized profile through Electric Nation. For EE we could use a normalized response; if we knew the technology provides a response, then the delta could be used (need proof of EE measure installed). Question with EE is over what timeperiod you pay for.
- Learn by doing: Better to get a trial going and learn from it, agile-style, rather than cook up a perfect project. Speed matters.

Aggregated data:

- MINDED TO PROCEED – but recommend tying this in with Industry-led data
- Advice:
 - DSO position: Some concern about watering down DSO current requirements data, because location is tight enough already. As you move to larger sample sizes, confidence improves – what is the minimal population size?
 - Statistics: It would be helpful to have statistical analysis of a population of points, and then understand the delta inaccuracy at a particular population level – then inform the safety margin applied.

Valuing low carbon:

- PROCEED IF OFGEM APPROVES
- Advice:
 - Metrics: It will be helpful to quantify the carbon impact of flex, to create metrics of this
 - Ofgem: Essential to engage – ideally shape FutureFlex as an action on Ofgem’s Decarbonisation Plan. Consider adopting a regulatory sandbox so that Ofgem support is on board.
 - BEIS: Note that BEIS have existing methodology for assessing electricity products and carbon intensity – this informs Ofgem’s CBA.

Value beyond electricity:

- DECLINE, as less aligned with the aims of NIA.

3.4. DISCARDED IDEA: VALUE BEYOND ELECTRICITY

The following idea was discarded and will not proceed.

Value from domestic flexibility does not have to just come from the electricity sector. DSOs could link up with local level initiatives to unlock a more diverse value stack.

Participant feedback

A key barrier for domestic flexibility providing DSO services is low value. There were 20 comments to this effect in the workshops which touched on the uncertainty, volume and, most importantly low value of DSO services: “[The] value of DSO flex contracts is too low to justify investment”. There were also wider economic comments on the high capital and operational cost of participation.

The ultimate motivation of consumers is not to provide DSO services. Consumer motivations go beyond electricity. Provision of DSO services is generally a secondary motivation, and often only desired as a way to help achieve primary motivations such as consumer experience, community energy schemes, cost or climate emergency concerns. Often these motivations are place-based.

DSO services can align with local authority social and environmental initiatives to address the challenge of low value and low consumer engagement. In doing so, this idea can push the boundaries of the DSO’s role in the transition to net zero and unlock access beyond just electricity markets. Local authorities have been selected as the best organisation to engage with because:

- They are locational, aligning with participant feedback on taking a local approach.
- Working within defined geographic areas gives the DSO the ability to target activity in areas that align with areas of network need.
- They are the key stakeholder in many existing social and environmental initiatives.
- They work on scale, and cover all demographics,

Objective

The objective is to *produce a set of proven opportunities where a DSO can align with local level initiatives to unlock a more diverse and more attractive value stack, accelerating the rollout of domestic flexibility.*

Scope of Work

1. **Identify a local partner.** Find a local authority with whom we can partner.
 - a. **The partner needs to be keen.** We are searching for a local authority with the appetite, capability and available resource to engage.
 - b. **Find the right point of contact.** Local authorities typically have multiple workstreams ongoing and link with numerous other public bodies and community organisations. The point of contact will ideally have an overview of all that the local authority is involved with, and power to act on climate and energy initiatives. To expedite the future rollout of similar initiatives across other local authority areas, preferably this person will hold a role that is common across other local authorities.
2. **Identify relevant initiatives.** Search for local authority initiatives that display parallels with domestic flexibility provision, and which might be used to promote provision of flexibility services from homes, creating a diverse value stack that does not solely consist of electric market revenues. This could include:
 - a. Actions deriving from a climate emergency plan.
 - b. Measures to address fuel poverty or social deprivation.
 - c. Energy efficiency initiatives
 - d. Community cohesion initiatives
3. **Examine how DSOs ally with these initiatives.** After identifying relevant existing or proposed initiatives, the task is to explore how DSOs might align themselves with these initiatives to deliver combined benefits both to the local authority and to homes.
 - a. **Alignment could take multiple forms.** It could be the provision of advice, or of a financial incentive. But this is most likely to be delivered by local authority channels rather than by Flexible Power. An example could be to help a local authority delivering an energy efficiency programme to identify the areas which deliver the greatest benefit to the network and future DSO-service procurement.
4. **Trial promising initiatives.** Run a real-world trial of between one and three initiatives where a DSO could ally with a local authority.
 - a. **Local focus.** Trials would be focussed on a single geographical area, with trial findings presented considering the extent to which they are relevant nationwide.
 - b. **Review feedback.** On conclusion of the trial engage with all participants to seek their feedback.

Deliverables

The outputs of this work are:

1. **A report summarising the findings of scope items two and three.** This describe the initiatives identified and the areas of alignment that have been found between these local authority initiatives and DSO service provision.
2. **A real-word trial.** Testing out the interventions identified.
3. **An analysis of trial results.** Including feedback, costs and recommendations for how to transition from trial to BaU.

Partners required

The support required at this stage is not known. Everoze's team will be able to deliver the majority of the scope. However, the nature of the trial is not yet fully understood and specialist support may be required at this stage, depending on the scope of the trial.

Key benefits and risks

Benefits

- **Increased attractiveness of DSO services:** Linking incentives for DSO services with other key consumer motivating factors could help overcome the lack of monetary value of DSO-service provision.
- **Strengthening local links of DSO:** Working with local authorities can allow DSOs to build closer links with local actors that hold power over topics relevant to domestic energy flexibility such as homebuilding and planning.

Risks

- **Difficulty finding a local authority to work with.** There is a strong likelihood that an appropriate local authority cannot be identified, or that for various reasons no authorities are willing to engage to the level required to carry out this idea.
- **Incompatibility of initiatives.** There is a risk that no feasible method is found to ally the financial incentives of providing DSO-services with other, non-monetary incentives.
- **Ceding control of the trial to the local authority.** If the trial incentives are to be delivered through local authority channels there is a risk that control of the trial could be ceded to the local authority.
- **Perceived overlap with SSEN work.** In 2019 SSEN launched Social Constraint Managed Zones, an extension of their existing DSO service known as Constraint Managed Zones. It could be thought that this idea overlaps with the Social CMZ scheme, which targets smaller providers such as homes and also considers, albeit to a limited extent, non-monetary benefits.