Developing a practical retrofit early-stage survey tool to inform the decision-making process for existing homes

July 2023

Research funded by the Welsh Governments Collaborative Research & Innovative Support Programme (CRISP)

Authors and acknowledgements

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Thanks to contributions from Dr Xiaojun Li, Dr Emmanouil Perisoglou, Huw Jenkins, Miltiadis Ionas and Esther Tallent from the Low Carbon Built Environment team at the Welsh School of Architecture, Cardiff University; Kate Solomon and Lyndon Evans from Wales and West Housing Association; all other social housing and local authority representatives who have engaged with the authors to provide feedback during the development of the PRESS-1 tool.

This report should be referenced as: Patterson J., Cui Z. and Coma-Bassas E., 2023. Developing a Practical Retrofit Early-Stage Survey tool to inform the decision-making process for existing homes. Project Report. Welsh Government. ISBN: 978-1-899895-28-1

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Executive summary

Improving the energy efficiency of homes will contribute towards Welsh Governments ambitions for a better future for Wales, responding to net zero targets and tackling fuel poverty (Welsh Government, 2020), supporting the 'Well-being of Future Generations Act' (2015), as well as assisting global ambitions to achieve net zero targets by 2050 and the UN Sustainable Development Goals (United Nations, 2015). The low carbon delivery plan from the Welsh Government "Prosperity for All: A Low Carbon Wales" (2019), outlines how more energy efficient homes can help to tackle the climate emergency and that warmer homes can also keep people healthier and improve their wellbeing and quality of life.

85% of the 29 million homes in the UK will still be present in 2050 (Committee on Climate Change, 2019). The quality and performance of these homes is not only crucial for addressing climate change, but also for reducing fuel poverty and ensuring the health and wellbeing of people whilst providing safe, secure and attractive places to live. Collecting reliable and accurate information about a home, its occupants and context can help to provide a clear understanding of its energy consumption and what affects it. Data collected can help to identify potential energy saving measures that are appropriate and enable analysis of the technical and economic feasibility of implementing such measures. This data has to be collected quickly and accurately to enable carbon emission reductions to happen at a pace fast enough to meet our targets. A survey that can be completed by non-experts at the early stage of a retrofit can help deliver this.

This report provides an overview of the development of a practical retrofit early-stage survey tool for the domestic sector and includes a review of existing survey tools together with the process involved in the development of the content of the tool together with the testing and improvement process. Development of the tool involved engagement with the social housing sector to evaluate ease of use of the tool, relevance of the data collected, the data collection process and alignment with other data collection methods.

The practical retrofit early-stage survey tool developed, PRESS-1, enables the collection of relevant information that can be used to help determine appropriate retrofit measures and their effectiveness in the drive towards a zero-carbon future, improving energy efficiency and reducing fuel bills. It has been designed to be used by non-experts to speed up the data collection process whilst enabling accurate data to be collected.

1 Introduction

The UK has committed to the development of a net zero carbon economy and society by 2050 (UK Government, 2019). With over 14% of UK carbon emissions coming from energy use in homes (Climate Change Committee, 2019), urgent action is needed in this sector.

85% of the 29 million homes in the UK will still be present in 2050 (Committee on Climate Change, 2019). To achieve Wales, the UK and global emission targets, improvements have to be made to existing housing to be make it low-carbon, low-energy and resilient to a changing climate whilst also tackling fuel poverty and provide good quality places to live. Low carbon retrofit offers extensive benefits for residents improving thermal comfort in homes, reducing pressure on the national health system and promoting skilled local jobs in the construction sector (IET & NTU, 2020). The quality and performance of these homes is not only crucial for addressing climate change, but also for reducing fuel poverty and ensuring peoples' health and wellbeing whilst providing safe, secure and attractive places to live. In 2019, an estimated 155,000 households in Wales were living in fuel poverty, roughly 12% of all households, a result of a combination of low-income, high-energy prices and energy inefficient housing (Welsh Government, 2020). The estimated cost to the NHS in England in 2020 from poor quality housing is £1.4-2 billion per year (Nichol S, et al, 2015).

Within the UK, the domestic sector is often considered to be an easier target for decarbonisation than other sectors (Morgan & Killip, 2017). It is technically possible to retrofit homes to achieve low and zero carbon emissions (Jones, Li, et al. 2017), however economic challenges have to be overcome to achieve the implementation of these solutions successfully and at scale (Stafford, Gorse, & Shao, 2011). In 2016 the UK Government launched a review to tackle the lack of momentum in retrofitting the housing stock, the results included a quality and standards framework for the retrofit housing sector which included 27 industry-led recommendations (Bonfield, 2016). In 2019, the report was followed by the revision of PAS 2030, a standard which focuses on the quality of the installation of energy efficient measures with the introduction of PAS 2035, a standard of good practice to ensure that retrofitted homes achieve energy saving potentials. Despite the recent withdrawal of the Green Homes Grant and the failure of the Green Deal, small steps are being made within the retrofit sector, but much remains to be done.

Literature is largely in agreement that a single-solution approach is highly unlikely to achieve carbon savings necessary and that a deep retrofitting programme using a whole house, systems-based approach is the only way to achieve anywhere near net zero carbon targets (Jones, Lannon and Patterson, 2013; Jones, Li et al., 2017). Deep retrofit projects have indicated a major improvement in energy performance of domestic dwellings and associated carbon reductions (Baeli, 2013, Jermyn and Richman, 2016).

The social housing sector has been identified as a key way to stimulate the growth of the domestic retrofit sector with the potential to stimulate economy recovery following COVID-19 and provide a stable market for SMEs. Social housing provides an opportunity to develop supply chains and knowledge to stimulate the wider sector. One of the main difficulties that Registered Social

Landlords (RSLs) and Local Authorities (LAs) have traditionally faced is that available funding is often only available for individual or a limited number of measures and procurement procedures can make on site programmes difficult to plan long term. As a result, a typical retrofit approach can often involve installing individual components at different times. The design and implementation of technologies in existing occupied dwellings is a challenging process involving a variety of stakeholders and expertise with a high risk for performance gaps.

Schemes such as the Optimising Retrofit Programme (ORP) in Wales with £20million of initial investment in 2020-21 (Welsh Government, 2020) and £62m initially available in England to fund social housing retrofits through a demonstrator project for the Social Housing Decarbonisation Fund (BEIS, 2021) aim to install multiple solutions together. To enable 'no regrets' when taking either the individual measure approach or 'deep retrofit', reliable and accurate information is required. Collecting accurate and reliable data during the early planning stage will help to inform decision-makers to make appropriate choices on properties to retrofit with the funding available whilst limiting the impact on future opportunities.

Energy surveys are essential for diagnosing and improving the energy performance of existing buildings, confirming current levels of energy demand and existing energy efficiency situation. Having a consistent set of quantitative baseline information available about the domestic stock will help to reduce unnecessary costs associated with rectifying changes, particularly relevant in staged retrofits, limiting financial impact on property owners and preventing additional costs to rectify at subsequent stages. An early-stage retrofit survey tool that gathers relevant information quickly but accurately to help inform property owners and decision-makers to make appropriate choices with limited funding available. This would speed the planning and design stage up to identify retrofit solutions that could be implemented.

This report provides an overview of the PRESS-1 tool, developed to collect essential information as quickly as possible for the planning stage of a retrofit to help inform decision-makers as to what properties to retrofit to accelerate the transition towards a low-carbon built environment. This planning tool will be flexible enough to include a diverse range of domestic properties and a variety of occupants and behaviours, while providing a quantitative and consistent method that can be implemented by non-experts.

2 Domestic energy use and the need for early planning in retrofitting

Buildings are a major contributor to greenhouse gas emissions contributing around 100MtCO2 e, 20% of the UK total for 2017 (Climate Change Committee, 2019). This is more significant in countries with an older building stock, such as the UK, where emissions from buildings account for 37% of the total emissions with 14% of this coming from residential properties (Jones et al., 2017). The Welsh building stock is one the oldest in Europe, with over 30% of homes built before 1919, 36% before 1944 and 75% before 1980; with only 6% built since 1990 (Green et al, 2018). For successful decarbonisation, around 20,000 homes per week must move to a low carbon heat source between 2025 and 2050. Despite energy efficiency initiatives, 80% of Welsh homes still use mains gas for heat. This change will require considerable coordination, communication, resources and a reliable and efficient supply chain (Green et al., 2018).

Improvements to the existing building stock is of major importance to reduce emissions, energy bills and levels of fuel poverty and increase the standards in comfort and health (Gupta et al., 2015). Funding programmes provided through Governments can stimulate the market by providing incentives and schemes that offer a variety of mediums towards low carbon retrofitting. However, the design and implementation of technologies in existing occupied dwellings is a challenging process involving a variety of stakeholders and expertise with a high risk for performance gaps.

2.1 Energy Demand

It is essential to reduce dependency and consumption of fossil fuels in every sector of the economy, not only in relation to global issues of climate change and security of energy supply but also as part of a future low carbon-built environment. In the UK the domestic sector is responsible for 29% of total energy demand (BEIS, 2020) which has increased from 25% in 1970. Reducing this should be a key component of a retrofit.

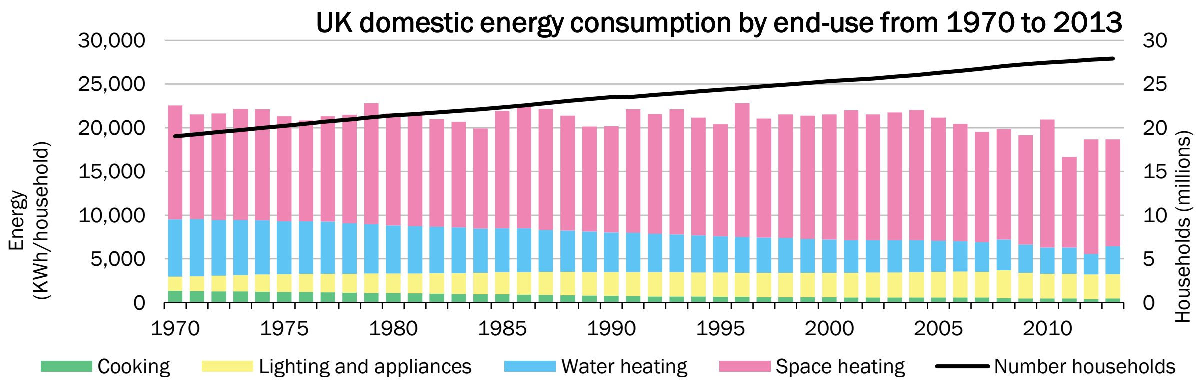

Figure 1 – Graph showing the UK's domestic energy consumption from 1970 to 2013 by end use per household unit (DECC, Jul 2015) plotted against the number of the UK's households (Office for National Statistics, 2013).

Error! Reference source not found. shows the UK's domestic energy consumption for end-use per household unit between 1970 and 2013 (DECC, Jul 2015)(Office for National Statistics, 2013). Overall, energy consumption per household decreased by 18% between 1970 and 2013, reaching its lower point in 2011 (the UK's second warmest winter since Met Office records began in 1910) (Prior & Kendon, 2011).

The majority of energy consumed by the domestic sector is for space heating (Figure 1), which accounted for 65% of all domestic energy demand in 2013 (DECC, Jul 2015). Despite significant improvements in building fabric and insulation in new homes (Eyre & Baruah, 2015) there has only been a reduction of 6% in space heating energy demand in homes since the 1970s. Internal comfort level requirements have increased from 13°C in 1970 to 18°C in 2000 and the proportion of homes with central heating has increased from 5.6 million homes in 1970 to 21.7 million in 2000 (Eyre, N., and Baruah, P., 2015). Between 1970 and 2013, energy demand for lighting and appliances increased by 70% due to an increase in the total number of appliances such as dishwashers, IT and number of lights per household (DECC, 2015). Energy use for cooking is only 75% of 1970 levels due to changes in lifestyle (Hager and Morawicki, 2013) and domestic hot water has reduced by 52% due to an improvement in water heating technologies.

Energy demand in the domestic sector is dependent on many factors such as climate, physical building characteristics, appliances and systems characteristics, maintenance, ownership, and occupant behaviour (Yao and Steemers, 2005; Jones, et al., 2017). The collection of reliable and accurate information during the early stages of planning a retrofit can help to understand these factors and identify potential energy saving measures. The selection of building integrated renewable technologies is restricted to what energy sources are available in the location and what can be fitted in, on, or around the building. Although solar energy is freely available everywhere and environmentally friendly, renewable energy systems are often perceived to be expensive with a long payback time, thus it is important to optimise size and integrate them into the building construction where possible to reduce construction costs.

2.2 Energy supply

The fuel mix for the domestic sector has changed significantly since 1970 when the main fuel source was coal at 39%, followed by natural gas at 24% and electricity at 18%. Natural gas is now used for 63% domestic space and water heating. This is followed by electricity at 21% and petroleum at 6%, while coal use is minimal (BEIS, 2020).

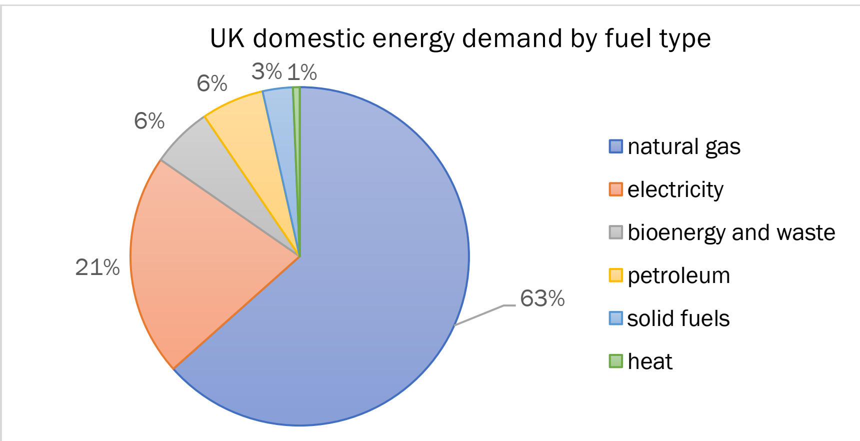

Figure 2 – Graph illustrating the UK domestic energy demand by fuel type in 2019 (BEIS, 2020)

Many factors can influence the choice of including availability of energy supply and existing heating systems. A short-term switch from carbon-intensive and inefficient heating systems such as

LPG/oil to an efficient mains gas boiler, where the gas network is near, would help reduce carbon emissions and alleviate fuel poverty. This first step to reduce emissions at relatively low cost and limited disturbance to residents is less carbon-intensive than electric energy from coal and gas plants due to the low efficiency of electricity at point of generation and transmission losses. As the carbon intensity of the electricity grid reduces through the increase in renewables supplying energy to the grid, electricity will become the lower carbon option, driving a change to electric heating systems on a larger scale. Government policy will help to drive this, as seen in the recent ban of gas and oil boilers in new build homes from 2025, which will stimulate the electric market (BEIS, 2020).

2.3 Energy storage

Energy can be stored during periods of excess generation when combined with renewables as part of a whole-house systems-based approach. Batteries can be used to store excess energy and they can also be charged directly from the grid during periods of preferentially low electricity rates reducing energy bills (BRE and RECC, 2016).

Storage is particularly favourable if the occupants are away from the home during periods of renewable generation. If battery storage is not part of the energy system, excess energy is exported to the grid, providing little benefit to the householder. However, if a battery is combined with renewables such as a PV, energy generated by the PV can be used during the evening/night when generation is not possible. This was not such an issue when Feed-in-Tariff was available as payments were made based on amount of energy generated, regardless of where it was being used. Smart Export Guarantee (SEG) (OFGEM, 2021), introduced in January 2020, calculates payments for export using a smart meter, meaning payments will be more in line with actual export values.

Storage equipment can be relatively large requiring additional cabling and network connections. An appropriate and safe location for this should be identified as early as possible to minimise impact on available space and minimise energy losses. Batteries vary significantly at present in both performance, functionality and additional features such as monitoring and feedback.

2.4 The need for domestic property surveys

A domestic property survey can provide information to investigate the potential for installing renewable energy generation and localised energy storage and propose general improvements to reduce heat loss which can optimise the reduction of carbon emissions, improve efficiency of the building and systems, reduce fuel costs and provide a more comfortable living space for occupants. By collecting information in an accurate and quantifiable way, the quality of the services, economic savings and the environmental conditions of a domestic property post retrofit can be appropriately assigned. Knowledge can be obtained that provides evidence on:

- energy consumption;
- greenhouse gases to the atmosphere;
- environmental impact;
- potential for renewable energies supply, storage and demand reduction solutions;
- impact on energy bills;
- security of supply;
- risks from fluctuations in the prices of energy resources;
- impact on climate change;

- compliance with legal requirements;
- image of commitment to sustainable energy development.

Understanding the current status of a home and its occupants is essential for implementing a retrofit that will help to achieve carbon savings necessary, a whole house energy system. Energy use is highly influenced by the size of the dwelling and the number of people living in it (Palmer and Cooper, 2013). Energy use is also driven by residents' needs on the level of services required in relation to the type of home and its heating system, lighting and appliances.

It is important to minimise the building's energy demand before considering or designing a renewable energy system, as this will heavily influence the overall amount of energy required from renewables/storage.

Energy storage can be used to store energy during periods of excess generation. Storage equipment can be large and require cabling and network connections, an appropriate location for this should be identified as early as possible.

An energy survey involves collation of information of features that can impact on a buildings' energy use including:

- existing elements such as building fabric, services and equipment including lighting and appliances;
- location and context of the building;
- operation and efficiency of the existing heating, cooling and ventilation systems and their components;
- performance measurements of the main parameters such as electrical and thermal technologies;
- occupant numbers, behaviour and need.

The main objectives of a domestic survey at the early stage of a retrofit is to collect reliable, quantifiable and relevant data in a simple way over a short period of time that can be used within the decision-making process. Combining the exercise with existing data collection procedures, where necessary, will maximise efficiency of the process.

3 Review of existing survey tools that can be used to inform the retrofitting of domestic properties

A literature review has been undertaken to support the development of the practical retrofit early-stage survey (PRESS-1) tool. The review has investigated UK building energy performance assessment documents, tools and retrofit standards that contain a survey component, together with an investigation of building energy retrofit related tools developed internationally. A comparison between resources found has been made and recommendations for future research have been identified.

3.1 Overview and evaluation of UK energy performance assessment tools and procedures

The Standard Assessment Procedure (SAP) in the UK provides a recognised method to assess the energy performance of new domestic buildings. It is a desk-based assessment tool that enables a like-for-like comparison of the performance of domestic buildings and complies with Requirements of part L of the UK Building Regulations (Building Research Establishment, 2012; Smith, R., 2011). The Reduced data Standard Assessment Procedure (RdSAP) has been developed in line with SAP to assess the energy performance of existing homes combining a site survey and reduced version of the SAP dataset method (Building Research Establishment, 2012; Smith, R., 2011). The RdSAP site survey should be conducted by an accredited Domestic Energy Assessor (DEA) which requires up to 5 days of training for qualification costing over £1,000.

SAP and RdSAP are based on the Building Research Establishment Domestic Energy Model (BREDEM) methodology, which provides a framework for estimating domestic buildings' energy consumption. SAP and RdSAP have been adopted by the UK and Welsh Government to support energy and environmental policy initiatives such as Building Regulations for England and Wales, HM Treasury's Stamp Duty, Warm Front, Energy Company Obligation and Local Authority stock reporting and are therefore recognised measures of performance. RdSAP is used to generate an Energy Performance Certificate (EPC) for existing domestic buildings (Building Research Establishment, 2012; Smith, R., 2011) which includes information about the property's energy use and typical energy cost, providing a summary of general energy efficiency options to reduce energy use and energy costs. An EPC gives a property an energy efficiency rating from A (most efficient) to G (least efficient) with a valid period of 10 years (Ofgem, 2021). An EPC is needed whenever a home is built, sold, or rented. Some on-going financial incentive schemes such as Renewable Heat Incentive (RHI) and Smart Export Guarantee (SEG) require an EPC for a property to be considered in the application process (OFGEM, 2021b; OFGEM, 2021c). Both SAP/RdSAP ratings and EPC scores are comparable with each other and can be understood by a broad range of expertise within the sector.

However, datasets used within SAP or RdSAP limit the accuracy of the outputs. The use of a standard energy use pattern is limiting as it is not representative of all households which vary significantly. Regional climate datasets are used in SAP and RdSAP which limit the accuracy of domestic energy calculations, particularly where microclimates exist in specific areas. Materials, lighting and electrical appliances, and renewable energy datasets are not updated frequently enough to match the availability, development and improved performance of technologies in the market. These out-dated datasets cause gaps between estimated and actual energy performance calculations. The accuracy associated with the data input into these tools risk producing unrealistic actual energy performance calculations.

The National Home Energy Rating (NHER) and Home Energy Master Plan (HEMP) tools are based on BREDEM 12 and can be used to assess energy performance and fuel cost of domestic buildings. NHER includes detailed occupancy energy usage patterns to calculate accurate carbon emission and fuel costs for a specific domestic building. HEMP was developed by Parity Projects and released in 2013 to support the identification and comparative evaluation of energy efficiency measures and determine the energy efficiency measure (Smith, R., 2011).

Table 1: Overview of energy assessment methods and retrofit approaches for UK domestic buildings

Name	Developer	Description	Building type
SAP (Standard Assessment Procedure)	BRE	SAP quantifies a domestic buildings' performance in terms of energy use per unit floor area, a fuel-cost-based-energy efficiency rating and emission of CO_2.	New domestics buildings
RdSAP (Reduced data Standard Assessment Procedure)	BRE	RdSAP was introduced as a low-cost way of assessing existing domestic buildings' energy performance using a combination of on-site survey and desk-based assessment method.	Existing domestic buildings
National Home Energy Rating (NHER)	BRE	NHER is a tool to assess energy performance and compute running cost and carbon emission of a specific domestic building	Existing domestic buildings
Home Energy Master Plan (HEMP)	Parity Projects	HEMP is designed to support the identification and comparative evaluation of improvement options and the provision of improvement advice.	Existing domestic buildings

HEMP and NHER can deliver more accurate energy performance results for a specific building compared to SAP and RdSAP as they consider the detailed occupancy and appliances data. However, HEMP and NHER have the same climate data issue as they use the SAP climate dataset. HEMP and NHER have been designed to respond to different needs. NHER was designed for calculating carbon emission reductions (broken down by end-use) and running costs for an existing building with general or the specified occupancy. HEMP is used for comparing different improvement options.

Table 2: Comparison of application, advantages, and disadvantages of SAP, RdSAP, NHER and HEMP.

Name	Examples of Application	Advantages	Disadvantages
SAP	• Building regulations for England and Wales and the developed Administrations • HM treasury's stamp Duty exemption for zero carbon homes • Code for sustainable homes • Warm front • Energy Company Obligation • Local Authority stock reporting	• Covers a wide range of data input in energy demand calculations. • Different systems (heating, lighting, electrical appliances etc) are considered in energy estimation. • A dedicated dataset (appendix T) is used to generate typical energy efficiency improvement measures.	• Standard occupancy patterns and heating regimes (heating times and temperature) do not reflect the specific occupancy energy usage pattern. • Only using floor area and wind orientations does not accurately estimate actual electricity consumption. • Region-based climate data might cause errors in the energy estimation. • Standard U-value, thickness, material, technical lighting data might not be accurate enough for energy estimation. • Standard thermostat cannot be applied to any specific domestic building. • Proposed improvement options might not be suitable for the specific domestic building.
RdSAP	• EPC • FiT application (closed to new applicants from April 2019) • RHI application • SEG application • Green Deal • ECO assessment	• Specifically designed to compute energy performance for an existing domestic building when the complete SAP dataset is not available. • Uses combined on-site survey and desk-based method (SAP) to estimate energy performance of the existing domestic buildings. • Uses the dedicated dataset (appendix T) in SAP datasets to generate general energy efficiency improvement measures.	• Lack of consistency in the quality of the collected site data. • RdSAP is less accurate than the full SAP. • RdSAP might be less accurate in estimating the energy performance of a specific existing domestic building. • Proposed improvement options might not be practical to apply to specific domestic building.

Name	Examples of Application	Advantages	Disadvantages
NHER	• Assessing the energy performance and fuel cost for the existing domestic building considering a general or a specified occupancy energy usage pattern	• Detailed occupancy energy usage data like heating, hot water, cooking, lighting, and appliances included which can improve the accuracy of the estimated annual fuel use, fuel cost and CO_2 emission of the specific building. • SAP dataset can be used to work out the standard fuel cost and CO_2 emission. • Allows users to adjust inputs to strengthen SAP dataset, making it better suited to analysis tasks.	• Some datasets, like occupancy energy usage patterns, are costly and difficult to collect. • SAP datasets (climate datasets and material's U-Value) used in this tool would still impact the accuracy of the calculated energy performance, fuel usage and cost, and the CO_2 emission to a specific domestic building.
HEMP	• Supporting the identification and comparative evaluation of energy efficiency improvement strategies. • Providing advice for improvement strategies	• Added modules and linked databases enable detailed modelling of energy use for heating, hot water, lighting, and appliances which could increase the accuracy of the energy performance. • used to support the identification and comparative evaluation of improvement options. • It allows users to adjust inputs to fix SAP dataset, making it better suited to certain analysis tasks.	• Some datasets like occupancy energy usage pattern are costly and difficult to collect. • Tool cannot generate the potential improvement options for the specific or standard building. • SAP datasets (climate datasets and material's U-value) used in this tool might impact the accuracy of the estimated carbon emission and fuel cost to a specific domestic building.

3.2 UK building retrofit standards

PAS 2030 is the British Standards Institute standard that sets out the requirements for installing, commissioning and handing over energy efficiency measures in domestic building retrofit projects. Installers involved in schemes such as Energy Company Obligation (ECO) scheme, Green Deal scheme, TrustMark and Microgeneration Certification Scheme (MCS) must follow PAS2030 to ensure energy efficiency measures have been completed to an appropriate standard (The Retrofit Academy, 2020). PAS 2030 includes a series of energy efficiency measures including building fabric, mechanical building services, electrical building services and renewables.

PAS 2035 covers the broader steps involved in a retrofit including how to assess a domestic property for retrofit improvements, how to design and specify measures and how to monitor projects – a more project management role. This was launched following Bonfields Review 'Each Home Counts' (EHC) recommendations in 2016 (Urbanism Environment Design, 2012 and The Retrofit Academy, 2020). PAS 2035 uses a systematic site assessment considering site condition, environment and resident information to generate the most suitable measures for each home.

TrustMark is the Government Endorsed Quality Scheme, which aims to deliver the whole building retrofit strategy to UK homes under PAS 2035 (Trustmark, 2019). TrustMark register businesses who have been approved to install energy efficiency measures. This provides a level of confidence that work delivered to will be carried out to PAS 2035 standards (The Retrofit Academy, 2020).

Table 3: Applications and advantages and disadvantages of PAS 2030 and PAS 2035

Name	Application	Advantages	Disadvantages
PAS 2030	• Building fabric measures installation • Building service mechanical installation • Building service electrical installation • Microgeneration installation	• Sets out clear requirements for all chartered installers to follow to ensure installing the energy efficiency measures conducted by installers registered with Green Deal, ECO, TrustMark and MCS are correctly completed. • Covers a wide range of energy efficiency installation measures. • Accredited installers can be informed on how to deliver robust and quality installation work of energy efficiency measures to homeowners.	• Only the Standard for the installation of energy efficiency measure in buildings.
PAS 2035	• Deliver the most suitable and high-quality whole building retrofit solution	• Helps to deliver a whole building approach to the retrofit process. • Helps to establish the clients expected energy efficiency measurements. • Eliminates problems associated with defects, shallow retrofit, accountability, poor design and performance gap • Considers multi factors and stakeholders' perspectives to deliver the most suitable retrofit strategy to homeowners. • Accreditation involved in PAS 2035 have to have strict and systematic training. • PAS 2035 has incorporated with TrustMark in delivering the high-quality retrofit strategy to homeowners.	• Limitations in site collection process. • Time consuming data collection process. • Data collection process is disruptive to the residents. • Training to enable accreditation for initial retrofit steps is expensive and takes time.

Table 4: Comparison of different site collection approach for RdSAP and PAS2035

Name	Quality of data collection	Data type	Assessor type	Summary
RdSAP	Quality is not consistent	• Building component survey. • Fire safety system data like smoke detector not been collected. • Housing quality data and Housing health and safety rating data not collected.	Domestic Energy Assessor (DEA)	• Collected site data is relatively quick and easy to collect. • Data aligns with the SAP dataset for the energy performance assessment. • Quality of the site collected data is inconsistent. • Data collected is limited but this supports the rapid collection process. • Energy efficiency improvement solutions are potentially less practical as the recommended solutions are not generated based on a whole building retrofit concept but potential stand-alone options.
PAS 2035	High quality and consistent	• Building component survey • Detailed floor plan • Current house condition report • An occupancy assessment (questionnaire based)	A qualified PAS 2035 retrofit assessor	• A broad range of site data is collected. • The survey process is time consuming and disruptive to the resident. • At the initial stage, PAS 2035 may apply to the limited building retrofit projects because of lacking the relevant professional assessors and coordinators. • The occupants may not cooperate with the assessor to finish all questions.

PAS 2035 enables the collection of domestic property information to identify energy efficiency measures that are appropriate for a particular building and its occupants. PAS 2035 is undertaken by a trained assessor who undertakes an accreditation process taking 2 days. PAS 2035 also involves the collection of a comprehensive set of domestic property data including house condition and occupancy questionnaire data. A higher level of detail is collected when compared to RdSAP.

3.3 International building retrofit tools

Domestic properties vary significantly between countries due to factors such as climate, culture, materials available with associated tools and Regulations varying as a result. Despite homes requiring different retrofit solutions determined by their characteristics, data collection processes, tool content and time taken to implement the process can provide useful information for the development of methods in other countries. Therefore, a review of international tools for retrofitting was carried out. An overview of the eleven tools identified are summarised in Three 'types' of tool have been identified:

- Renovation assessment tools - used to assist in the evaluation of retrofitting solutions, delivering technical recommendations, energy reduction, design guidelines and comparison of scenarios.

- Financial assessment tools – used to assist in the evaluation of the economic performance of the renovation process.

- Knowledge transfer tools – used to calculate potential energy savings or find a general cost of optimal measures. These can help to define profitability of renovation measures and promote the benefit of renovation or to help stakeholders to produce better guidelines, policies or standards.

Table 5.

Seven of the eleven tools have been designed for domestic retrofitting with four tools designed for both domestic and non-domestic. Seven tools have been developed for users with limited building and energy system knowledge such as homeowners, policymakers, property managers. Most of the tools can be used to determine the most cost-effective renovation strategy to reduce energy (and water) consumption in homes.

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- Renovation assessment tools - used to assist in the evaluation of retrofitting solutions, delivering technical recommendations, energy reduction, design guidelines and comparison of scenarios.

- Financial assessment tools – used to assist in the evaluation of the economic performance of the renovation process.

- Knowledge transfer tools – used to calculate potential energy savings or find a general cost of optimal measures. These can help to define profitability of renovation measures and promote the benefit of renovation or to help stakeholders to produce better guidelines, policies or standards.

Table 5: International tools for retrofit

Tool	Type of tool	Year of release	Cost to buy	Country developed	Building type assessed	Developed for?	Data requirements	Main purpose of the tool
INSPIRE Tool	Renovation assessment tool	2016	Free of charge	Switzerland (collaboration)	Domestic and simple office building	Users with little knowledge of building energy system	• Energy performance of envelope. • Outdoor climate. • Target indoor temperature. • Internal heat gains.	• Investigate Trade-offs and synergies between different retrofitting packages. • Estimation of energy consumption. • Techno-economic analysis
A56opt-tool	Renovation assessment tool	2017	Free of charge	Portugal	Domestic and simple office building	Building professionals	• Geometric features and thermal performance. • Renovation options related to interventions on envelope and systems. • Energy use and efficiency for reference and renovation packages. • Different costs. • Impact of the materials.	• Trade-off and assesses different energy renovation measures. • Supports the decision-making process to identify the cost-optimal and the cost-effective renovation measure.
EheD	Renovation assessment tool	2016	Free of charge	Norway and Chile	Chilean existing domestic buildings	Designers, builders, homeowners	• Site location. • Home type. • Home dimension.	• Assess airtightness at design stage.
RenoFase tool	Renovation assessment tool	2016	NA	Multi-European countries	Individual existing domestic buildings	Architects and contractors	• Common examples of damage in façade. • Dimension of the building. • Specific information for each building component (interior wall, exterior wall, floor).	• Identifies the cost-optimal combination of renovation measures for a specific building.
EZ Retrofit	Renovation assessment tool	2017(V3.0)	Free of charge	USA by Stewards of Affordable Housing for the Future	Small to medium size omestic buildings	Homeowners and managers	• Envelope, heating, and cooling, DHW, clothes washer, kitchen appliances, lighting. • Motors and controls, air sealing, duct sealing, water fixtures.	• Identifies the cost-effective energy and water efficiency improvement measures.

Tool	Type of tool	Year of release	Cost to buy	Country developed	Building type assessed	Developed for?	Data requirements	Main purpose of the tool
Energy Planning Assessment Tool (ENERPAT)	Financial assessment tool	2018	Free of charge	Spain	Domestic buildings	Auditor, architects, urban planners, and engineers	• EPCs. • Cadastre and census. • Geographic information.	• Enable building professionals to assess the state of the domestic building stock. • Define rehabilitation strategies to enhance the energy efficiency of the buildings.
Energy Saving Check 3.0	Transfer of Knolwedge tool	2017	Free of charge	Bulgaria, Germany, Slovenia	Domestic buildings	Auditor, architects, urban planners, engineers, homeowners, and tenants.	• Energy and water use and costs (bills). • Electrical appliances. • State of the building.	• Estimate energy and water consumption. • Create strategies that help users to save water and energy.
Energimerke Kalkulator	Transfer of Knolwedge tool	NA	Free of charge	Norway	Domestic buildings	Homeowners and building professionals (No English version)	• Basic information about the building (age, floor area and energy sources). • Detailed information of building envelope as well as HVAC system.	• The basic registration mode generates each energy improvement measures based on the default values. • The detailed registration mode provides a more comprehensive calculation method to compute energy improvement measures.
The HERON-DST	Transfer of Knolwedge tool	2017	Free of charge	Greece	Domestic and non-domestic buildings	Policy makers and market stakeholders	• Economic and institution information.	• Minimise negative impact of end-user's behaviour in energy efficiency policymaking and leading to the optimum combination of energy efficiency technologies and practices.
TABULA	Transfer of Knolwedge tool	2012	Free of charge	Intelligent Energy Europe Programme (IEE)	Domestic buildings	Policy makers and researchers	• Construction periods and building sizes. • Specific energy systems. • Property types. • Building envelope. • Domestic hot water system.	• Create a harmonised model and classification for European domestic building typologies. • Calculate the energy need, the energy usage by energy carriers and energy assessment.
EDGE	Transfer of Knolwedge tool	NA	Free of charge	International Collaboration	Domestic and commercial buildings	Architect, developer, homeowner, and engineer.	• Available embodied energy data of construction materials.	• Identify the most cost-effective ways to reduce energy and water use as well as embodied energy in materials.

Detailed building and system data are required by some of the international tools. For example, site location, type of home and dimensions are input into *EheD* to assist the assessment of airtightness at the design stage. In the *RenoFase* tool, the interior/exterior wall, floor and other building-specific information are input to support the decision-making of the cost-optimal renovation measures for a specific building. Inputs including building envelope, kitchen appliances, HVAC and lighting are used to decide the cost-effective energy and water efficiency improvement measures in *EZ Retrofit*. The basic registration mode in *Energimerkekalkulator* can be used by homeowners to calculate energy efficient measures based on default data. The detailed registration mode can be used by building professionals to calculate the impact of each energy efficiency measure by using more comprehensive method. In *Energy Saving Check 3.0*, building-specific energy bills and electrical appliance data are used to compute energy and water consumption and the water and energy-saving strategy generation for a specific building. The construction periods and building size, building types, specific energy systems, building envelope and domestic hot water system are used to compute domestic buildings' energy consumption in Europe. EheD, EZRetrofitm, Energy Saving Check 3.0, basic registration mode of Energimerkekalkulator and HERON-DST have been designed for building professionals but can be used by non-building-experts.

3.4 Overview of tools available

Existing retrofit survey tools are available to non-building-expert users including homeowners, policymakers and high-level decision-makers for the early stages of a domestic retrofit.

Ease of use

The tools collect simple building data at the early planning stage in the domestic building retrofitting process but are still difficult for users with limited building and system knowledge. PAS 2035 requires a higher quality and depth of on-site data than RdSAP. Surveyors implementing PAS 2035 are required to participate in a more systematic and complex training process to become qualified than a DEA implementing RdSAP. There is a trade-off between the depth that PAS 2035 goes to and the simpler and shorter RdSAP training.

Current methods of data collection, as illustrated from the review, need to be used by accredited surveyors who require specific training. Questions often require subjective answers which can result in inconsistent responses. Existing surveys are time consuming to carry out – often taking more than a few hours to complete for one property which is costly and disruptive for the occupants. Despite enabling the collection of valuable information at design and implementation stages of a retrofit, a quick simple survey at the planning stage will enable rapid decisions to be made across larger numbers of stock.

Data collected

None of the tools identified categorise building site data so that it can be used to as a guide towards different retrofit solutions, such as enabling a comparison between different retrofit measures and associated energy consumption changes. SAP and RdSAP provide general, individual energy efficiency improvement options for buildings. However, the improvement options might not be practical or considered as a whole-house perspective for a building to enable a strategic approach, particularly at scale. The quality/standard of the home and safety aspects are also not collected in existing tools. Costs associated with a poorly maintained home can cause significant additional costs to a retrofit and having initial planning stage information about

Very few of the available tools identified collect information about occupants and their behaviour, specifically occupant energy use behaviour at the early planning stage of a retrofit. Number of occupants and a general understanding of behaviour is essential in the decision-making process for retrofitting at the planning stage even though occupancy changes frequently. High-quality, accurate occupant and building data can strengthen the reliability and accuracy of the estimated domestic building energy consumption and therefore support decision-making.

Regional climate data can be too generic, resulting in significant gaps in the energy performance of a building being forecast, for example, systems can be sized incorrectly at the planning stage, based on this inappropriate climate data. Datasets such as boiler efficiency, wall U-values and window characteristics within a tool need to be constantly updated to enable accurate energy performance results to be obtained and new to the market technologies need to be incorporated into assessment processes to enable a fair and timely assessment to be made. Guidance should also be provided on current and upcoming Regulations so that decisions can be based on cost, performance and longevity.

Data collection process

Where on-site data is required, collection methods in existing tools are generally complex and time-consuming. This can prevent larger numbers of homes being surveyed and is also disruptive, and off-putting for the occupants. When designing the detail of a retrofit it is important to collate accurate data for a specific building but at the planning, decision-making stage, less detailed data is required. It is highly beneficial to collect information at the early stage in the same format that it is useful at later stages.

Most existing retrofit tools/software are used in energy performance assessment, analysis of occupancy energy usage pattern and retrofit strategy decision-making. Existing retrofit tools have been developed to be used at the design stage of a retrofit. There does not seem to be a tool available that focuses on on-site data collection at the planning stage.

4 Development of PRESS-1 – a Practical Retrofit Early-Stage Survey tool

There are 230,000 social homes in Wales, owned by 36 organisations (Welsh Government, 2021). Working across large numbers of stock provides an ideal opportunity to identify and test a method to collect reliable and accurate information at the early-stage of a retrofit. An early-stage survey needs to be brief and be able to be carried out by non-experts due to a lack of trained staff and funds and time to carry out this training. This method should support whole house retrofitting, whether it is a one-off whole house systems-based approach or a staged approach to ensure that the carbon targets are achievable in the longer term.

Researchers at the Welsh School of Architecture (WSA) at Cardiff University have collaborated with the social housing sector in Wales, to plan, design and implement more than 30 whole house or deep retrofits since 2008. This has involved the selection of appropriate, affordable and replicable energy demand reduction, renewable energy supply and energy storage technologies based on data collected at the property and from the occupants. WSA researchers have worked closely with all stakeholders involved in the retrofit process. This research has highlighted the need for an initial visit to a property to collect a basic set of information about the property and engage with residents to establish minimal detail about their current behaviour and energy use that can be used to inform decisions. This experience, together with information obtained through the review presented in Section 3 has enabled the development of the Practical Retrofit Early-Stage Survey – PRESS-1.

The PRESS-1 domestic tool focusses on simplifying the data collection process at the early planning stage of a retrofit. It has been identified that there is a need for the tool to be easy to use by non-experts who are familiar with the housing sector. It has not been designed to be used directly by householders. Research at thee WSA has demonstrated that individual element retrofits cannot achieve Net Zero carbon targets. PRESS-1 has been designed to support a whole house, whole energy system approach to retrofitting. A whole house, systems-based approach considers the home, the environment, the occupants and the improvement objectives when determining suitable retrofit measures to install and in what order.

The survey has been designed to enable responses to be aggregated into a database for analysis for retrofitting as well as general stock management. This would facilitate the decision-making process and could be used to inform large stock owners such as Registered Social Landlords and Local Authorities about their existing housing stock and what could be achieved with the potential retrofit strategies, in terms of energy, carbon, cost, payback, etc.. PRESS-1 has been designed so that it could be translated into a user-friendly app that could be used directly on site.

Questions have been developed so that responses are easy to quantify to enable accurate responses by knowledgeable, but not necessarily fully trained staff. The survey has been developed to take around an hour to complete and to stimulate engagement with the residents. The aim was to be as unobtrusive as possible, whilst collecting useful data. Basic instructions have been provided as part of the survey including a supplementary ‘Guidance Sheet’ at the end to help clarify any points and to justify the inclusion of the questions in the survey.

The survey has clearly defined sections to enable ease of use on site and focusses on the following essential features which all influence the retrofitting options possible:

1. **Building location**: including orientation, context and exposure.
2. **Building construction**: including year, type and existing measures.
3. **Ventilation**: including behaviour and systems.
4. **Heating**: including space and water fuels and systems and usage.
5. **Appliances and lighting**: including types and usage.
6. **Energy bills**: including fuel types, payment method and cost.
7. **Potential retrofit**: including feasibility on behalf of resident and social housing company and wider data available.
8. **Residents:** including household structure and occupancy patterns.

Spaces are available with each section for note taking to record features that are 'of note' or unusual to be highlighted. Photos are suggested that may be helpful for future reference if the elements are present. A space is also provided for a plan of the home to be drawn. The PRESS-1 survey tool can be found in Appendix 1.

5 Testing PRESS-1 with the social housing sector

Following development of the initial PRESS-1 tool, project partners at Wales and West Housing trialled the tool on-site and provided feedback via a series of interviews. This feedback was incorporated into the tool, where relevant.

PRESS-1 v2.0 was then tested by staff across RSLs/local authorities in Wales as presented in Table 6. Engagement involved a series of online interviews, e-mail feedback from others and a workshop was held with a group of officer level staff representing a range of social housing organisations across one local authority, as illustrated in Table 6.

Existing survey procedures, available resources and expected time frames were discussed together with overlaps with other data collection processes for housing. Recommendations to modify the survey were discussed and where relevant and appropriate they have been included at the end of the testing process in an improved version of the survey. Feedback received from respondents are grouped under the headings of ease of use, data collected, data collection process and alignment with other data collection methods. A summary of responses can be found following.

Table 6: Social housing/Community Housing Companies and staff involved in testing of PRESS-1

Social housing and Community Interest Companies	Staff involved	Semi-structured interview or email response
Wales and West Housing	Asset management officer, Technical services officer, Technical contracts manager, Commercial manager	Interviews and email response
Swansea County Council	Asset manager, Housing and planning delivery manager, Energy efficiency coordinator	email response
Carmarthen County Council	Surveyor, Energy specialist, stock analyst	Interview and email response
Newydd Housing	Property director, Surveyor in asset team	email response
Trivallis Housing	Corporate director, Property surveyors	email response
NPT County Borough Council	EPC Surveyor, housing surveyor, senior housing officer	email response
Warm Wales	Project manager	Interview
Rhondda Cynon Taff Energy Operational Group	Officer level staff – contract management, asset management, asset surveyor, decarbonisation and energy efficiency, retrofit, maintenance	Presentation and discussion with follow up emails

5.1 Ease of use

Overall, the form is clear and simpler than other forms with the majority of the questions having simple tick box responses which are easy to answer. It was felt that the level of detail collected for the planning stage of a retrofit involved the right level of detail. The survey is succinct and indicates the retrofit project drivers.

It is very helpful that the tool has been developed to be used by non-accredited staff. The visual aids are helpful to steer non-experts providing clarity on why data is being collected and the photos provide a useful aid. A planning stage survey tool that can be used by someone with limited building knowledge whilst still acquiring a level of detail that is useful to inform the decision-making process will speed up the initial planning of retrofits. With so many homes to survey, speeding up the process will really help.

One respondent suggested that a summary table be included on the form that has a row for each room, then collection of data such as ceiling height, where the room is heated, no. lights, no. radiators etc.. This would provide a simple way of collating information and could be included in future versions.

Feedback was that the survey took between one-two hours to complete. This was dependent on many factors including the complexity of the home, the level of additional detail collected, the support of the resident and the knowledge/experience of the person carrying out the survey. Those who carried out PRESS-1 on more than one property found that familiarity with the survey increases the speed of implementation. Further testing of the processing and usefulness of the data would help to clarify the level of detail needed and therefore the time required to complete the survey.

5.2 Data collected

It was felt that PRESS-1 collects a good breadth of data including information about the residents which is often not included in other tools. This provides a more comprehensive overview of the needs for retrofit and the current situation of the home and its residents. Some of the information included would fill data gaps and it could also be used to verify existing data.

The flow of data collected is obvious and logical and the structure of the form is simple which makes it easy to use. A suggestion was to include the floor plan at the start so that the respondent is aware of it and uses the plan throughout the process. This could be modified in future versions.

There were questions that respondents would have expected to see based on their local stock, for example, dwelling type does not differentiate between the number of storeys in a block of purpose-built flats and data such as roof pitch and material, age/make/model/size of boiler, presence of pets and window glazing – single, double, triple. Questions were raised as to the level of detail/accuracy required within the survey, for example, should all TRVs be recorded, heating controls etc.. It was appreciated that fringe/more unusual details would make the form cumbersome for more general use and also make the form more difficult to understand by non-trained staff. The tool has been developed to be as simple as possible to collect information about typical domestic stock. It was felt that as more complexity is added to cover less typical homes the form would become longer, more time consuming and confusing, particularly for the non-expert.

Instructions for the survey need to clearly explain that information that is collected at this stage needs to be as accurate as possible but not to the expense of slowing down the survey process. For example, collection of orientation of building information can be time consuming and/or costly if utilising official support. It needs to be clear that at this planning stage approximate orientation of the front façade helps to identify the potential for solar generation. Guidance notes could be expanded to cover this.

The Notes box has been included to capture any relevant or unusual information and should be used where appropriate. It was agreed that deeper levels of detail would only be required at the design stage of a retrofit. It was confirmed that the Notes boxes are extremely helpful to add anomalies for future reference.

Feedback supported the opportunity to briefly engage with residents on the potential for future retrofit. This would enable a general impression of the acceptability by the resident to be recorded and also any general conditions of the property and how these may impact on the delivery of works. Energy bill information can be difficult to obtain from the resident. To support this engagement and to gather relevant and useful data, an appointment to carry out the survey should be made with resident/s before a visit is made, it should not be a cold calling process. During the setting up of the appointment the resident should be asked to collect information together before the visit to make the process as efficient as possible, minimising disruption and maximising the collection of useful information. The guidance notes have been adapted to include this.

As tenancies and occupation numbers change quite frequently, standard usage figures should also still be used based on property person capacity. However, data on occupation and the use of appliances such as microwaves, washing machines may give base data and an idea of usage which is likely to be relevant in the short term. Retrofits should be future proofed based on standard occupation. However, accurate data from the residents can help to identify and respond to property-based issues such as locations of frequently occurring condensation. Without this direct, informal engagement these could be missed.

5.3 Data collection process

There is a need for a consistent, meaningful data collection process that not only covers the different stages of retrofitting but other housing management aspects that is all aligned in a single database. This would prevent duplication of data collection and enable cross sharing of data. This tool would be an ideal initiation into this process.

A mixed response was received with regards to the survey being available on paper vs as an app. The majority of the responses supported a paper-based format but highlighted the fact that this would require input and therefore extra time. This could be viewed as a validation process. Recognition software could be used, where the paper survey is scanned and uploaded as text automatically. Paper format is useful for enabling the floor plans to be drawn and A3 is better than A4 for use on site. However, completing a paper copy of this survey onsite, particularly in poor weather would be very difficult. Having the facility on an app would avoid this and also would enable images and documents to be uploaded such as the floor plan from REVIT. An editable version of the pdf would be useful to fill in directly.

A template database should be provided to accompany the tool so that information collected can be aggregated. This could be set up with a small amount of further funding.

An App would be the most efficient way to collect information. This could link directly to the database to minimise data processing. The data download would be dependent on network connection which may be limited/not available in more rural locations.

5.4 Alignment with other data collection methods

It was felt that PRESS-1 would work well with other survey tools. Collecting quantifiable information provides the opportunity to collate information in one place and also to combine with information collected at future stages. Data collected could form the baseline for larger and subsequent data sets.

Most respondents felt that PRESS-1 was easier to complete than an EPC. Where data is not already collected as part of the EPC, it should be added. PRESS-1 could be carried out whilst doing an EPC and is useful as it contains more information about the residents. This type of information would be a valuable addition to current stock condition database. Information collected could be used to sense check EPC data available. Based on the recommendations that are felt suitable to implement, works could be completed to a higher standard with the additional data avoiding the pitfalls that have been experienced in the past.

The PRESS-1 tool could be implemented during face-to-face home energy advice visits by community workers with a small amount of early guidance. Once staff have used it a few times, they would be able to carry it out quite easily. Further information on residents would provide valuable insight, potentially linking up to enable advice on further funding options.

The tool does look similar to the 'Pathfinder Whole House Survey (WHS)' tool which has been developed through funding by Welsh Government. The WHS is comprehensive as it is designed to be PAS2035 compliant. There are concerns that social housing sector may not understand the difference between the two tools and this needs to be explicit.

6 Conclusions

The UK Government has supported successful survey tools for existing housing such as the EPC or PAS 2035. These surveys are designed to be carried out by accredited surveyors who require specific training to use them. Outputs from these tools can provide inconsistent results regarding energy performance due to the subjectiveness of the questions. The surveys can take a relatively long time to undertake if implemented correctly. These factors all limit the speed in which the surveys can be carried out due to a lack of trained staff which will hinder progress towards the net zero carbon targets needed.

The survey tool developed focusses on optimising the data collection stage so it can be used by Registered Social Landlords and Local Authorities to collect relevant and appropriate information about their existing housing stock accurately and effectively. Engagement with representatives from the housing sector has confirmed through trials that it is easy to use by non-experts and although it functions as a paper-based tool, would be enhanced if developed into a user-friendly App that could be completed directly onsite linking to a common organisation wide database that collects a wider, but equally quantifiable dataset. This would enable the collation, analysis and interpretation of large datasets to better understand current stock condition, enable financial planning, identify where best to undertake trial studies and to present meaningful data – efficient asset management.

This would facilitate the decision-making process for whole-house retrofit and will provide RSLs and LAs with information about their existing housing stock and what could be achieved with the potential retrofit strategies. This early-stage survey tool for retrofits is available for all social housing organisations to assist with the collection of relevant information to assist the decision-making process for retrofitting and will support the retrofit process from planning to design to construction to operation and management.

The WSA would like to work with an IT organisation to develop an appropriate platform for the PRESS-1 to be used by relevant organisations and to investigate how this can link with other data collected across the social housing sector.

The PRESS-1 tool provides a rapid way of gathering information to provide a better understanding of the home environment. This will help to eliminate mistakes during high level decision making to create a culture of 'no regrets'.

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Annex 1 – Practical Retrofit Early Stage Survey 1

Low Carbon Built Environment
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PRESS-1 – Practical Retrofit Early-Stage Survey

This survey has been designed to be used at the very early stages of a retrofit. Please answer as many questions as you can, as accurately as possible. Please take photos. Use the ***Notes boxes*** for extra information and use the space on page 4 to draw a 'plan' of the home marking on features that you feel are **relevant or unusual**. The questions in BLUE require responses from the residents which you may want to complete at the same time minimise resident disturbance.

Surveyors Name:

Role:

Company:

House Number:

Address:

1. BUILDING LOCATION

1.1. Front façade orientation ⓘ

Tick one box.

- ☐ North
- ☐ North East
- ☐ East
- ☐ South East
- ☐ South
- ☐ South West
- ☐ West
- ☐ North West

1.2. Urban Context ⓘ

Tick one box.

- ☐ Urban
- ☐ Sub-urban
- ☐ Rural

1.3. Exposure ⓘ

Tick one box.

- ☐ Open
- ☐ Normal
- ☐ Dense / Enclosed

Notes - for example, complex roof layouts, access issues due to location for deliveries, etc.

2. BUILDING CONSTRUCTION

2.1. Year of construction ⓘ

Tick one box.

- ☐ Pre 1919
- ☐ 1920 - 1944
- ☐ 1945 - 1964
- ☐ 1965 - 1977
- ☐ 1978 - 1984
- ☐ 1985 - 1994
- ☐ 1994 - 2006
- ☐ After 2006

2.2. Floor Area ⓘ

Insert details that apply.

Total internal floor area ____ m²
Number of bedrooms _____

2.3. Type of construction ⓘ

Tick one box.

- ☐ Steel frame (low thermal mass)
- ☐ Timber frame (low thermal mass)
- ☐ Cavity wall (medium thermal mass)
- ☐ Solid wall (high thermal mass)
- ☐ Modern Method of Construction
- ☐ Other – Specify:

2.4. Dwelling type ⓘ

Tick one box.

- ☐ 1 storey house / bungalow
- ☐ 2 storey house
- ☐ 3+ storey house
- ☐ Purpose built flat
- ☐ Converted flat

2.5. Existing retrofit improvements

Tick all boxes that apply and add notes below.

- ☐ External wall insulation
- ☐ Cavity filled insulation
- ☐ Double glazed windows - ______ %
- ☐ Loft insulation–approx. thickness___
- ☐ Loft hatch insulation
- ☐ Floor insulation

2.6. Location of adjoining properties ⓘ

Tick all boxes that apply.

- ☐ Above
- ☐ Below
- ☐ Left
- ☐ Right
- ☐ None

Notes - for example, presence and date of extensions/conservatories/garages, details of wall thickness, location of thermal bridges, quality of property in general, locations of damp, renewable energy supply such as PV, etc.

Take pictures of the following elements

3. VENTILATION

3.1. Ventilation

Tick when you generally open windows or doors.

- ☐ Cooking
- ☐ Having a bath/shower
- ☐ Washing / drying clothes
- ☐ Smoking
- ☐ Always
- ☐ Never

3.2. Additional ventilation ⓘ

Insert number of each and mark them on the floor plans on p4.

- ☐ Extraction fan
- ☐ Cooker hood – extract to outside
- ☐ Cavity vents
- ☐ Positive input ventilation
- ☐ All house - MVHR
- ☐ Room - MVHR

3.3. Other key features

Insert number of each and mark them on the floor plans on p4.

- ☐ Chimneys and open fireplaces
- ☐ Damaged windows
- ☐ Loft hatch ☐ insulated
- ☐ Door letterbox
- ☐ Cat flap
- ☐ Other – Specify:

Notes - for example, other ventilation, trickle vents etc.

4. HEATING

4.1. Space heating – Primary

4.1.1. Energy source

Tick one box.

- ☐ Gas
- ☐ Electricity
- ☐ Oil
- ☐ Coal
- ☐ Biomass
- ☐ Other – Specify:

4.1.2. Boiler type

Tick one box.

- ☐ Conventional boiler
- ☐ System boiler (with DHW tank)
- ☐ Combi boiler (instant DHW)
- ☐ Air source heat pump
- ☐ Ground source heat pump
- ☐ Biomass boiler
- ☐ Storage heaters

4.1.3. Heating delivery

Tick one box.

- ☐ Radiators
- ☐ Underfloor heating
- ☐ Air source

4.2. Space heating – Secondary

4.2.1. Energy source

Tick one box.

- ☐ Gas
- ☐ Electricity
- ☐ Oil
- ☐ Coal
- ☐ Biomass
- ☐ Other – Specify:

4.2.2. Heating type ⓘ

Write number of occurrences.

- ☐ Fireplace
- ☐ Stove
- ☐ Electric heater
- ☐ Oil filled radiators
- ☐ Other – Specify:

4.2.3 Frequency of use

Write number of times they are used per week.

- ☐ Fireplace
- ☐ Stove
- ☐ Electric heater
- ☐ Oil filled radiators
- ☐ Other – Specify:

4.3. Water heating

4.3.1. Demand source

Write number of times they are used per week.

- ☐ Bath
- ☐ Shower
- ☐ Hand washing clothes
- ☐ Hand washing dishes
- ☐ Washing machine
- ☐ Dishwasher

4.3.2. Water heating type

Tick all boxes that apply.

- ☐ Boiler - same as space heating
- ☐ Electric shower
- ☐ Hot water tank – _______ litres
- ☐ Immersion heater
- ☐ Other – Specify:

4.4. Heating settings

Insert details that apply.

Heating months: _______ to ______
Heating times winter: ______ to ____h
Heating times summer: ____ to ___h
Heating temperature winter: ______ ºC
Heating temperature summer: ___ ºC

Notes – for example, heating control type and location, TRVs, thermostats, timers, rooms where no space heating etc.

Take pictures of the following elements

- ☐ Ventilation elements
- ☐ Loft hatches
- ☐ External doors
- ☐ Primary heating boiler
- ☐ Boiler brand & model
- ☐ Radiators
- ☐ Secondary heating elements
- ☐ Bath
- ☐ Shower

5. APPLIANCES AND LIGHTING

5.1. Lighting ⓘ

Write number of bulbs in the home.

☐ LED bulbs
☐ Compact Fluorescent bulbs
☐ Fluorescent bulbs
☐ Halogen bulbs
☐ Incandescent bulbs
☐ Other – Specify:

5.2. Cooking

Write number of times used per week. If not owned, please put a cross.

☐ Electric hob
☐ Gas hob
☐ Electric oven
☐ Gas oven
☐ Microwave
☐ Other – Specify:

5.3. Appliances

Write number of times used per week. If not owned, please put a cross.

☐ Dishwasher
☐ Tumble dryer
☐ Washing Machine

5.4. Smart meter

Tick one box.

- Yes
- No

Notes

6. ENERGY BILLS

6.1.1. Energy source A

Tick one box.

☐ Electricity –Tariff type __________
☐ Gas
☐ Oil
☐ Coal
☐ Other – Specify:

6.1.2. Type of payment

Tick one box.

☐ Monthly direct debit
☐ Variable monthly direct debit
☐ Quarterly direct debit
☐ Prepayment meter
☐ Pay on delivery (note frequency)

6.1.3. Energy cost

Write energy bill cost as above.

Winter – £ _______________
Summer – £ _______________

6.2.1. Energy source B

Tick one box.

☐ Electricity
☐ Gas
☐ Oil
☐ Coal
☐ Other – Specify:

6.2.2. Type of payment

Tick one box.

☐ Monthly direct debit
☐ Variable monthly direct debit
☐ Quarterly direct debit
☐ Prepayment meter
☐ Pay on delivery (note frequency)

6.2.3. Energy cost

Write energy bill cost as above.

Winter – £ _______________
Summer – £ _______________

6.3.1. Energy source C

Tick one box.

☐ Electricity
☐ Gas
☐ Oil
☐ Coal
☐ Other – Specify:

6.3.2. Type of payment

Tick one box.

☐ Monthly direct debit
☐ Variable monthly direct debit
☐ Quarterly direct debit
☐ Prepayment meter
☐ Pay on delivery (note frequency)

6.3.3. Energy cost

Write energy bill cost as above.

Winter – £ _______________
Summer – £_______________

Notes

7. POTENTIAL RETROFIT: ANSWERS BASED ON DISCUSSION BETWEEN RESIDENT AND SOCIAL HOUSING REP

7.1. Possible modifications required

Tick all boxes that apply.

☐ Roof
☐ Building fabric
☐ Heating system
☐ Renewable energy supply
☐ Ventilation
☐ Whole house retrofit

7.2. Project targets

Tick all boxes that apply.

☐ Energy reduction
☐ Carbon reduction
☐ Cost reduction
☐ Improve internal conditions
☐ Improve external conditions
☐ Improve health conditions

7.3. Available data

Tick all boxes that apply.

☐ EPC
☐ Energy bills
☐ Architectural drawings
☐ Building fabric specifications
☐ Systems specifications
☐ Broadband/internet availability

Take pictures of the following elements

8. RESIDENTS – if more than 5 residents, please record information on an additional sheet

8.1. Person 1

8.1.1. Age

Tick one box.

- ☐ Under 16 years
- ☐ 16 – 25 years
- ☐ 26 – 49 years
- ☐ 50 – 65 years
- ☐ Over 65 years

8.1.2. Weekdays Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.1.3. Weekends Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.2. Person 2

8.2.1. Age

Tick one box.

- ☐ Under 16 years
- ☐ 16 – 25 years
- ☐ 26 – 49 years
- ☐ 50 – 65 years
- ☐ Over 65 years

8.2.2. Weekdays Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.2.3. Weekends Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.3. Person 3

8.3.1. Age

Tick one box.

- ☐ Under 16 years
- ☐ 16 – 25 years
- ☐ 26 – 49 years
- ☐ 50 – 65 years
- ☐ Over 65 years

8.3.2. Weekdays Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.3.3. Weekends Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.4. Person 4

8.4.1. Age

Tick one box.

- ☐ Under 16 years
- ☐ 16 – 25 years
- ☐ 26 – 49 years
- ☐ 50 – 65 years
- ☐ Over 65 years

8.4.2. Weekdays Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.4.3. Weekends Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.5. Person 5

8.5.1. Age

Tick one box.

- ☐ Under 16 years
- ☐ 16 – 25 years
- ☐ 26 – 49 years
- ☐ 50 – 65 years
- ☐ Over 65 years

8.5.2. Weekdays Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

8.5.3. Weekends Hours at home

Tick all boxes that apply.

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ Night
- ☐ Flexible working

Notes - for example, scenario for hours at home during weekday/weekends, etc.

9. FLOOR PLANS

9.1. Building elements

- ☐ Wall thickness
- ☐ Position and size of windows/door
- ☐ Position and size of loft hatch
- ☐ Changes to layouts/extensions

9.2. Heating & ventilation system

- ☐ Position of boiler
- ☐ Position and size of radiators
- ☐ Position secondary heating
- ☐ Position of vents/fans

9.3. Lightings

- ☐ Position and number of bulbs

9.4. Energy Meters

- ☐ Position and types of meters
- ☐ Position and type of fuel storage

Draw plan of different floors of home here or on separate sheets - provide relevant notes associated with questions above where possible.

PRESS-1 Guidance sheet

An appointment should be made with householders where PRESS-1 will be implemented before the visit is carried out. At this point the resident should be asked to gather energy bills together to share during the visit to maximise efficiency.

1. BUILDING LOCATION

1.1. Front façade orientation: The orientation of the front façade helps to identify the potential for solar generation of all orientations of the property.

1.2. Urban Context: The urban context may impact on the routes for access, overshading, supply chain availability, etc.

1.3. Exposure: The exposure of the building and site may impact on wind exposure, solar radiation, overshading, etc.

2. BUILDING CONSTRUCTION

2.1. Year of construction: The year of construction can help to determine the building fabric specifications. The different age ranges listed on the form refer to major changes to the UK Building Regulations.

2.2. Floor Area: An approximate internal floor area may help the assessor to evaluate energy costs per floor area, enabling results between different houses can be compared like for like.

2.3. Type of construction: The type of construction has an impact on the thermal mass of the building as well as on the likely airtightness of the building.

2.4. Dwelling type: The dwelling type has an impact on the heating demand of the building.

2.6. Location of adjoining properties: The location of adjoining properties has an impact on the heating demand as the more neighbouring walls the building has, the less the heat loss through these walls is likely to be.

3. VENTILATION

3.2. Additional ventilation

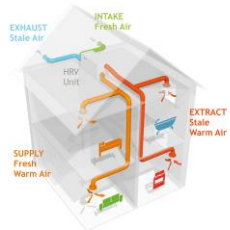
Extract fan

Cooker Hood

Cavity Vents

Positive Input Ventilation

All House MVHR



4. HEATING

4.2.2. Heating type

Fireplace

Stove

Electric Heater

Oiled filled radiator

5. APPLIANCES AND LIGHTING

5.1. Lighting

LED bulbs

Compact Fluorescent

Fluorescent Bulb

Halogen bulb

Incandescent bulb