OPTIMISED RETROFIT PROGRAMME

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Active Building Centre Research Programme

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Glossary

ASHP - Air source heat pump – Air source heat pumps (ASHPs) takes low-grade heat from the outside air and convert it into heat for use in providing central heating and hot water. They are best suited to "off-gas" properties.

EPSRC - The Engineering and Physical Sciences Research Council is the main funding body for engineering and physical sciences research in the UK.

IES - The Intelligent Energy System includes two thing – a smart meter and an Intelligent Energy System. This collects information about how energy is used in your home and figures out how it can be managed in the most energy efficient and cost-effective way.

LA - Local Authorities

MVHR – Mechanical Ventilation with Heat Recovery -a system of ventilating buildings, in which heat is recovered from the exhaust air stream to preheat the fresh air intake. Normally there are two sets of ductwork, both connected to an air-to-air heat exchanger, with the air flows in the supply and exhaust branches carefully balanced

Optimised Retrofit (ORP) is a whole house, pragmatic, approach to decarbonising existing homes. It is far more sophisticated and bespoke than previous schemes. It takes into account the fabric or materials homes are made from and the way we heat and store energy. It also takes into account how energy reaches our homes. It is open to Registered Social Landlords (RSLs) and local authorities (LAs) to install a variety of home decarbonisation measures in existing social housing stock.

PAS 2030 – 2017 Specification for the installation of energy efficiency measures (EEM) in existing buildings.

PAS 2035 – Retrofitting Dwellings to Improve Energy Efficiency: Specification and Guidance

Passivhaus – A low energy building standard. Passivhaus Institut (PHI) originator of the Passivhaus movement and of the Passivhaus Standard

PV – Solar Photovoltaic panels

RSL - Registered Social Landlords

Retrofit Assessor – Carries out all assessments of a retrofit

Smart meter – As the next generation of gas and electricity meters, smart meters have an accompanying in-home display to help residents keep track of the energy used in their homes, cutting out the need for meter readings. SPF – Seasonal Performance Factor. A metric usually used for heat pumps, boilers and other space heat generating technologies.

TLO Tenant Liaison Officer

Thermostat – A thermostat is a component of a heating control system which ensures the temperature is maintained at a set level.

UKRI – UK research and innovation. UKRI is a non-departmental public body sponsored by the Department for Business, Energy and Industrial Strategy (BEIS) and the UK's largest public funder of research and innovation

Descriptions taken from: Glossary from The Retrofit Academy CIC TRA_Glossary_2019-1.pdf (retrofitacademy.org); Resident Information - Optimised Retrofit (optimised-retrofit.wales)

1 Introduction

The main aim of this report is to present an outline of the key barriers and facilitators that influence whether homes are retrofitted with low carbon technologies. This study included an exploration of people's experiences of the retrofit process.

The Healthy Living in Low Carbon homes study was a pilot study aimed at examining the impact of low carbon homes on older people. An initial aim was to better understand if low carbon homes may bring health, social and financial wellbeing benefits to residents. The project also explored older people's motives and decisions to agree to retrofit and the ways in which low carbon homes can potentially modify people's energy behaviours and social practices.

About the Active Building Centre Research Programme (ABC-RP)

The Active Building Centre Research Programme (ABC-RP)¹, funded by the Engineering and Physical Sciences Research Council (EPSRC) as part of the UK Research and Innovation (UKRI) Transforming Construction Challenge, is delivering an evidence-based transformation of the UK's built environment.

As part of its activities the Active Building Centre Research Programme is supporting Welsh Government Optimised Retrofit Programme (ORP) as an opportunity to be part of this particular route to low carbon via retrofit within social housing.

Discussions with the WG ORP team revealed key areas of interest from our ABC research activity including:

- Tenants' motivation for taking part in ORP (or their refusal)
- How new technologies are understood, interacted with, and adopted
- What can be learnt from the early ORP process
- Understanding attitudes and behaviours towards the process and living with the new technologies

What is Optimised Retrofit?

"Optimised Retrofit" is the Welsh Government's programme to test a way to decarbonise Welsh homes, based on the recommendations of the Jofeh Report published in July 2019.

¹ About Us - Active Building Centre Research Programme (abc-rp.com)

It is a whole house, pragmatic, approach taking into account the fabric of homes and the way that energy and heat is supplied, stored and used. The programme is trialling different upgrades in different locations and includes installation of solar panels and batteries, heat pumps and intelligent energy systems. It requires analysis of different parts of this process.

Research overview – ABC-RP Healthy Living in Low Carbon Homes

The Healthy Living in Low Carbon Homes (HLILCH) research was primarily focused on 'consumer' or 'end-user' experience. This specific research was focused on those people having their homes retrofitted with low carbon technologies as part of the Welsh Government ORP scheme. With an ageing population, there is an increasing need to understand the housing needs of older people. Research shows that less than 10% of those aged 65+ are not living in a traditional home environment (Wahl et al 2003) – however with ageing there is greater likelihood of increasing requirements to support independent living. The age group 85+ is the strongest growth dynamic in many societies (Oswald & Wahl, 2004). Understanding how older people interact with zero carbon technologies and the potential impact on their health and wellbeing is therefore important work. This is particularly so when it relates to the design of low carbon thermal systems which need to be flexible, particularly around when to heat and to what temperature (Day, 2015).

The overarching research question for this project was:

What are the barriers and facilitators that influence whether homes are retrofitted with low carbon technologies?

- The ABC Healthy Living in Low Carbon Homes team conducted research related to WG ORP from January 2021 to January 2022. The research deliverables focussed on tenant's motivation for taking part in ORP, how they understood, interacted with and adopted the new technologies in their homes and what could be learnt from the ORP process to date.
- The research involved the design and use of pre and post retrofit surveys and qualitative interviews with tenants; interviews and focus groups with professionals from Welsh Government, Local Authority Housing Associations (LHA) and Registered Social Landlords (RSL) taking part in ORP and documentary analysis comprising review of past related research and reports and also a review of readability of tenant's engagement materials.

The project underwent a number of staff changes, with both Sarah Hillcoat Nallétamby, and Charles Musselwhite, the two co-investigators leading the Healthy Living in Low Carbon Homes project, both leaving the project, Sarah in October 2020, and Charles in August 2021. While a research assistant Aled Singleton supported the project for three months in summer of 2021.

The impact of Covid-19 on the research

It is worth noting from the outset that Covid has impacted considerably throughout the project. The whole of this first phase of ORP was undertaken during lockdown or some other form of restrictions instigated as part of Welsh Government Covid-19 responses. This caused significant delays in initial planned retrofit activities, and then on the continued approach to delivering the programme. Similarly, the design and conduct of the research had to be amended without the possibility of face-to-face tenant engagement in recruiting to the study or conducting in-person interviews and with amendments required to survey tools to include questions about the possible impact of Covid-19 on responses.

Public Involvement -Expert Panel and Advisory Board

Public involvement as intended with this research aims to include discourses and shared learning between diverse stakeholders and improved understandings of the different and possibly competing value sets of those involved in the transition (Chahal, 2012). Public involvement and engagement were embedded throughout the research via a specifically recruited expert panel and advisory board. The expert panel (EP) comprised entirely of older people (n=6) and an advisory board (AB) with a mixture of lay older adults (n = 3) and co-opted members (7) from stakeholder organisations and individuals (e.g. NEA, Public Health, Housing Learning and Improvement Network (LIN), Care and Repair Cymru, independent architect, and professor of Ageing and Digital Health) were recruited to support the research activities. Members of both roles (EP and AB) had specific lived and/or experiential expertise across sectors and disciplines (e.g. low/zero carbon technologies in a housing setting; health, fuel poverty, housing – particularly social housing and energy efficiency schemes). The EP and AB contributed amongst other activities in the conceptual model discussions, design, reviewing and redesign of marketing materials, review and piloting of data collection tools and providing perspectives on the ongoing project, challenges and report preparation.

Report Aims

This report provides an understanding of ORP from the perspective of tenants who have experienced the retrofit process and professionals involved in the process. It provides additional background to the process of tenant engagement and the general context within which the research is set.

The report continues with the following sections; Section 2 provides a summary of the ORP aims including briefly, the drivers and policy context; Section 3 provides greater detail of the mixed methods approach taken, including more details of the sites and people involved in the process as well as the supplementary documentary analysis and assessment of tenant engagement materials; Section 4 presents the main findings from the tenant interviews and surveys and the housing professional interviews and focus groups and results of the documentary analysis and assessment of tenant engagement materials; Section 5 discusses some of the key learnings within the context of the research activities; Section 6 provides some recommendations for future activities.

2 Optimised Retrofit and Context

Energy use has become an increasing important issue for the Welsh Government (WG) in terms of addressing the three main energy policy objectives of climate change, energy security and fuel poverty. There were an estimated 1,437,600 dwellings in Wales² in March 2020. These homes are responsible for 27% of all energy consumed and 15% of all demand-side green house gas (GHG) emissions³. Owner occupiers account for the greater part of housing stock at 70%, with registered social landlord stock at 10% and Local authority stock at 6%, the remainder 16% is private rental¹.

The Welsh Government Innovative Housing Programme (IHP) was launched in 2017 as a blueprint to creating 20,000 additional affordable homes. The first three phases of the IHP focused on new build innovation and the change of use for existing buildings. The fourth phase

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² <u>Dwelling stock estimates: as at 31 March 2020 | GOV.WALES</u> [some data collections feeding into these estimates were cancelled due to Covid and components have been estimated. There is greater uncertainty surrounding the dwelling stock estimates for March 2020.

³ National Atmospheric Emissions Inventory, (2016). Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2014, p. 74 cited in Better Homes, Better Wales, Better World; Decarbonising existing homes in Wales; Report to Welsh Ministers from the Decarbonisation of Homes in Wales Advisory Group 18 July 2019 Independent review on decarbonising Welsh homes: report (gov.wales)

includes innovation within retrofit of existing buildings. The retrofit approach taken is largely based on the recommendations from the Advisory Group on the Decarbonisation of Homes in Wales (Jofeh Report published in July 2019)⁴. Here we focus on social housing, identified as a "test-bed" for WG Optimised retrofit.

In Wales, decarbonisation and housing are two of the cross-cutting priorities in the Prosperity for All National Strategy (Welsh Government 2017). The decarbonisation program requires Welsh homes to have reduced carbon demand by 80% by 2050. Furthermore, the Well-being of Futures Generation (Wales) Act 2015⁵ is a unique legislative framework for climate policy. The Act merges key policy issues such as climate change with prosperity and public health so that all policies contribute to sustainability and to prevent persistent problems such as poverty, health inequalities and climate change. It includes the legal obligation to improve our social, cultural, environmental and economic well-being. Reducing fuel poverty is also central to WG decarbonisation and social justice objectives⁶. Current energy performance of housing stock in Wales contributes to the circumstances where it is thought that 12% of households are living in fuel poverty (Welsh Government, 2018). The link between poor housing and poor health is long-established, dating back to Chadwick's (1842) report on sanitation. The Black (1980) and Acheson (1998) reports have emphasised housing as a health inequality issue and considered decent housing as a key pre-requisite for health (Pevalin, Taylor & Todd, 2007). Poor housing can contribute to poor health including increased mortality but also may reduce quality of life and exacerbate inequalities (Marmot, 2020; Marmot et al., 2008; WHO, 2018).

What is Optimised Retrofit?

The aim of the ORP phase 1 was to help test the approach, identify good practices in optimising the benefits across the whole process including procurement, surveying and installations. "The intention is not to upgrade all homes to zero carbon this year but to learn how to upgrade homes well, at an optimised cost, setting us on the right path towards the decarbonisation of all homes in Wales.[...] It require the critical analysis of every part of the process from survey and procurement to post completion support and monitoring to ensure the 'optimum' benefits and impacts are realised."

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⁴ Written Statement: The Optimised Retrofit Programme 2020-21 (6 November 2020) | GOV.WALES

⁵ Well-being of Future Generations (Wales) Act 2015: <u>The Well-being of Future Generations</u> | <u>GOV.WALES</u>

⁶ Financing-Wales-Housing-Decarbonisation.pdf (neweconomics.org)

⁷ https://gov.wales/written-statement-optimised-retrofit-programme-2020-21

A competitive application process for Registered Social Landlords (RSLs) and Local Housing Authorities (LHAs) to participate in the scheme was commenced in August 2020 Applications were to be submitted by the 13th September 2020 with successful applicants notified by the 12 October 2020 and ready to have an 'on site' start date of no later than the 8th of January 2021. There was an expectation that retrofit work would be completed/money committed by end March 2021.

Four schemes secured funding and included are from local authorities with a fifth being a consortium involving 27 social housing providers from across Wales.

What does ORP entail in this Research?

The plan for ORP phase one was to better understand and carry out a combination of building fabric improvements and low and zero-carbon technologies (such as solar panels, battery storage and heat pumps), as well as use of intelligent ongoing systems (IES) to support optimum use of technologies.⁸ This mean that each individual property might need slightly different adaptations to achieve the required low carbon footprint (and over a planned period of time.

3 Methods

Approach

This study aimed to explore barriers and facilitators for tenants to take up the ORP offer. This was a mixed-method study, using surveys and qualitative interviews, along with a documentary analysis of retrofit tenant engagement materials and interviews/focus groups with professionals involved in the Optimised Retrofit Programme, as described within each section, below. All homes included in the case sites were social housing.

Ethics and Anonymity

Ethical approval was granted from the College of Human and Health Sciences Research to support this ORP research (12050d) and for including housing professional interviews (19102a) as an amendment to research planned and conducted as part of the ABC HLILCH research in new build homes (181219b)

⁸ Home - Optimised Retrofit (optimised-retrofit.wales)

Anonymity Statement

We have endeavoured to anonymise all findings from the research. However, the study involves a relatively small number of organisations and individuals and details of their participation in the Welsh Government's Optimised Retrofit Programme and Innovative Housing Programme are in the public domain. Therefore, we cannot guarantee that all information which may identify case sites, housing professional participants, or tenants has been removed, although every effort has been made to avoid this through use of ID numbers and anonymisation of place names, organisations and localities.

Project Time frame

The Healthy Living in Low Carbon Homes Optimised Retrofit WG ORP data collection ran from January 2021-January 2022. In October 2020 the research team were introduced to the WG ORP plans and personnel from WG launching the scheme. At this stage the ORP aims of this research were identified: to explore barriers and facilitators of social housing tenants to take up the ORP offer.

Those RSL/LAs successful in their bid had to commit to an 'on site' start date of no later than the 8th of January 2021. The research team required a full year, incorporating all seasonal changes preferably to complete the full cycle of surveys and interview. The project end date of February 2022 remained fixed.

Case Sites

The whole ORP initially had around 1200 homes on the programme, consisting of four local authorities and a consortium comprised of twenty-seven registered social landlords. These sites were divided between the Swansea team and a team at Cardiff Metropolitan University for different research purposes. Delays to the ORP meant that only five case sites are included in the study, with only three of the sites involving recruitment of tenants. Housing professionals from two remaining sites however, did participate in focus group/interviews.

To take homes to their lowest achievable carbon footprint generally requires a combination of fabric improvements and installation of technologies. A summary of the sites and their ORP typology is presented in table 1 below. In short sites included: Site A - a Hybrid system Air Source Heat Pump (ASHP) and solar installation with building fabric improvements; Site B - Solar panels and battery and building fabric improvements; Site C – Hybrid ASHP and oil; Site D carried out on void properties as a trial. Site E was Housing with care and was approached but retrofit works were being undertaken on supported living units with care, which

would have required NHS ethics, the timeframe of the works meant it was impossible to obtain approval within the allotted ORP timeframe. Due to the requirements on fabric improvements this may mean that each individual home requires slightly different upgrades to achieve the status required. This was attempted to be captured in a 'home passport' and was performed by the RSL/Las as part of an initial home review prior to any ORP activities. The passport aims to consider renovation/retrofit roadmap over a period of time providing a pathway to the end goal. With potentially different starting points, it is therefore quite difficult to compare experiences across sites as well as within sites as the upgrades are not the same.

Table 1 Optimised Retrofit Typology in Case Sites

C	G		
Case Site Site A	Start - completion 12/10/20- ongoing (6 pilot houses completed 31/5/21)	No. houses 44 2 refusals	ORP technologies and fabric improvements (if done) Fabric improvements, PV, Battery storage, Hybrid system Air source heat pump (ASHP), electric heating, IES = Passivsystem, Data monitoring Challenges: 17 batteries/installed 10; supply chain issues; 45 hybrids – installed 24; a number of issues inc. connectivity - led to pausing the hybrid install. Programme on hybrids is on hold until resolved
Site B	21/10/20- 31/07/21	55 5 refusals	External Major Repairs + ORP: Fabric improvements, Glazing, Insulation, PV, Battery and water tank, IES system and data monitoring [Additional education within retrofit team: PAS2035 Advisor City and Guilds Energy Awareness; Technical training (data literacy, PV and battery installation); PAS 2030, MCS accreditation]
Site C	04/01/21 - ongoing Main ORP activity commenced Oct 2020	Completed 39 of the 57 planned 24 refusals-	Rural - Hybrid Retrofit: Hybrid System ASHP, electric heating; PassivSystems, data monitoring [Additional education within retrofit team and tenants: PAS2035 (planned) Carbon literacy training for 'champion' residents] Challenges included refusals, Contractor not local Residents not having wifi/pre-paid meters in place. Refusal reasons given were: covid, age related issues, illness
Site D	04/01/21- 16/04/21	7 void homes	Void Retrofit Programme Fabric improvements, Triple glazing, Electric heating, ASHP, mechanical ventilation heat recovery (MVHR), Energy generation TBC, IES -Tyrell Products SmartDB-36, data monitoring Aims to achieve 65% average CO2 reduction; and design scalable model that can be used across 2,096 more homes.

Case Start Site completion No. houses ORP technologies and fabric improvements (if done)
Site E Housing Retrofit works were being undertaken on supported living units with care, requiring NHS ethics and it was impossible to obtain approval within the allotted ORP timeframe

Conceptual Model

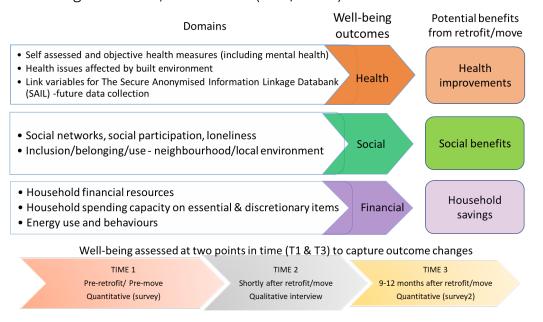
As part of a wider research brief for ABC-RP the researchers conducted a rapid evidence review to explore the role of low carbon buildings and their potential to help alleviate issues associated with poor housing and fuel poverty as correlates of healthy ageing. The review informed the development of a conceptual framework that provided an assessment model for this research (conceptual model – Figure 1) that could facilitate a better understanding of the transition from pre to post retrofit from the perspective of the tenants in their homes.

The model included data collection points to support this.

Figure 1 Conceptual Framework 1: Well-being Outcomes

Conceptual Framework:

well-being outcomes, domains & (cost/value)benefits of low carbon homes



Data Collection Tools

Surveys

The survey tools were developed in response to the rapid evidence review, and discussions with the expert panel and advisory group. The bilingual surveys were developed for T1 (prior to retrofit) and T3 (9-12months post retrofit). A brief survey was also designed to capture reasons why the offer of the retrofit was declined.

As well as collecting demographic data to enable data linkage in the future, the surveys collected data on:

- Health self- reported, mental well-being (Short Warwick-Edinburgh Mental Wellbeing Scale), existing illness (respiratory, cardiovascular, rheumatic), changes in medication, visits to GP.
- Social Loneliness, social isolation, participation neighbourhood cohesion.
- Financial income, energy expenditure, affordability of key items,
- In addition, we also explored attitudes and energy behaviour as well as motivations for moving/ having home retrofitted.

Surveys were administered using ID numbers and sent out via email links or postal surveys, at Time 1 (T1). Surveys with the same variables were then intended to be resent at Time 2 (T2) 9-12 months post retrofit. This timeframe was amended as delays to the process meant that to capture post data, some residents received post surveys just as their systems were being switched on in October- December 2021.

Interviews

The interview schedule was amended from a schedule used on a similar project in Australia. Permission was granted to use the tool from the lead researcher Dr Trivess Moore. The semi structured interview was intended for use within three months of moving of having the home retrofitted. Again, delays in retrofit made this timeframe impossible as some sites were only completed at the end of the year. Where possible we offered post retrofit interviews to capture as much data as possible, alongside the post survey links.

The semi structured interview schedule explored motivations for taking part in ORP, experience of living with the retrofit, thermal comfort, energy consumption, energy behaviours, sustainability and information needs as well as any recommendations for future schemes. An energy diary was also developed but not used due to Covid restrictions and the ability to post

back the diary, but the topic areas were discussed at interview (e.g. any changes in energy practices post retrofit).

Professional Interviews/Focus Groups

Individual interviews and focus group were held with professionals working on the Optimised Retrofit Programme (ORP). The aim of the interviews/ focus groups was to understand the wider value of the ORP from the perspectives of different groups involved. In addition, we also wanted to explore the barriers and facilitators that influence and impact on the implementation of the optimised retrofit programme. The interview/focus group schedule therefore explored, social value, barriers, and facilitators of implementation. A total of three focus groups and two individual interviews were conducted, participants included Registered Social Landlords, Local Authorities, Tenant Liaison Officers, Architects/ surveyors, and civil servants involved in the ORP.

Documentary Analysis

A documentary analysis of the available tenant engagement materials was undertaken.

The rationale for undertaking a documentary analysis of the tenant engagement materials was to develop an understanding of the context in which the ORP was being marketed to tenants as well as to assess how accessible the engagement materials were. Ensuring tenant engagement materials are accessible in terms of readability and reading ease is important as research indicates that 12% of the population have a reading age of age 11 or younger and that 45% of those of those at Entry Level (school year 7-8), also live in rented accommodation (Millar and Lewis, 2010).

The documentary analysis had three aims.

- 1. To assess the readability of the tenant engagement materials.
- 2. To explore the values underpinning the ORP and how these were framed to tenants
- 3. To critically consider how the call to action was being framed.

A range of tenant engagement materials were accessed from ten RSLs, including three of the ORP case site and included letters to tenants informing them of planned works, newsletters, and flyers. All of the documents accessed were included in the analysis, in order to assess, overall, how the ORP was being framed, whose values were considered, and to benchmark readability and reading ease across the RSLs for who materials were available.

Critical discourse analysis was used to understand power relations and consider ways that calls for action are framed (Grant 2019).

The documents were analysed for readability using the Flesh Kincaid reading level test reading ease (Flesch 1948, Farr, Jenkins, and Patterson, 1951). Both scales use a formula based on word and sentence length, using different weighting factors to provide a score of readability and US education level.

Recruitment and data collection

As indicated earlier, Covid 19 impacted significantly on the planned design of the research. Due to Covid 19 restrictions the researchers were unable to take part in any planned tenant engagement or recruitment events or visit the site locations to hand out recruitment marketing materials and resident interest forms for the study and be on hand to answer any questions arising. Instead the researchers, via the ABC HLILCH project manager were put in contact with tenant liaison officers or equivalent who were visiting the sites as part of their ORP role to hand out the materials to tenants in the three sites in different locations in Wales. The researchers were provided with contact details of homes that had agreed to take part in the retrofit and of those who had refused. This proved to be a difficult recruitment process for a number of reasons; primarily most of the initial recruitment was attempted during Covid lockdown. The tenants were receiving different information materials about the retrofit process from the same people eg Tenant Liaison Officers (TLOs) and it may have been difficult to determine what all the separate pieces of information were about and to understand this as an independent piece of research distinct to the ORP process. In some instances, the Resident Interest Forms were completed by the TLOs and returned and on contacting the resident to introduce ourselves and them to the research some had little recollection of the research information or of signing up to register their interest to be involved. We attempted to contact tenants up to three times, via mail or phone (if the details were available to us) to confirm willingness to participate and introduce ourselves and the research. The reliance on mail outs was also problematic due to issues around freepost and access to University mail. Similarly, distribution of marketing and recruitment materials via the tenant liaison officers, was also not ideal due to their own difficulties in efforts to deliver these.

It was hoped that tenants would agree to do a pre and post survey and if they were aged over 50 years old a post retrofit interview. The initial Resident Interest Forms and the pre-survey included options to indicate interest in these options, providing a space to leave contact details. All materials, including surveys were bilingual (English and Welsh). Delays in retrofit start

and completion meant it was impossible to gather post surveys at the intended 9-12 month point.

Amendments to Research Conduct

Surveys

Due to the exceptional circumstances caused by researching during a pandemic it was necessary to adjust some aspects of the way the research was conducted and to amend some of the data collection tools - and hence a return to ethics for amendments to be notified and approved. Pre and Post surveys were intended to be delivered, if possible, via an anonymised link to a survey and this remained the same. Additional questions were added to capture what, if any difference Covid 19 may have had on their responses and included additional responses in some questions, an additional free text and a standalone question as follows: Regarding the previous questions, how much do you think Corona virus/ Covid 19 has affected your responses: A lot; A fair amount; Not very much; Not at all.

Interviews

The semi-structured qualitative interviews were intended to be held in person to provide an opportunity for the tenants to be able to show us, if desired, the new technologies and home adaptations facilitated by use of an energy diary if completed. This was not possible to conduct in person and so participants had the option of a phone or a video conference type call (for example zoom, skype).

All 14 interviews were conducted by phone between 6th October and 2nd December 2021 and include tenants from the three case sites where tenants were involved (as per table 1). A key aim was to conduct the interviews between about three and six months post installation allowing time for the residents to have 'lived with' their particular home upgrades. This did not occur as desired due to delays in the retrofit – pushing back timelines before we had to close data collection. Particularly with respect to site C, some of the tenants had only just had their heat pumps signed off when the interviews were conducted and so the system was still very new for them.

Housing professionals

No changes were required to interviews and focus groups with housing professionals as these were specifically designed to add an additional perspective to the study

Approach to Analysis

Data management and analysis

Due to the small number of participants completing the surveys the data were analysed only using descriptive statistics and no inferences can be made from the data with regards to changes in health, social or financial well-being.

The interviews and focus groups were professionally transcribed to enable rigorous analysis and the extraction of verbatim quotes. All transcripts and additional post interview notes were uploaded into QSR NVivo 12 to form the data set for research. The data was analysed using a framework approach, with each researcher taking responsibility for analysing either tenant or professional interviews, two researchers examined the documentary data, due to staff changes. To increase robustness of the process, regular discussions were held to verbally discuss the analysis and interpretation of the data. The findings were drawn together over several meetings exploring similarities and difference in relation to the key research questions.

Resident Interest Forms

In total 36 resident interest forms (RIF) were received. Issues with Freepost hampered, and delayed RIFs and postal surveys being returned. Despite follow up calls to all the individuals for whom a RIF was received, 15 did not respond to additional marketing material/paper version mail outs, repeated phone calls and messages (up to three), and four individuals refused outright, three citing lack of interest and one on health grounds.

Pre survey

A total of seven pre surveys were completed across two sites A and B (Site A n=3; Site B n=4). Site C did not commence the main retrofit until October 2021 and so the option determined to be most appropriate to maximise data gathering was an interview only.

Semi-structured Interviews

A total of 14 semi structured interviews were conducted across the three sites between October and December 2021 (Site A n=3; Site B n=5; Site C n = 6). The interviews lasted between 30 minutes and 1 hr 20 with most around 50 mins.

Post Survey

A total of 2 post retrofit surveys were completed (One each from Site A and B); Site C was not involved in the survey option.

Table 2 presents a summary of the tenant details participating by Site and which aspects of the study they completed. It also indicates some key dates of retrofit start and completion as participants recalled in their interviews.

Table 2 Tenant's interview and survey summary

ID	Household composition	Pre survey date	Interview date	Post survey date	Retrofit start and completion
Site A A2000	couple age range 75-79		06/10/21	Paper copy received 8/2/22	Due to start 01/2020 began 03/20 finishing off Oct 2021 House assessed in
A2001	Couple age range 60-64	08/01/202 1	01/10/21 Declined day of	29/11/21	08/01/2021 work finished in July 2021
A2002	Couple age range 65-69	07/01/21	interview - personal reasons		Started in Jan 2021
A2004	On own mainly age range 45-49	Survey Jan 7 2021	11/10/21		Covid stopped work- all working since August 2021
Site B 1000	On own age range 55-59 Lives with children age range	26/4/21	Booked no reply		
B1006	75-79 Lives with partner and children	20/1/21			Scaffolding early Dec 2020 started at
B1008	age range <50 Lives with partner		19/10/21		end of Jan 2021 Due to start 11/2020 but started
B1011	and children age range <44		30/11/21		3/2021 Signed off 10/2021 Started 2/21 supposed to be 6
	Lives with children	Paper survey			weeks –took 6 months. completed
B1012	age range <50-54	17/6/21	14/10/21		June/July 2021.

ID	Household composition	Pre survey date	Interview date	Post survey date	Retrofit start and completion
	Lives with spouse and children				retrofit work
	Age range 60-64	26/5/21			started 2/2/2021
B1013		survey	11/10/21	30/11/21	completed 15/5/21
	Lives on own				retrofit start end 2/2021
B1015	Age range 55-59		02/12/22		completed 09/21
21010	Tigo tunigo de es	Refusal	0 = / 1 = / ==		03/ 2 1
Site C	Lives on own	survey			
C3001	Age range 70-74	10/2/21			
					Offer 10/21. Heat
					pump installed 1 st week Nov
	Lives on own				switched on
C3002	Age range 60-64		1/12/21		11/11/21
	Lives with partner				Had new windows
	and child				(approx Sept, heat
C3003	Age range <44		22/11/21		pump end October
					Working 4/10/21
	Livrag with north on				(about 10 days installation time)
	Lives with partner and adult child				heat pump /LPG
C3005	Age range 65-69		24/11/21		boiler.
	Couple				12/11/21 heat
C3006	Age range 70-74		1/12/21		pump turned on
~~~~	Couple		1 /1 2 /2 1		
C3007	Age range 60-64		1/12/21		Installed around
	on own				8/2021 signed off
C3008	Age range 65-69		30/11/21		mid Nov)

Despite the limited number of participants, the research team were able to gather survey responses and interview data from tenants at each site (excluding Site D where retrofitted houses were unoccupied) and also interview/focus group data from housing professionals involved in the retrofit process from the case sites.

# Housing Professional Interviews/Focus Groups

A total of three focus groups and two individual interviews were conducted. There were 12 participants in total. Participants included Registered Social Landlords, Local Authorities, Tenant Liaison Officers, Architects/ surveyors, and civil servants involved in the ORP.

# 4 Findings regarding Retrofit Homes

This section of the report will focus on drawing together the qualitative data gathered from both tenants and professionals involved in the ORP as well as the documentary analysis. The main focus of this report is to present the learnings of greatest relevance to WG ORP team regarding the barriers and facilitators to retrofit.

Analysis of pre and post surveys has shown no change with regards to health, social and financial well-being. This is a result of delays to the retrofit programme and the planned timing of the pre and post surveys being significantly condensed from the planned 9-12 month follow up, and on the limited number of participants from which to extract data. Many of the participants who responded to the post survey, or the post interview had only recently had the system turned on, so it is too soon to see changes with regards to the health, social and financial benefits of low carbon retrofit. For this reason, this data will not be presented. However, reference will be made pre survey data to describe the sample and motivations for retrofitting, and energy behaviours.

#### Information and Communication

Information and communication were identified as key issues of concern by both professionals and tenants.

For professionals' information and communication both within the organisation, and between RSLs was perceived as lacking causing uncertainty within the process.

But personally, I didn't feel comfortable encouraging them to go for something that new because I didn't know enough about the system myself, there wasn't evidence of it actually working. If tenants were actually making a saving of it as well. (Professional PRF007)

So I think like [PRF0006] mentioned earlier, it's kind of been lumbered on certain team members, or certain members of housing, to kind of lead on the engagement, lead on the information, lead on the, to reassure tenants, but without actually having information and not knowing exactly all the information required. That's been, yes it's been quite hard really. (Professional PRF0007)

I think we've been quite rightly or wrongly we've been relying on using the steering group check form to see all these directives that we didn't – so we have the summary, the good news, so and so got four homes so and they've progressed," and you start panicking already, "I haven't started mine yet." [Unclear 00:59:51] only hear the good news and you are far behind. There is a number of occasions that I have had to phone up the project manager to actually test out if we actually are far behind, and we're not, because I can only hear good things from people. (Professional PRF0001)

While what communication there was between RSLs tended to focus only on the 'good news' stories, this contrasted with what was happening on the ground.

I think – and I'll be careful what I say, because we are being recorded. But it seems like a lot of the communication is about what a brilliant project it is and how well it's going, and that, when you speak to the practitioners and the [unclear 01:00:22] who are having to run it, that's just not our experience (Professional PRF0002)

Similarly, there was also a lack of consistent messaging among contractors and tenants with different engineers giving conflicting messages, which has implications for tenants and how they use the technology.

Yes, I found the same as well, on the same topic as you've said now, is when we've had different engineers coming out to do the handovers with us and the tenant. Every engineer that I've spoken to, they say different things. So it's not consistent, the information that we're getting is not consistent at all (Professional PRF0007)

The lack of accurate information or training also fed down into interactions with tenants, with potentially negative consequences in term of operation of the systems.

It's like an example, I had, I did a street, a full street of surveys, had about 24 in the street. Went to each tenant there to speak to them, with one of our operatives from [RSL4], and he was shadowing me, but he didn't say anything. And when I did the first commission of handover with [company 2], [company 2] explained the system to the tenant, and everything that I said to that street was wrong, I'd been given. Then I had to go back and speak to all those tenants again, because I know I didn't explain myself correctly to them. (Professional PRF004)

#### **Tenant Engagement Materials**

The issues with communication also extended to communications between RSLs and tenants. The analysis of the tenant engagement materials created by the marketing companies and then often summarised by RLSs found the documents provided to be too technical, and were aimed at a university level reading age, overlooking the high levels of literacy issues in social housing as indicated earlier in the document. Indeed, only one RSL (not one of the case sites) produced materials that were accessible. The inaccessibility of material was also reflected in the narratives of the professionals, with one noting that materials were not produced in other languages nor were they bilingual.

I mean you have to realise, it's what everyone always thinks, with the marketing materials and the information you give out to tenants, we have to be – just in the one that I was doing – you have to understand that in areas of deprivation within social housing, probably as a rule, there are going to be a high levels of probably literacy issues, and there's lots of people that – materials and not being produced in – well, we haven't produced them anyway, in other languages at the moment. [marketing company] haven't provided them in Welsh even. So you've got lots of issues where people don't necessarily

have technical knowledge, and then also, you throw in words to them 'optimised retrofit,' (Professional PRF0002)

In an attempt to make the materials produced by the marketing companies accessible, some RSLs condensed the information, or it was rewritten before being given to tenants.

The pack from [Marketing company] from the project, is helpful to me as a person professionally, so I understand what it is that we have to do for customers or when we're talking to people, I didn't use any of that. I didn't use any material with the tenants. And it would be thrown to the bin straight, not interested, what does it mean optimised retrofit. So I condensed that. How many pages, I don't remember, it was really small print wasn't it (Professional PR0001)

There were eight pages, double sided, lots of technical terms, and drawings that people wouldn't understand. So, we think – I had a go at it, I reduce it down, but the problem was that I was familiar with it at that point. I was familiar with the products. So I've given it to a colleague. I had a go at it, and then I gave it to another colleague, and I said "right, go through that. Anything you don't understand take out, anything you've got some questions about, ask me and I think I did explain it," (PRF0002)

#### While others produced their own resources.

That I did create, because right at the beginning we didn't have any information to be honest. Like he said, we would just Google some things to try and obviously educate ourselves. So, I did create like a webcast of questions that I had from the tenants and like forums online, easy read document, how-to guide. So, I've created all them, my own really. So it would have been ideal right at the beginning if we had all those documents ready for us to go out so we knew 100% what we were talking about, and we felt comfortable trying to encourage the tenants to actually buy in to the scheme. (Professional PRF0007)

The accessibility and ease of reading are important factors in the ORP as the extent to which net zero targets will be achieved will be tempered by the ability of social landlords and policy makers to effectively engage with tenants (Genus and Theobald, 2016).

Indeed, it has been argued that to date sustainable discourses have been shaped by 'middle class, tertiary educated urban policy makers and environmentalists' (Beasley, 2019). The analysis of the tenant engagement materials would indicate that this is the case. The tenant engagement materials were positioned around climate change targets and framed as 'this is something that Government says we must do' yet when asked in the pre survey what was important in the decision to retrofit their homes, although respondents mentioned climate change, energy and cost saving were generally the priority. This was consistent with professional views of tenant priorities.

I think the vast majority of the people, and we have to remember again this is social housing, the vast majority of people will be more interested in "am I going to save money on my heating bills and just generally? "Now the decarbonisation but is important, and I think it's probably more important to us and the Welsh government than it possibly is to the tenant. You would get a handful who would be interested in becoming part of the decarbonisation and upskilling themselves maybe through carbon literacy training (Professional PRF0002)

Climate change is quite nebulous or is it nebulous and we won't make any progress on that unless we're offering people something tangible, something better. (Professional PR00010)

Of some concern, was the admittance by one social landlord that they were only giving tenants aged 60+ years 'the big picture' as indicated in the narrative below.

So with the over 60, I've been very, very limited on the information that I'm giving, I'm just giving the bigger picture, saying we have things that we have to do, basically we do it on trust. We have to do this, if you want to know more about this, obviously we're quite happy to come and sit down and talk about it with you, or otherwise let us get on and you can contribute to the bigger picture. So, I've been lucky in a way that none of the tenants at the flats object to what we're doing. But they haven't seen the IES yet. (Professional PRF001)

For uptake of the retrofit offer to be successful, tenants must be given the full picture, with adequate information about the process, technologies being fitted, timescales of the work and level of disruption expected. The information given must also reflect the tenants' values and priorities. As well as being accessible, and not overly technical.

#### Information and Communication: Tenant Experiences

Information and ongoing communication were expected by tenants throughout the process. In the first instance people wanted to know what the retrofit process would entail, when it would commence, including who was coordinating the work (with subcontractors involved), overall time frame, installation process, and likely impacts on home environments.

However, on case site B, tenants reported they were unaware that their homes were having low carbon technologies fitted.

All we got a letter was saying I think it was in September saying, "You're having a new roof." So that's all we thought we was having was a new roof. We didn't know we was having solar panels. We didn't know we was having stuff done on the property, like the insulation. We didn't know nothing, it was just a letter saying, "You're having a new roof." That was it. (Tenant B1008)

It's literally just an A4 piece of paper, I remember that, just an A4 piece of paper saying they were going to start on this date and saying they were going to have a new roof and the outside doing. (Tenant B1011)

Some tenants in Site A mentioned that they had had the opportunity to meet up at a community venue and various options about fabric improvements to the properties were discussed.

Do you want your hedge cutting down?" which I did. "We're going to be doing houses." Just told us everything they do, you can pick your pebbledash colour and do roofing and stuff like that, and then they just started (Tenant A2004).

It does not appear that any there was any discussion about the solar/hybrid system. In contrast other tenants at the same case site felt well informed.

A woman from the council came initially "She came with another girl and explained a lot to us and she sent me a big pack of information about it. I feel like we were well informed on it but it didn't go as it was planned but it, it was, you know, yes I can say yeah, we were informed well. (Tenant A2001)

Another tenant reported having had no information but learning from neighbours that work was to commence.

*Int:* So you didn't really have anything written down?

Res: No, no. Just words of mouth [...] A couple of people said, "Oh, we're getting houses done." "Oh, are we?" A couple of weeks later it all started a Tenant Liaison Officer who would come round and explain that something needs to be done, or can you just make sure your door's open at 10 o'clock in the morning? They were usually there on time, so pretty good. They way they've been, especially with Covid and stuff. (Tenant A2004)

The different experiences reported even within the same sites may indicate that written information was not getting through or read. Covid 19 no doubt impacted on TLOs ability to visit properties and may have affected tenants' comfort in interacting with people at the time and thus receiving any written or verbal updates.

Even when information was given it was not as detailed or as accurate as tenants would have liked and it may well have been that those involved in this initial information dissemination (eg. tenant liaison officers) were not entirely aware of all the details themselves.

RES: None (information). I had a phone call, saying the council are trialling these new air source pumps, would I be interested. I said, yes, carry on They came out, they did a survey, and they said, "It'll be this big, it won't be intrusive, it's quiet as a mouse." And I'm, "Yes, go for it, do what you want." This thing is a monster – it is huge. It is noisy. [...] Outside my kitchen window where they've put it (the heat pump), I had plant

stands. And they're, "It's not as big as those plant stands, you won't even notice it's there." It's twice the size. And it sticks out further and all sorts.

*INT:* So, do you think they didn't know that then?

*RES:* I don't think they did (Tenant C3003)

Tenants also wanted information about the technologies and how to use them effectively. They wanted ongoing support on the new technologies installed, for example instruction manuals and verbal information on correct operation. Also importantly, what would happen if the technologies and interfaces to operate them were not fully understood or did not appear to be operating as expected or there were any problems- who would they turn to for help and report any issues to?

There was a general lack of understanding of the technologies being fitted suggesting information provided (if it was) was too technical.

I didn't understand everything, don't get me wrong [laughs]. [...] I can't criticise, I think it was just because it was new to me. It wasn't maybe lack of words; it was 'cause it was new to us. I'd never heard of it. I didn't understand how the boiler would work and you know, it's not, I felt like the information... My husband kind of read it and didn't kind of click on it. He was like oh I don't know, but I, you know, yeah. It's all new isn't it? We don't really know, you know (Tenant A2001)

It was helpful for people to have information provided to them both verbally and in writing. As several people mentioned the technologies were all new to them, including the language of retrofit and carbon reduction/renewable energy as well as in many cases operating systems via apps on phones or other devices. It seemed to be appreciated that there was a visit from 'someone' (TLO or other) who could explain what was going to happen and who would be at the other end of a phone if needed.

The opportunity for tenants at site A to meet up at a community venue and discuss various options about fabric improvements and choices they could make regarding colour of pebble-dashing for instance seemed a useful mechanism. Although it did not appear to feature information about new retrofit technologies eg heat pump /solar panels at this time it nevertheless seems like a positive way to let multiple people come together and talk about, and if possible demonstrate any new proposed technologies People then may have a better idea of what the retrofit would entail and prompt any questions.

There was acknowledgement among some professionals interviewed that tenant engagement was lacking and this could contribute to refusals

Yes, yes. We're certainly getting a number, an increasing number of objections, obviously we're one step away from the landlords who are doing the work. But there have been reports of landlords reporting tenants that are refusing or not refusing of, are very cautious around electric, switching to electric heating, particularly with bills rising, which makes sense at the moment. We often get anecdote and I don't know how well this is researched about. So some social homes still have direct or indirect electrical storage heaters. And ideally, we'd like social landlords to put in central heating systems linked to heat pumps. But we get with feedback and I don't- but things the replacing direct electric heaters is much cheaper than putting an air source heat pump, so landlord say, "Yes, well the tenants like it, because [s/l it's different 00:21:11]." What I don't know is how well they've actually engaged and explained what, why and you know, and the benefits to the tenant about you know, the fact that if you've got a central heating system, your home potentially could be more consistently warm. Sorry, yes. So yes, the technological, yes, the piece of work that we're not doing well is about the engagement. (Professional PRF0010)

But yes, there's a lot to learn, there's a lot of things that have not gone quite well. I think that was just the lack of information and possibly evidence that we could have shared with the tenants [...]about having something new in their homes. And possibly how to use the system as well. But yes, so that's my job anyway. (Professional PRF0007)

#### Information about the Technology and Optimum Use

Post retrofit, tenants also want information on the operation and ongoing support of the new technologies installed, for example instruction manuals and verbal information on correct operation. Also importantly, what would happen if the technologies and interfaces to operate them were not fully understood or did not appear to be operating as expected or there were any problems - who would they turn to for help and report any issues to?

It was apparent that there was some uncertainty as to how to operate the different technologies – with several commenting on the lack of written or verbal information provided to them. Some commented that they were learning as they were going along.

If that's one complaint I had to have, would be communication was poor. ...] We've had to wing it between us, me and my wife really. We're learning as we're going along because we haven't been given a handbook, or we haven't been given a little chat by somebody or anything. We've sort of got on with it, you know (Tenant B1013)

An issue raised by the professionals, was that some tenants were not using the systems properly, adjusting the heating from the thermostat on the wall, which was more expensive than using the app.

And it's one thing as well that we identified a few weeks ago, well if the tenants, maybe [PRF007-other FG participant]'s aware of this, I think. If the tenant doesn't use the App, if they use the house thermostat, it costs more to run... Because the system's

working harder. So then when you like, [PRF007] will know the feeling on this one, when we meet some of the tenants, a lot of them, they haven't got a clue what Apps are, they haven't got a clue what anything is. They've got their phone, but when you're trying to show them, "This is the App", they're like, "No, no, no, we want to use the thermostat", then you're like standing there and like, God what am I going to do because they're going to use the thermostat, and then the machine's going to be working harder, so it's going to use more electricity, so it's a lot more — (Professional PRF004 in focus group)

This was consistent with tenant narratives about how they were operating the system as always from the thermostat on the wall, but states

RES2: We've got an app for the heating we can use. -Well yes but to be honest it's easier just doing it the old way.[...] Me personally I just go upstairs and turn it up but there is an app on participant's> phone that she uses sometimes. [...] They programmed it for you didn't they? (husband talking to wife) (Participant B1011)

Some tenants had spoken to those installing the equipment and had been told how to operate their devices/equipment

I remember the man who did the new thermostat for the heating, and he was off out the door, and I went, "Oh sorry, hang on mate. How do I switch that on?" And he went, "Oh, you just best keep your finger on there until you see the plus sign, and then when you want it off keep your finger on it until you see the minus sign." And that was it.

[...] we were always told by the workmen who came and put the battery in, the best advice I can give you when the sun's out, hammer your washing machine and hammer your tumble dryer. That was their easy way of putting it to us, you know (B1013)

It was helpful for people to have information provided to them both verbally and in writing. As several people mentioned the technologies were all new to them, including the language of retrofit and carbon reduction/renewable energy as well as in many cases operating systems via apps on phones or other devices. It seemed to be appreciated that there was a visit from 'someone' (TLO or other) who could explain what was going to happen and that would be at the other end of a phone if needed.

Some of the professionals interviewed, who had tenant facing roles acknowledged the difficulties and were looking at implementing Carbon literacy training for staff but also for tenants.

So now I've arranged some City and Guilds Energy Awareness training, and we'll role that out for our neighbourhood officers, and we'll role it out for tenants as well to try and spread the word, the message wider. I think that's our only option at the moment.

But we've only just now created a solar guide, bi-lingual solar guide, so you know that's taken us this long. So now we'll do drops, you know to the tenants, so they can know exactly how to work it. (Professional PRF007)

The importance of good communication and training for tenants is not to be underestimated. The process is a partnership between the RSL and the tenant and how the tenant engages with the technology will influence how effective it is. Using it incorrectly can lead to higher costs and ultimately have a negative impact on meeting the net zero targets.

For the retrofit, though, we have always said that 50 per cent of it is us installing the works. The other 50 per cent is how the tenants use them. Again, we can have the best will in the world. We can make the most energy-efficient, air-tight property that doesn't lose its heat and performs perfectly, but if you have a tenant that likes to wake up every morning and open all the windows, because they like the fresh air, you know we have got the NVHR⁹ system in there doing it for them, then you are going to very quickly find yourself constantly using your heating to keep your heat and [s/l put yourself in fuel poverty 00:57:30] and then eventually turn round and say, "Oh, this equipment's not working. I am spending more money on my fuel bills. (Professional PRF008)

Explaining the rationale behind, things such as vents and the app to control heating and how they contribute to the overall functioning is important if tenants are to effectively live with the technology.

Some of the learning that we've heard from other local authorities and our work with the [architectural school], particularly along NVHR systems, because there is a vent in every single room, every habitable room, like your living room, your kitchen, etc tenants have plugged the holes up. They have taped them off, because they think there is a draft coming through them. But that can completely knock the system out of balance and then cost a lot of money to run. (Professional PRF008)

#### Ongoing Communication

Information and Understanding (How to use the systems, and new interfaces)

Information was not just required at the start of the project; it was evident from tenant interviews that information needs were ongoing after the retrofit was complete. This was in part due to the time lag between the new solar panels and heating systems being installed over the summer, and tenants only recently thinking about using them as the colder weather approached. In most cases it appears that some of the heating programmes (times, temperature

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⁹ Natural Ventilation with Heat Recycling

duration) had been set up on the tenant's app (phone or iPad device) by the engineers or TLO around the time of the installation.

It appeared to be welcome and useful that the controls and scheduling of the heating times and temperatures could be adjusted remotely, but also does lead one to question if this is likely to be a service that will continually be desired and provided? It seems likely that additional training and or information that is accessible and will allow tenants to adjust their own heating as and when they need to will be required.

No that's the thing, I didn't really put it on properly at all (the heating) because I wasn't sure what I was doing, until these last few weeks, or I would say two weeks when it started to go a bit chilly and I rang TLO and said, "I still haven't mastered this heating," and she did it over the phone (Tenant A2000)

As people are learning things by themselves as they go along (and this may be some time since they had any verbal (or written) instructions, it is possible that the heating systems are not being operated as effectively as they could be (possibly reminders/ written, verbal may be required periodically)

I sent TLO this text and in it I said, 'Do you think it would be a good idea to give everybody a leaflet explaining simply how to do it, what to do and what to do if something goes wrong? (Tenant A2000)

Yeah, and they put it, they put it onto my phone, the lady from the council and <heating engineer> from the company, they both. They were here like doing it all. Fair play. (Tenant A 2001)

"I've got to be honest with you. It's only in the last couple of weeks that we really started to understand how to use it [laughs]. But it's been warm enough so not to worry, but now it's getting colder in the evenings, and I said I've got to be honest, because we were just sticking it on manual when we needed it which you shouldn't do because that's not using the heating, [...] but I've learned, I've learned it now. But I mean I've never had that kind of things, so you know, you've got to learn all that haven't you? (Tenant A2004)

There have been several opportunities for information provision that have been used, and this is useful as people want to receive information in different formats (written, verbal, links to alternative media eg YouTube videos) and at the right time and in the right amount of detail. As stated previously at the time of installation many had their systems set up to suit their needs at the time, but it is only later when trying to amend or adjust things themselves that they realise that they have not remembered everything that they have been told or read.

the young lad that came to look at it when they kind of finish off, he went through quite a lot with me but again, I didn't take everything in but you know, he did, and I remember

quite a lot of it and he said just do one degree, leave it for quite a while and then if it's still not warm enough do again but you know, and I haven't had to do it. Just the one degree was enough for now. (Tenant A 2001)

There may also be specific needs about holiday modes or 'out of the house' modes that can be overridden easily

RES1: Yeah. I've still got a problem with that (App on phone). I can't work one out you [...] My husband is poorly so, he's in more than I am. I'm the one that goes out shopping. I go with the grandchildren. So when I'm out, I take my phone with me which the app is on and it goes off (the heating), it says on my app that I'm out. [...] But he's at home and he texts me and he says, "I'm freezing" [laughs] The heating's gone off, and he's kind of very underweight and he feels the cold very quick. [...] so I have to stop wherever I am and switch the-, I'm, there must be another way of doing this but this is what I'm doing, is switching it back to that I'm in. (Tenant A2001)

Some felt that despite lack of information or instructions they were working things out themselves

We have not received written or verbal information about the technologies but I still don't know. I've sort of guessed myself by the pictures. You know, obviously how much is coming from the sun, how much is coming from the box, and how much is coming from the national grid. I've worked that bit out (Tenant B1008)

So, I've pressed it and what comes up is it asks you to log in, and then it's telling me what kilowatts it's using and it's also telling me- It's on green at the moment so it's free electricity. So, at the moment I've got the fridge turned on and so that's going on for free, and of course all these sensors, the battery pack, that's all free at the moment. (Tenant B1015)

I think, I'm not sure whether it's the sensors or it's the solar panels, but apparently you can do it up to your phone – connect it to you phone somehow and turn your heating on that way.

RES: That's what some people are saying, but as I say, we've had no information, so I don't know.

INT: And you haven't got that?

RES: No. (Tenant B1012)

#### Communicating Problems or Concerns

One of the main issues that contributed to the overarching view of the whole process was the management of problems and the actual/perceived lack of timely responses to questions or problems that were arising.

The following comments are from one tenant who was concerned about the cost of operating the heat pump and rang the council housing department in the first instance. They seemed unaware of the retrofit activities, and she found it difficult to track down the TLO who she

thought would be the key contact or anyone else to contact in their absence with concerns. The lack of response to the urgent request (certainly from the tenant's perspective) was causing further concern and annoyance.

I could not believe my eyes, so what I did that night after midnight, I went and I switched the hybrid off completely at source outside, and the next day I did a wash, it was a warm day, I hung them out, I didn't put them in the dryer, I used my dishwasher once, and I used the oven for 30 minutes and it was £2.24, so I wrote it all down, I typed out an email, sent it to TLO and it came bouncing back saying I haven't got the right email address, I rang housing, not that she knew what I was talking about but of course she knew TLO, [...] Yes, to ignore my emails and to ignore my messages, and I left a message on the phone and then I sent her an email, so I'm doing my best, and they know I'm looking for her and they said, three people have said, "Oh there's somebody called TLO she'll be in touch with you," no, TLO hasn't phoned me, I've been in every day, I mean if I'm not here <husband> is and nobody has phoned to say anything. [...] You don't want to be ignored do you? Especially when you're struggling, well I wouldn't say struggling but you know what I mean, it's making me quite cross. (Tenant A2000)

There was uncertainty about who to speak to sometimes and some had tried to contact several people (including installation engineers) to get the answers they wanted.

Because you'd ring one person, and they'd be like, "Well, who's responsible? Accidents happen." Not on the extent that it's happened to our property. You know, you go to <TLO>, "I'll get back to you." Or she'll forget. "Oh yes, I meant to get back to you." And you'd go to [TLO support] and he'd be like, "Yes." And I'm like, "Are you actually taking any notice?" (Tenant B1008)

But we spoke to her about it, spoke to the company who put the battery pack in, spoke to another guy, the other site manager who came round. About three or four people we told because obviously it shocked me and I wasn't happy about it. I thought you know when I come back home to be able to do my washing and stuff like that and I couldn't do it. All they said was it shouldn't be costing more. (Tenant B1011)

I know there was a few of us that did get in touch with the council because we weren't happy with the way things were going. But you couldn't get a reply from any of them [...] Int: So you've got the tenant liaison that's being somebody who's trying to keep you informed of the progress, but you've also got the individual people for the different things that have happened.

RES: Well, we were supposed to just carry on with them two (TLO and site manager), but I was getting nowhere, so I phoned <solar installation company>

Int: And how did you get their contact details?

*RES:* It was on the battery. (Tenant B1012)

One of the key issues is that even when tenants contact someone from the RSL, the current lack of training being filtered down throughout the organisation can mean the wrong information is being given to tenants, as illustrated below.

There's so much involved, you know in the installing all this, not just knocking on the doors. It goes to the call centre; you know they need the knowledge on it. It's like an example yesterday, when I had the old lady who doesn't know how to use the machine, or first of all she went through to the call centre, "I haven't got any heating". Then the call centre hasn't got any knowledge what kind of system's there, there's an air source there. So the lad that took the phone call put it through to me, "I've asked her to bleed the radiators", and I went, "Don't say that, because there's glycol in the air source system, and you can't put it down the drain". So then again, it has to go back to the call centre not to advise any to bleed any radiators. So there's so many people that has to be involved from it, the knowledge to the call centres as well. So it's just not about fixing the air source there, a lot of people need the knowledge— (Professional PRF0004)

One RSL overcame such issues by retrofitting a void property to use as a demonstration home to transfer knowledge through the organisation.

We did like a demonstration house; it was only because it turned into a void house and there was no one in there at the time. So we had maintenance round there, I mean the CEO was there as well, but they could see exactly what we'd put into these houses, and then, because there was a call centre guy there as well, they could see what it was physically you know. And that knowledge will get transferred then to their teams. (Professional PRF005)

## Monitoring

Tenants had a mixed reaction to the use of apps to operate the new technologies. As indicated earlier in most instances it appeared that either the TLO or someone from the ASHP/battery installation team had set up Apps on people's devices. From the professional interviews conducted we had the impressions that it was preferable financially (cheaper) to operate the system from the App rather than via the thermostat, but that did not seem to have been conveyed to the tenants. The option of different modes or advanced functionality such as holiday mode or being able to turn on the heating in advance of returning home did not appear to have been utilised by most.

#### Sensors and Monitoring

Monitoring using Intelligent Energy Systems (IES) was a contentious issue among tenant facing professionals and tenants. From the professional perspective it was unclear in many instances what was being monitored and for how long.

we're going to have this monitoring system coming to their home, which is only going to operate for 12 months, anything beyond that, we don't know. I don't know what the government's decision, whether you're going to continue to get it – to continue to operate past 12 months? (Professional PRF0001)

There were also concerns around the IES and data sharing and GDPR with one professional stating, 'It just feels like we're heading down something that's just going to be a car crash'.

I just can't get my head round why does every property need one, could they not just be like in a sample of properties? The data sharing is a real headache. And the latest was that it's the bill payer that has to give consent for the data to be shared. Well that might not be the tenant, and then for 100 properties we could keep that up to date if we could find out who was paying the bill. But how we going to do that across 6,500 homes, going into the future, with new tenancies moving in? It just feels like we're heading down something that's just going to be a car crash I think, of managing that, the data protection aspect of it. (Professional PRF0006)

This same professional was concerned that there would be pushback from tenants with regards to data sharing

One of the things that we know is a strong value for tenants is data protection, just from other projects that we work on. I can see a lot really challenging the data sharing around the information and I think that it's something that they, a lot of people, the general public, probably feel quite strongly about. What's happening to my data? Where's this information going? And I think that's, definitely data security is a value for tenants. (Professional PRF0006)

Some professionals viewed monitoring as 'ammunition' to counter claims of damp.

At the moment I'm not sure where it does fit in....we're collecting the data, one thing that would come in handy on our side is, because most of our claims, insurance claims is through damp, and that's just because of a lack of heating. But with these monitors, I think it's like ammunition for us to go back to say, "No you're not using your heating". ....the inspectors are inundated with these types of repairs, tenants arguing with them, stating that they're using the heating and it's our fault, it's not proper insulation. But then you could just put your computer on and say, "No, sorry you're not using the heating at times, and we've got the data here". But that's like Big Brother's watching as well, so some tenants will react to that kind of thing in the future, with data protection. (Professional PRF004)

It's like if we're monitoring homes and ensuring that they are temperature and relative humidity is good, so part of one of the features of the optimised retrofit programme is this idea that it's putting monitoring equipment that's kind of live. ....so it means that one of the local authorities involved with the social homes that have those kit, they now know what the quality of the internal environment is. That sounds a bit draconian, but it does they go round if they know the home isn't being heated, they can go round (Professional PRF00010)

From a tenant perspective some thought that the ability of 'someone' to be able to monitor their devices and in particular to be able to view current settings and detect and repair or correct any problems remotely was useful although the extent of this advantage was still uncertain.

About a week ago at my house, sorting out the battery pack under the stairs. Apparently, something had gone off. Somehow it had got switched off. I don't know how that had happened.

*INT:* And how did they know that?

*RES:* They've got sensors. (Tenant B1015)

it's set up centrally, they can check everything, what we're using, and you know [...]and I mean their office they could see exactly what temperature we were playing round with at the time, and he could actually see what was happening from this end as well. I don't know what sort of advantage that is. I suppose the only thing is perhaps they're looking at it to monitor it themselves to see how beneficial it is themselves, because as the gentleman said to me, it's all new to them at the moment, so I think it's all in the learning stage at the moment with everything, isn't it, you know (Tenant C3007)

Regarding the sensors – there seemed to have been little communication of their purpose or where they should or could be positioned, and this was not ideal. For some this caused some disquiet and, in some instances, tenants were very unhappy with the siting of these as they were described as ugly and considered obtrusive or too bright

And we have boxes in the living room in the ceiling, and we have a box in the ceiling in the boys' bedroom. But again, I didn't want them because it looks stupid, but they didn't tell us what they were for. [...]

Yes, our middle one (child) is autistic. [...] he keeps saying, "We're being watched." Because there's a box on the wall. I say, "It's not me." I said, "It's to try and make our house better." You know, but he doesn't understand (Tenant B 1008)

...all these sensors on everywhere flickering. They've got little blue lights, so it's not dark anymore when you go to bed. There's one in the bedroom and that's quite bright. (Tenant B1015)

# One tenant was happy with the process and technologies apart from the sensors

RES: No, apart from the sensors in my bedrooms and my living room.[...] Because I know they have got information on, but with it being at the top of my bedroom wall, I can't really see nothing. [...] You can notice the one in my living room because they've put it bang in the middle of my wall, right above my TV. Why they've done that nobody knows, even my council don't know why they've put it there, but we'll get used to that now. Because you look at the TV, I've got a big white baton running down the wall behind it. (Tenant B 1012)

### Retrofit Process

Several issues were identified relating to the retrofit process from an RSL perspective. Professionals interviewed highlighted issues with procurement, and a disconnect between internal procurement processes and those stipulated by the funding. There were issues identified in relation to the surveys and the level of detailed required.

my only concern with these de-carb surveys, particularly with the level of detail being put into them now, we've got potentially ten years to do all this work. We may not be

going to that property for nine years' time. By that time staff could have changed, materials could have changed, products could be changed. The whole property could change because.. particularly in some of the bigger HA' (Professional PRF0003)

## As well as challenges in relation to recruiting trades with experience of the technology.

We were struggling to recruit a local company that would, that had the experience of installing air source heat pumps. Obviously, we did in the end, but [company 2] started work on the estate. Obviously, they had the expertise and things as well, so they started installing one or two, but unfortunately things did go a bit pear-shaped on things going wrong, not working, tenants were going without heating, things were happening to the original boiler. So we had to draw a line and say obviously we were going to look for local contractors that could do the actual work. But finding a local contractor who was able to that was a challenge, yes so, we were quite lucky when we came across one. (Professional PRF0007)

All of which impacted on timescales of the project with some RSLs noting they felt the risk was not being able to 'spend the money in the timeframe.'

#### Time frame of the Installations

The time frame between the different types of installation considered in this report varied considerably. The heat pump could take between a few days and 10 days (excluding weekends). Properties that were undergoing fabric improvements that included external cladding, new roofs and any replacement windows and doors required prior to the installation of heat pumps and or solar panels took up to six months.

Some of the properties took longer than the tenants expected for example one tenant was told the process would take six weeks when in fact it took six months (partly due to delays beyond the council control but also due to the process selected (fabric and renewable technologies). It appeared to some tenants that several (if not all) properties involved in the ORP were having similar tasks completed before they moved on to the next task -meaning that for individual tenants the process seemed never-ending, thus prolonging the process for them.

The scaffolding went up 6 January, but they didn't even use it until the end of February [...] It was the last to come down – that didn't come down until July. It was (a long process), but it is worth it in the end. (Tenant B1012)

The timeframes were also highlighted by the professionals as being problematic particularly in reference to the order works were undertaken as illustrated below.

The timescales the Welsh government are putting all the RSLs under, the fact that the flow of the events, the flow of the actions is not quite what we were hoping for it to be, i.e. we should have really started talking to the tenants first. We should have done the

survey first before we actually had gone out and get a contractor and identified retrofit measures. But because of the timescale we were put under, the RSLs and [PRF0002] would perhaps agree with me on this, is basically just happens to be reactive and firefighting, waiting for information to come from the project, and having to go and identify retrofit measures before we actually start with that proper engagement with tenants. (Professional PRF0001)

Many felt they were being driven by deadlines, with some stating that the timescales inhibited long term thinking

That's the problem isn't it, it's all driven by deadlines, when actually you'd like to take a step back and think, let's do this properly and let's research it. So we're reluctant to bid for any more money until we've seen how these first lot go. (Professional PRF 0006)

But what we've ended up doing at the moment is a very short-term action to deliver things on the ground. Like [P2] said it himself, and I'm in the same position, we are unable to think long-term because we're just having to focus on "let's get this out of the way, let's get that out of the way, we need to tick the boxes because we need the money." Which is by the way, a very small amount of money compared to what we have to invest on the homes ourselves. (Professional PRF 0001)

Which in turn impacted collaboration internally, with some reporting that homes were initially selected for the programme that were unsuitable.

The thing is we haven't had time to collaborate, have we? We've just been out there, you know, we put in a bid for something like thirty odd properties and then they went, can you do a few more? So, it was like fifty odd properties then and it's trying to find those in a short period of time and try to get the tenants on board, and some of them haven't got a clue what we're talking about. I didn't have a clue what we were talking about to start off with until I've learnt, you know, bits. (Professional PRF00012)

# Experience of retrofit

There was mixed experience for tenants of the retrofit from the point of view of installation and workers carrying out the process. With some having very positive things to say about the workers and conversely some who found the workers disrespectful and the whole process very distressing - even at the same site.

They were really good, the lads that did it. They were very friendly, yes. You know, there was no problem with them at all. They were very approachable. They just got on with the job, they didn't waste time. And they were efficient, they cleaned up after themselves. Yes, they were very good. (Tenant B1015)

# Issues, Disruption, and Intrusiveness of Process

There were a number of issues raised during the course of the interviews from being surprised at the size of some of the new technologies (particularly the heat pumps), and the space required to site new batteries or pipework for instance, more disruption than anticipated to being very distressed by the whole process

This section attempts to cover all of these issues as they are useful points to be aware of in future.

Some of these issues were more or less of a concern to the tenant's seemingly dependent on factors such as household makeup (children, somebody in the house with a disability, pets etc)

# Size and space required for technologies

I do, I spent a lot of money and time in the garden, you know, in the summer I do love it. Anyway, that boiler is obese. That outside boiler. So fair play, they've put it round kind of the back of my shed because they were originally going to put it by my house a bit. I said, "Oh I can't have that" [...] So I've put like a screen thing just on the side of it. It's not blocking anything of it. They've seen it and I've got planting growing up the side so I can't see it [laughs] you know what I mean? (Tenant A2001)

It's in the outhouse now, they had to move it, because they put it bang at the bottom of my stairs when they first installed it, which was a no-no

*INT:* And was that because it was big?

RES: Yes, it was big, but I've got two little grandchildren as well, and it was literally bang at the bottom of the stairs. Even the assessor said that no way should that have been there.

*INT:* And was that when they signed everything off?

RES: They didn't sign it off, no, they had to have it moved before they'd even consider signing it -[...] I did send them all the photos, and then he says, "Well, have you got any other paint the same colour." I said, "No, as I hadn't decorated it before it all started." So, he says, "Well, we can get paint and you can have my workers do it, or we can reimburse you and you can do it." I said, "Well, I'll do it, as you've made enough mess of my house, so I don't want you in again." So, they did reimburse me. (Tenant B1012)

The intrusive nature of the technology was also noted by professionals and the difficulty in explaining that to tenants,

you've got to understand that the perception our tenants may not have a lot of space, I mean some of the [consortium] flats that we have, they're tiny. And you take this massive thing and put it in the flat and coming back to the point [P2] made earlier, some of these tenants are elderly. How do I explain that to them, this here is another gadget that they have in their home and they haven't got a clue how they're going to make the most of them? (Professional PRF0001)

### Disruption

There was some disruption expected considering the extent of the work involved.

So, the scaffolding went up, then the old roof tiles came off and anything else that was then past its date like some of the houses had their joists taken out and replaced. Then the rubber roof went on and then the slates went on after that. And then after the slates it was the cladding, then they put a kind of rendering on first and then that sets after about four days or something, and then they put the cladding on. The tiles went on after the solar panels.[...] and then the battery pack and everything came last. The wiring and stuff.) (Tenant B1015)

For some there was an understanding of the issues encountered, and current problems were tolerable as there were apparent benefits and the outstanding issues seemed fairly minor to them if they were likely to be resolved soon.

DR1015 Yes, it's lovely to have a new roof, and the cladding is all right, but it made such a mess of the windows. It's this like white dust that comes off every time it rains, and so after the storms we can barely see through our windows now. Yes, and all these little stones are falling off all the time (from the pebbledash) [...] The noise from the battery pack under the stairs is just a constant drone. (Tenant B1015)

the head contractor, he, 'cause he's had his hands full. You know, lockdown, no supplies, then all his workers have gone off to other jobs and left him without a joiner and everything. We haven't had our shed finished yet. We've got no roof on the shed (Tenant A2001)

– but some problems seemed to be extensive and were not dealt with in a satisfactory manner.

We didn't think it was going to be as intrusive as it was.[...] The mess, I mean that's-When the scaffolding went up it was a bit of a shock to the system because it was like the whole house was plunged into darkness, and the amount of people that were here and things like that, on a daily basis. In the height of it, it was quite overwhelming, if that's the word I'm looking for. More of a pain than anything. When it's written down on paper and you think, "Oh, they're going to do that, they're going to do that," and then when it actually came down to it, it was like I'll be glad when this is done with, it's getting on my nerves now. (Tenant B1013)

For one resident in particular – a catalogue of disruption and damage compounded by poor communication (lack of or inadequate responses to questions or concerns), had actually impacted on her view of her home and she was audibly upset recounting this during the interview. She stated that:

"I loved my house. My house is my safe place, nobody comes in my house".

But since the retrofit work and lack of satisfactory responses to remaining issues of concern her attitude had changed:

"I give up caring anymore to be honest with you, and it's sort of like well, if there's something wrong with it, it's not our property, it's their property. I'm not arsed anymore, and I took good pride in my property. And now I'm just arsed. Really not bothered about it anymore." ", the wind comes through and the gate rattles now because the hole has got bigger, it's knocking all the stuff off the wall. (B1008)

The impact on tenants is evident from the above narratives and was also acknowledged by the professionals interviewed.

I think with going in and doing the physical works it's going to be the physical intrusiveness of some of the works, you know, in the old WHQS days you had quite a few people who would refuse kitchens or heating systems, because they were happy as they were and I can see the same thing going to happen again with certain people are going to say well I'm happy I don't want it. I can't see how we can force this on them, because I try and look at it from does it matter if it is a social tenant, private tenant or a homeowner. (Professional PRF0004)

As one professional noted 'these are tenants not guinea pigs' and more consideration needs to be given to the impact on tenants well-being during the works but also how they will live in the home post retrofit.

But, you know, some of the homes you go into quite a few of them, are very well decorated, nice carpets, they have been there a long time and they have really made it their home, you feel then that you look and think this was wallpapered maybe five or 10 years ago, actually the wallpaper is immaculate, we can't match that, you know. It's hard, you know, and you've got to try and think of the best way to do things, because it's their home and that is the way I always look at it, would I do that in my own home. It's a bit like, you know, when we have to put trunking up on the wall, I will try and think, right how is the most sensitive way we can run this because I wouldn't want to piece of trunking running down the middle of the wall. (Professional PRF0003)

# **Learning Process**

The retrofit process was a learning curve for both professionals and tenants alike. Understanding the new technologies and what is required is part of that learning process. There were issues identified as works progressed with hybrid heat pumps being incompatible with old size piping, and IES systems that were non-compliant with current wiring regulations. There were also issues with planning on one site.

Well, we asked the question at the beginning, and this is one of my bugbears, if you like, is that we asked the question, will they require planning? I asked the question to our building control, and they came back with a very generic nonplussed answer. It was like, well as long as you can't see them from the side, from the main road, you know, it will be fine, you know. So, we put them at the back. And then we asked our system providers about the planning requirements, and we tried to get hold of our own planners but they didn't get back to us in time and, you know. It turned out that <heat pump providers>had said, yes, we've done the surveys, they're all good to go, none of the SOC pumps will be

within a meter of the boundary and that's the requirements. But it turns out the Welsh planning requirements for an SOC pump is three meters away from the boundary. (Professional PRF0011)

# Discussing Retrofit among Neighbours

For tenants' part of the learning process was the frequently ongoing discussions among friends/neighbours having similar work carried out to the properties. There are advantages and disadvantages to this. One the one hand this can operate as a positive support system and informal peer learning experience. However, if the information shared is not supporting the optimal operation of the system, then this can mean having to rectify repeated errors and possibly additional expense to the tenant if things are not operating as they are designed to be. Additionally, both good and bad news stories can be shared quickly and oftentimes it is the bad news regarding poor communication or problems with processes that can then impact on others thinking about taking part in the scheme.

One of the tenants recounts her neighbours experience – who has been having difficulties with operating the system via the App

Somebody in the row here, and I have asked her and she came in and showed me what she was doing, she reckons she's turned it back to having just gas like we were before (Tenant A2000)

Next door seems to not (understand), she rang me and she says, "How do you use it?" She was asking me last week. I was trying to explain to her on the phone and in the end, I said look, 'cause she said, "I'm freezing". She's quite frail. I said well actually my husband said, "Look just put it on manual for now rather than be freezing". Switch it on the main boiler inside just to get warm, and then call (the council) because I'm not really, I don't know how, I did try and explain but I'd rather somebody go there and, you know, properly, so they did go at the end of the day anyway. So I don't know. I think there's going to be more a little bit confused. (Tenant A2001)

Yes, my friend up the road has had it done, but she's had a bit of trouble with hers. I had to have a new inverter because mine was broke.

*INT:* Are you able to talk and discuss how things work?

RES: Yes, because mine's working well and she's not getting no benefit from hers. We don't know what's happening there. (Tenant B1012)

While another tenant interviewed mentioned that among neighbours "everybody's moaning about it" when talking about aspects of the retrofit

they just all say the same thing really. The battery pack's noisy. Some of them have lost space altogether under the stairs and stuff. Some of them have had issues about where it was going. (Tenant B1012)

This was also a concern for RSLs who noted that "Bad new enjoys travelling faster than good news." While many of the professionals interviewed were concerned at the negative impact on customer satisfaction and tenant relationships.

what I'm more worried about, is it's going to affect our customer satisfaction ratings now, we sort of – some people have been having a go and I've said our customer service ratings are down, yet I sort of engaged with tenants, asked them whether they would like to be part of the project, probably back in February (Professional PRF002)

It is worth noting too that with the different retrofit types and/or fabric improvements there are also likely to be more people involved in the process including subcontractors. It was not easy for tenants to differentiate who was carrying out work on their properties or if they were Council/RSL personnel or contractors. For example, there would have been an initial home survey and a final signing off process and in-between a variety of installers of ASHP, PV, Battery (dependent on installation type) and also contractors related to building fabric works. It was difficult to know sometimes who to ask questions about what. At site B one tenant had recorded there were 24 people (and not all wore masks) throughout the process as she was so "upset by the numbers coming and going and wanted them all to go away" B1008.

As mentioned previously Covid 19 had implications regarding start dates and some uncertainty about dates and time frames. However, it may have made a difference to tenants' overall experience of the ORP if they had some indication of what the process was likely to entail and timeframes involved. Regular updates were also desired if there were likely delays or if things were not going to plan.

It is important to be upfront that this is a learning process, and where there is uncertainty, there should be plans in place to manage that and ensure that the issues are picked up and lessons are learnt and incorporated into next stages of the retrofit process and this reassurance is passed onto tenants. Acknowledging that issues raised are important to tenants and require a response is critical to greater acceptance of the process. "The only thing is that is it's a new system, that's all I know, and the company's still learning about it as well. That's all I know. B1008"

### Digital Exclusion and Retrofit

What is evident from both the tenant narratives and those of tenant facing professional is that digital exclusion is a significant problem.

So from what I've seen, you know I have had tenants refusing point blank, said, "I'm not getting the App, I'm not getting the App". And then, because using the thermostat then, then you're feeling it's going to cost more to them because they're not regulating it off the timer off the App, and you feel like, a bit rubbish for them because you know that it's going to cost a bit more for them. But you know, and I totally understand, because I know my family, you know my mother, dad, wouldn't have a clue how to use the App you know, it's a different generation you know. (Professional PRF004)

We've just had one or two of them point blank refusing, now wanting to take part in the programme because they have to have Wi-Fi, or they have to have the digital device to obviously work the heating system. (Professional PRF007)

Digital exclusion also meant that some RSLs were ruling out older householders because of lack of Wi-Fi connectivity, potentially widening existing inequalities.

But then what he didn't know was, right, they need to have fabric first approach done first before we can even look at it, they need to have internet connection, yes. So, that rules out most of the elderly properties that we had because they don't need it. They need to have access to a smart phone, you know, and all of these things in the background that are key to installing it. (Professional PRF0011)

Furthermore, other RSLs were overcoming the problem of digital exclusion by bypassing the older adult and giving a family member control of the app and the technology/heating.

That was a suggestion in the beginning, we were going to pay for it if they didn't have it. The smart phone thing I think is more, like if you've got an elderly lady and it's ideal for her, this system, then a family member can have the smart phone, you know, with the info on, and we've gone down that route, haven't we? (Professional PRF0012)

This paternalistic and ageist approach removes agency from the older adult and is unacceptable. When retrofitting homes, consideration needs to be given to who will use the technology, how it will be used. If there is no option but to go down the digital route, then digital skills training should and could be offered to those wishing to have the technology but who lack the skills to utilise it effectively.

As wi-fi connectivity is required for the retrofit systems to work, this is currently being paid for by RSLs, with some expressing concern about the long-term cost implication of continuing to provide wi-fi. However, consideration needs to be given to affordability of passing these costs onto tenants, as the survey results show that of those responding, most were struggling to make ends meet.

# Long Term Impact of ORP

Some concerns were raised by professionals that most tenants would not see the benefits of the retrofit programme due to high tenant turnover.

I think – believe that at least 50 homes, [consortium] homes that we put forward. I don't think they're going to see the benefit. I think the only way people will see the benefits [...] this optimised retrofit promised them, when you are talking about installation, like solar PV, you don't do that you're not going to see a reduction in bills, so they're not going to see anything. (Professional PRF0001)

While others felt uncomfortable pushing the ORP because the extent of savings (if at all) was an unknown and there was a fear of pushing people further into poverty.

But personally, I didn't feel comfortable encouraging them to go for something that new because I didn't know enough about the system myself, there wasn't evidence of it actually working. (Professional PRF007)

This was of particular concern in homes where tenants were living in very challenging circumstances.

Some tenants that haven't got any carpets, you know they haven't, they can't afford what they're paying at the moment, and you're trying to sell it to them without you know making fuel poverty, and sometimes it's quite hard because you want to sell it, but you look around then and you see children with not a lot of food in the house, no carpets, and just poor, really you know it's quite horrible to see that really, that some people still live like that in this day and age...And you're there, you're trying to do a job, but sometimes you feel, am I confident in selling this to them? And sometimes I don't believe in the product because I don't want to put these in poverty. (Professional PRF0004)

While others expressed doubts over whether the costs of works and the potential return were viable long term.

I think we have got to look at this viably if okay well what can we realistically do for the money because there are some improvements for example that I have seen in some properties we could do. It'll cost thousands of pounds and it'll make very little difference, but that might tip you into EPCA and you think actually okay we are just below EPCA the cost now of tipping over is not viable, but that would be a similar thing for the private sector as well you know. (Professional PRF003)

Further research is needed with tenants over a longer period to fully understand the long-term benefits and any potential unintended consequences of the ORP programme and retrofit in general before it is scaled up across tenures.

# **Energy Behaviours**

There is a general belief that people's behaviour in relation to energy use need to change for climate change targets to be achieved. Tenants of all ages were aware of the need to address climate change, and this was one motivation for signing up to the ORP, along with their primarily interest in savings on energy costs. Based on the few survey responses received, most respondents were aware of energy saving measures (not leaving tv on standby, turning off lights, always doing a full load of washing etc). So, the extent to which behaviour can and will change among social housing tenants is yet to be determined. As indicated in the quote below, having access to 'free' energy may have the opposite effect with people using devices within the home, in a less frugal way.

Well I'm not scared to use my washing machine now. I put that on, yes, because when I was using it before, I used to wait until I had a big load. But now, I'll just put it on because I know I'm not using as much. [I can use the drier more, whereas if it's been raining, I've had to put it up on the radiators around the house. But now, no, I'll just shove it in the dryer. My solar panels are paying for it. (Tenant B1012)

# Recommendations from Tenants

The research team asked interview participants for suggestions as to how the ORP process could be improved. Below are those recommendations

I think I might have arranged to go away for a couple of weeks actually.[...] it would be easier for them to have an empty house to work on, wouldn't it, and then for, you know, for us, but I think I'd have arranged my thing a bit if I'd have known it was going to be as much as upheaval as ours but then again, that's just ours. What happened here, wasn't it? Water everywhere, floods. [...] my husband just said, do it in the summer more (Tenant A2001)

One tenant felt the process worked well and would recommend having the work, demonstrating how ongoing communication and adherence to stated schedules worked well.

Just the way they explained things. Like the Works Manager, whatever his name is, <foreman>. He's very good. They would knock on the door. They had a Tenant Liaison Officer who would come round and explain that something needs to be done, or can you just make sure your door's open at 10 o'clock in the morning? They were usually there on time, so pretty good. They way they've been, especially with Covid and stuff. (A2004)

Another, firstly said 'I'd advise everybody not to have it done' as the process had been such a bad experience for them but then on reflection said

I'd have it done, yes we would have it done because obviously it's made the property warmer and we're saving electric, do you know what I mean? But not the way they've

done it or they've gone about it. You know, finish one property at a time, don't, you know. Do one house and finish it!(Tenant B008)

Yes Yes, if they're concentrating on just that house and not a scheme. Oh God, yes, definitely, solar panels and the insulation, definitely. [...] It would have gone better if they did so many houses first and then moved onto the next. Because as I say, my scaffolding was up from the beginning of January right through to July. And it should have only been six weeks for the work start to finish. We were waiting, sometimes it was two weeks for the next part of the job to be done. Because they'd already started them in another house.[...] Yes. And then, some had to wait for pebble dashing, and some were waiting weeks because they put it down to Brexit. They couldn't get the deliveries. But we were still waiting for the house to be finished. (Tenant B1012)

Dependent on the type of retrofit and work to be done there may be some guidance that people could be given regarding preparation they could do themselves. For example, if the roof was coming off – would they need to move protect anything stored there.

I just wish we'd have known a bit more and like you say, we could have done a bit more preparation on our side of things. That's some advice I'd give to somebody if they were getting it done, you know prepare yourself. [...] Just like upstairs, for arguments sake, there was a terrible mess, the attic was basically destroyed. It took me a long time to get it sorted (Tenant B1013)

I think perhaps, like with all technology, the first time the battery pack could do with being a bit smaller and a bit less noisy. But of course, as we've learnt with the mobile phone, these things will shrink as the years go on. Otherwise it's fabulous, yes. It's been a really good improvement. [...]

I would encourage people to take part, yes, with the improvements. Yes, through time it's only going to get better and the technology's going to get better. (Tenant B1015)

One comment from a tenant demonstrates the type of response that would be useful to capitalise on – particularly if the overarching experience was positive and provided confidence in the ability of the contractors to deliver the process. Private houses in the same block would have been prepared to pay for the retrofit. It may or may not have happened, but it seems an opportunity to consider widening the scope and making connections that could facilitate a parallel process perhaps?

It hasn't changed much really apart from my neighbours that haven't had it done in the private houses, they keep saying, "We're coming to yours — your house is warmer than ours," because we've had it done. But they did say if they had been offered it, they would've accepted it and paid for it. So, I think they missed out there. [...] Because I'm in the middle of four houses on my block. And I'm in the terraced in the middle. There are two of us and then there are semi-detached at the end. And the two semi-detached ones are private houses, but they both said, if it had been offered, they would have had it done, so the whole block would have looked basically the same. (Tenant B1012)

### Good Practice and Lessons Learnt

Despite the problems listed there was evidence of good practice that could be useful in future works. Firstly, ensuring that marketing material is accessible- very little of the marketing information was at an appropriate reading level. Indeed, only two RSL (neither were case sites) had this material written in an accessible way at an appropriate reading level. These were Cadwyn and Newydd Housing, both with a reading ease score of 70.

Tenant engagement at the outset and throughout is of paramount importance an example of good practice in tenant engagement is evident in the quote below.

Our tenants – they're our tenants on these particular homes – they've been involved again, every step of the way. We approached them, asking if they would like to be part of a retrofit programme at [University]. They were involved in the modelling. They know me personally. They know [P9] personally. We used to go out on site. But back then, it was also a learning journey for me and [P9]. We didn't know much about batteries [...] etc. So, every time we were learning something, we would go back to the tenants, sit down, maybe have a cup of tea and say, "Look, so this is what we are looking to do," and I'd show them a picture of what it would look like. They were very bored. Probably [s/l the gutter hadn't been done yet 00:16:04], but it is important that we keep them on board, because this is a risky journey as well. Bad new enjoys travelling faster than good news. So, we need to make sure our tenants are engaged from the start and also learn at the same time as us, as well (Professional PRF008)

Walking tenants through their home, explaining where the works will take place what is being fitted and giving the tenant the opportunity to feed into the process could also avoid issues.

# 5 Discussion and Key Learning Opportunities

The main aim of this report is to present an outline of the key barriers and facilitators that influence whether homes are retrofitted with low carbon technologies. This pilot study included an exploration of older people's experiences of the retrofit process. Older person households will be an increasingly important consumer group for LCH due to ageing populations in the UK (and other countries) and their generally higher energy requirements (Wrapson and Devine-Wright, 2014).

The project also sought to understand the ways in which installation of new technologies can potentially modify people's energy behaviours and social practices. The study used a mixed methods approach. Semi-structured qualitative interviews provided the opportunity for tenants to describe their experiences of the retrofit process and their ongoing understanding of and

adaptations to the new technologies as well as provide insights into what was important to them regarding energy use and behaviours within their homes.

Professional interviews and focus groups presented an additional understanding of the drivers, social value, facilitators and barriers from the perspective of those involved in progressing the ORP. The inclusion of a lay expert panel (EP) and an advisory board (AB) provided an additional element of robustness to the research activities. The groups comprised a mix of people with different knowledge and expertise (lived and experiential across sectors and disciplines). Their contributions to this process provided additional opportunities to challenge more traditional scientific/technical approaches and contributed to the research design and understanding (Norström et al., 2020)

This exploration of retrofit has provided different insights into experiences of the retrofit process and the potential for improvements to this. The delays to the retrofit progress have meant that our data is limited as most tenants had not lived with the technologies for as long as we had desired for this research, with the maximum amount of time around four/five months from retrofit completion to interview and some having just had the installations signed off in the preceding weeks. Nevertheless, the data has provided some understanding of energy behaviours and which adoptions/adaptions may be required and where additional explanation and support may be needed

### Differing Values and drivers from the outset

This brings us to the point of the apparent differing value sets between those funding, delivering and being recipients of the current ORP. At its simplest, the drivers for Welsh Government are defined and time sensitive decarbonisation targets, with additional ambitions to support economic growth, boost workforce skills, bolster supply chains and reduce fuel poverty. For RSL and LA social housing there was an opportunity to receive funding towards their own new or existing goals regarding decarbonisation plans, general improvements to housing stock and similarly reducing fuel poverty. The bidding process and approval of funding defined the agreement between the two parties. Although there was some acknowledgement that the process would "not succeed (in our endeavours) if we seek to impose solutions on people" (Welsh Government, 2020) this avoidance of imposition seemed to be planned only via the production and dissemination of tenant engagement materials (and some planned events). It

appears that there was limited consideration from the tenants' perspectives and their desires and expected outcomes of retrofit from the outset. And indeed limited consideration of any possible behavioural changes required or additional learning requirements to optimise use of new technologies. From the tenant interviews the selling point offered to them by those encouraging them to participate in ORP was the likelihood of reductions in fuel bills.

#### Barriers and Facilitators

# Information provision and Communication

The main issues presented throughout the research was that of information and communication. ("If that's one complaint I had to have, would be communication was poor. ... We've had to wing it between us" B1013)

# Tenants experiences of retrofit process

Greater clarity about the retrofit process was wanted. In terms of the process of retrofit: time frames, details of what would happen, when and who would be carrying out the work and what if anything tenants could or should do in preparation. Importantly, who would be their key contact in the event of questions or problems.

Those that described a more positive experience tended to be more satisfied with the level of communication and information and responsiveness to any queries or issues (or had this perception -where they had not particularly experienced any problems but felt confident that someone was on the other end of a phone as in "project manager from <retrofit organisation> and she seemed to be managing the project, and she was very good. She was always on the end of the phone whenever you needed her" Tenant B1015

# Information about the technologies

There are often assumptions that installations of new low carbon technologies will be accepted and integrated into domestic routines in the ways intended by those designing them (Bickerstaff et al., 2015). Users' behaviours can contribute to a gap between the designed and the actual performance. Tenants in this study voiced some difficulties with their interactions with the new technologies and energy systems embedded within their retrofitted homes. There was often limited access to information in the format they wanted in an accessible and timely manner and in some instances, it did not appear to have been provided at all. This has implications for optimal usage. As observed in other studies technical barriers can reduce retrofit energy efficiency (Gianfrate et al., 2017). This seemed to be the case for some of the tenants in this study, where there were reports of being unable to achieve thermal comfort or energy use as

desired at a cost that was unacceptable to them. For example at the time of the interviews two of the participants had switched off their systems (Tenant A2000 had switched "hybrid off completely at source outside" and a neighbour," she reckons she's turned it back to having just gas like we were before" while; Tenant B1011 had turned off "a battery pack thing, as I say it's never worked. So I turned it off because it was using, for some reason it's been using up our electric.") Others may not have been using the systems optimally for example by working from thermostats as opposed to Apps "because they're going to use the thermostat, and then the machine's going to be working harder, so it's going to use more electricity (Professional PRF004)"

Information about the 'look' and 'sound' of the new technologies and the space and place they would be located was needed in order to appreciate the impact they would have when incorporated into their homes (some of the [consortium] flats that we have, they're tiny. And you take this massive thing and put it in the flat PRF0001). As in previous research the provision of a user manual in non-technical, understandable language, aimed at informing users about the new technologies as well as what are considered to be the 'correct' behaviours required to operate and maintain the new systems is needed (Bickerstaff et al., 2015; Gianfrate et al., 2017). Some tenants had 'taught themselves' using YouTube videos and via peer learning. This is useful but could lead to learning about systems that do not operate in an identical way to the one that have (eg YouTube) or passing on incorrect advice within groups. It does demonstrate that people like to receive information in different formats and so to avoid any potential for errors – bespoke videos/ or correct online versions could be referenced and shared and likewise opportunities for learning sessions could be offered in person or potentially on line to those who would like that option. These options could facilitate improved assimilation and social acceptability (Gianfrate et al., 2017).

From the professional's perspective improved information and communication was required for them to operate effectively too, both within their organisations and externally to tenants and others involved in the process. As of the time of interview there were still many unknowns for them in terms of how the technologies worked and looked and their efficiency for them to be able to pass on these details to tenants and to feel confident in doing so; "to reassure tenants, but without actually having information and not knowing exactly all the information required (Professional PRF0007). This may be particularly important around the issues of sensors and monitoring systems as there was much uncertainty for the professionals as to why it was needed

in all homes and how long they would be used and exactly how the data would be used and by who.

#### Project Management and Time frames

The ORP is a complex process particularly when attempted at the scale and speed that was planned for this initial phase. The ORP planned to retrofit over 1200 homes on the programme across four local authorities and a consortium comprised of twenty-seven registered social landlords, with different retrofit typologies planned. From the outset successful administration and completion of this Phase 1 ORP was problematic due mainly to the timeframe imposed particularly taking into account the presence of Covid 19 and accompanying restrictions, Christmas and then winter to carry out some often-extensive renovations and installations. This begs the question are such inflexible time frames necessary? Do they run the risk of setting the RSLs/LAs up to fail or force decisions on which properties can be completed in the time frame ("tick the boxes" to get the money) rather than retrofit the properties that should be done first for example? This was not the preferred approach of the RSLS (the flow of the actions is not quite what we were hoping for it to be, i.e. we should have really started talking to the tenants first. We should have done the survey first before we actually had gone out and get a contractor and identified retrofit measures. But because of the timescale we were put under[...] and having to go and identify retrofit measures before we actually start with that proper engagement with tenants. (Professional PRF0001)- and you'd like to take a step back and think, let's do this properly and let's research it. PRF0006)

The above examples demonstrate clearly how other critical aspects of the process i.e. tenant engagement were not managed as the RSL wanted neither were the possibilities of collaboration and informing those who would be informing others. This impacts not just on the immediate process in hand but on ongoing relationships and confidence were a concern.

The speed required of the process may also have impacted om other aspects of the work including recruitment of additional contractors/subcontractors to carry out the necessary work. There were mixed experiences of this work and attitudes and behaviours reported in tenant interviews - ranging from happy with the process and workers to extremely unhappy "I give up caring anymore to be honest with you [...], if there's something wrong with it, it's not our property, it's their property (B 1008). And as suggested in some of the professional's interviews this type of response may have been remedied or at least reduced by adequate tenant engagement from the outset.

ORP is still a learning process. Issues, problems and where things have worked well should be picked up and lessons learnt incorporated into next stages of the retrofit process. This requires good project management and communication within and outside (eg extending to contractors) the organisations of those driving the project. Lessons from previous research, locally and relevant exemplars elsewhere should be incorporated into planning. "WG and UK government and other governments, you know, have the same problem and commission research or reviews or inquiries every two years, and then the recommendations are either implemented for a short time or forgotten all about over a 10 year period. They lose that organizational memory. I think that would be one of your recommendations really - I'm not trying to do you out of a job or research projects in the future, but we ought to look at what records are already in existence" (Advisory Board Member -AB1)

There are enormous opportunities for shared learning within and between those taking part if there is an openness and willingness to learn from mistakes and capitalise on positive experiences of others where systems and processes have worked well¹⁰. The housing professional interviews intimated that this was not always the case and there was a preference for hearing only the positives — which may have prevented those finding certain issues problematic to share this and then benefit from others experiences and learnings. There have been a number of similar schemes of varying sizes conducted throughout the UK (eg Nottingham, Cambridge and in Europe) and there are lessons too to be learnt here.

### **Key Contact**

It was apparent that with the multiple people that tenants were coming into contact with during the retrofit process that information and instructions were sought and provided by those involved in specific installations (told by the workmen who came and put the battery in, the best advice I can give you when the sun's out, hammer your washing machine and hammer your tumble dryer B1013.) This could lead to inconsistencies in information provision and incorrect operation. Having the one person or team that are key contacts and will respond in a timely manner with accurate information is essential to good relations.

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¹⁰ Elsharkawy, H., & Rutherford, P. (2018). Energy-efficient retrofit of social housing in the UK: Lessons learned from a Community Energy Saving Programme (CESP) in Nottingham. *Energy and Buildings*, 172, 295-306.

It is likely that there will be a need for ongoing reminders on best use of the technologies (for example when seasons change) and possibly updates as more information is learnt about the technologies and should be fed back to tenants. Specific areas where more information was requested was on the purpose of sensors and monitoring and rapid responses were required to queries regarding unexpected energy cost increases.

# Digital Literacy -Reducing Potential for Widening Inequalities

Many unintended consequences can arise from top-down decision-making choices and implementation mechanisms. As was evident in the interviews several tenants were not, digitally confident. Initially at least, several tenants were not particularly comfortable with the app installed on their phones or tablets and how to operate their new system from there. Several people had the app installed for them by members of the ORP team and in some instances, they were uncertain as to how to alter settings as and when needed. This only accounts for those who were offered the retrofit as when reflecting on professional interviews there were many excluded from the outset as "they need to have internet connection, yes. So, that rules out most of the elderly properties that we had because they don't need it. They need to have access to a smart phone" PRF0011]

The instant dismissal of these properties (and people) may also have been more to do with the forced speed of the process not providing sufficient time to 'leave no one behind' and reach first those who are furthest behind as per the mantra of the Sustainable Development Goals (*Leaving No One behind — SDG Indicators*, 2016)

This paternalistic and ageist approach removes agency from the older adult. If the best option within ORP is to progress down the digital route, then it would be preferable to understand people's concerns as to why they are reluctant to pursue this. A possibility is to offer digital skills training to those wishing to take part in retrofit but feel that they lack the skills to use the technology effectively.

Such processes and exclusions may exacerbate inequalities and inequities as also highlighted by a member of the AB "May be unintended outcomes for those who are already marginalized - we risk making situation worse - not bringing them on the journey. Need to match the different agendas" AB5

Given that the carbon footprints for low-income communities are substantially lower than middle- and high-income bracket groups (Oswald et al., 2020) there is a need to ensure that social inequities are not further exacerbated by placing the burden of addressing sustainability on those most vulnerable.

### Tenant Engagement

A lack of understanding of the value placed on people's homes and their energy decisions and behaviours can lead to resistance to the uptake of technologies and tension between project aims and mutually appreciated outcomes. This provides a strong rationale as to why tenants must be considered as important stakeholders in the process of transitioning to low carbon energy (Schot, Kanger & Verbong, 2016) in this case via the retrofit process, while living through the process.

Incorporating tenant engagement and participation in the ORP process could help to focus on these "consumer" or "end-user" perspectives and help our understanding of the potential impacts of renewable energy (RE) designs and use in a wider social context. "Transition is only going to succeed if people are being involved in the process from the outset. Our relationship (to energy) is not about kwh but is more emotional - to affect people's behaviour will involve finances, attitudes, security confidence etc. AB6"

It is well established that public involvement (of intended beneficiaries) supports the implementation and development of new sustainability projects and that lack of stakeholder support can results in a significant opposition (Devine-Wright 2009, 2011). Consequently, public engagement is integral to the success of such projects.

# Meaning and Value of Energy

The success of uptake of renewable energy at the domestic home level requires a greater understanding of consumer engagement with and acceptance of new energy technologies such as solar PV (Devine-Wright, 2007, Sommerfeld et al., 2017). A narrow focus on the economic and environmental benefits of Low Carbon Homes (LCH) will not adequately convey the social and cultural meaning and importance that home heating systems provide (Wrapson and Devine-Wright, 2014).

The role of energy behaviour and attitudes of the individuals who occupy the proposed retrofit properties (tenants' homes) is an essential part of driving the success of any retrofit installation, both in terms of the initial adoption and the effectiveness of their use. However, if longer-term

behavioural changes regarding energy reduction are required, we need to start exploring values and perhaps begin to consider what values are important to stakeholders such as the concept of social value including health, environmental concerns, social relationships and community participation (Brown et al., 2014; Geels et al., 2018; Swan et al., 2013). This perspective focuses upon how radical innovation is about creating new sociotechnical systems through the co-construction of multiple elements including knowledge and value systems.

# Wider Sustainability

The amount of energy used and its impact is not always readily apparent, these are largely abstract concepts. It may be difficult to link daily energy using activities particularly when considering impact beyond individuals needs and use – for example the larger decarbonisation agenda (Chahal, 2012). With this in mind, when addressing the key barriers to the take up of retrofit measures it is important not to dictate values to people but encourage values that will lead to engagement with energy efficiency (Corner 2011). As expressed by a member of the advisory board "People are using energy for variety of essential fundamental activities and to improve living for everyone. Using power and appliances. Paramount that we look at the impact that this has and the value that this may bring" AB6

#### Social Return on Investment

A Social Return on Investment was an initial aim of the research team however delays to ORP and hence limited access to sites and participants made this impossible. An ability to demonstrate that achieving low carbon/improved energy efficiency within homes can impact positively on social value to a variety of stakeholders (including the financial, health, and social wellbeing of tenants) remains a very important outcome for future research.

It is recommended that a SROI is conducted in the future taking into account some of the items discussed above (meaning and value of energy to a range of stakeholders, wider sustainability issues). At the time of the interviews and project close any health, social and financial benefits could not be determined as it was still too early to tell if the changes of importance to the tenant (energy costs and/ thermal comfort) were going to be delivered. Some commented that they felt improvements provided by the fabric improvements such as added insulation, and improved access to 'free' energy for those with solar panels. A few thought they were having financial benefits by seeing their energy spend reduced (where some were able to tell from

their prepayment or smart meters) - but time was insufficient to determine if bills, health and social wellbeing were likely to improve longer term. Understanding how these additional benefits are or are not of importance to housing tenants is key to future uptake and success.

# 6 Recommendations

#### **Process**

- 1. Timescales of the ORP prevent timely tenant engagement in the process. This process takes time if done properly and more time needs to be given to tenant engagement.
- 2. Good practice would be where possible to undertake work on void properties. As suggested by one of the tenants and in the professional interviews do the retrofit on empty properties first (voids).

This was the approach taken by case site D. Although ostensibly this does not appear to be a solution for rapid scale roll out, there have been multiple benefits from this approach. There was no disruption experienced by tenants and some lessons regarding procurement and process including skills required have been done without adversely affecting them. There is then an 'available property' available for prospective retrofit tenants to view the 'finished product'. People could visualise them as they may appear in their own homes and ask questions about them regarding operation etc. This is important too for all those involved in the retrofit team; from installers to those running the call centres/help desks to have sight of the technologies, to learn about the installation and provide advice as required from a point of confidence. Case site D were able to perform checks that were then able to reliably inform them of operation and performance of installed equipment that could be passed on to tenants.

- 3. Staff training is essential to support tenants. This training should be throughout the organisation, including customer support.
- 4. Walking tenants through their home, to discuss where technologies will be fitted, is important and should be good practice. If this is not practicable then a demonstrator house (as above) could be used to show tenants what will done to their home

- 5. Improved project management to incorporate shared learning from own and other current experiences on this ORP scheme in addition to including wider experience of those who have conducted similar schemes elsewhere and from previous commissioned research and reports. Time frame to include all necessary aspects of process including adequate tenant engagement. It is important to be upfront that ORP is still a learning process, and where there is uncertainty, there should be plans in place to manage that.
- 6. Technology and older adults. Some RSLs have sought permission for ORP from family members or given the control of the heating App to family rather than the older person. This is not acceptable and removes agency from older people by removing their voice and choice from the process. Digital skills training should be offered routinely to all age groups.
- 7. Some RSLs are not offering retrofit to households living in extremely challenging financial circumstances as they are fearful of putting people further into poverty. These risks widening inequalities and additional support may be needed if bills initially risee.
- 8. Monitoring and Data Protection. It should be made clear to tenants and RSL staff what is being monitored, by whom, and where that data goes. The process of data monitoring needs to be clear and transparent

### Tenant Engagement

- 9. Tenant Engagement materials need to be written in an accessible way, and readable for a wide range of reading levels. Current material is aimed at graduate level readers. Recruiting tenants' groups to help draft the material may be helpful.
- 10. Tenant engagement materials need to reflect tenants' priorities and values rather than Welsh or UK Government. This means positioning retrofit as energy saving, cost efficient before achieving low carbon targets.
- 11. To work with tenants to identify the most appropriate/preferred mode of tenant engagement information transmission.

- 12. All tenants must be properly and fully informed of their right to refuse retrofit. Furthermore, all tenants regardless of age, need to be fully informed of the process, timescales of work and extent of disruption to their homes prior to work starting. Some sites were not fully informing older householders of the works to be done and some were unaware they were having low carbon technology installed or that they could refuse. This is not acceptable and could be considered ageist.
- 13. Provide information about the process and technologies: Ensure this is in a variety of formats (different languages, non-technical, easy read (non-technical language) and links to online resources including YouTube videos. An opportunity to see the technologies (as above) and talk to others who have lived with them/know about them is recommended. (This also links to tenant engagement)
- 14. Based on experience of new build low carbon homes- some tenants will need reminders about how to adjust heating or need to keep windows closed as season change.
- 15. Ensuring there is a contact or team responsible for responding to customer queries and concerns. Residents should be provided opportunities to be listened to and supported prior, during, and after the installation of low-carbon energy systems.
- 16. Supporting digital inclusion reducing potential for widening inequalities. Improve the relationship between user and technological system -working with tenants to identify their needs as this was a key reason given for refusal.
- 17. Providing behavioural interventions such as tailored information and support during periods of change such as new energy system installation have been shown to increase understanding of energy efficient appliances and lead to behavioural changes (Verplanken 2011). This can also result in reduced anxiety of those contending with new equipment with new user interface requirements. Additional training and support must be provided to allow tenants to adjust their own heating as and when they need.
- 18. Tenant Engagement: Pre-requisites for successful energy transition include an understanding of the actors, innovations, and processes involved (Pandey & Sharma, 2021).
  Therefore, It is recommended that tenants are involved in the design, planning and ongoing

delivery of the retrofit process this has the potential to ensure that all the other recommendations are considered and developed. Building on existing tenant engagement mechanisms where tenants were invited to see examples of the fabric improvements that they may wish. Having a 'show' home would seem ideal for this purpose. Tenant experiences revealed in this research highlight the importance of long-term engagements with energy transitions with citizens at the heart of transitions (Axon 2016; Ianakiev, 2020).

- 19. It is recommended that a SROI is conducted in the future. An ability to demonstrate that achieving low carbon/improved energy efficiency within homes can impact positively on social value to a variety of stakeholders (including the financial, health, and social wellbeing of tenants) remains a very important outcome for future research. Conducting an SROI would ensure that measuring/valuing 'what counts' to different stakeholders is achieved.
- 20. **Further research is needed** over a longer period to fully understand the long-term benefits and any potential unintended consequences of the ORP programme and retrofit in general before it is scaled up across tenures.

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