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# **Optimised Retrofit**

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Partners



### **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 1,372 homes on their Pathway to Zero as Pathfinder Homes
- additional homes via the additional funding provision, due imminently



### 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

### 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 reasonable 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

### 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





This graph shows the predicted emissions intensity of the UK Grid in grams of CO <sup>2</sup>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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### 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<sub>2</sub><sup>eq</sup>, but 1kWh drawn from the grid at 6pm costs c.>250gCO<sub>2</sub><sup>eq</sup> = **not** net zero carbon
- Whilst individual residents could manually control this all day, every day, the optimum route is to automate



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### Practice – Project Delivery

- The Optimised Retrofit project is run as a collaboration strategically overseen by a Steering Group of all involved
- A Project Board provides tactical management to guide the delivery, with day-to-day management by Sero
- The project has three key themes:
  - Pathfinder Homes. 1,372 homes across Wales forming the basis for the development of the Optimised Retrofit approach
  - Foundational Economy. 30+ individual projects to help drive skills & training, research, community engagement, financial tools and more
  - Digital Tools. Building and refining technological solutions to support decarbonisation, in collaboration with those delivering on the ground





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**David Bolton** Valleys to Coast





### Background

- Welsh Government ORP funding and the Consortium
- Funding to set up a 'Framework' that builds on successes of previous programmes
  - Pan-Wales
  - Well-being of Future Generations
  - Foundational Economy
  - Opportunity & Level Playing Field for Wales Economy

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### Current

We have identified the following as the optimum procurement devices

- 4-year pan-Wales Framework for Materials Supply
- Dynamic Purchasing Sytem (DPS) for;
  - Labour/Installation
  - Specialist Services (Surveying, Design/Consultancy, Training)





### 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





### Timescales

- Agreeing terms and commencing the information gathering across Wales
- ORP Consortium has set up a Procurement Sub-Group with representation from;
  - Housing Associations
  - Can Do Toolkit
  - Welsh Government
  - Installers & Suppliers
  - Federation of Master Builders
  - Trustmark
- Expected that the Procurement will be in place and operational from June 2021
- 'Get it done well'





### Next Steps

- Spread the word substantial opportunities for benefits from purchasers and suppliers,
- Information gathering and requirements for;
  - Specifications,
  - Qualifications and Certification for systems and installers
- Finalisation of work streams, systems/technologies and Welsh regions

This is an opportunity for SME's and micro-SME's to work with their clients to have a presence and the opportunity to grow their business and capacity





Wyn Prichard Director of Construction, skills and Strategy, NPTC Group of Colleges



### Skills & Training Goals

- Number of initiatives in the past, that have not become mainstream qualifications
- Need to ensure skills is not left behind
- We need to reflect the changing nature of the construction sector, in terms of modern methods of construction, as well as manufacture and smart technology
- The project will provide a focus and partnership that will create new training models and also influence current main stream learning...mainstream not specialist.
- There is some good construction and built environment skills intelligence, but very limited in retrofit and green skills...there is an urgency to create a skills and demand methodology



### Skills & Training - Competence

- Skills and training is not enough, we need to ensure competence, through sound assessment and learning modules
- Patchwork of training being developed in the form of Trailblazers, CPD courses and manufacturers training
- We need to look at the modules that are appropriate for the overall projects and will deliver quality.







### Skills & Training – New & Existing Skills

- We need to look at the training network in terms of developing ability to deliver the training.
- Look at training already in place to deliver projects, in terms of level and appropriateness to the optimised project
- We need to establish a strong assessment network to ensure ongoing quality control both on and off the job
- We need to develop knowledge beyond a specific Skillset, but a wider understating of that skills impact on a project

- We need to work closely with Awarding Bodies and QFW, to implement qualifications, when required, this cannot be an afterthought
- We need to create a partnership between the project, industry and Academia



### 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





**Colin King** Technical Lead – Retrofit & Construction, Sero



### 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



### Whole Home Survey – PAS2035

- The survey undertaken is in line with the principle of PAS2035, but requires the recording and capturing of more extensive data to reduce the risk of Unintended Consequences
- A new British Standard is being created to cover the extent of the Retrofit Assessment requirement, and I have been asked to Chair that Standard.
- The risk assessment requirements, including significance and heritage are required as part of the survey, as well as detailed assessment of ventilation and condition



### Whole Home Survey – The Four "C"s

- The survey incorporates the principles of the 4 C's to retrofit risk assessment and management.
  - Context (condition, location, occupancy, ventilation, significance) to eliminate any measures the property is not "Retrofit Ready" for
  - Capacity ( to ensure the building fabric is not over optimised and pushed to hard, resulting in failure).
  - Coherence (to ensure that all the contextual information is used to determine the correct specification and measures) It require a building suitable approach, not predetermined measures.
  - Caution ( where there are any unknowns or uncertainties, then apply caution when setting the targets)



### 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

# sero Frontwall 29 Macia Road Base Model: 3 Bed Mid Terrace SFLFCTUT Widd' Height Thicknest Startigon. HeadlEn DPC FEATURI Winds Vents and Flues AUDINTIONINE TEATURE 2 Drag and drop to hor

### Classification of Unintended Consequences

- Physical aspects of a good process with reduced risk.
- When undertaking thermal improvements these should be considered at every stage: planning, procurement, design, construction, operation and maintenance.



Matt Kane Head of Digital, Sero



### **Design Principles**

- Interoperable & best practice standards
  - Intelligent Structure
  - System Interoperability
- Secure & robust data
  - Encryption in transit (TLS)
  - GDPR data stored in isolation
  - Encryption at rest (AES-256)
- Replaceable elements
  - Micro-service architecture
  - Individual home requirements



### 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



### Digital Intelligent Energy System

- Residential client side Building Management Server (BMS)
- Manages local data collection and dispatch
  - Standard transmission protocols (MQTT, UDMI)
- Container architecture
  - Device is service provider agnostic
  - Profile and expansion
- Modular physical interfaces
- Future proof cabling specification (CAT6 / 23AWG)



### **Digital Building Passport**

- Digital representation of the building's physical and performance attributes. Must maintain currency.
- Building data
  - Survey output
  - Pathways to Zero input
  - RSL O&M input
- Performance data
  - Sensor readings
  - Meter data
  - ML Integrations



Jim McArdell Head of Projects, Sero



### Pathfinder Homes - Goals

- Every Pathfinder Home will have a Whole Home Survey, a Pathway to Zero and an Intelligent Energy System
- Each home will also take its first Step on the Pathway to Zero (selected by the RSL) as part of the project
- These homes provide the basis for developing processes that are rooted in reality,
- They also start to build a significant dataset of post-retrofit performance understanding to inform future decisions



Pathfinder Homes – All Across Wales

# **1372 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

### 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

### 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 96 trainees who have completed Module 1 to date
- A further 101 trainees are booked on to subsequent modules over the coming weeks
- Programme (dates) for remaining modules
  - Modules 2,3 & 4 = w/c 25/01/21
  - Modules 5 &6 = w/c 01/02/21
  - Module 7 = w/c 08/02/21
- 'mop up sessions' for any who were unable to make initial dates are running from mid February
- The Total number of RSLs in attendance to date = 22
- Other notable attendees of the sessions include Welsh Gov & ABC

### Pathfinder Homes – Extra Credit!

- Some Pathfinder Homes are to be expedited; homes with early low risk measures identified which don't lock out subsequent measures being implemented will be targeted as early movers.
- For example, a home considering installation of PV & battery systems can go ahead without significantly affecting other measures identified during the Survey and Pathway processes.
- As this example measure will require specialist survey by appropriate competent contractor, this can be carried out in parallel with Whole home Survey and Pathway development systems

- Generally speaking, measures which don't interact or affect the fabric of the building would be appropriate
- The measures will however be reviewed by the technical team on a case-by-case basis prior to implementation to ensure they do not artificially lock the property low.
- c.200 off-gas Pathfinder Homes are targeted to have hybrid heating systems (heat pump + fossil fuel) to build evidence on these