

TABLE OF CONTENTS

1. INTRODUCTION 2

1.1 Background.....2

2. DEFINING A DSO READY HOME 3

2.1 Definition3

2.2 Elements of a DSO ready home5

2.3 What ‘highly ready’ looks like6

2.3.1 Data consent 6

2.3.2 Route-to-market partnership..... 6

2.3.3 Enabling habits.....7

2.3.4 Energy efficiency7

2.3.5 Control potential8

2.4 ESO readiness.....8

2.5 Stakeholder mapping.....8

3. NEXT STEPS..... 10

I. INTRODUCTION

I.1 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 (WPD), Everoze and Smart Grid Consultancy (SGC), funded by the Network Innovation Allowance (NIA).

DSO Ready Homes is one of the three work streams in FutureFlex project. Two workshops with industry stakeholders were held during Phase I of the FutureFlex project; key findings included:

1. DSO procurement timelines are processes and framed around DSO needs
2. Consumer interest in domestic flexibility is generally low
3. Mindset and consumer-led business models should be addressed to stimulate consumer interest and participation in DSO services.

As a result, the DSO-Ready Homes workstream aims to put the consumer first – seeking to make homes DSO-ready by targeting natural intervention points. This trial puts 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.

The objective is to deliver a set of proven, costed interventions to make homes DSO-ready, through adopting a customer-centric approach. The figure below summarises our approach to the DSO-Ready Homes workstream, and the green arrows signal where this paper fits in.



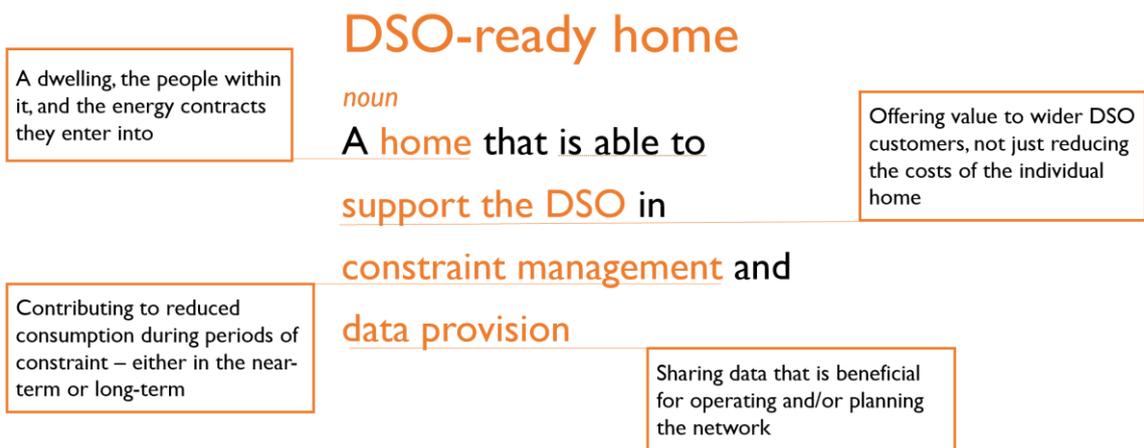
FIGURE I: APPROACH TO DSO-READY HOMES WORKSTREAM

2. DEFINING A DSO READY HOME

2.1 DEFINITION

Our approach in defining a DSO-ready home has been to start with first principles, as DSO-readiness is a new concept. We are grateful to the Association for Decentralised Energy and Active Building Centre for testing out this concept with us, and to Sustain-H prospective participants for their feedback.

We propose the following definition of a DSO-ready home:



The table below provides clarifications upon the definition.

QUESTION	ANSWER & RATIONALE
<p>Tech solution</p> <p>Does DSO-readiness refer to flexibility only, or does it also include energy efficiency?</p>	<p>DSO-readiness can be mediated through flexibility, energy efficiency, or ideally both.</p> <p>This is because both routes can contribute to peak demand reduction within a CMZ. Reducing peak consumption can be achieved by:</p> <ol style="list-style-type: none"> 1. Shifting demand away from peak times; and/or 2. Shifting the load curve down through energy efficiency gains <p>See Figure below.</p>

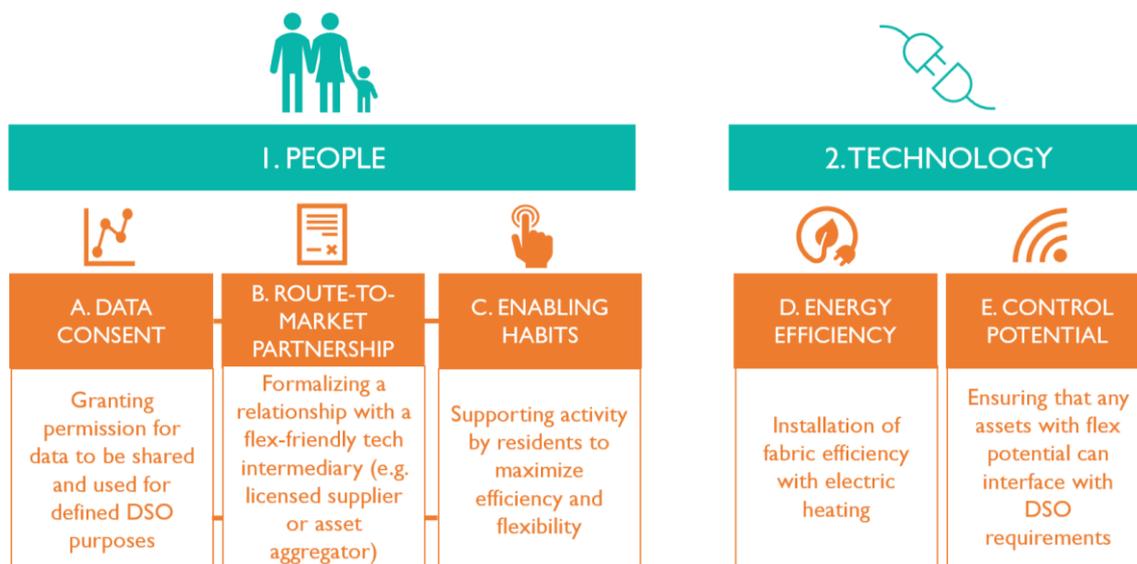
	<p>Taking an example, an electrically heated PassivHaus comprised of highly energy-efficient appliances has a high level of DSO-readiness, even though it has limited flex potential due to very low power consumption. This is because the PassivHaus has low demand during periods of network constraint (and more generally has low demand at all times).</p> <p>However, energy efficiency is only relevant when specifically reducing <u>power</u> consumption during constrained periods. This is because DSOs are concerned with electrical infrastructure only. For instance, consider a highly insulated house with a gas boiler; the insulation levels only impact DSO-readiness when matched with an electrified heating solution.</p>
<p>Whom the homes should be ready for: DSO services only, or ESO too?</p>	<p>ESO-readiness is NOT a prerequisite to being DSO-ready.</p> <p>ESO service requirements are often more stringent than DSO requirements.</p> <p>However, our project <u>will</u> additionally strive to seek low-hanging fruit on ESO-readiness, reflecting wider participant feedback around the need to take a holistic view.</p>
<p>Pre-existing assets Does a home need low carbon technologies (LCTs) to be DSO-ready? By LCTs, we mean technologies such as electric vehicles, heat pumps and batteries.</p>	<p>A home does <u>not</u> require LCTs to be DSO-ready – but where those assets exist, they must be able to interface with DSO services in order to be DSO-ready.</p> <p>To be DSO-ready does NOT require the promotion of the takeup of LCTs/appliances directly, but rather to ensure that where LCTs/appliances exist, they are ready to access DSO services.</p> <p>The DSO is neutral as to whether LCTs are installed, other than not wishing to be a barrier to their installation.</p> <p>Taking an example, a home that has an EV, but does not have a smart charger and is not optimizing its EV charging, has a low level of DSO-readiness.</p>
<p>Location Does a DSO-ready home have to be in a CMZ?</p>	<p>A DSO-ready home does not have to be in a CMZ. The home merely needs to be ready to support the DSO, even if the DSO does not (yet) need it. DSO-readiness is about being activated to support the DSO, even if that capability is not yet required.</p> <p>In addition, the data-provision aspects of DSO-readiness are useful regardless of location.</p>
<p>Sliding scale Is DSO-readiness binary (yes/no), or a sliding scale (more/less ready)?</p>	<p>DSO-readiness is a sliding scale, not an on/off determination.</p> <p>Homes can be more or less DSO-ready, because there are multiple elements of readiness – described in the next section.</p>
<p>Data transparency Is a home fully DSO-ready if it is not sharing data with DSO?</p>	<p>Full DSO-readiness requires data-sharing.</p> <p>Direct contribution to constraint management is helpful, but to capture full value, data evidencing both capability and performance must be shared too.</p>
<p>Impact on home Does supporting the DSO mean sacrificing energy services in the home?</p>	<p>DSO-readiness does not require material impact to a customer’s experience of energy services in the home</p> <p>DSO-readiness can be achieved without incurring adverse impact on energy services for customers. For example, houses should not have a significant temperature drop in order to support the DSO – unless the householder explicitly chooses to make this tradeoff for financial gain.</p>

<p>Provision of DSO services</p> <p>Does DSO-readiness mean being ready to provide services to the DSO?</p>	<p>DSO-readiness will equip customers not only to provide DSO services, but also to support the DSO in other ways</p> <p>In the future, there may be alternative mechanisms by which DSO-ready homes can support the DSO; for instance via network time-of-use-tariffs. We do not necessarily presuppose that DSO services are the only vehicle for support.</p>
<p>Benefit</p> <p>Is a home DSO-ready if it benefits the individual home occupier/owner only, but not the DSO?</p>	<p>A home is DSO-ready only if it offers some wider value to DSO customers, not just reducing the costs of an individual home</p> <p>DSO-ready homes must have the potential to offer some benefit to the DSO directly – and thus benefit customers as a whole. It is acceptable, and even expected, that some benefit will also accrue to individual home occupiers/owners too; however, for a home to be DSO-ready, it must offer some value to the DSO.</p> <p>We note that the benefit to the DSO depends on the regulatory allocation of reinforcement costs, which may change with Ofgem’s Significant Code Review (SCR). At present the reinforcement burden falls on the DSO for LCTs at domestic scale and on existing properties.</p>
<p>Motive</p> <p>Must DSO-ready measures have been primarily motivated by a customer’s desire to support the DSO?</p>	<p>A home occupier/owner’s motive for adopting DSO-ready measures could be wide-ranging; DSO considerations may be secondary</p> <p>A number of measures which improve DSO-readiness may be primarily (or exclusively) motivated by factors other than supporting the DSO.</p> <p>For example, the adoption of energy efficiency measures by home occupiers/owners may primarily be motivated by a desire to reduce energy costs. This still contributes to DSO-readiness, as long as it is shown to deliver value to the DSO. Put simply, DSO-readiness is agnostic on <i>motive</i>, but prescriptive on <i>benefit/outcome</i>.</p>

TABLE 1: CLARIFICATIONS ON DEFINITION OF A DSO READY HOME.

2.2 ELEMENTS OF A DSO READY HOME

DSO-readiness requires activated PEOPLE and activated TECHNOLOGY, as summarized in the figure below.



The above three items are interlinked. They reflect the likelihood of supporting the DSO.

The above two items are independent. They reflect capability to support the DSO.

FIGURE 2: ELEMENTS OF DSO-READINESS

2.3 WHAT 'HIGHLY READY' LOOKS LIKE

Following on from the above, the next question is: what does 'highly ready' look like for each element? We answer this for each element below.

2.3.1 Data consent

A home with high levels of DSO-readiness grants permission for data to be shared with the DSO. This requires us to define:

- What data needs to be shared? We categorise the data into 'Building', 'Assets' and 'Usage'.
- Who grants consent? The answer to this depends on the data category.

A home that scores highly on the Data Consent element is one where authorised parties have granted consent for data to be shared as per all of the rows in the table below.

DATA CATEGORY	DATA TO BE SHARED	PARTY WHO CAN GRANT CONSENT
USAGE [all homes]	Total electricity consumption OR asset usage data Household identifier (e.g. MPAN or address)	Home occupier
ASSETS	Presence and capacity of flexibility/generation assets (e.g. PV, EV chargepoint, heatpump, battery) – or confirmation that they are not present.	Asset owner (likely to be, though not necessarily, the homeowner), or asset user (i.e. home occupier).
BUILDING [all homes]	Location Property information from EPC certificate (walls, roof, floor, windows, main heating, main heating controls, secondary heating, hot water, and lighting) Residency numbers/utilisation	Home developer, owner or occupier. Ministry of Housing, Communities & Local Government (see here).

TABLE 2: DATA TO BE SHARED BY A FULLY DSO-READY HOME

2.3.2 Route-to-market partnership

A highly-DSO ready home will have a relationship between the *home occupier/owner* and a *route-to-market partner*.

A route-to-market partner is an organization which acts as intermediary between DSO and home occupier or homeowner. The intermediary has the primary role of translating DSO flexibility opportunities into a format that is accessible to the home occupier/owner.

The route-to-market partner may have a *contractual* or *information-only* relationship with the home occupier.

The means of translation can vary from direct to indirect influence. Example relationships include:

- Direct third party control of flexibility assets – e.g. automated optimization, for instance via an energy-as-a-service tariff
- Translating the DSO flexibility benefit into a half-hourly price signal that a consumer can respond to – e.g. a variant of the Octopus agile time-of-use tariff
- Communicating the value to the DSO through an app – e.g. the Open LV project.

Examples of route-to-market partners are:

- A licensed energy supplier;
- An asset aggregator, without a supply license;
- A community energy organization;
- A local authority.

AND WHAT ABOUT ROUTE-TO-MARKET PARTNERS FOR ENERGY EFFICIENCY?

The above definition focuses on a partner to offer a route-to-market for flexibility services. Where do energy efficiency installation partners fit in here?

This is a difficult question to answer due to the immaturity of the sector. It is unknown to what extent the energy efficiency and flexibility supply chains will join up in future:

- On the one hand, there is a clear logic for a joined-up approach on heat in particular. For instance novel comfort-as-a-service propositions led by flexibility innovators depend upon a minimum level of building fabric efficiency. Greater energy efficiency is an enabler for greater timeshifting of heat pumps. Greater efficiency also avoids oversizing flexibility assets. Moreover, there are examples of pioneering organisations taking a joined-up approach – such as Sero Homes and Carbon Coop.
- On the other hand, energy efficiency and flexibility entail different core competences: it may be difficult for organisations to develop the required diverse competences internally. The former entails practical installation skillsets, whereas the latter entails desk-based software and market competence. The former is a capex-led business with one-off customer transactions, whereas the latter entails developing a long-term customer relationship for ongoing revenues.

Industry engagement for the Sustain-H service demonstrated little interest in the energy efficiency aspects of the service, except amongst community energy groups; and unfortunately the pioneering organisations taking a joined-up approach did not have sufficient assets within eligible CMZs. This lack of interest may reflect the immaturity of the heat flex market, or may indicate that efficiency and flexibility supply chains will remain bifurcated going forwards. It is too early to say.

We propose to address this complexity further in the next stage of the DSO-ready homes project.

2.3.3 Enabling habits

A fully DSO-ready home is occupied by residents who both (a) know what DSO-enabling habits are, and (b) engage in these habits consistently.

DSO enabling habits are the behaviours that either promote energy efficiency or maximise flexibility potential. Consistency is key: a home which only occasionally performs energy efficiency or flex-enabling behaviours is not a highly DSO-ready home until the behaviour becomes routine.

The enabling habits vary depending on the home (building, assets, usage). Some examples of enabling habits include:

- The occupier always plugs-in their EV so that their vehicle is available for DSO service provision.
- The occupier changes the time they turn on their heating to 1 hour earlier everyday in the winter, to avoid periods of peak network constraint.
- The occupier develops a habit of responding to demand shifting signals via an app (e.g. from their ToUT electricity provider)
- The occupier chooses to wash their clothes at a lower temperature of 30°C, and fills their kettle with only the required amount of water.

2.3.4 Energy efficiency

We take the Energy Performance Certificate (EPC) of a home to be a reasonable proxy for a building's energy efficiency rating, as this is the preferred metric used in the housing sector. A rating of 'A' confers high DSO-readiness; whereas a rating of 'G' confers a low readiness.

The most DSO-Ready Home will be one which conforms to the Future Homes Standard. The Future Homes Standard requires new builds from 2025 to be future-proofed with low carbon heating and higher energy efficiency standards of the building fabric and lighting, coupled with self-generation assets.

2.3.5 Control potential

A home with high DSO-readiness will have appliances with control potential. A “smart appliance” has been described by BEIS as being communications-enabled and able to respond automatically to price and/or other signals by modulating its electricity consumption.

Typical controllable appliances include EV charge points, battery storage and electric heating. In general:

- Controllability is inherent to all battery storage units
- Controllability is now the norm for EVCPs; from July 2019, the Office for Low Emissions Vehicles changed the eligibility criteria of its home charger grant to only cover installation of smart chargers – though there remain API integration issues with aggregator platforms.
- Controllability is immature in heating appliances.

To be fully DSO-ready, the appliance should offer more than an ON/OFF switch, offering a degree of controllability over rate of charge to allow for optimization of power flows. For example, if a chargepoint operator has the ability to vary the rate of charge of an EV rather than simply turn it on or off, then the charging demand could be spread, thus contributing to reduction in the instantaneous and/or projected aggregated peak demand.

Controllability can either be achieved via:

- **Utilising existing hardware:** This is the long-run direction of travel, entailing cloud-to-cloud communications between back-office of device manufacturer and aggregators.
- **Installing additional hardware:** Aggregator/supplier installs an additional ‘black box’, with associated installation costs. This often increases controllability due to reducing comms latencies; however, such additional functionality is unlikely to be necessary for DSO services.

The 4DHeat Network Innovation Allowance Project, supported by SSEN and ESO, is exploring the costs and options for smart control retrofit and installation in domestic settings. Activity is also ongoing by BEIS and BSI on smart appliances. As a result, further activity on the definition on Controllability is not recommended under the DSO-ready homes project.

2.4 ESO READINESS

The definition of ESO-readiness is largely the same as that for DSO-readiness. Therefore, if a home is DSO-ready, it is largely ready to provide ESO services too: there are synergies.

However, there is one key difference, on control potential. For ESO-readiness, ‘control potential’ is a higher bar; for instance, the provision of Firm Frequency Response (FFR) requires second-by-second response, with the portfolio testing certified by an Independent Technical Expert.

A further difference is that energy efficiency is not primarily relevant to the ESO; efficiency is not required for the provision of system services.

2.5 STAKEHOLDER MAPPING

The stakeholders who influence each element of DSO-readiness are summarized in the table below. Everoze notes that some of these parties sit outside the energy sector; for instance, working in the housing sector or in finance. This suggests that achieving DSO-readiness may necessitate partnerships with actors who the DSO does not traditionally engage with.

DSO Ready-Homes: definitions

ELEMENT	DATA CONSENT	ROUTE TO MARKET PARTNERSHIP	ENABLING HABITS	ENERGY EFFICIENCY	ENERGY CONTROL POTENTIAL
WHO INITIATES ACTION?	Home occupier or home owner	Home occupier or home owner	Home occupier	Housing developer, home occupier or home owner	Device manufacturer Tech aggregator
WHO INFLUENCES THE DECISION?	Energy suppliers' marketing team Aggregators Community energy Green groups Government policy Peers/friends	Energy suppliers' marketing team Third party comparison sites/advisors Peers/friends	Housing developer Heat pump and EV installers Device manufacturer Energy supplier Community energy groups Not-for-profits EPC Energy assets Local authority Peers/friends Energy supplier	Not-for-profit advisers Installers' marketing teams Government (via conditions attached to grants) Green mortgage provider Local authority EPC certificate providers	Device manufacturer Tech aggregator BEIS
EXAMPLE INFLUENCERS	Octopus Energy Plymouth Community Energy	Moneysavingexpert.com Carbon Coop	Developments Bristol Tesla	Energy Saving Trust Sero Homes	Upside Energy Daikin

3. NEXT STEPS

At this stage of the project, we now have a working definition of DSO-readiness, an understanding of its constituent elements, and who influences each element.

The next step is to understand the 'stakeholder journey' better. Specifically we will:

1. **Map out the intervention points for key stakeholders:** Everoze will scope out the intervention points for high impact stakeholders – understanding their 'journey', and identifying how the DSO can intervene to promote DSO-readiness.
2. **Engage with stakeholders:** Everoze will engage with interested stakeholders on a one-to-one basis to refine our approach, shortlist interventions and identify partners to test this with. We will start by engaging the parties who have informed this paper.

When shortlisting interventions, Everoze will consider how we might explore three novel themes identified in this paper:

1. **Promoting a joined-up approach to energy efficiency and flexibility:** Testing out how a holistic approach to DSO-readiness might work – and the benefits it might bring to DSO customers.
2. **Exploring the role of a DSO beyond energy:** Testing the appropriate role of a DSO in providing an intervention/evidence-base to those outside energy – and whether this offers good value-for-money for DSO customers.
3. **Capitalising on the distinction between *motive* and *benefit* of DSO-ready measures:** Testing if it is possible to leverage non-DSO motives to deliver outcomes that benefit the DSO – and ultimately all customers.