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Optimised Retrofit

26 February 2021

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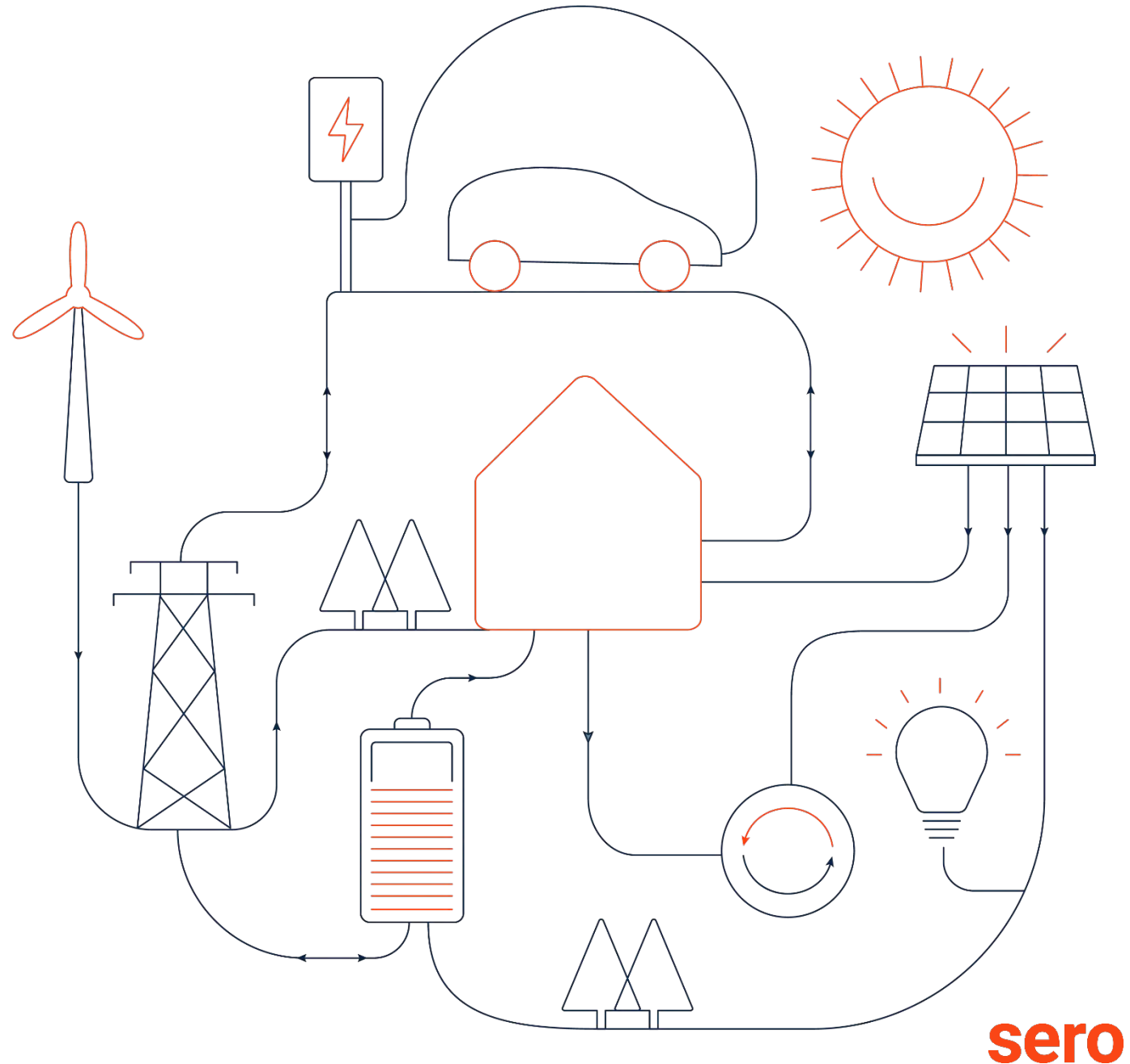
Overview of the Collaboration

Partners (Phase 1)

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Overview of the Collaboration

Project Goals

The main priorities of the project are to;

- create the processes to enable pragmatic decarbonisation across Wales

- build these to enable the development of Welsh skills & local economy benefits

- create a robust dataset of performance and operation from which to measure future steps

Plus as an additional benefit;

- Sets 1,724 homes on their Pathway to Zero as Pathfinder Homes

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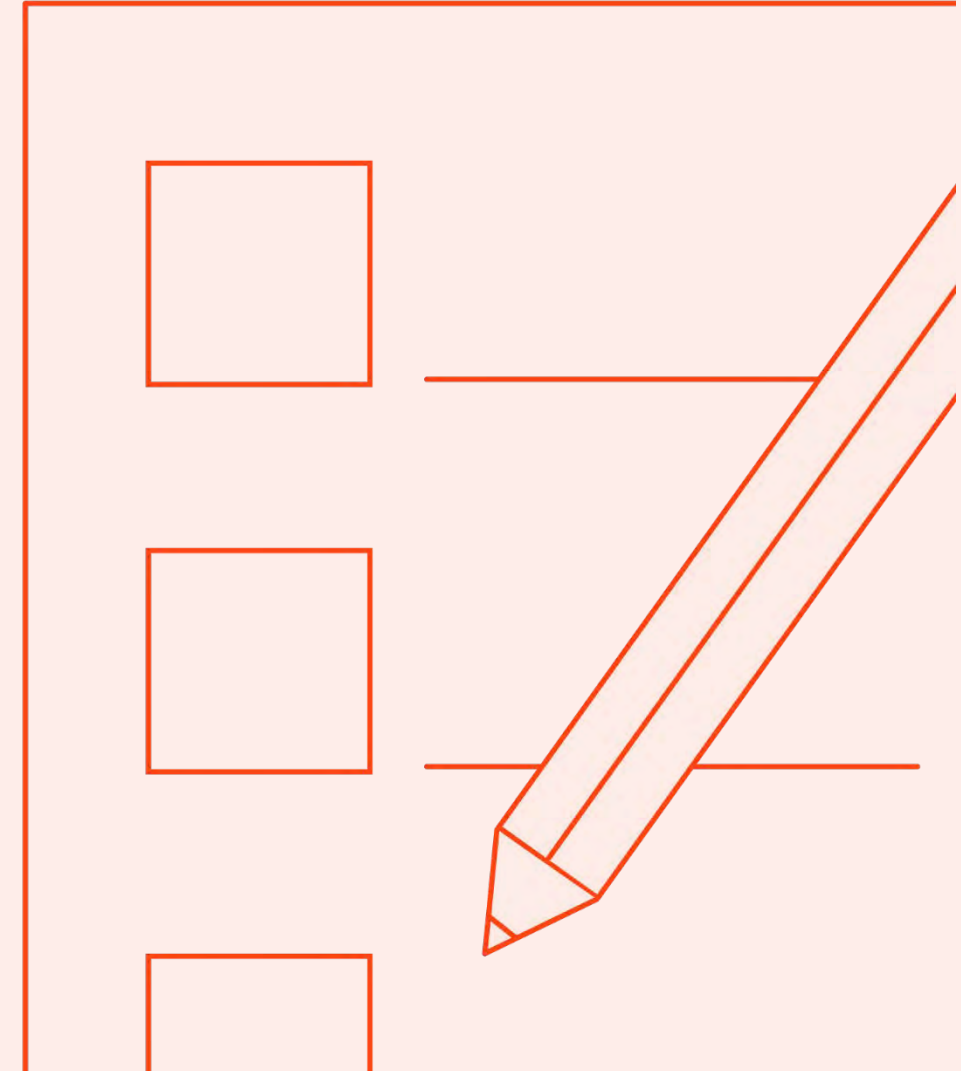
Overview of the Collaboration

Principles – Each home is unique

- There are c.29m homes in the UK, with c.1.4m in Wales
- A limited number of typologies can describe the majority of these home as general stereotypes
- This is commonly sufficient for overall financial planning or long term programme work
  - this might be akin to the NHS planning to perform heart surgery 2,000 times per year

- Each individual home, however, is a unique combination of environmental conditions, original construction quality, previous alterations and historic operation
  - This could be thought of as akin to the unique nature of each individual NHS heart operation patient
- Prior to undertaking any retrofit work, it is therefore important to have an independent survey of the unique condition of that home

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Principles – Retrofit can occur in Multiple Steps

- Most homes are not rejuvenated by comprehensively gutting them, then top-to-toe refurbishments. Instead, replacement of components or refit one room at a time

- PAS2035 and prior documents largely assume comprehensive "deep retrofit", enabling appointment of a series of retrofit specialist roles

- Whilst a sound approach where feasible, deep retrofit is disruptive and can mean removing components that are not at the end-of-life. It does this largely to ensure coordination of measures

- Optimised Retrofit aims to deliver coordination of measures even when they are not occurring at the same time, allowing the planned decarbonisation of homes as components are changed

- This doesn't remove the need for networks of quality, competent installers, nor the need for supporting expertise on measures, but is enabled by more digital processes and benefits more from automation of some technical supporting tools

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Principles – Zero Carbon is the Overall Target

- In the last decade or more, the electricity grid has quietly achieved massive decarbonisation, which continues

- For the built environment, ignoring this grid decarbonisation makes the task of achieving net zero significantly more difficult and more expensive for buildings

- Understanding this also means you can change you mindset, if you're getting the designs right, then
    - it's not about **if** you achieve net zero carbon,
    - it's about **when** you achieve net zero carbon

- This is because you can anticipate grid decarbonisation and build homes that will become net zero in future, without any future physical changes, and pick a "Zero Carbon by..." date to do this by

It matters where you aim...
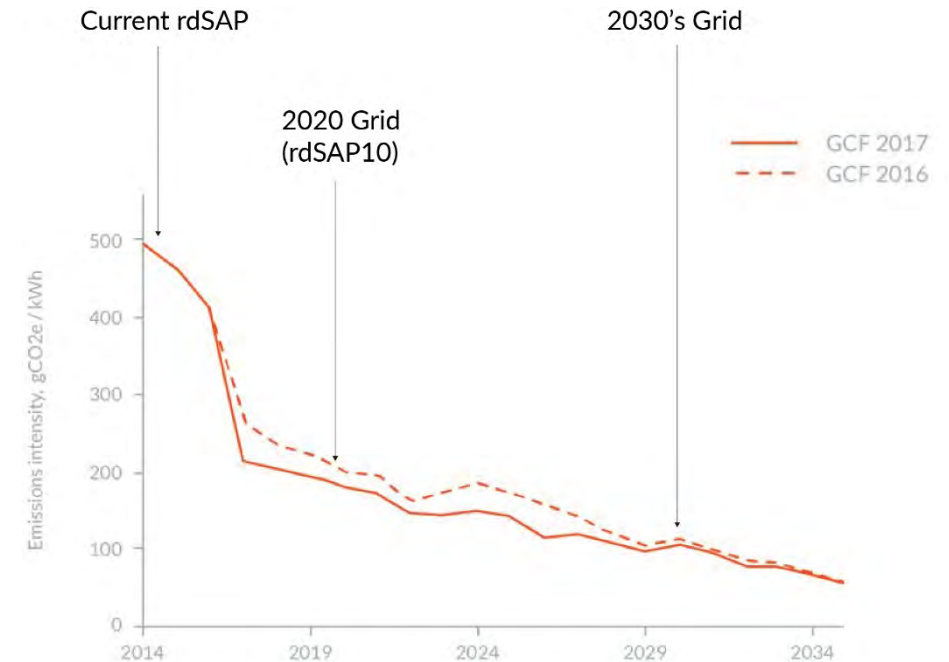
This graph shows the predicted emissions intensity of the UK Grid in grams of CO $_2$ equivalent for each kWhr of electricity supplied for the years up to 2035. The data for 2014 to 2016 comes from DEFRA, the projections from 2017 onwards were published by BEIS in January 2018.

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Overview of the Collaboration

Principles – Zero Carbon means Grid-Linked Homes

- Electrical energy has a variable carbon footprint: If you want to achieve zero carbon, you have to measure in carbon

- The carbon of 1kWh changes every ½ hour of every day – a typical day might see 50% changes, extremes can be 300% from peak carbon to minimum carbon

- If you measure in energy, 1kWh sent to the grid balances 1kWh drawn from the grid = net zero energy

- If you measure in Carbon, 1kWh sent to the grid at solar noon saves c.$<150gCO_2^{eq}$, but 1kWh drawn from the grid at 6pm costs c.$>250gCO_2^{eq}$ = **not** net zero carbon

- Whilst individual residents could manually control this all day, every day, the optimum route is to automate

$>150gCO_2^{eq}/kWh$

$<250gCO_2^{eq}/kWh$

Legend: Jan, Feb, March, Apr, May, Jun, Jul, Aug, Sept, Oct, Nov, Dec
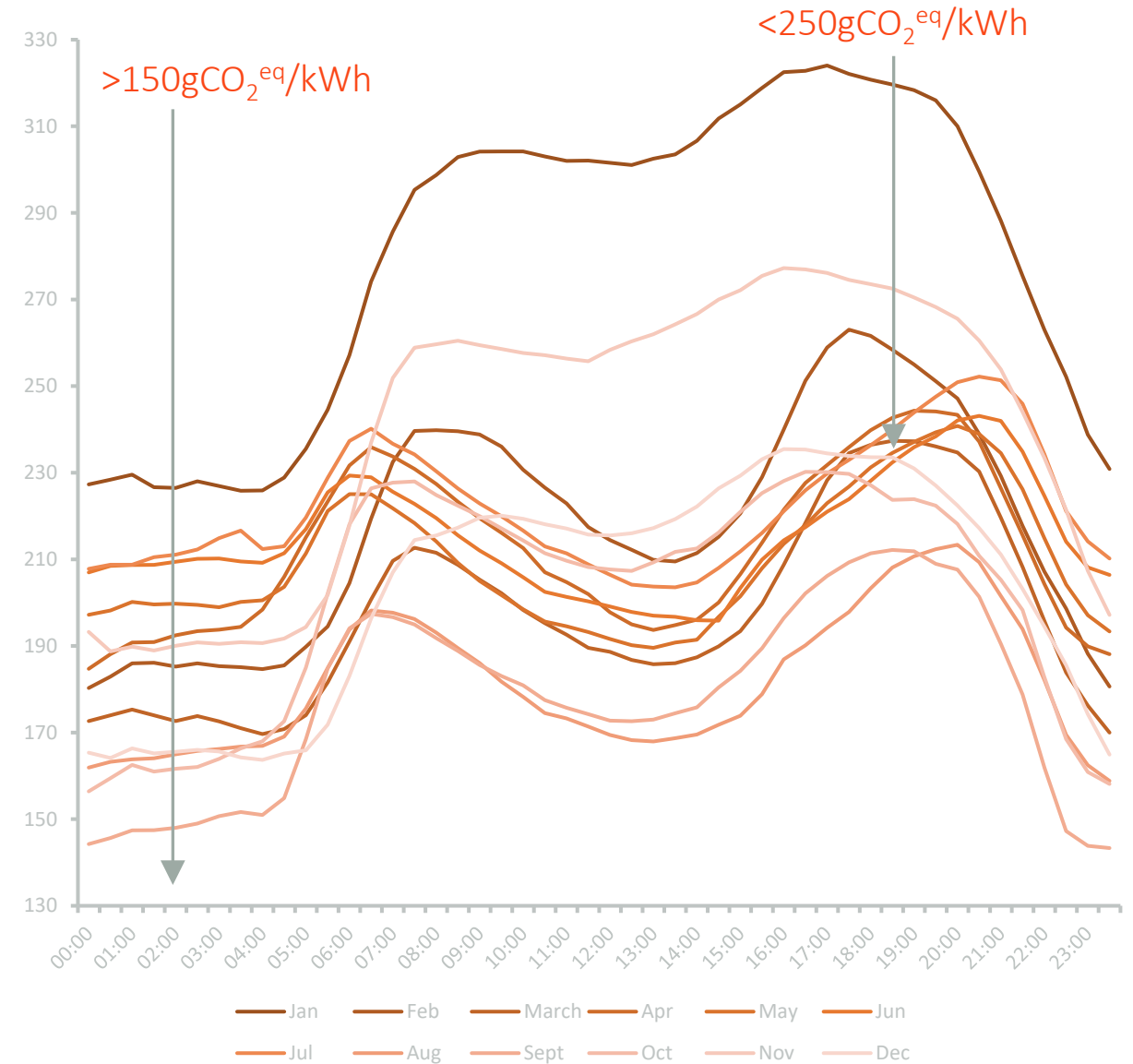
Digital Tools & Standards

Whole Home Survey Goals

- The collaboration are developing and testing a comprehensive home survey digital tool

- This will capture all information required to assess what retrofit measures are not suitable for that home

- The intention is to enable a whole home survey to be delivered in under an hour, making it a realistic price-point

- Over time, automated data analytics will provide a further level of quality assurance to assure a robust basis for decisions

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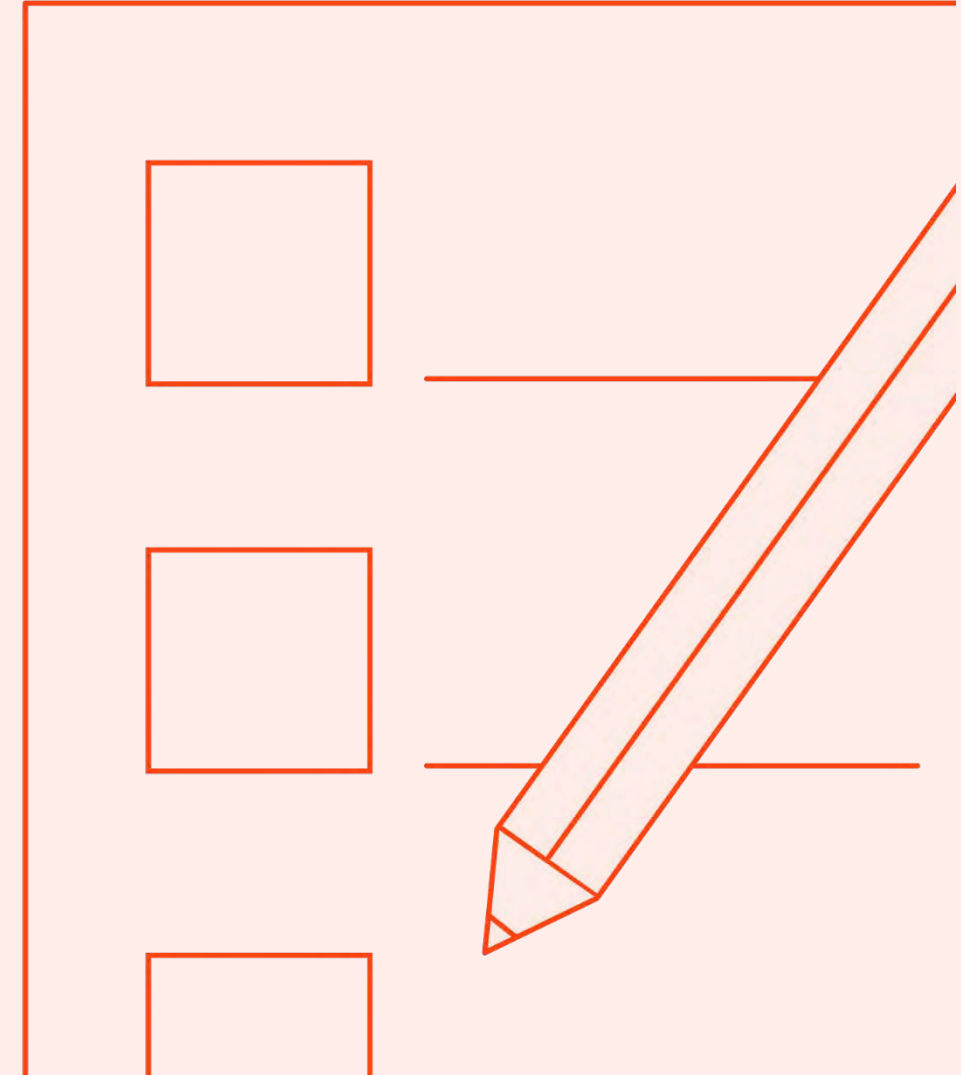
Digital Tools & Standards

Whole Home Survey

- Captured digitally and captures all the information and parameters using the 4 C's principle

- Captures all the information to create the carbon footprint baseline

- Provides additional guidance and background information on suitability of measures.

- Ensure compatibility of measures for selection in the pathways tool

- Primary design is to capture elements or features that indicate a building is not "Retrofit Ready"

- Reduces the risk of Unintended Consequences

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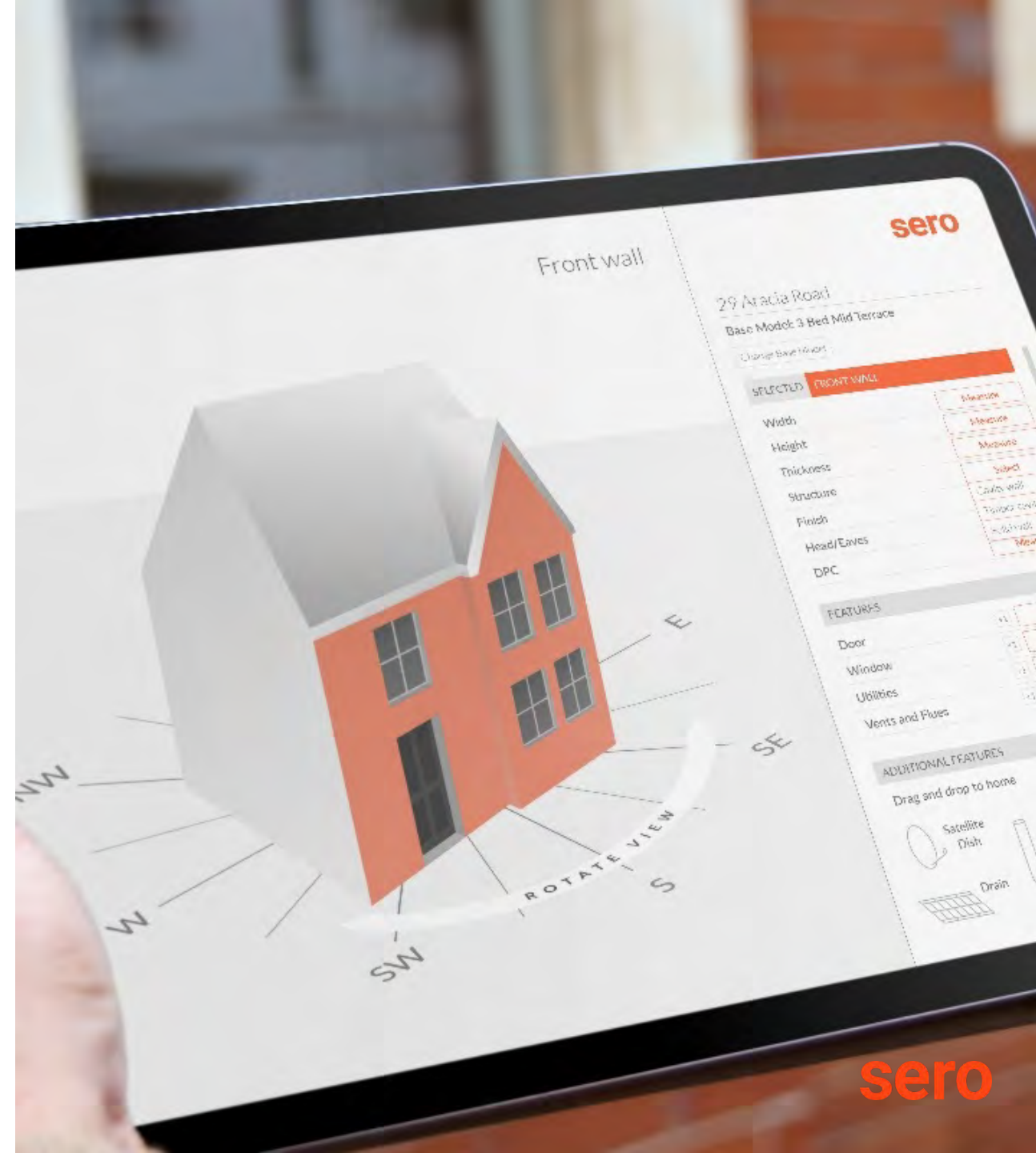
Digital Tools & Standards

Digital Pathway to Zero

- Innovative tool to inform PAS2035 "measures"
- Driven by competent designer
- Automated removal of incompatibilities
- Prioritisation of pathways
- Fun "Top Trump" representation
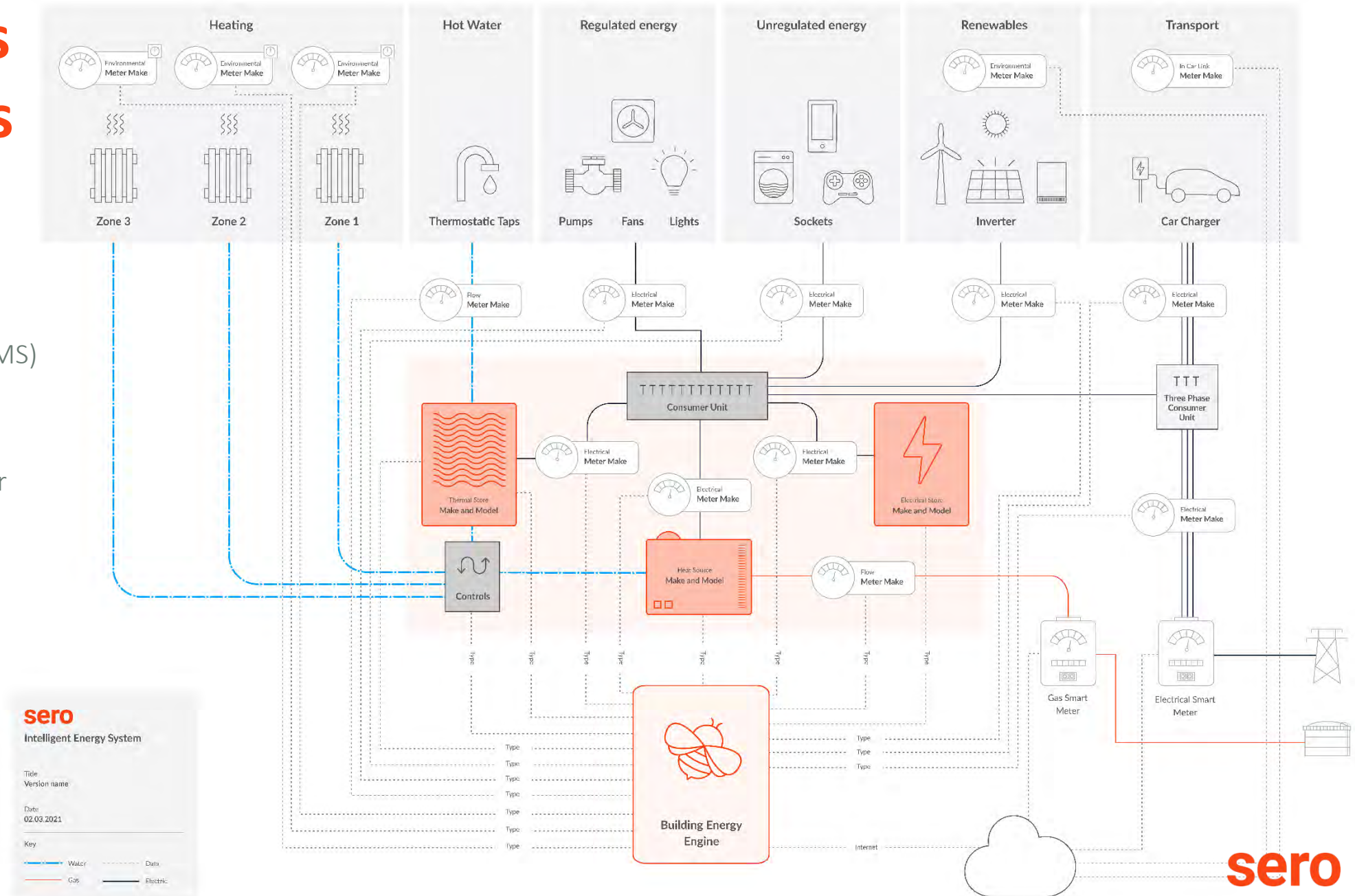- "Zero Carbon By"[tm]

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Digital Tools & Standards

Intelligent Energy System

- Residential Building Management Server (BMS)

- Manages local data collection and dispatch

- Reconfigurable for other service providers

- Modular physical interfaces

- Future proof cabling specification (CAT6 / 23AWG)

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Digital Tools & Standards

Digital Building Passport

- Digital representation of the building's physical and performance attributes, maintained over time

- Building data

  - Survey output

  - Pathways to Zero input

  - RSL O&M input

- Performance data

  - Sensor readings

  - Meter data

  - ML Integrations

- Forms a Digital Mode, Digital Shadow or Digital Twin depending on the hardware and occupant options

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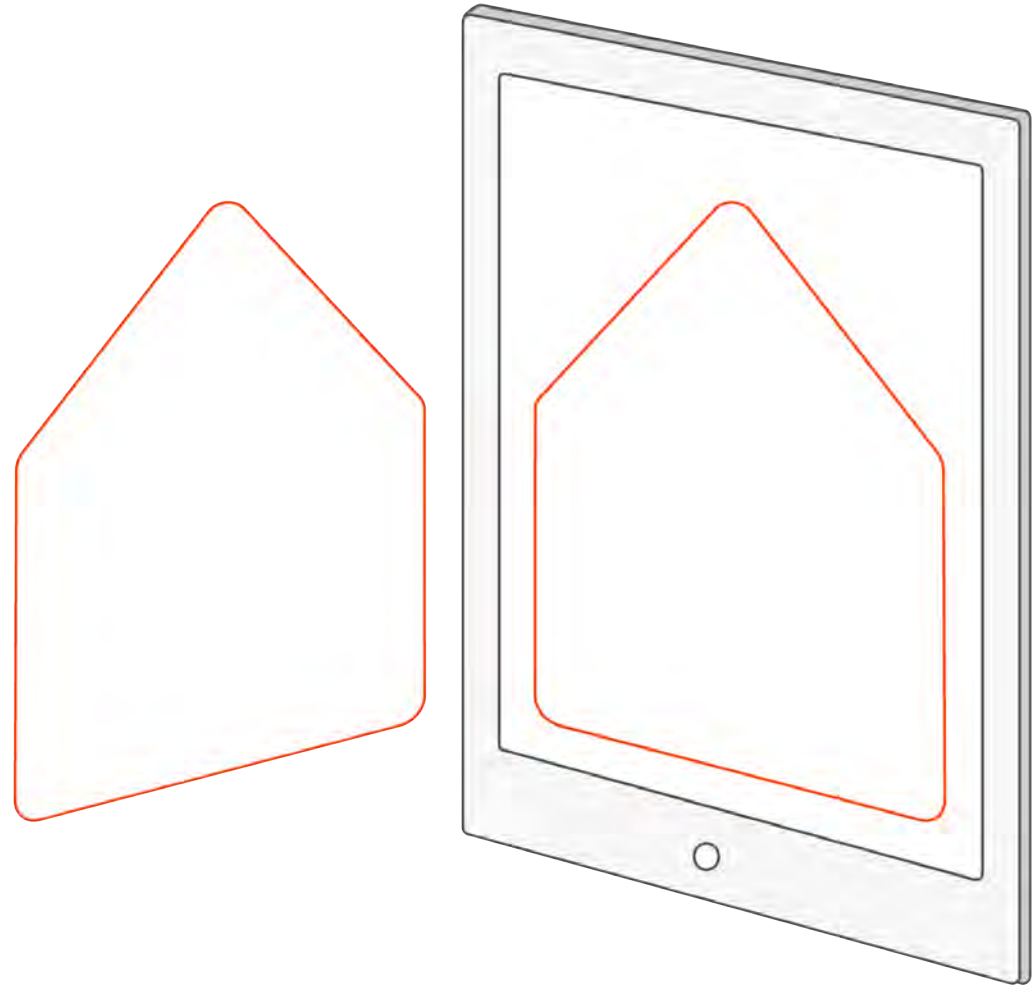
Pathfinder Homes

Pathfinder Homes – All Across Wales

1,724 homes
Architypes

House Type

End Terrace = 101

Mid Terrace = 309

Semi detached = 354

Other = 5

Detached = 52

Flat = 551

Age

Pre 1900 = 36

Pre 1919 = 184

1919 – 1944 = 97

1945 – 1964 = 222

1965 – 1990 = 494

Post 1990 = 339

Fuel

Oil = 7

LPG = 22

Solid Fuel = 63

Electric = 263

Gas = 962

Other = 45

Wall Construction

Cavity = 780

Solid = 251

System = 1

Not Traditional = 340

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Framework & Dynamic Purchasing System

Benefits to the Framework and DPS

Materials Framework will allow for stable pricing catalogue and identification of local and national suppliers. Will also allow for additional control for purchasers.

Dynamic Purchasing System;

- Will allow for suppliers to join at any time (as they develop their capabilities etc.) and will allow purchasers to support their suppliers to join,

- Is not time bound - the DPS can be in place for as long as it is required,

- Will allow for new suppliers to on-board as new technologies/solutions are identified

- Pay as you go approach on a not-for-profit basis

- Control is retained by the purchasers to procure

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Valleys to Coast
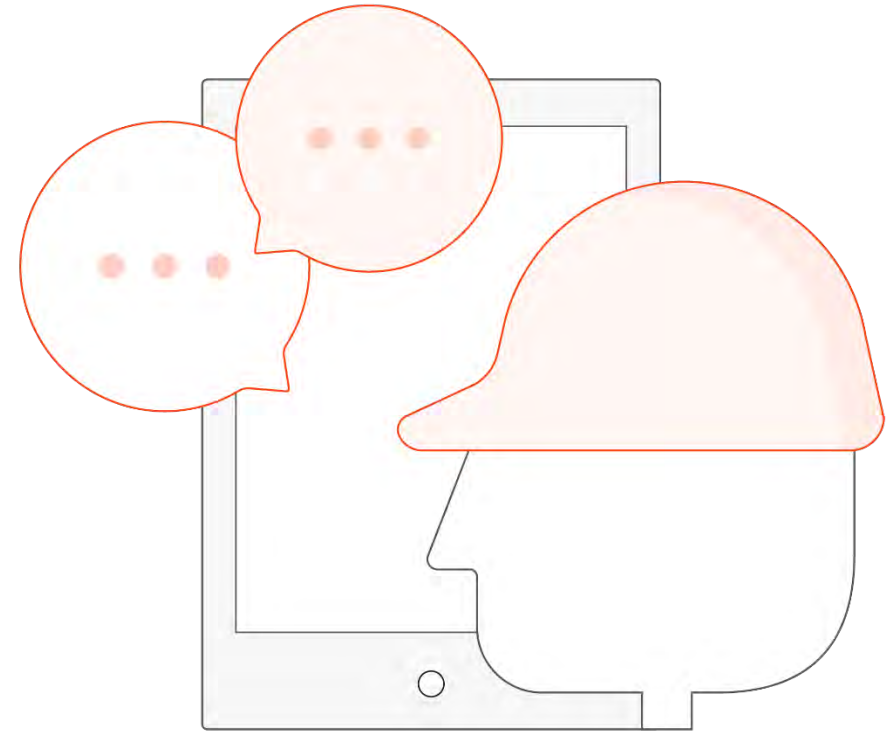
Skills & Training

Skills & Training –
Mapping Future Skills Demand

- The project also building digital tools to help anticipate future skills and training requirements

- Based on anonymised, aggregated Pathways to Zero for individual homes, the likely future measures in an area can be forecast by year

- Using these measures, skills & training associated with their installation can be consequentially mapped

- These maps are intended to provide skills & training providers with better foresight of decarbonisation skills & training demands
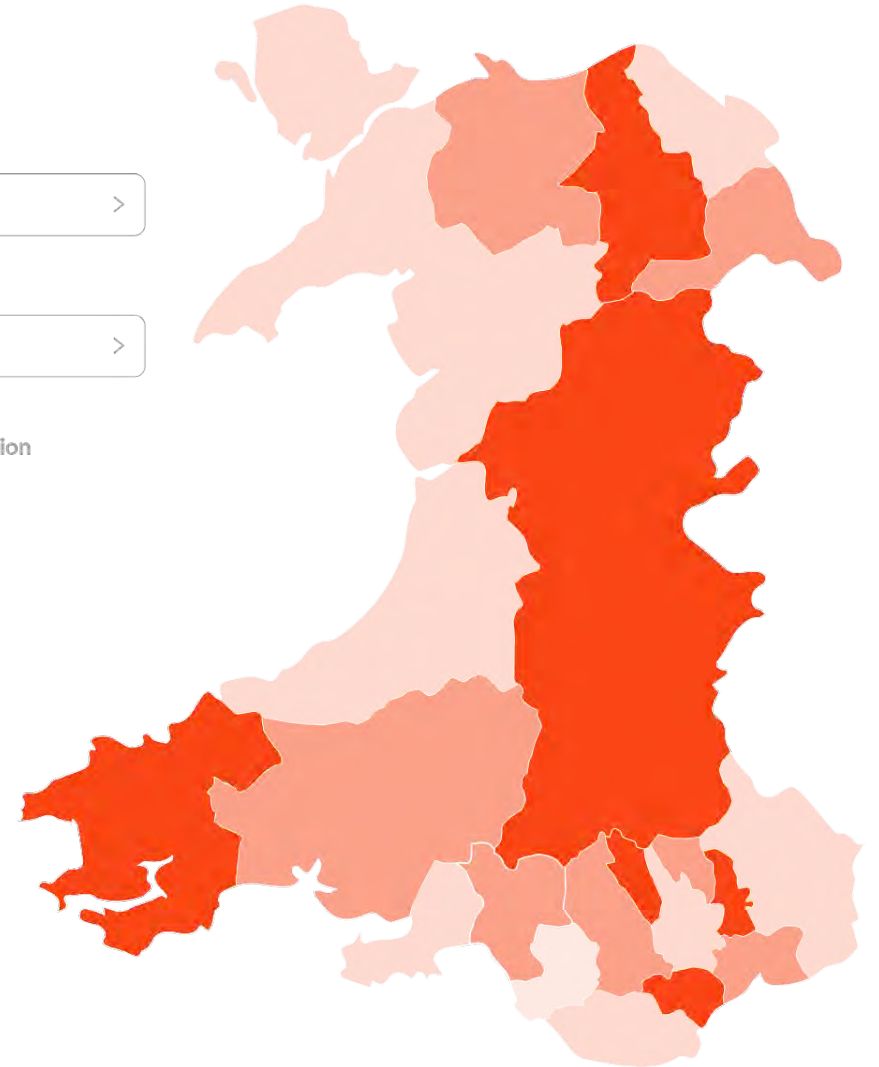
Measure:

Cavity Wall

Date:

2028

Cavity Wall Insulation

0 - 500

500 - 1000

1000 - 1500

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NEATH PORT TALBOT COLLEGE
COLEG CASTELL NEDD PORT TALBOT
NPTC

Pathfinder Homes

Pathfinder Homes – Approach

- Each Pathfinder Home ideally follows this sequence:
- Nominated internal/external team are trained to become competent in methods and digital tools
- Whole Home Survey is undertaken for the home by the nominated competent person
- Pathways to Zero presents all technically viable measures; the RSL's competent person then selects;
  - Preferred retrofit measures,
  - Number of steps and planned year
  - The measures in each Step
  - This can be done in conjunction with tenants

- RSL then procurers Step 1 works (with specification support from Pathway output), and commissions installers
- Works implemented in the home, with quality assurance checks
- Building Passport updated to reflect Step 1 implementation
- Repeat for Step 2

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Pathfinder Homes

Pathfinder Homes – Survey Training

- As part of the Programme there are 7 training modules being delivered

  Module 1: The 4 C's
  (Context – Coherence - Capacity – Caution)

  Module 2: Building condition

  Module 3: Construction Assessment

  Module 4: Exposure

  Module 5: Ventilation and Condensation

  Module 6: Thermal bridging

  Module 7: Digital Survey Intro

- There have been more than 100 through the training so far

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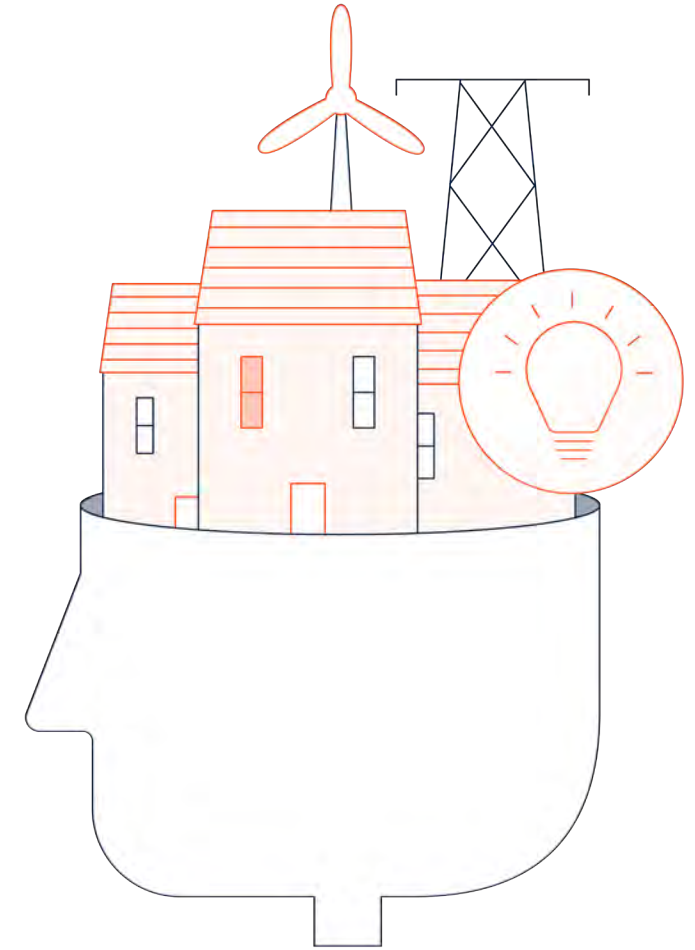
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Thank you

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