SUSTAIN-H SERVICE

GUIDELINES FOR PARTICIPANTS, 19 JULY 2020

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

everoze

SGC

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VERSION HISTORY

A	Design guidelines to share with participants	9 July 2020
B	Clarification to heatpump baselining profiles	19 July 2020

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1. INTRODUCTION

1.1 BACKGROUND

Sustain-H is Western Power Distribution's (WPD) new DSO service tailored for homes. It is an evolution of **Sustain**, the Scheduled Constraint Management service being rolled out across all DSOs, following standardization work by the Energy Networks Association.

Sustain-H forms part of Future Flex, an innovation programme pioneering second generation DSO services for domestic scale assets. Two workshops with industry stakeholders were held in early 2020 to inform service design. Future Flex is delivered by Western Power Distribution, Everoze and SGC, with National Grid ESO as observer. Future Flex is funded by the Network Innovation Allowance.

The objectives of Sustain-H are to:

- Remove barriers to domestic flexibility in providing DSO services
- Probe the data options, methods and benefits of taking a portfolio view
- Transition the trial into business-as-usual procurement.

This document outlines the design features of Sustain-H. We request confirmation of your intent to participate by 31 July 2020.

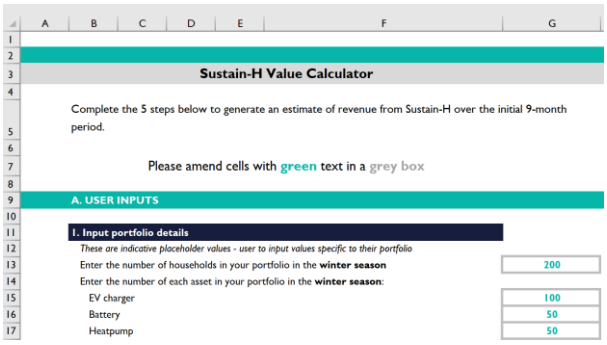
1.2 ACCOMPANYING DOCUMENTS

This Design Guidance should be read in conjunction with the following materials. In response to your feedback, we have already made tweaks to the design; for instance, offering an improved schedule. Thus, in the event of conflict, please treat this document as offering the latest position. We remain open to making further revisions based on your feedback.

SUSTAIN-H ENGAGEMENT PACK dated 17 June 2020
A ppt introduction to the service

	A	B	C	D	E
1	Postcode	CMZ Code	CMZ Name	Winter	Summe
2	PL1 5JZ	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
3	PL1 5JP	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
4	PL1 5DD	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
5	PL1 5JR	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
6	PL1 5JS	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
7	PL1 5JQ	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
8	PL1 5JN	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
9	PL1 5LA	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
10	PL1 5EQ	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
11	PL1 5EN	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
12	PL1 5ES	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
13	PL1 5DH	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes
14	PL1 5ED	CMZ_T2A_SWE_0001	Plymouth/South Hams	No	Yes

CMZ_POSTCODE_LIST, dated 17 June 2020
Excel tool to help you identify which households are in CMZs



SUSTAIN-H VALUE CALCULATOR
Excel tool to estimate revenue. We expect to issue an update with amended baselines closer to Nov 2020.

2. OVERVIEW OF REQUIREMENTS

2.1 SERVICE OVERVIEW

Sustain-H is a scheduled demand reduction service	The service requires a pre-agreed change in import (kW) over a defined period of time.
…worth up to £5-75/household/year	The service is readily stackable with other revenues. Payments come directly from WPD's core business rather than innovation funding, signalling a pathway to commercialisation.
…procured by WPD in targeted locations	The service is procured in Constraint Management Zones (CMZs) within the Midlands, South West and Wales where there are existing constraints.
…from market intermediaries with domestic portfolios	The service is open to energy suppliers and/or asset aggregators. Eligible households are those with an EV charger, and/or heat pump and/or battery.
…starting November 2020.	We are seeking your feedback to finalise the service design. Sustain-H will commence in November and run for 9 months. We will then look to transition to business-as-usual.

2.2 DESIGN PRINCIPLES

The design principles of Sustain-H are as follows:

1. Sustain-H aims to be simple.	Rather than reflect the precise network need of WPD (which varies substantially by location & time), we aim to radically standardise and simplify requirements.
2. Sustain-H aims to be inclusive of participant type and technology	Rather than limiting the service to licensed suppliers only, we seek to include asset aggregators too. Rather than targeting a single technology, we aim to attract participation from households with flexibility and/or energy efficiency solutions. For the trial only, we are focusing on EVs/EV chargers, heat pumps and battery storage technologies.
3. Sustain-H aims to be aligned with other services	Rather than develop a new service with new terminology, we choose to align with the *Open Networks* activity led by the Energy Networks Association. Rather than work in an innovation bubble, we aspire to collaborate closely with *Flexible Power* team to ensure integration and alignment with WPD's existing commercial service suite.

2.3 ELIGIBILITY

Eligibility requirements as follows.

HOUSEHOLD	**1. Have EV chargepoint, and/or heat pump, and/or battery**	Households must minimally have an electric vehicle & charger, heat pump and/or battery. Having additional smart appliances or energy efficiency solutions may make it easier to meet requirements, but are not necessary.	*Clarification: Our slide pack signalled that assets must be installed by November 2020. We would like to clarify that assets must be installed and qualified by 1 November 2020 for the Winter Season, and installed and qualified by 1 March 2021 for the Summer Season. It is possible to only participate in the Summer Season if assets are not ready for the Winter Season.*
HOUSEHOLD	**2. Located in WPD Constraint Managed Zones**	Households must be located within a Constraint Management Zone (CMZ) – see map below. The portfolio of households can be spread across multiple CMZs during the trial.	*Clarification: We would like to emphasise that it is expected that most participants will develop a portfolio that spans multiple CMZs. It is not required to limit the portfolio to a single CMZ.*
FLEXIBILITY PROVIDER	**3. Able to influence domestic consumption**	Flexibility Providers (FSPs) must be able to influence consumption at household or asset level. Consumption can either be influenced directly (e.g. control algorithm) or indirectly (e.g. time-of-use price signal).	*Clarification: The packaging to householders is entirely at the FSP's discretion. We request transparency on which approach is used.*
FLEXIBILITY PROVIDER	**4. Able to share usage data**	FSPs must share consumption data from household meters or asset meters. There is some flexibility on data format and resolution.	
FLEXIBILITY PROVIDER	**5. Strategic positioning for future revenues**	WPD seeks participation from FSPs who are not just eager to pursue a trial but if successful have the intent of long-term service provision when the service transitions to business-as-usual.	*Clarification: It is additionally requested that FSPs offer 10kW minimum volume across their portfolio; if this threshold is a barrier, let us know.*

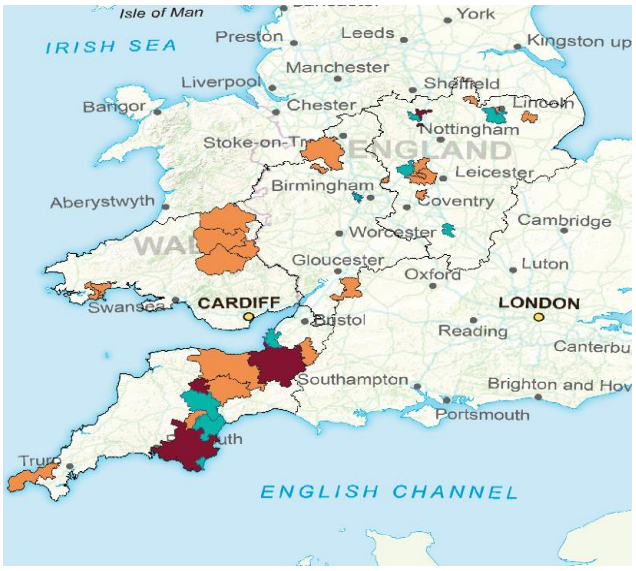


FIGURE 1: MAP OF ELIGIBLE ZONES

Eligible Constraint Management Zones are shown in the shaded regions in the map: orange for both summer & winter seasons, red for summer-only and teal for winter only. The wider Flexible Power CMZ map is available online here.

2.4 NEXT STEPS

Key milestones

Key milestones are as follows:

31 July 2020	Confirmation of intent to participate
1 November 2020	Start of Winter Season (for trial)
1 March 2021	Start of Summer Season (for trial)
31 July 2021	End of Summer Season
Q3 2021	Review results; consult participants, propose next steps / any design amendments for upcoming Winter Season.

Between August 2020 and the start of the Season, key activities will be:

- Confirmation of your eligibility to participate
- Making any final design amendments in response to your feedback
- Answering your questions and developing an FAQ document
- Contracting
- Confirmation of qualifying assets and establishing baseline for portfolio.

We have received feedback that many participants are onboarding assets continually, and that you have a general preference to confirm assets/volume as close as possible to Season start. As such, we will enable participants to finalise their portfolio ~1 month before Season start. This supersedes the guidance offered in the Introductory Slide pack.

Intent to participate

We request confirmation of your intent to participate by 31 July 2020, by submitting the form below. We will circulate a Word Document version of this form for your completion.

SUSTAIN-H INTENT TO PARTICIPATE			
ORGANISATION			*Enter the organization that will be contracting with WPD.*
CONTACT(S)			*Name* *Email address*
I intend to participate in Western Power Distribution's Sustain-H service as outlined below. I also confirm that I am willing to provide feedback and relevant data to support the service development over the course of the trial.			
WINTER SEASON			
	Minimum expected	Maximum expected	Notes
Number of households			*We understand that these numbers are indicative only. Please enter minimum and maximum expected range.* *You can elect to participate in a single season only.* *It is not possible for the same assets to provide services to WPD under Flexible Power during the same season.*
Number of EV chargepoints			*Indicative.*

Number of batteries			*Indicative.*
Number of heat pumps			*Indicative.*
Portfolio size (kW)			*Indicative only. We aim for each portfolio to be at least 10kW (total across all CMZs). If this proves to be a barrier, let us know.* *The portfolio size is the Contracted Flexible Capacity which is calculated as the Target Demand – Baseline Demand. Use the accompanying Sustain-H Value Calculator tool to inform these indicative values.*
SUMMER SEASON (if different from above)			
SUMMER SEASON (if different to Winter season)	Minimum expected	Maximum expected	Notes
Number of households			*Indicative.*
Number of EV chargepoints			*Indicative.*
Number of batteries			*Indicative.*
Number of heat pumps			*Indicative.*
Portfolio size (kW)			*Indicative.*
METERING CAPABILITY			
	Do you have access to household Smart Meter data?		[Yes / No]
	Do you have metered data from the individual asset level?		[Yes / No]
	Can you provide one or both of the metered datasets as part of the trial?		Smart meter data: [Yes / No] Asset meter data: [Yes / No]
OTHER COMMENTS			
Feedback / comments / questions			*Please let us know if you have suggested design improvements. We will collate questions into an FAQ document.*
Please send this table to Benjamin.lock@everoze.com and Freya.espir@everoze.com by 31 July 2020. If you have questions, please contact Felicity.jones@everoze.com and Nithin.rajavelu@everoze.com. We look forward to working with you!			

3. SERVICE DEFINITION

3.1 SERVICE DEFINITION

The key features of Sustain-H are summarised below.

- **Definition:** Sustain-H is a Scheduled Constraint Management[1] service that requires providers to deliver a pre-agreed change in demand over a defined period of time. We call this service Sustain-H as it is the Sustain service adapted for homes.
- **Explanation:** Sustain-H is procured months in advance by the DSO as a pre-fault service to prevent a network going beyond its firm capacity, and thereby ensuring all loads remain secure following any subsequent fault. The Sustain-H service is designed as a 'drop-to' service to simplify service characteristics in response to industry feedback. FSPs reduce their portfolio demand to a level at or below a *Target Demand*, for one or more 4-hour *Delivery Periods*.
- **Example:** A typical example of how this service is used would be a reduction in demand over an evening peak period. This is designed to mitigate risk of overload that might result should a fault occur in one of two in-feeds to a group.
- **Implications:** As a scheduled service, Sustain-H does not require any dispatching capability.. This brings the benefit of simplicity, is inclusive of energy efficiency, and means that the achievable revenue is predictable.
- **Technologies:** Sustain-H targets households with flexibility and energy efficiency solutions. The service focuses initially on homes that have installed new energy technologies that may contribute to increased peak loads on the network, potentially causing adverse effects compared to the diversified profiles used for 'Extra High Voltage' (EHV) network planning.
- **Location:** Only households connected to the relevant part of the distribution network will be eligible to participate (through FSPs). These locations are designated as 'Constraint Management Zones' or CMZs. Simplifications have been made for the trial in defining the CMZ operational groups.
- **Metering:** The data source for assessment can be either smart meters or asset-level meters. Assessment is done at an aggregated portfolio level.
- **Remuneration:** Remuneration for the service is based on the demand reduction achieved compared to an established *Baseline Demand*. The difference between the *Baseline Demand* and the *Target Demand* is the *Contracted Flexible Capacity*[2] – these three parameters are illustrated in Figure 2 below.

Simplification for trial

The *Target Demand*, *Baseline Demand* and *Contracted Flexible Capacity* for a FSP's portfolio are fixed close to commencement of the winter and summer seasons, respectively. The portfolio make-up and delivery volumes will need to be fixed (latest) October 2020 for the winter season, and February 2021 for the summer season.

[1] Open Networks, ON-WS1A Product Definitions, https://www.energynetworks.org/assets/files/ON-WS1A-Product%20Definitions%20Updated-PUBLISHED.pdf

[2] *Contracted Flexible Capacity* is an Open Networks definition which has been adapted for the Sustain-H service.

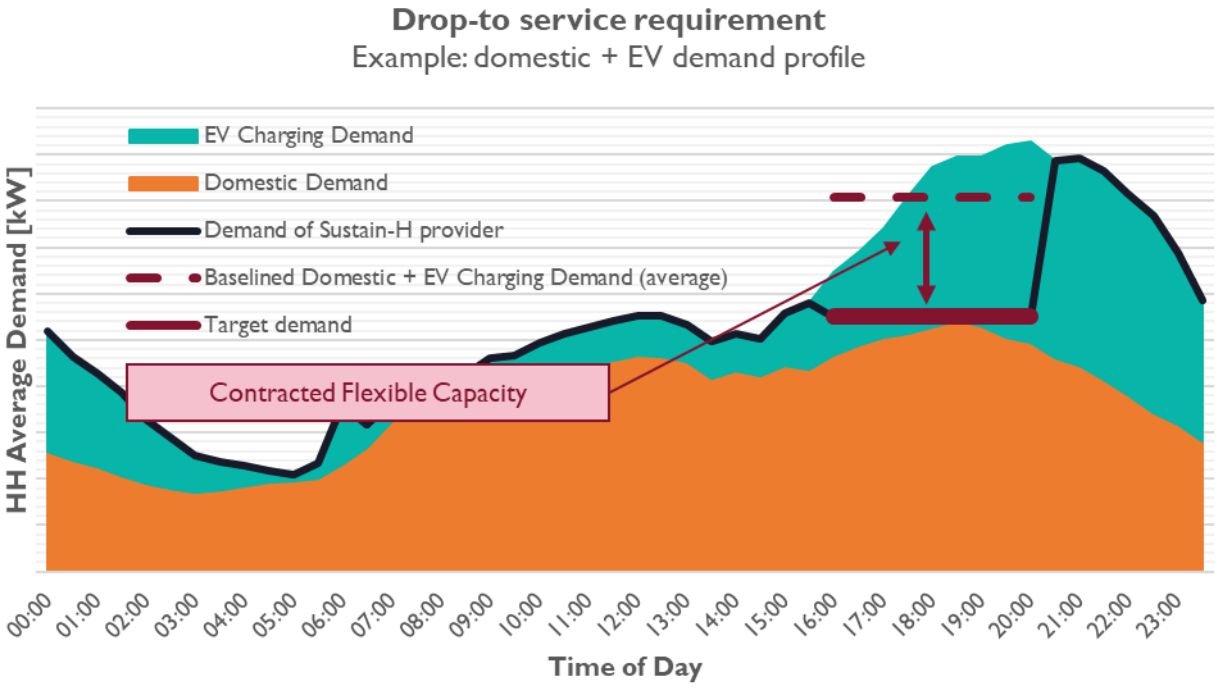


FIGURE 2 EXAMPLE DOMESTIC AND EV CHARGING DEMAND PROFILE SHOWING THE TARGET DEMAND, BASELINED DEMAND AND THE CONTRACTED FLEXIBLE CAPACITY

3.2 TARGET DEMAND ('DROP-TO' DEMAND LEVEL)

The *Target Demand* is the grid import level below which FSPs will be required to reduce their portfolio demand, during the defined service delivery periods. The FSP defines the *Target Demand* that is suitable for their portfolio. The FSP contracts for *'X' kW of Target Demand from 'Y' households*.

Demand is measured and assessed on an aggregate portfolio basis. The FSP can set a different *Target Demand* for the morning and evening *Delivery Periods* for each of the summer and winter seasons, respectively. The *Target Demand* is fixed for the entire season.

The FSP can build delivery risk into the *Target Demand* defined for their portfolio. For example, an FSP can choose to set the *Target Demand* at a higher (less onerous) level than the full portfolio capability, to allow for unpredicted non-delivery from a proportion of households.

3.3 BASELINE DEMAND

Baselining for Sustain-H utilises the diversified demand profiles used by WPD for Extra High Voltage (EHV) network modelling and planning. The baselining methodology proposed for the Sustain-H service thus considers what *could* have been done, rather than what *would* have been done.

The *Baseline Demand* is established prior to service commencement and remains the same over the full season. No active and ongoing baselining is required.

Baselining is based on:

i) Number of households in the portfolio, and
ii) Technology make-up of the portfolio.

WPD's diversified demand profiles are used to create an aggregate demand for a given portfolio. The average demand over the target *Delivery Period* is calculated as the *Baseline Demand*.

Metering approach

The selected metering approach has an implication for baselining:

- If using smart meters, the baseline includes the diversified domestic demand.
- If using asset meters, the diversified domestic demand is not included.

Review process

- For the trial: WPD are in the final stages of revising the diversified demand profiles for EV charging demand, anticipated to be available before October. The new EV charging demand profiles, when available, will be used in the baselining calculations.
- Beyond the trial: The diversified demand profiles are periodically reviewed by WPD as more data on usage patterns of these demand technologies are available to improve WPD's understanding of the impact of these technologies on its network. In future (beyond the trial) the underlying demand profiles used for baselining for the Sustain-H service will also be reviewed and updated.

We are aware that baselining is a keen area of interest for the industry. Further details are provided in Appendix 1 & 2.

3.3.1 Baselining example

Number of homes in portfolio	100 homes
Asset make-up of portfolio	60 homes with EV home chargers and 70 homes with heat pumps (with electric back-up). *Each home is equipped with at least one of these demand technologies, with some homes equipped with both EV chargers and heat pumps*
Metering option	Smart meter data
***Delivery Period* targeted**	Winter evenings 4-8pm
***Target Demand* defined**	450 kW

TABLE 1 ASSUMPTIONS USED IN EXAMPLE BASELINE DEMAND CALCULATION

The FSP defines the *Target Demand* for its portfolio. They define this based on the demand reduction capability of their portfolio over the evening period, factoring in some risk allowance for some homes not delivering as required. We will assume they set this at 450 kW. This *Target Demand* is the 'drop to' demand for the portfolio.

The *Baseline Demand* is calculated using the diversified demand profiles as set out in Appendix 2.

Baseline Demand = 100 x domestic demand + 60 x EV charger demand + 70 x heat pump demand

Using the values from the corresponding diversified demand profiles, averaged for the Sustain-H service period (4-8pm in this example):

Baseline Demand = 100 x 1.0 kW + 60 x 0.6 kW + 70 x 5.6 kW

Baseline Demand = 530 kW

The *Baselined Demand* for the FSP's domestic portfolio is calculated as 530 kW.

From this we can derive the *Contracted Flexible Capacity*:

Contracted Flexible Capacity = *Baseline Demand* – *Target Demand*

Contracted Flexible Capacity = 530 kW – 450 kW

Contracted Flexible Capacity = 80 kW

3.4 DELIVERY PERIOD

Context

The flexibility volume currently procured under Flexible Power[3] varies across CMZs by i) the time of day that the volume is required: mornings, afternoons & evenings; ii) the duration over which the volume is needed (evenings-only or morning and evening); and iii) the month and the season.

This has been substantially simplified for Sustain-H to reduce barriers to entry. Service requirements for Sustain-H have been defined to be consistent across CMZs and across the four WPD licence areas. This allows FSPs to easily aggregate larger portfolios spanning multiple CMZs as opposed to managing smaller portfolios for different CMZ sub-groups.

Description

The *Delivery Period* is the period of time that the FSP is required to provide the service. The four *Delivery Periods* used for the Sustain-H service are as follows:

FLEXIBILITY PROVIDER OPTIONS WEEKDAYS ONLY	**DAYTIME** 8AM-NOON	**EVENING** 4-8PM
WINTER NOV-FEB*	DELIVERY PERIOD 1	DELIVERY PERIOD 2
SUMMER MAR-JUL	DELIVERY PERIOD 3	DELIVERY PERIOD 4

Specifically:

- The Sustain-H service is contracted for all weekdays in the month. This removes variability across CMZs, simplifying service requirements.
- The FSP can choose which *Delivery Period(s)* to contract for.
- It should be noted that not all CMZs have both a Winter and Summer need. The *Delivery Periods* available within each CMZ will depend on the local network need.
- The FSP can define a different *Target Demand* for different *Delivery Periods*, if desired.
- Unlike other Flexible Power services, where FSPs have the discretion to declare themselves available depending on their capability, the scheduled nature of the Sustain-H service requires that FSPs contract for the full duration of the *Delivery Period*. FSPs will need to ensure that the portfolio demand is reduced to a level below the *Target Demand* and maintain this for the entire duration of the *Delivery Period*.

Simplification for trial

As a simplification for the trial only, the service will be contracted for all months in the seasons contracted during the trial. However, for any future roll-out of Sustain-H, the service may only be contracted for some months in the season, depending on the local network requirements.

[3] https://www.westernpower.co.uk/network-flexibility-map-application

3.5 DESIGNATED CONSTRAINT MANAGEMENT ZONES (CMZ)

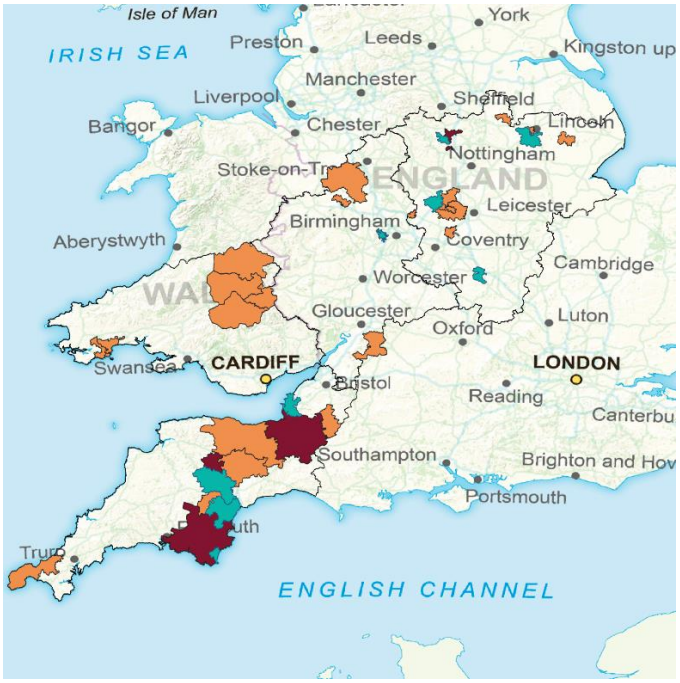
The CMZs in WPD's network have been consolidated into two groups: a Summer CMZ Group and Winter CMZ Group. This simplifies the Sustain-H service requirements by reducing the 50 CMZs in WPD's network (based on current network need) to 2 CMZ groups.

The Sustain-H service keeps delivery requirements consistent across CMZs in the group. For example, all households within the Winter CMZ Group participate through an FSP as a single large portfolio for the winter months.

Simplification for trial

This simplification increases costs to WPD due to some over-procurement in CMZs where there is only a targeted requirement for one or two months in the year. Such additional costs to WPD have been considered acceptable in the context of the trial. This will be reviewed and revisited following completion of the trial.

The grouped CMZs that are eligible for the Sustain-H Trial are shown in the shaded regions in the map in Figure 3 below:



Orange: both summer & winter seasonal requirement. Red: summer-only requirement. Teal: winter-only requirement.

FIGURE 3 MAP OF CMZ GROUPING TO BE USED FOR THE SUSTAIN-H TRIAL

The Sustain-H Trial is targeted to run for nine months from November 2020 to July 2021. For the trial itself, the winter season runs from November 2020 to February 2021, and the summer season runs from March 2021 to July 2021.

3.6 DATA AND METERING REQUIREMENTS

We aligned data requirements with existing domestic metering solutions to avoid additional hardware and metering costs. FSPs have two options, outlined in Table 2 below.

	Smart Meter Dataset	**Asset Meter Dataset**
Data source for assessment	Household smart meters	Asset-level meters
Target market intermediary	Supply-license holders and non-licensed entities who have access to smart meter data	Non-licensed entities who do not have access to smart meter data
Data required (for ongoing delivery assessment)	HH meter data (aggregated) HH meter data at individual property level to be provided upon request	Asset-level meter data (aggregated). Data resolution based on metering capability and is to be discussed with prospective FSPs if this data option is to be used. Asset meter data at individual asset level to be provided upon request
Data collection and assessment	Data supply and assessment is conducted for the portfolio as a whole. Data manipulation for assessment and remuneration calculation is performed by WPD to minimise administrative effort for FSPs.	
Data provision frequency	Monthly – as a single dataset for the full calendar month prior. Data is provided for the entire month, including weekends and days when the service is not procured. This is to be provided as a single aggregated dataset for the whole portfolio.	
Data format	The HH time-series data can be provided as either: i) column-wise timeseries data showing the HH timestamp and the corresponding metered data, or ii) matrix of 48 settlement periods (row-wise) across the days in the month (column-wise). The data can be provided in .xlsx or .csv file format.	The time-series data is to be provided as a column-wise timeseries data showing the timestamp and the corresponding metered data. The data can be provided in .xlsx or .csv file format.
Delivery assessment approach	Whole household assessment	Asset-level assessment only and so this approach does not capture the whole household demand behaviour

TABLE 2 SUMMARY OF DATA OPTIONS FOR THE SUSTAIN-H TRIAL

Data requirements are defined on a *'trust but verify'* principle where the datasets to be provided by FSPs are streamlined to reduce admin requirements, but WPD retains rights under the Sustain-H service contract to request additional information needed to verify the dataset provided.

Additionally, the following data will be required at an upfront stage during qualification:

- Full list of properties included in the aggregated portfolio: i) postcode and ii) MPAN.
- Details of the flexibility and energy efficiency equipment installed.

The Sustain-H team may additionally seek to collect data that demonstrates customers with new energy technologies can stay within the peak demand limits of conventional domestic customers. The objective of this is to manage any over-procurement by WPD to reduce its risk of service provider non-delivery and consider the level of conservatism in procurement volumes. This will also aid the exploration of the feasibility of dynamic portfolios.

3.6.1 Data derating factor

The above metering approaches bring some uncertainties to WPD:

- The metering solutions for delivery assessment may be considerably lower resolution than the current minute-by-minute metering requirements for Flexible Power services. The DSO only has visibility of the averaged demand from the portfolio, and the actual real-time demand profile during the averaged period can vary considerably. Therefore, using lower-resolution averaged demand carries uncertainties in actual real-time delivery for WPD.
- Furthermore, the Asset-level metering option does not give a household view of demand and so there is uncertainty on the overall network outcomes from the service procured.

This uncertainty in real-time service delivery means WPD may need to over-procure to meet the network need, translating to higher cost of meeting the constraint management needs of the network. To capture the effect of this uncertainty on the value of the flexibility service to the DSO, a Data derating factor is used in the payment assessment.

Simplification for trial

The Data derating factor is set to 1 for the trial, meaning that participate payments are not affected. However, this factor will be considered for any future roll-out of the Sustain-H service, supported by data analysis.

3.7 PAYMENT FORMULA

The formula to calculate the monthly payment to the FSP is shown below:

Monthly Payment = Tariff X *Contracted Flexible Capacity* X payment score X data de-rating factor

The four variables included in the proposed payment formula are as follows:

i) **Tariff (GBP per kW):** This is the fixed tariff for the Sustain-H service.
ii) **Contracted Flexible Capacity:** This is the contracted demand reduction. It is the difference between the *Baseline Demand* and the *Target Demand*.
iii) **Payment score:** This is the payment score calculated for the month. It is averaged from the daily delivery assessments.
iv) **Data de-rating factor:** This parameter reflects data uncertainties. It is set at 1 for the trial.

3.7.1 Sustain-H service tariff

The Sustain-H tariff is pre-defined, to offer a clear revenue signal to FSPs. The tariff is set at £1.8 per kW. It is informed by WPD's Flexible Power value calculator[4] tool, which shows the cost per MW for flexibility services procured.

Participants bear any cost in developing their own systems, procedures and tools to provide the service.

3.7.2 Delivery assessment

Remuneration for the Sustain-H service is utilisation only and excludes any availability component : FSPs are remunerated for *actual* demand reduction achieved relative to the *Baseline Demand*. The principal of availability is generally applied where a FSP is required to be ready should their assistance be requested. This service has a high level of certainty and the delivery periods are defined in advance, mitigating the need for the two-stage approach.

The *Contracted Flexible Capacity* represents the demand reduction expected from the FSP. Satisfactory performance is achieved when the FSP is able to reduce its portfolio demand to a level below the *Target Demand*.

If the portfolio demand is not reduced to a level below the *Target Demand*, this under-delivery will be reflected in the payment calculation.

[4] https://www.flexiblepower.co.uk/value-calculator

3.7.3 Payment calculation approach

Monthly payment calculations

Payment calculations are performed monthly, in line with current Flexible Power practice. No data pre-processing is required of FSPs. Data manipulation for the purposes of delivery assessment and remuneration calculation is performed by WPD / SGC with a view to minimise admin efforts on part of the FSPs.

Delivery assessment: frequency

Delivery assessment is done on a day-by-day basis for all the contracted delivery days in a given month.

Delivery assessment: approach

For each delivery day, service delivery is assessed on the highest HH metered demand over the contracted *Delivery Period* for that day. For the asset-level metering option where data resolution is higher than 30-minutes, the average of the metered data over the 30-minute settlement period is used.

The maximum HH metered demand over the *Delivery Period* for that day is used to calculate a payment score. Therefore, if the portfolio exceeds *Target Demand* even for one HH settlement period during the *Delivery Period* in that day, remuneration is based on the single exceeding HH settlement period. This is illustrated in an example below:

- The *Target Demand* for a hypothetical portfolio is 50 kW and the *Delivery Period* for this hypothetical case is assumed to be the evening period between 4-8pm (4 hours).
- Let's say for 7 out of the 8 HH settlement periods the portfolio demand is below the *Target Demand*.
- But even if 1 out of the 8 HH settlement periods the portfolio demand exceeds the *Target demand*, say at 55 kW, this highest HH-metered demand is used for assessment of service delivery.

Delivery assessment: scoring

For each delivery day, the maximum HH metered demand over the *Delivery Period* for that day is used to calculate a payment score.

- If the maximum portfolio demand is below the *Target Demand* for a particular delivery day, then the payment score for that day will be 1.
- If the maximum portfolio demand is greater than the *Target Demand* (ie., not fully meeting the delivery requirement) for a particular day, then the payment score for that day will be between 0-1.

The payment score calculated for each day in the month is averaged over the whole month (only for the delivery days) to calculate the payment score for the month. This value is used in the payment formula.

Over-delivery

No payment for over-delivery by FSPs is offered. This is to avoid additional costs to WPD for such over-delivery where this may have minimal network benefits as the required flexibility volume is procured by WPD in advance.

3.7.4 Calculating the payment score used in payment assessment

When the maximum HH metered demand is higher than the *Target Demand*, there are two steps in calculating the payment score, outlined further below:

1. Calculate ratio of actual delivery against contracted delivery – the *Performance Factor*.
2. Translate this ratio to a payment score.

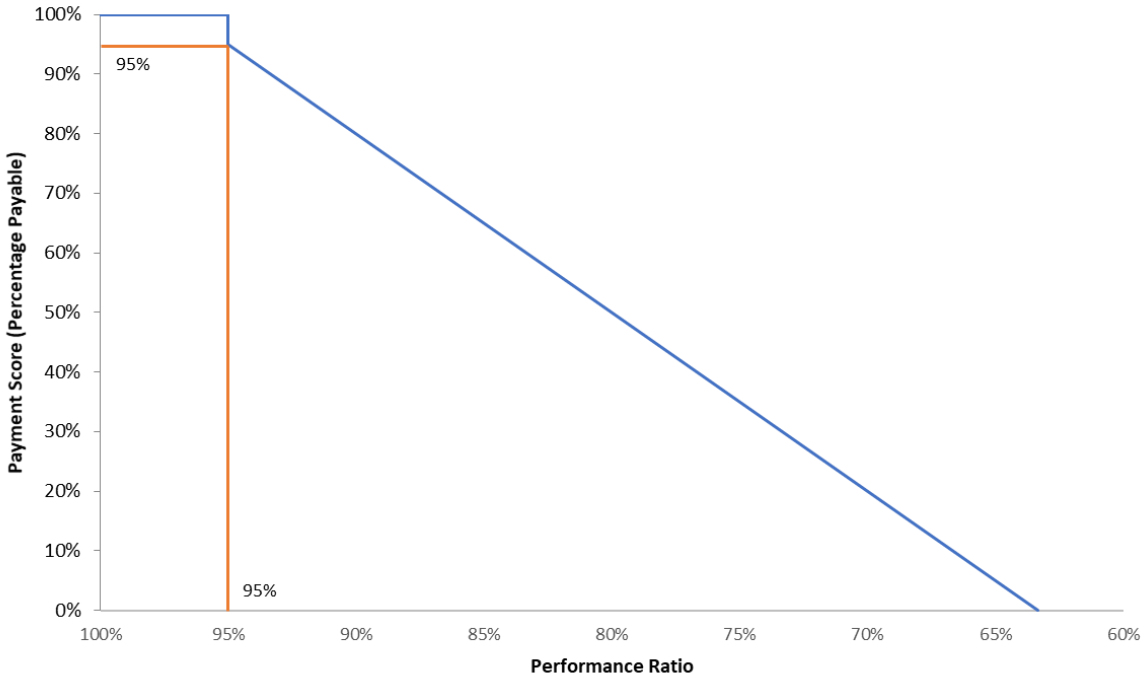
Step 1: Calculate ratio of actual delivery against contracted delivery

$$Performance\ Ratio = \frac{Baseline\ Demand\ -\ Maximum\ HH\ metered\ demand\ in\ the\ day}{Contracted\ Flexibile\ Volume}$$

This value represents the ratio of measured demand reduction against the contracted demand reduction.

Step 2: Translate the *Performance Factor* to a payment score

The Performance Ratio is used to calculate the payment score (percentage payable), shown in the figure below.



Source: Flexible Power, Payment Mechanism; https://www.flexiblepower.co.uk/downloads/52

FIGURE 4 SCORING FOR THE SUSTAIN-H SERVICE

As illustrated in Figure 4 above:

- For a Performance Ratio at 95% and above, the payment score is 1. In other words, a performance grace factor of 5% is used.
- For a Performance Ratio below 95%, the payment score is calculated based on a 3% gradient per 1% performance drop starting from a 0.95 payment score at just below 95% Performance Ratio.

3.8 PROCUREMENT AND CONTRACTING

Flexible Power utilises a three-stage procurement process[5] for the existing active power services currently procured in its CMZs. For Sustain-H, we are still developing the procurement and qualification processes; this will be shared with participants in due course.

The key data requirements for qualification for the service and the trial are outlined below.

3.8.1 Enrolment of households in a domestic portfolio

The FSP provides the following information for each household in its portfolio:

1. **Unique identifier for household:** The FSP supplies the MPANs for each home. The MPANs are used as a unique identifier to ensure that a household is not double counted in different portfolios. Each household is included as part of only one portfolio from one FSP during a contract period. If the FSP is not able to provide MPAN data, we are open to agreement on other datasets that can be used as a robust unique identifier for validating households.

[5] Flexible Power, Procurement process v1, https://www.flexiblepower.co.uk/downloads/136

2. **Location of household:** The FSP provides the postcode for each home. The postcode is used to check whether all homes are within the CMZ groups used for the trial. We seek feedback from FSPs on whether there are any restrictions in being able to share this data.
3. **Details of low-carbon assets**: The FSP is provides details of the portfolio's technology make-up. This is to include the number and type of low-carbon assets installed at each household. .

This data is to be provided in an MS Excel spreadsheet or CSV file, with the corresponding postcode for the MPAN of the household included. A summary record of the details of the low-carbon asset at each household are also to be included as separate columns in the spreadsheet.

3.8.2 Dynamic Portfolios

FSPs fix their portfolio for the entire season but we intend to allow the option for FSPs to update their portfolio once per month if necessary. If so, any such changes will take effect from the start of the following month. To allow this transition, the FSP will need to provide the relevant information a certain number of days in advance (to be defined in the contract) such that this allows sufficient time for review and follow-up required.

In addition, Sustain-H allows FSPs some limited ability to add/replace households from their portfolio during the season. This flexibility is proposed to be afforded to FSPs considering:

i) Customers may change their supplier at any time, and the flexibility contract cannot present a barrier for the customer's right to change supplier.
ii) Where one/more customers change suppliers mid-way through the contract and is therefore no longer part of the FSP's aggregated portfolio for the Sustain-H service contract, they would seek to onboard new households to maintain the portfolio to meet its contracted delivery requirements for the Sustain-H service.

The FSP's ability to change its household and technology make-up is subject to the following:

1. Any new household(s) proposed to be onboarded to a FSP's existing portfolio is subject to the same qualification assessment (including confirming the household has a 'qualifying asset') as that of households at time of procurement/contracting – as outlined in Section 3.8.1 above.
2. Upon adjustment of the portfolio, the *Baseline Demand* for the portfolio will be re-calculated considering the new technology make-up and will be used in future payment assessments.
3. The new *Target Demand* for the portfolio will be calculated based on the new *Baseline Demand* and the *Contracted Flexible Capacity* for the domestic portfolio. This is calculated as the new *Baseline Demand* minus *Contracted Flexible Capacity*.
4. The *Contracted Flexible Capacity* does not change when the portfolio make-up is changed. Therefore, i) the net change in demand expected from the domestic portfolio over the term of the contract, and ii) the maximum remuneration to the FSP under its contract both remain the same and are not impacted by any changes to the portfolio including adding/removing/replacing households as well as changing the technology make-up.

Simplification for trial

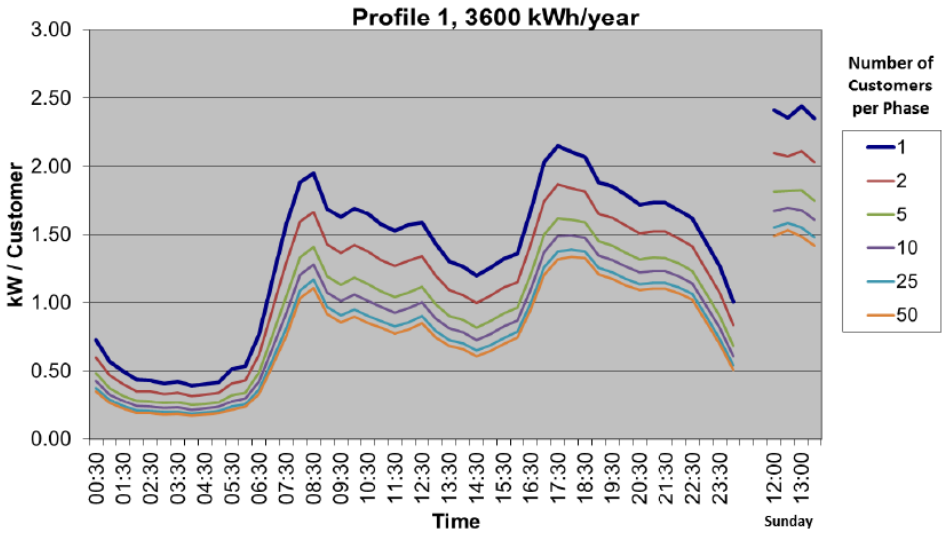
For the purposes of the Sustain-H Trial, it is proposed that there is limited dynamic updating of the portfolio during the season. This is a pragmatic simplification for now but may be revisited in any future roll-out of the service.

4. APPENDIX 1: BACKGROUND TO BASELINING APPROACH USED

4.1 DIVERSITY MODEL PROFILES

4.1.1 What is the Diversity Model?

WPD calculates the maximum demand on a substation during studies for network planning and new low voltage domestic connections based on several standardised customer demand profiles, including load profiles for low carbon technologies like EV chargepoints and heat pumps. During these calculations a '*diversity factor*' is applied on the demand profiles – this is on the basis that where consumers of similar types with similar home technologies (eg, EV chargepoints and heat pumps) are grouped together, their collective consumption pattern is less than the proportional scaling of the demand profile by the number of consumers. This is illustrated in Figure 5 below. The diversity is attributable to differences in consumer behaviour in the population, ie., on the basis that not all consumers will be turning their heat pumps on and off at the exact same time. This modelling approach and the standardised profiles are collectively referred to as the 'Diversity Model'.



Source: WPD, Standard Technique: SDK5K/8 Use of WinDebut Software

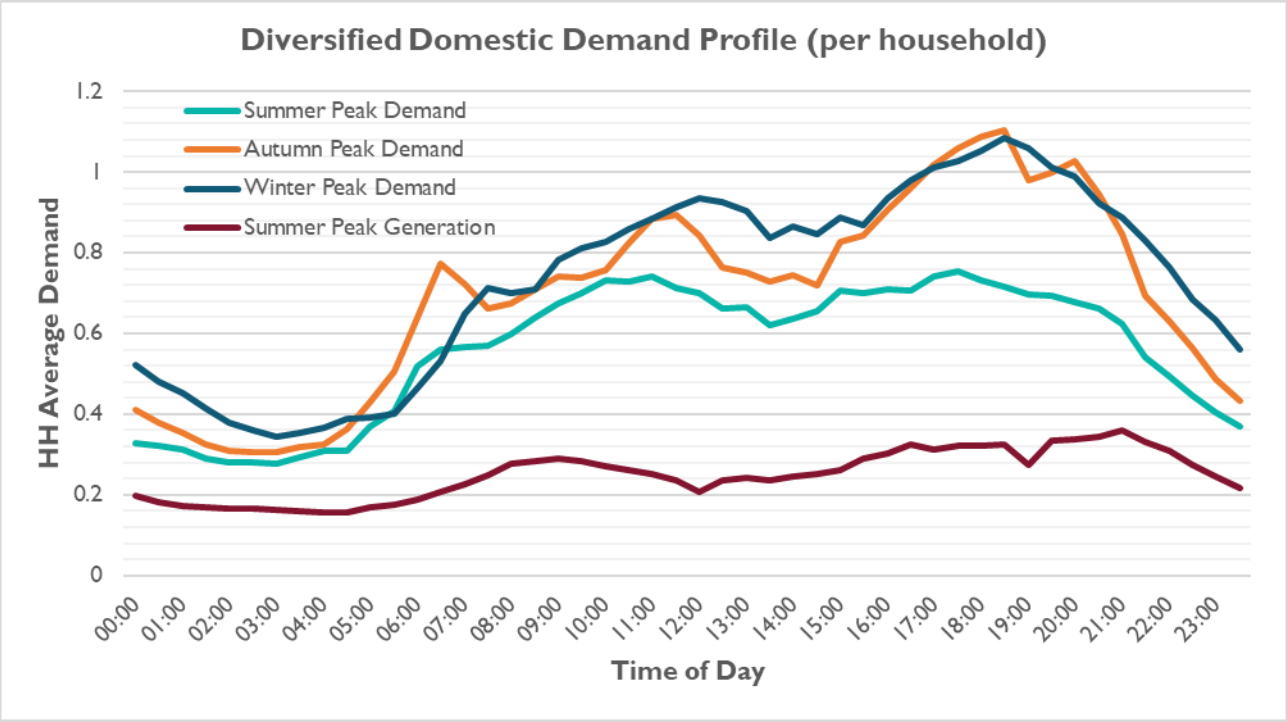
FIGURE 5 LOW VOLTAGE DIVERSITY MODEL PROFILE FOR A SINGLE RATE DOMESTIC CONSUMER

The aforementioned diversified maximum demand is used for wider distribution network planning and identifying any reinforcement needs. New home technologies from electrification of heating and transport have the effect of increasing demand during peak hours of network usage. The growing demand from these new domestic loads presents the risk of overly stressing the existing distribution infrastructure. The new technologies with most material impact on the network are: EVs/home chargers, battery storage (with or without co-located solar PV), and heat pumps.

4.1.2 Highly diversified demand profiles for EHV network planning

As constraints in the low voltage distribution network are rare, WPD has suggested using the highly diversified profiles used for the 'Extra High Voltage' (EHV) distribution network planning as the basis to assess network benefits and for consideration as part of the baselining options for baselining for Sustain-H.

A domestic consumer without any low carbon technologies like EV chargers and heat pumps is described in network planning by the diversified demand profile shown in Figure 6 below. The diversified EV charging and heat pump demand profiles that are considered in network planning are shown separately in Section 4.1.3 below.



Source data from Figure 23 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 6 DIVERSIFIED DOMESTIC DEMAND PROFILE FOR A SINGLE HOUSEHOLD USED IN EHV NETWORK PLANNING

Traditional distribution network planning is based on 'edge-case' modelling where only the network condition which is deemed to be the most onerous is considered – typically, the winter peak demand. In recent distribution network impact assessments as part of the *Strategic Investment Options: Shaping Subtransmission* studies undertaken by WPD, network behaviour was analysed for four different cases: i) winter peak demand, ii) summer peak demand, iii) intermediate warm peak demand, and iv) summer peak generation (as shown in the figure above). For each of these cases, the demand and generation profiles over a representative day were considered in WPD's analysis. Given the focus of Sustain-H on domestic flexibility and the Sustain-H service being a demand turn-down service, only the three demand profiles are relevant in this context and so the *'summer peak generation'* case is not considered further here.

The diversified demand profiles change over the year as shown in Figure 6 above, and the months for when these profiles apply are set out in Table 3.

Profile reference	**Applicable months**
Winter Peak Demand	November[6] – February
Intermediate Warm Peak Demand	May, September & October
Summer Peak Demand	June – August

TABLE 3 MONTHS IN THE YEAR FOR THE DIVERSIFIED DEMAND PROFILES

WPD has advised that the peak demand profiles are not calculated for the 'Intermediate Cool' network case which applies for the months of March, April and November. The 'Winter' peak demand profile is applied for November as

[6] The month of November falls within the 'Intermediate Cool' period per the new defined periods for overhead line ratings per P27/1, where per this definition 'Winter' period is from December-February. As asset behaviour during November is expected to generally follow winter seasonal behaviour (for example, November is considered part of the winter season for TNUoS charging), in the interest of simplicity, the 'Winter Peak Demand' profile is also considered for November.

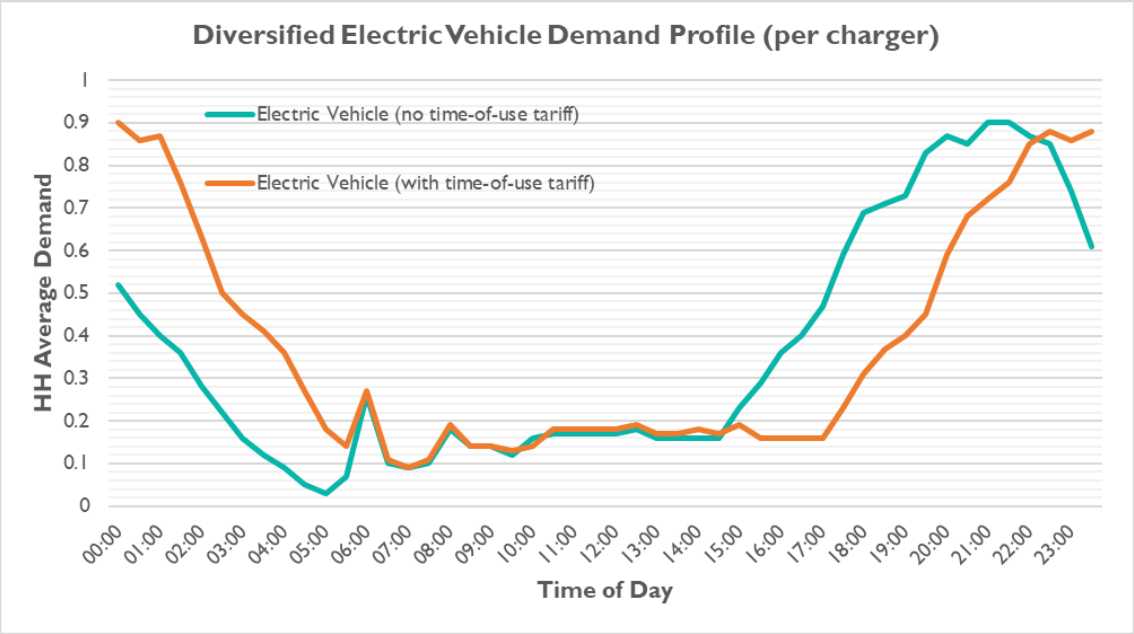
described in the footnote below. For March and April, the 'Intermediate Warm' peak demand profiles are used where required.

4.1.3 Diversified demand profiles for Electric Vehicles, Heat Pumps and Battery Storage

Distribution network impact assessments as part of the *Strategic Investment Options: Shaping Subtransmission* studies undertaken by WPD also considered diversified demand profiles for EV charging, heat pumps and battery storage, which are used in EHV network planning. Similar to that noted in Section 4.1.2 above, profiles for the *'summer peak generation case'* have not been considered here.

Electric Vehicle & Charger

For EV charging, two different demand profiles are used in network planning – with and without time-of-use-tariff. The demand profile otherwise remains the same across the year. This is shown in Figure 7 below.



Source data from Figures 21 & 22 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 7 DIVERSIFIED EV CHARGING DEMAND PROFILE FOR A SINGLE CHARGER USED IN EHV NETWORK PLANNING

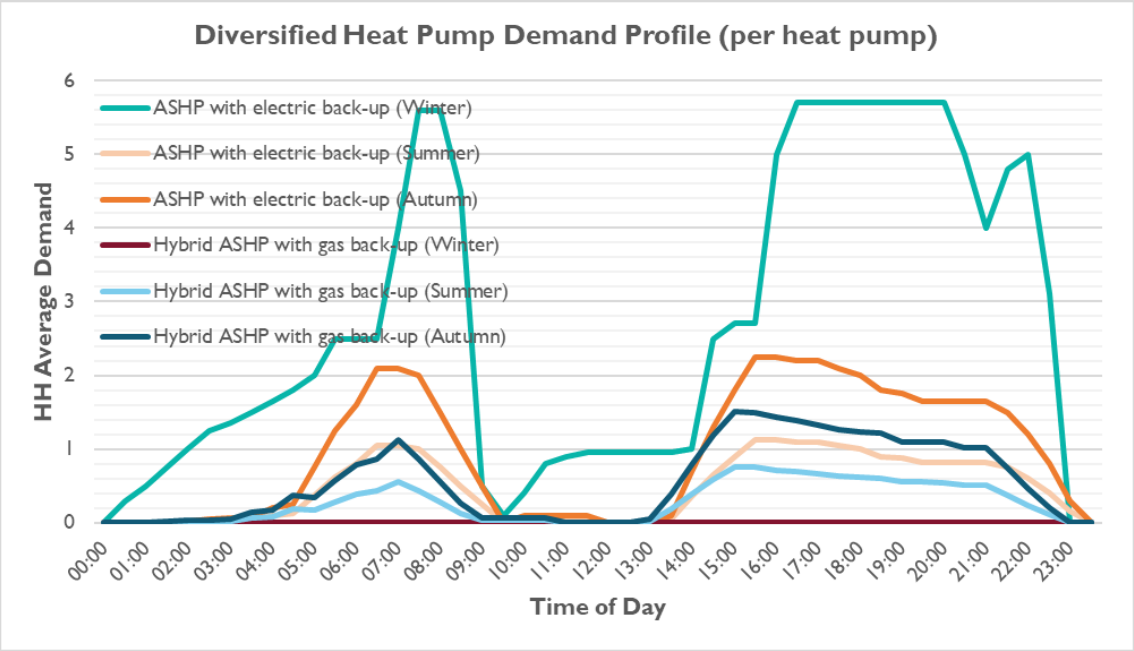
Heat pumps

For heat pumps, two different demand profiles are used in network planning depending on the type of heat-pump application:

i) Air-source heat pump with resistive electrical heater as back-up: Heat pumps installed on off-gas homes where an electric back-up is used at times where the heat pump is not sufficient, such as during cold winter days when the ambient temperature is sub-zero, the co-efficient of performance of the ASHP is poor and back-up heating is required. Different demand profiles for summer, autumn and winter months are used.

ii) Hybrid air-source heat pump with gas-back-up: Dual-fuel hybrid heating systems where the heat pump operates when the electricity price is low, with the gas back-up being used when the heat pump is not sufficient (as described above) or the electricity price is high. Different demand profiles for summer and autumn months are used, with zero demand during winter (full gas operation is assumed by WPD for winter months).

These profiles are shown in Figure 8 below. The winter season demand profile for an ASHP with an electrical resistive heater as back-up shows a peak demand of approximately 5.7 kW. Although this is high for a typical domestic ASHP, WPD consider the cumulative impact of the ASHP electrical demand as well as the electrical demand of the resistive heater for network planning for the winter season specifically. This cumulative demand profile is shown here.



Source data from Figures 19 & 20 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 8 DIVERSIFIED HEAT PUMP DEMAND PROFILE FOR A SINGLE UNIT USED IN EHV NETWORK PLANNING

Battery Storage

For battery storage, WPD assumes the demand to be 100% of rated power across all times of the day, irrespective of the use case of the battery. This is a conservative assumption in network planning as during periods of network peak demand, it is more likely for the storage asset to be operating in a discharge/generation mode rather than a charge/demand mode during the evening peak demand periods.

Using this demand profile for baselining would result in scenarios where the FSP would be eligible for payment under circumstances when the battery is at zero active power during the *Delivery Periods* (particularly where Asset Level Metering data option is used by the FSP. That is, the baseline would show a demand of 100% of nameplate power, and the delta for a *Target Demand* of 0 kW would mean the participant is paid for this delta demand reduction against the baseline even when the battery assets are not in a net discharge mode (ie., actively helping to reduce peak time demand).

As such, this is a potential loophole in the Sustain-H service design for battery storage driven by the nature of how the demand profiles for battery storage is defined for network planning purposes. Therefore rather than linking the baseline for battery storage to the network planning demand profiles directly, a slightly different approach is taken to avoid unintended consequences and undesired incentives by paying out for when the FSP is not actively helping the network – i.e. FSP not being eligible for payments unless the battery storage assets are in net discharge mode.

Therefore, it is proposed to set the baseline demand for battery storage at 0 kW. This means, FSPs will only be eligible for payment if the portfolio of battery storage assets are in net discharge mode during the *Delivery Periods*. This links the volume of demand reduction used in payment calculations (ie., the kW) to what is actively contributing to reducing peak time demand on the network. This also means the simplicity in design is maintained with all battery storage assets irrespective of nameplate power or energy capacity are treated the same for baselining.

4.2 HIGHLY DIVERSIFIED DEMAND PROFILE AS THE SELECTED BASELINE

Similar to the current baselining approach used under Flexible Power, fixing the baseline profile makes the flexibility service in effect a 'drop to' service and therefore preserves the principles of the baselining methodology as easy to use and providing certainty of delivery requirements.

The proposed approach, as described in further detail below, goes further by fixing the baseline at the start of the contract period and therefore is inherent to the service requirement, and does not change over the delivery period, as opposed to the current approach used under Flexible Power where the baseline is defined for each service provider and fixed monthly based on the previous month's consumption pattern.

Consumer behaviour is factored into the diversified demand profiles used in network planning studies. A suitably designed incentive structure (through price signals) that can shift consumer behaviour away from that represented by the diversified demand profiles to achieve improved network outcomes, when provided with sufficient levels of reliability, adds value to the DSO. When this demand reduction provided to the DSO has the effect of reducing peak loads relative to the diversified demand profiles, this can increase the headroom and improve network security before a constraint occurs on the network.

Linking the calculation of the flexibility volume to the diversified demand profiles has the effect of improving the transparency between the flexibility service provided and the effect it has on network planning and system security, and therefore would help with quantification of the benefits to the DSO (and therefore valuation of the service) in a transparent manner.

4.2.1 Baselining and network benefit from shifting EV charging and heat pump loads

A household with an EV charger or a heat pump is understood to be represented in EHV network planning by the sum of i) the diversified domestic demand profile, and ii) the diversified EV charger/heat pump demand profile. If a FSP with a portfolio of domestic properties that have EV chargers and/or heat pumps (with each household having at least an EV charger or a heat pump) contracting for the Sustain-H service is able to reduce its demand across its portfolio to a level below the T*arget* D*emand* (per Section 3.1), then its demand pattern would be improved (ie., less than) when compared to the diversified demand profiles with the EV charging and heat pump loads.

Therefore by shifting loads (EV charging and heat pump loads) away from the peak demand periods to the night time (for example), where the net portfolio demand during the peak demand period is better than the diversified profile demand patterns, the FSP is able to add value to the DSO. This is illustrated in Figure 9 below for a portfolio of 50 properties each with EV chargers for the winter months (November to February) with annotations.

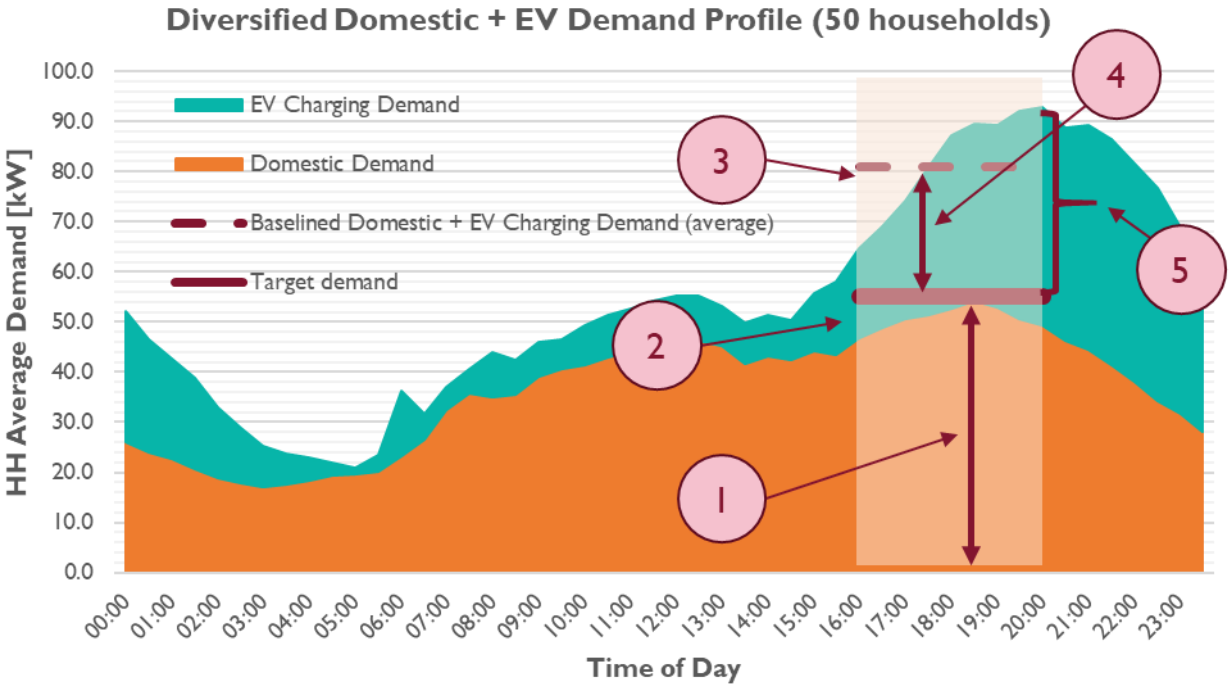


FIGURE 9 ILLUSTRATION OF POTENTIAL NETWORK BENEFIT FROM SHIFTING DEMAND

Annotation notes for Figure 9 above:

1. The diversified domestic demand considered in EHV network planning (households without EV charging, heat pumps, etc); a portfolio of 50 households.
2. The *Target Demand* (as discussed in Section 3.1) for the 50 household portfolio. In this example, this is set at 50 kW – FSP reduces its portfolio demand to below this level.
3. The B*aseline Demand* for the domestic loads and EV charging demand averaged over the peak demand period (*Availability Window* is 4-7pm). In this example, this is at approx. 80 kW.
4. Portfolio demand reduced to below the *Target Demand* means an approx. 30 kW reduction in average peak demand compared to the diversified domestic + EV demand profiles.
5. At the highest peak, this is an approx. 40 kW reduction in peak demand compared to the diversified domestic + EV demand profiles.

5. APPENDIX 2: BASELINING DEMAND PROFILES

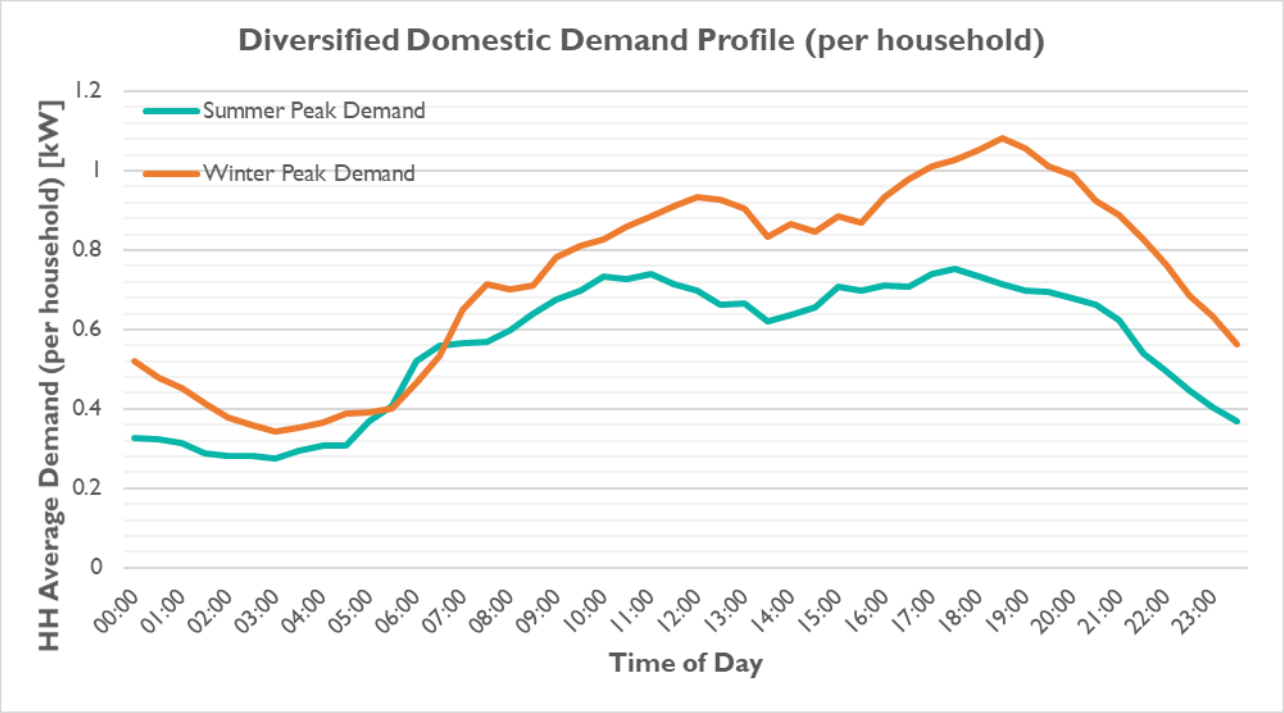
The following diversified demand profiles used for the 'Extra High Voltage' (EHV) distribution network planning are used to establish the baseline for the Sustain-H service. Table 4 shows which profiles to use for calculating the *Baseline Demand* depending on the month(s) considered.

Months in the year	**Profile reference**
September – February	Winter Peak Demand
March – August	Summer Peak Demand

TABLE 4: APPLICABLE MONTHS FOR THE TWO SUSTAIN-H SEASONS

These diversified demand profiles are used to create an aggregate demand for a given portfolio. The average demand over the *Delivery Period* is calculated as the *Baseline Demand*.

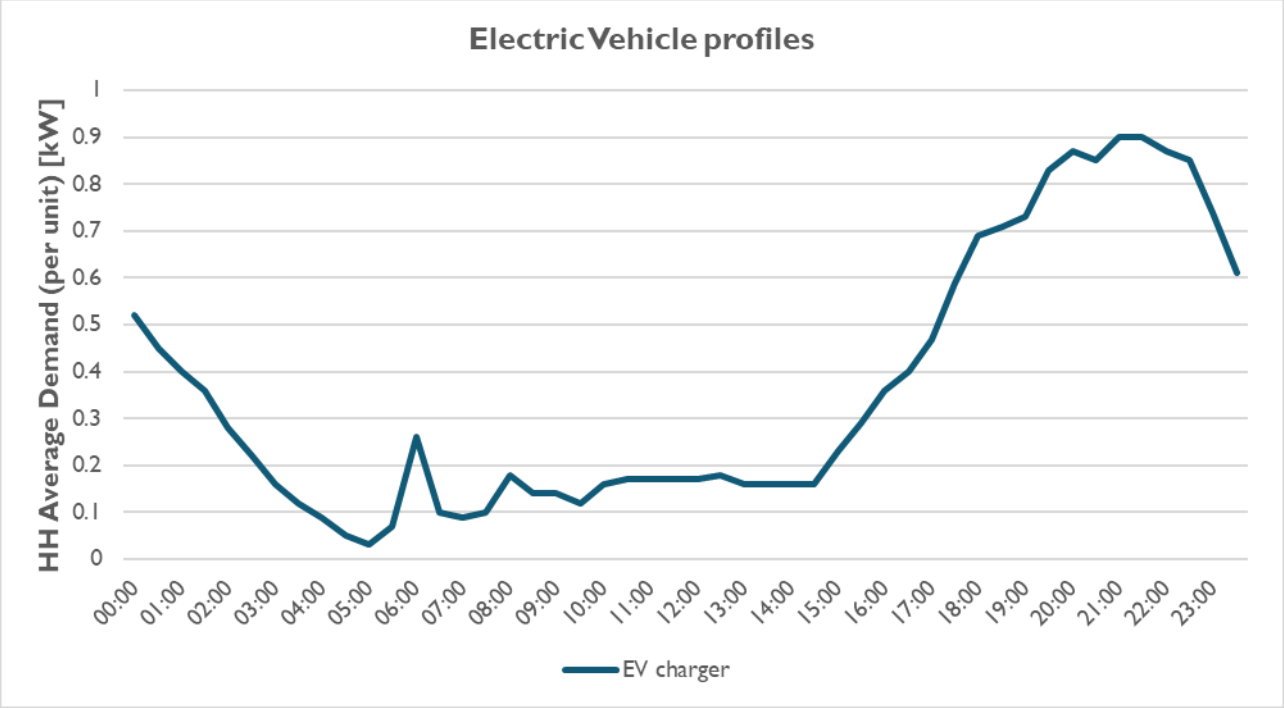
Domestic property



Source data from Figure 23 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 10 DIVERSIFIED DOMESTIC DEMAND PROFILE FOR A SINGLE HOUSEHOLD USED IN EHV NETWORK PLANNING

Electric Vehicle & Charger



Source data from Figures 21 & 22 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 11 DIVERSIFIED EV CHARGING DEMAND PROFILE FOR A SINGLE CHARGER USED IN EHV NETWORK PLANNING

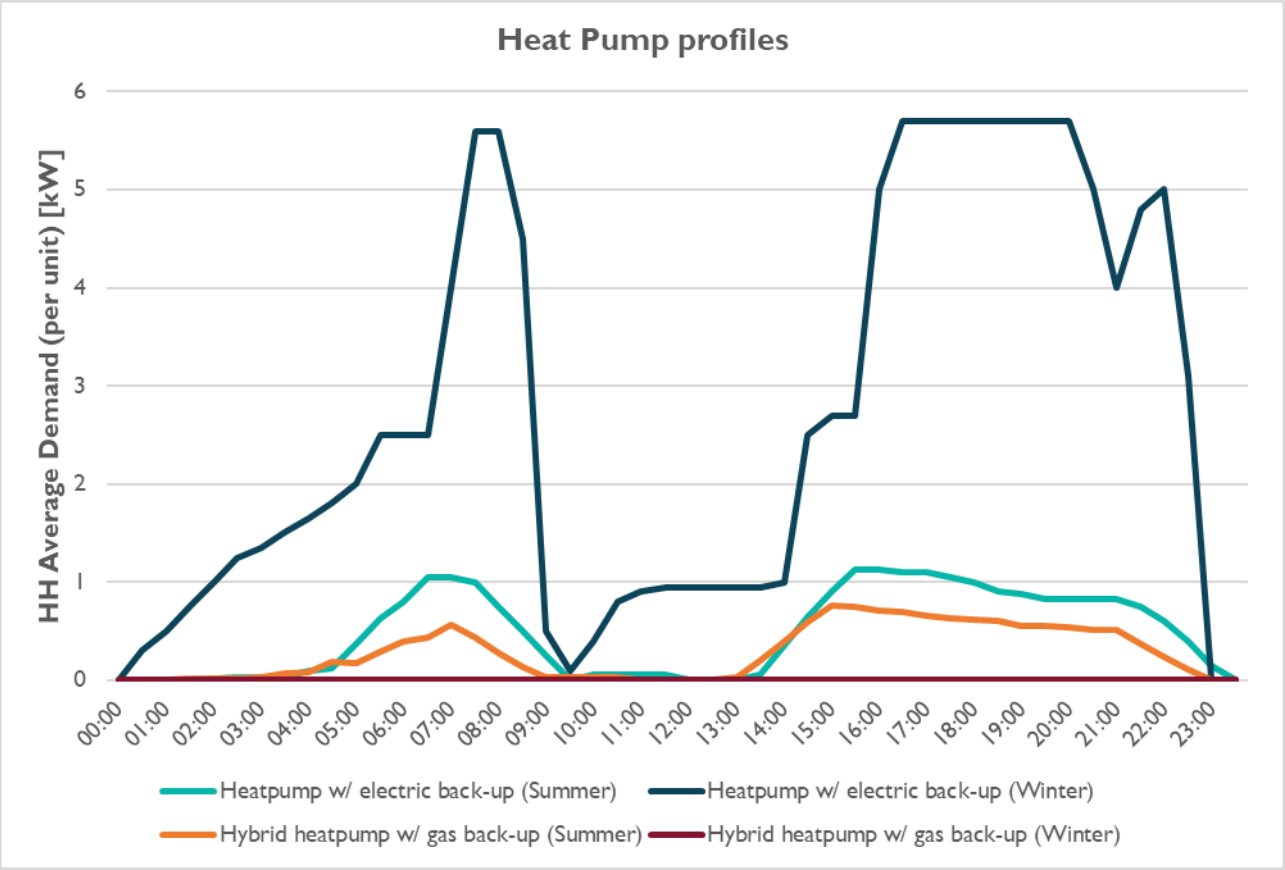
Heat pumps

For heat pumps, two different demand profiles are used in network planning depending on the type of heat-pump application:

i) Air-source heat pump with resistive electrical heater as back-up: Heat pumps installed on off-gas homes where an electric back-up is used at times where the heat pump is not sufficient, such as during cold winter days when the ambient temperature is sub-zero, the co-efficient of performance of the ASHP is poor and back-up heating is required. Different demand profiles for summer and winter months are used.

ii) Hybrid air-source heat pump with gas-back-up: Dual-fuel hybrid heating systems where the heat pump operates when the electricity price is low, with the gas back-up being used when the heat pump is not sufficient or the electricity price is high. Different demand profiles for summer months are used, with zero demand during winter (full gas operation is assumed by WPD for winter months).

These profiles are shown in Figure 8 below. The winter season demand profile for an ASHP with an electrical resistive heater as back-up shows a peak demand of approximately 5.7 kW. Although this is high for a typical domestic ASHP, WPD consider the cumulative impact of the ASHP electrical demand as well as the electrical demand of the resistive heater for network planning for the winter season specifically. This cumulative demand profile is shown here.



Source data from Figures 19 & 20 of WPD, Shaping Subtransmission – South Wales, Strategic Investment Options, dated March 2019

FIGURE 12 DIVERSIFIED HEAT PUMP DEMAND PROFILE FOR A SINGLE UNIT USED IN EHV NETWORK PLANNING

Battery Storage

For battery storage, the baseline demand is taken as 0 kW demand across all times of the day, irrespective of the use case of the battery.

6. APPENDIX 3: GLOSSARY

For consistency and clarity, we have used the terminology defined by Open Networks in '*Open Networks W1A - P3 Active Power Services Parameters*' where possible. However some changes have been made to suit the proposed service design. Capitalised terms, where not otherwise defined in this report, refer to the terms defined in the document referenced above.

ASHP	Air-Source Heat Pump
API	Application Programme Interface
Baseline Demand	The baseline calculated for the FSP's domestic portfolio per the proposed approach set out in Section 4.
CMZ	Constraint Management Zones
Contracted Flexible Capacity	The difference between the established Baseline Demand and the Target Demand for a domestic portfolio
Delivery Period	The time of the day when the Sustain-H service is contracted by the DSO
Diversity Model	The set of diversified demand profiles used by the DSO for network planning and modelling.
DPS	Dynamic Purchasing System
DSR	Demand Side Response
DSO	Distribution System Operator
EHV	Extra High Voltage
ENA	Energy Networks Association
EV	Electric Vehicle
Flexibility Provider (FSP)	A market intermediary with a portfolio of domestic properties with qualifying assets contracting with the DSO to provide the Sustain-H service
HH	Half-hourly
MPAN	Meter Point Administration Number
OEM	Original Equipment Manufacturer
PQQ	Pre-Qualification Questionnaire
SGC	Smart Grid Consultancy
Target Demand	The demand level which is the target for the FSP's domestic portfolio to reduce their demand to.
WPD	Western Power Distribution