Raven Housing Trust

Building homes Changing lives

The journey to net zero carbon

Delivering decarbonisation

Raven carbon zero webinar series

Raven Housing Trust

Building homes **Changing lives**

Welcome and introductions:

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Residential Heating

ecodan® Renewable Heating Technology

MITSUBISHI ELECTRIC

Delivering Affordable Warmth in Social Housing

April 2022

Presented by

Will Rossiter – Social Housing Account Manager

Social Housing

Agenda

- MEUK & ASHP journey
- Market growth
- Funding
- Product Overview & MEUK

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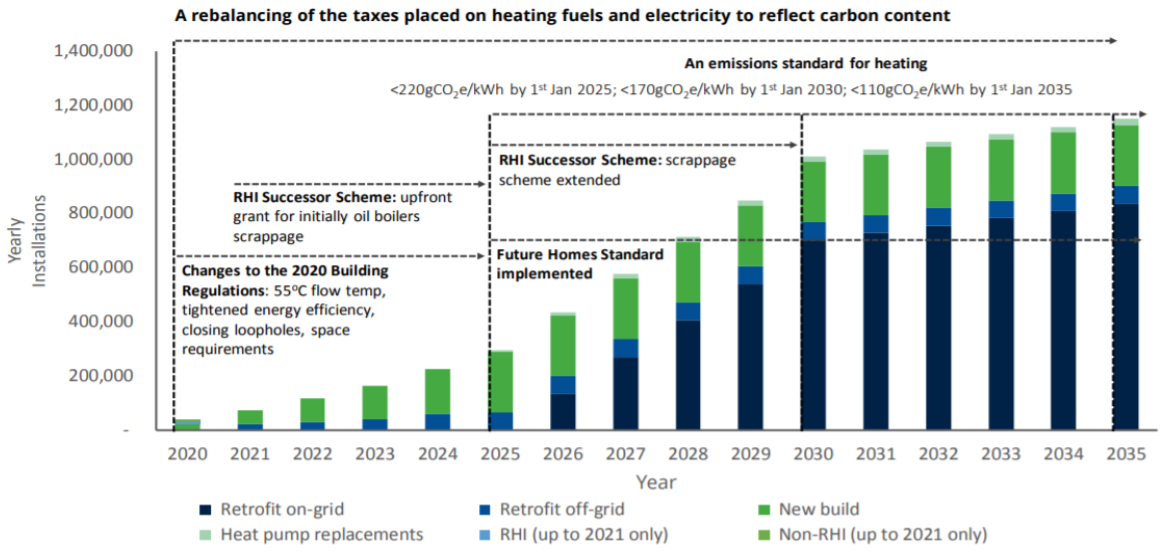
Introduction

- UK based
- Heavy new build presence
- Private market
- Social housing boom
- Exponential new build growth

1,000,000 heat pumps by 2030

What's next?

- Legislation
- Funding
- Continued R&D
- Above & beyond



Funding

- RHI ended in March 2022
- Sustainable Warmth Competition – £950m
  - Home Upgrade Grant
  - LAD
- Social Housing Decarbonisation Fund - £800m

Aim is to help social housing achieve EPC C target by 2030

Key features & Upgrades

- R32 refrigerant
- A+++ Performance Monobloc range – class leading
- New Ultra Quiet 6kW model
- Zero performance drop off across entire range – 7degC
- Improved SCOP's across the range
- Reduced Minimum water Volume requirement

Core heat pump range

Monobloc outdoor units

4.0kW	5.0kW	6.0kW	8.5kW	11.2kW	14.0kW[1]
					
Compact	Compact	Ultra Quiet	Ultra Quiet	Ultra Quiet	Zubadan
R744 (CO2)	R32	R32	R32	R32	R32

MCS CERTIFIED

Compatible indoor cylinder range

Packaged & Pre-Plumbed models

MELCloud™

Thermal Store	Packaged	Slimline	Standard	Solar
				
1 model	1 model	2 models	5 models	3 models
R744 (only)	R32	R32	R32	R32

Project Delivery

Thank You

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Raven Housing Trust

Building homes Changing lives

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BAILY GARNER

Retrofitting existing homes

A Practical Toolkit Towards Net Zero

CONTENTS

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Calculation and Energy Ratings

Energy performance certificates (EPCs) and the Reduced Data Standard Assessment Procedure (RdSAP) software are a broadly accepted measure of pre and post retrofit performance.

EPCs are required when properties are sold or first let and have a validity of ten years. A new EPC is also required following any works which would change the EPC rating. Many are generated as part of stock condition surveys and energy surveys but data is quite often cloned from similar archetypes. Data regarding EPC and SAPs can often be held on a landlord's asset systems but in some cases the quality of the data and the ability to manipulate it to inform programmes of retrofit works is limited.

Quality of data when making strategic decisions is key. Whilst RdSAP is useful in modelling potential programmes of retrofit works, the use of full SAP by a qualified assessor is necessary to achieve the granularity required in retrofit design. For many retrofit standards Passivhaus Planning Package (PHPP) software is required.

Retrofit Standards

It is possible to specify works which have been identified by SAP calculations whilst controlling risk and the quality of works within a PAS 2035 Framework. However, organisations may wish to drive their retrofits with reference to industry accepted standards. There a number of standards from which organisations can choose.

EnerPHit

An independent Passivhaus retrofit standard using PHPP modelling targeting exemplar levels of retrofit with an independent quality assurance process leading to certification.

AECB

An independent standard for retrofit using PHPP and certified as such.

Energiesprong

A retrofit standard targeting good levels of retrofit, using innovation to drive down cost, based upon the contract between occupier and landlord to achieve certain levels of comfort.

Super Homes

An independent rating scheme for retrofit based upon SAP with a star rating system.

PAS 2035: 2019 RETROFITTING DWELLINGS FOR IMPROVED ENERGY EFFICIENCY – SPECIFICATION AND GUIDANCE

PAS 2035 provides a risk-based quality control system for the energy retrofit of homes and best practice guidance about domestic retrofit projects.

It supports the TrustMark government-endorsed quality scheme and allows users to claim compliance with it. The PAS identifies roles within the retrofit process, for example a retrofit coordinator, which are specifically qualified to undertake different aspects of the retrofit process.

The PAS was introduced to address issues of poor quality in previous retrofit works and to avoid unintended consequences of retrofit such as dampness and condensation within homes. It has been adopted by the government where funding is provided and, if specified by clients, gives assurance that retrofit works will achieve their desired outcomes.

Figure 8 - Who does what in the new process?

PAS 2030 (2019)

Assessed Project Risk	Assessment	Strategy	Design and Specification	Installation	Handover	Monitoring/ Evaluation
A (Low)	Assessor, Coordinator	Coordinator	Coordinator, Designer	Installer *	Installer *	Coordinator, Evaluator
B (Medium)	Assessor	Coordinator	Coordinator, Designer	Installer *	Installer *	Coordinator, Evaluator
C (High)	Assessor	Coordinator	Designer	Installer *	Installer *	Coordinator, Evaluator

Coordinator

Temporary whilst Evaluators are trained and accredited.

Advanced Evaluation can not be performed by the same coordinator leading on the wider project

* Indicates "oversight"

PAS 2035 requires early engagement through key pre-works surveys such as condition reports, options evaluations, and production of medium-term improvement plans. In future, such plans are likely to form part of digital 'building renovation passports' containing all information about a building.

Project personnel must be qualified to fulfil the various PAS 2035 roles such as Retrofit Designer, Retrofit Assessor, Retrofit Coordinator, Retrofit Installer and Retrofit Evaluator. Documentation is collated by the Retrofit Coordinator who confirms compliance and uploads data to a central hub called the Data Warehouse. This allows for easy access to lessons learned, collaboration, and sharing of knowledge within organisations and for future schemes.

PAS 2035 insists on ventilation and moisture control strategies being developed at an early stage of the design. Compliance tools such as those available from The Retrofit Academy (more detail on their website here) ensure that the Retrofit Coordinator tracks the issue of key documentation and key hold points through the project. A PAS 2035 scheme must meet certain requirements depending on the level of risk assessed as part of that project (risk paths A – C). This informs the general approach and compliance requirements, as well as levels of monitoring, and pre-, mid- and post-works surveys and testing.

Certification, such as MCS accreditation, must be held by approved installers and all this information is presented to the Retrofit Coordinator to confirm compliance. In taking a fabric first approach, key upgrades to the building envelope are achieved ahead of the introduction of new energy generation systems, thereby reducing demand. In assessing both ventilation and moisture control impacts of measures, some of the worst failings of historical retrofit jobs are mitigated. It is likely the PAS 2035 and PAS 2030 standards for installation will be adopted for all publicly funded retrofit refurbishment projects going forward.

Figure 9 - Aims of PAS

CURRENT TECHNOLOGIES

Modern Methods of Construction

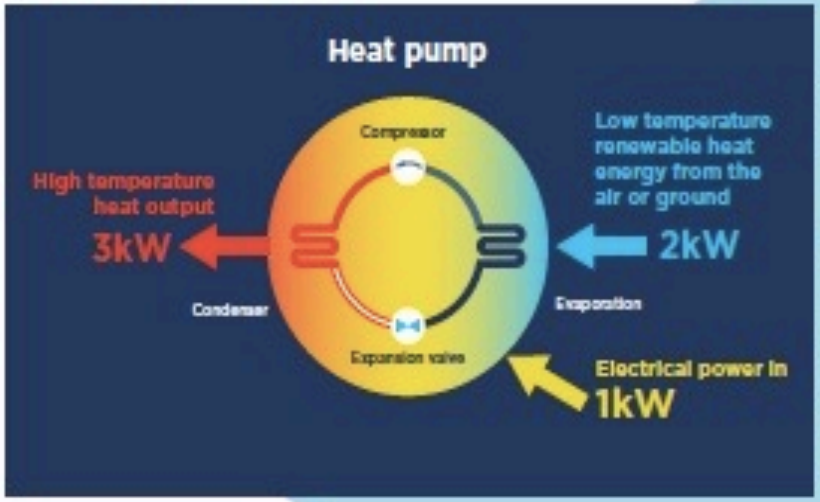
With the scale of retrofit required, the application of modern methods of construction (MMC) to produce economies of scale and efficiency will be required. Panellised insulation systems and premanufactured modules containing low carbon heating and energy storage could speed up programme delivery and reduce disruption and space loss but these technologies are not yet mature in the UK.

Heat Pumps

The most common are air and ground source heat pumps which use electricity to harvest energy from the air or ground into usable heat within the home. Ground source heat pumps use fluid in buried pipes laid horizontally or in vertical piles in the ground to capture ambient ground heat. Laid horizontally this can require a larger external area. Air source heat pumps capture ambient energy from the outside air. Both will generally transfer this using a condensing unit to a hot water cylinder from where it can be used to provide heat and hot water. Air source heat pumps are the most common heat pump but need to be correctly installed providing low temperature heat into an efficient and airtight building envelope. Larger low temperature radiators may also need to be installed.

Figure 34 – Energiesprong services pod

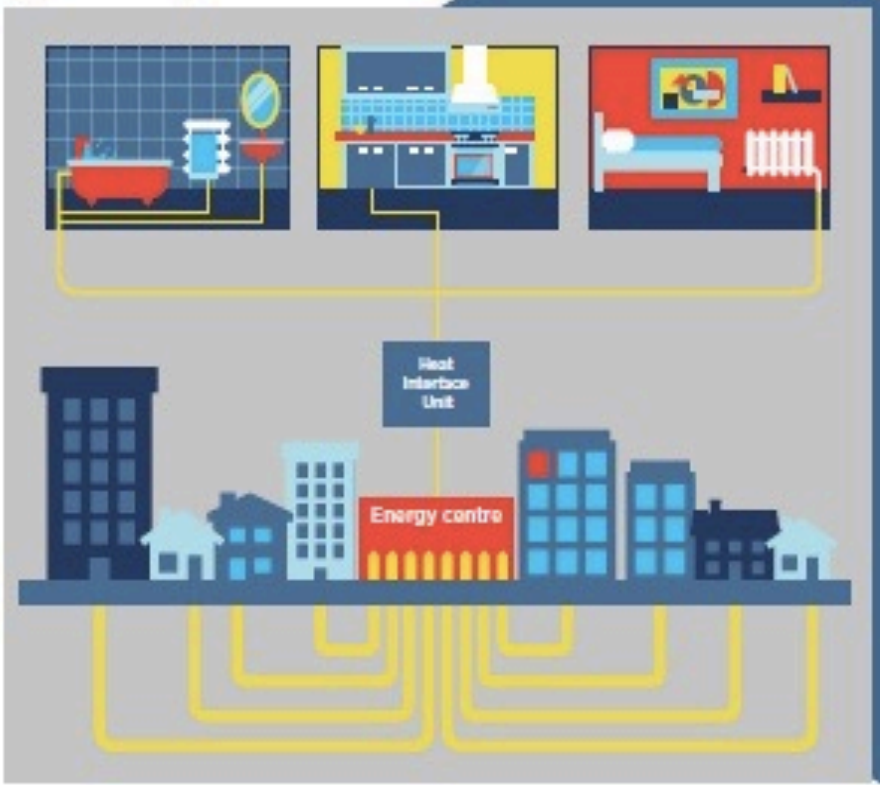
Figure 35 – Heat pump efficiency



Heat networks

In some locations, heat networks are available or can be constructed so that home heating and hot water can be provided by a heat interface unit (HIU) connected to the network that is supplied by central plant. Such central plant can be very efficient in cost and carbon terms, as shown in **figure 36** but heat networks require scale to spread the cost of the infrastructure among users.

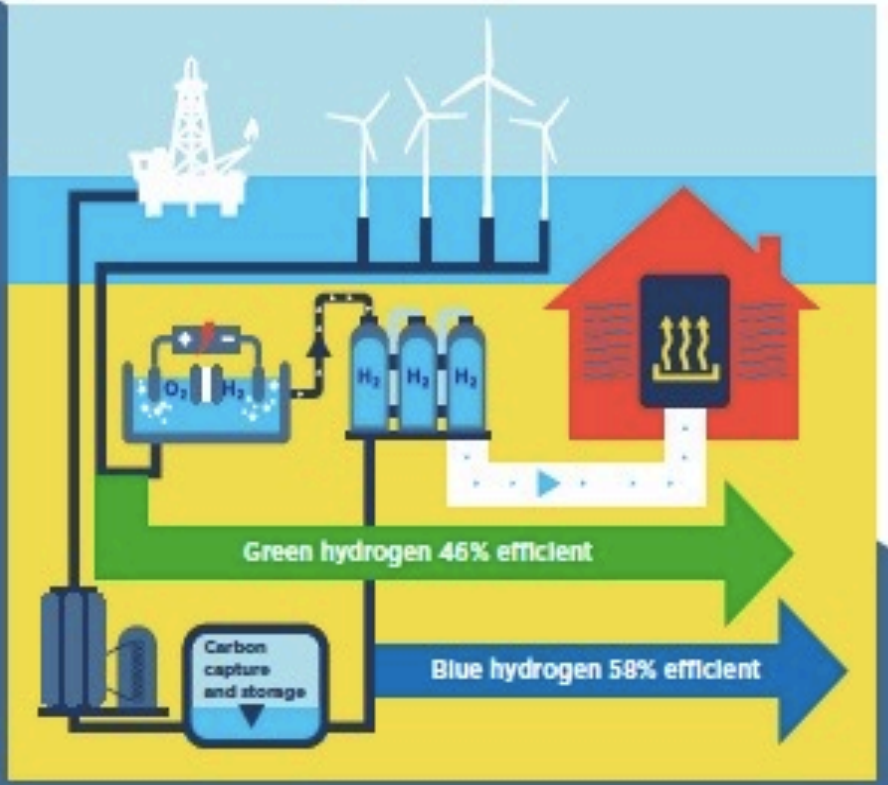
Figure 36 – Energy centre heat distribution



Hydrogen and Green Gas ready boilers

Hydrogen is being promoted as a zero carbon fuel of the future. The idea being that existing gas boilers can be replaced with hydrogen ready boilers so that blue and/or green hydrogen can be supplied in future via a new network or mixed into existing gas supplies to reduce their carbon intensity. Whilst this is an option, it is unwise because hydrogen production is inefficient, as can be seen in **figure 37** so it is likely that hydrogen will be used in other industries, transport or as an energy storage medium. This is reflected in the government's recently published hydrogen strategy and in the net zero strategy.

Figure 37 – Efficiency of blue and green hydrogen production



Strategic Asset Management

Retrofit strategies should take place within a strategic asset management strategy which coordinates asset planning and business planning (see **Figure 12**). Using their asset systems, social landlords should be able to identify poorly performing properties and archetypes in geographical areas and formulate retrofit works packages to meet their strategic objectives. The strategy is likely to lead with fabric first and trialling clean heat and contain deep retrofit specifications for freehold voids, shallow internal retrofit for leasehold voids and programmed works to the worst performing properties.

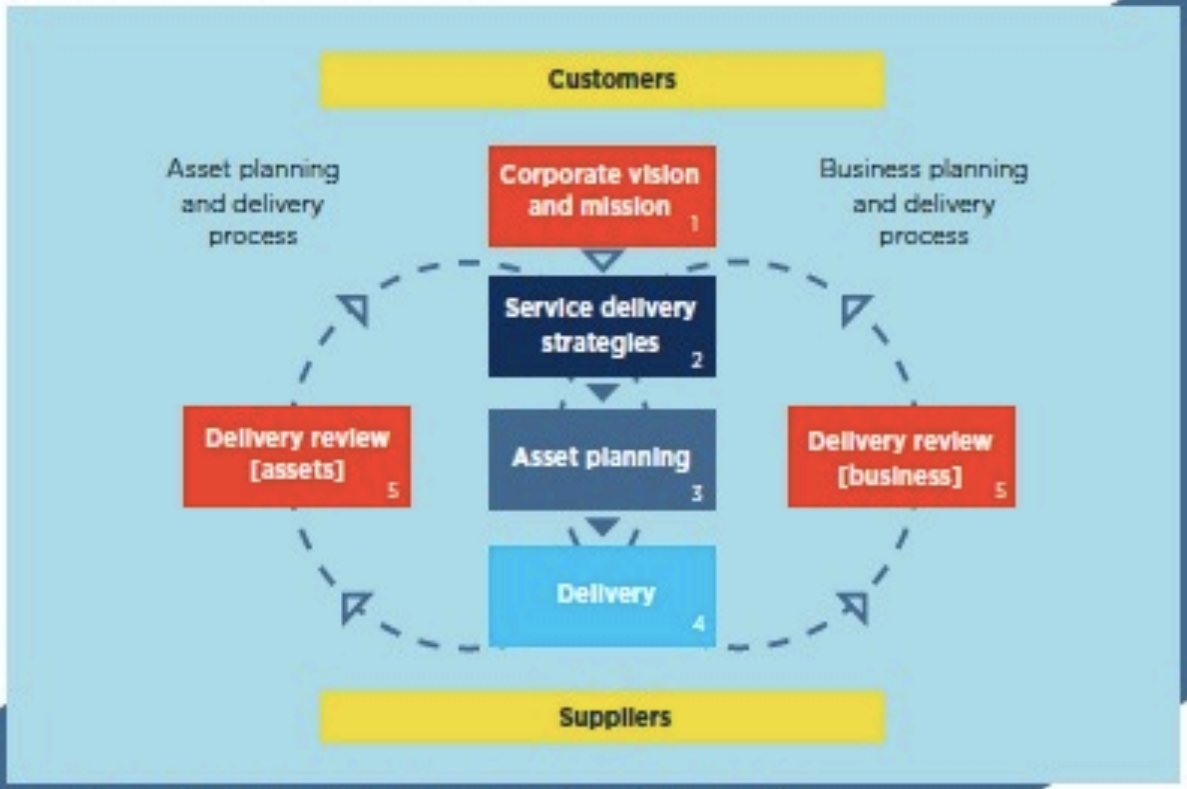
However, this cannot be distinct from a landlord's condition-led planned maintenance and component replacement cycles. Components and elements that would be replaced or upgraded as part of retrofit works to achieve performance criteria (high EPCs) may have a significant element of useful economic life remaining. Replacing them early is not only "wasting" the embodied carbon they represent but is not economically viable. Energy efficient measures such as external wall insulation are often linked to other components such as windows and doors, making them difficult to retain even if there is economic life remaining.

Therefore, the retrofit strategy must be integrated with planned maintenance and replacement cycles to determine when component replacement is best undertaken on a balance of cost and carbon. The challenge for organisations is to achieve a cultural shift to strategic asset management which applies weighting to condition, embodied carbon and improvement in operational energy efficiency, to drive programmes of planned maintenance and replacement including retrofit.

Such a strategy is likely to include programme replacement of non-energy related components (kitchens, bathrooms, fire safety works etc) and replacement and upgrade of energy related fabric elements prior to installation of ventilation and/or low carbon heating and hot water appliances. Developing and currently unknown technologies will appear which will change a strategy, so any strategy must be flexible and capable of modelling "what if" scenarios.

PAS2035 requires that each property has a "medium term improvement plan" on completion of the works which identifies the work required that will get as close to a nearly zero carbon building as possible. When aggregated across a stock, this approach is one that could form the basis of a strategic asset management strategy. It might also identify properties that cannot be practically, or cost effectively, retrofitted and might form part of a stock replacement or regeneration approach.

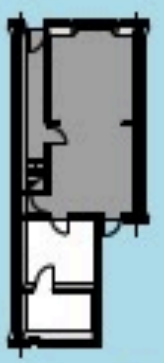
Figure 12 - Strategic asset management process



RICS Strategic public sector property asset management - 3rd Edition September 2021

Archetype 1 Pre 1900 terraced house, solid wall - 97.7m²

	Upgrades		Results		Total £	Cumulative Total £	Cumulative Total inc. OH&P, Prelims
			EPC rating	Space heating demand kWh/m²/yr			
			(SAP score)	SAP (PHPP) values			
	Existing		**D (64)**	150 (165)			
Fabric First Approach	**1. Top up roof insulation to 400mm**		**D (65)**	143 (157.3)	£1,637.67		£2,154.25
	2. Replace existing cavity fill insulation		N/A	N/A	N/A	£1,637.67	£2,154.25
	3. 75mm IWI front and 150mm EWI rear		**C (74)**	97 (106.7)	£24,031.53	£25,669.19	£33,766.28
	4. Triple glazing		**C (75)**	92 (101.2)	£5,621.35	£31,290.54	£41,160.83
	5. Air tightness measures		**C (77)**	79 (86.9)	£1,300.00	£32,590.54	£42,870.90
	6. Thermal Bridging calculations		**B (81)**	61 (67.1)	£1,000.00	£33,590.54	£44,186.34
HVAC	**7. Ventilation**	**Upgrades**	**CMEV**	**MVHR**	£5,475.05	£39,065.59	£51,388.44
		Results: EPC rating	**C (80)**	**C (79)**			
		Results: Space heating demand kWh/m²/yr	59 (64.9)	52 (57.2)			
	8. Low Carbon Heat Source	**Upgrades**	**ASHP**	**ASHP**	£10,661.95	£49,727.53	£65,413.59
		Results: EPC rating	**C (78)**	**B (82)**			
		Results: Space heating demand kWh/m²/yr	56 (61.6)	49 (53.9)			
Further Fabric	**9. Floor insulation**	**Upgrades**	**ASHP**	**ASHP**	£6,294.15	£56,021.68	£73,693.16
		Results: EPC rating	**B (84)**	**B (83)**			
		Results: Space heating demand kWh/m²/yr	44 (48.4)	37 (40.7)			
Renewable Technology	**10. Photovoltaics**	**Upgrades**	**PV**	**PV**	£4,725.00	£60,746.68	£79,908.62
		Results: EPC rating	**A (92)**	**A (92)**			
		Results: kWp	2.2	2			
		Results: Space heating demand kWh/m²/yr	44 (48.4)	37 (40.7)			
				Contingency @5%	£3,037.33	£63,784.02	
				Subtotal		**£63,784.02**	
				Prelims @ 16%	£10,205.44	£73,989.46	
				OH&P @ 8%	£5,919.16	£79,908.62	
				Total £		**£79,908.62**	



Notes

IWI to front will require careful detailing to avoid thermal bridges. Below DPC EWI at rear may be required (to avoid PAS non-compliance) not included, suggest circa £3,000. Full air pressure testing and careful remedial works will be required to reduce airtightness down to 5. Floor insulation is 1/3 solid and 2/3 suspended timber - dependent on site conditions insulation sprayed from floor void may be possible.

SOME FINAL THOUGHTS

As can be seen from the archetype tables, achieving EPC band C in many archetypes is relatively straight forward. However, the work required to take significant steps towards a nearly zero carbon home and move though EPC band C into EPC band B is significant. However, through this transition, the space heating demand drops by more than half in houses and more in flats.

In some cases, the introduction of CMEV and MVHR initially tends to have a negative effect on the SAP score as auxiliary energy is being introduced to power the fans in the ventilation systems. In some cases where the home is at the lowest end of the EPC banding, the introduction of mechanical ventilation systems even drops the EPC banding. However, the space heating demand continues to drop.

Our experience is that CMEV is less disruptive for residents and takes less space as the unit is smaller and there is less ducting, hence its selection for flats. However, from the point of its selection, MVHR will produce similar or marginally better SAP scores but always lower space heating demand. Once a low carbon heat source is introduced this gap opens up and stays consistent.

It is clear that, in many cases, a significant impact can be made upon EPC bandings, SAP ratings and, more importantly for residents, space heating demand and fuel bills, by following a fabric first approach with a ventilation package. When carried out within a PAS 2035 compliant strategic asset management programme with medium term improvement plans, this may enable better value low carbon heat and potentially new technologies to be introduced later. Whatever strategy is adopted across a portfolio, it must achieve the highest possible carbon reduction in the shortest possible time.

In considering whole life carbon, and particularly short term emissions, some emerging thinking is suggesting that if a low carbon heat source, such as an air source heat pump, is introduced, the embodied carbon of some fabric first measures (e.g. triple glazed windows) may never be recouped via better performance since the additional heat lost, via a less efficient product, is so low carbon. Detailed analysis of this area will require the use of product databases of embodied carbon which will change over time as industries decarbonise. An article on this emerging subject can be found here.

When considered as a cost per m² for the total retrofit works package, a very wide variance is seen ranging between circa £750 and £1800 per m². The key issue is the form factor where an archetype has a higher ratio of heat loss elements e.g. floors, walls and roof, compared to its usable floor area. As can be seen in archetype 7 (a bungalow) achieving a net zero ready retrofit is prohibitively expensive compared to other archetypes. This should be taken into consideration in your organisation's strategy.

The toolkit is intended as a guide only, but Baily Garner will be taking data from our ongoing retrofit projects to update the information presented and to produce new information to develop a library of archetypes as used in the toolkit.

We are all facing a climate and ecological emergency and the time to act is now. Retrofitting our old and poorly performing existing homes will help residents and is a crucial part of reaching net zero as soon as possible. However, it is difficult and expensive. This toolkit should assist organisations to shape their strategy and take practical steps to start retrofitting their existing stock now.

Designing, Specifying, Installing

Nigel Newman

Director of Strategy and Growth

Raven Renewables®

Taking Control – Raven

- We need more homes ……
- We need more sustainable homes …
- We need more affordable homes …
- We need customers who are engaged with the net zero agenda ..
- Business Plan pressures …
- Ambition to diversify ….
- Maintaining growth, building sustainability and resilience …
- Building upon our environmental commitment ….

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Taking Control – Renewable Installations

- Design and specify new systems

  - Heat Pumps – ground and air source
  - Solar Energy
  - Battery installations
  - EV charging points

And next?

  - Retrofit Co-Ordination (possibly !)
  - Insulation (possibly !)

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Rising to the Challenge – Skills

- Investing and growing existing core skills
- Building capacity and expertise in Raven
- Building the right working environment and employee offer
- Building relationships for the future
- Creating apprenticeships
- Creating a scalable model for growth

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Where?

Current Markets - London and South East

- Developers and housebuilders
- Local authorities / housing association and charities
- Grant Funded schemes as designer, installer

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Raven Renewables

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Questions?