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

Front cover design:

An illustration of the annual average temperatures for the World from 1850-2018 using data from the UK Met Office.

https://showyourstripes.info/

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
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Foreword

Dear Ministers,

I was honoured to accept your invitation last year to chair the independent Advisory Group on the Decarbonisation of Homes in Wales.

On 2 May 2019, the UK Committee on Climate Change (UKCCC) recommended that the UK Parliament legislate, without delay, to reduce domestic greenhouse gas (GHG) emissions to net zero by 2050. The UKCCC assessed the contribution that Wales can make to net zero in the UK under its statutory framework, and for Wales it recommends a 95% reduction in GHG emissions by 2050.

Welsh Government's response to this has been inspiring. On 12 June 2019, the Welsh Minister for Environment, Energy and Rural Affairs declared the ambition *"to bring forward a target for Wales to achieve net zero emissions no later than 2050"*[1].

There is real appetite across all parts of Welsh society to tackle the climate emergency. It is right that Wales takes a lead on this issue. By 1850, there were more people employed in industry in Wales than in agriculture, which made Wales the world's first industrial nation. As a result, the UK's economy and society were transformed, and the UK became one of the largest historical contributors to climate change. That makes it a moral responsibility. Tackling climate change offers the prospect of real benefits to all our citizens: cleaner air, improved health and new economic opportunities from clean growth.

In making its recommendations, the Advisory Group has considered the likely costs of implementation against the benefits that will flow from it. We strongly believe that, in the context of the Well-being Goals, the benefits will substantially outweigh the costs.

In Wales, our 1.4 million homes are responsible for 27% of all energy consumed[2] and 15% of all demand-side GHG emissions[3].

The Advisory Group recognised from the outset that decarbonising Welsh homes is not just, or even principally, a technical problem. It is about people and their homes. Decisions about home improvements emerge from the conditions of everyday domestic life. Owner-occupiers and private landlords own more than 80% of all Welsh homes. It is therefore important to test any idea for stimulating the uptake of energy efficiency improvements to homes against the question – will this make it

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[1] https://gov.wales/written-statement-response-committee-climate-changes-net-zero-report

Accessed: 02/07/2019.

[2] Department for Business, Energy & Industrial Strategy (BEIS). *Sub-national total final energy consumption in the United Kingdom (2005-2016)*.

[3] National Atmospheric Emissions Inventory, *(2016). Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2014,* p. 74. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/575458/DA_Inventories_1990-2014.pdf. Accessed 19/06/2019.

more or less likely for these people to choose to improve their properties and find it easy to do so well?

We sought expert guidance on creating the necessary conditions for success from experts at the Centre for Behaviour Change at University College London, and I would like to pay tribute to them for the powerful analytical techniques and insights that they taught us.

Welsh Government's recent Plan "Prosperity for All: A Low Carbon Wales"[4] recognises that, while climate change is the globally defining challenge of our time, decarbonisation offers enormous opportunities to create a vibrant and socially-just economy. But to do this will require unprecedented leadership, integration, collaboration and involvement. Business as usual is not sustainable and is not an option.

The Advisory Group has worked for 15 months to develop its recommendations and I would like to thank all the members of the Group for their hard work, enthusiasm, and commitment.

I would also like to express the thanks of the Group to the Welsh Government staff who have supported us and done not only all the essential but tedious and laborious tasks without which there would be no report but much more.

The Advisory Group is pleased to present its report and recommendations to you.

Christopher Jofeh

Chair, Decarbonisation of Homes in Wales Advisory Group

[4] https://gweddill.gov.wales/docs/desh/publications/190321-prosperity-for-all-a-low-carbon-wales-en.pdf


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Action for Warm Homes


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RESIDENTIAL
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RICS


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RTPI Cymru
Royal Town Planning Institute


sero
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BUILDINGS ALLIANCE


Taff Housing Association
Cymdeithas Tai Taf


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VALLEYS TO COAST
CYMOEDD I'R ARFORDIR


WALES&WEST
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WARM WALES
CYMRU GYNNES


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Summary of Recommendations

1. **Political parties in Wales should make a strategic commitment to national residential decarbonisation and stick to it**

2. **The Welsh Government should set ambitious housing targets to meet its ambition of achieving net zero carbon by 2050**

3. **The Welsh Government should put in place the right quality system and delivery mechanisms across all tenures to help achieve the targets**

4. **The Welsh Government, working with others, should develop a holistic package of support across all tenures to motivate and facilitate action**

5. **The Welsh Government should collect data about the status and condition of the housing stock to inform future decisions and measure progress towards targets**

6. **The Welsh Government should continue to monitor and test new solutions to decarbonise homes**

7. **The Welsh Government and its partners should make maximum use of communities, networks, associations and Third Sector organisations in helping to decarbonise homes**

The Welsh Context

The Challenge for Wales

The planet is facing its sixth mass extinction event. Our climate is changing because we have produced, and continue to produce, too much carbon dioxide from fossil fuels.

The Welsh Government's recognition of the urgency of the situation was demonstrated on 29 April 2019, when the Welsh Government declared a Climate Change Emergency. In a commitment that was welcomed by other political parties, Lesley Griffiths AM, Minister for Environment, Energy and Rural Affairs, said:

> *"We hope that the declaration by Welsh Government today can help to trigger a wave of action at home and internationally. From our own communities, businesses and organisations to parliaments and governments around the world."*[5]

On 2 May 2019, the UKCCC published its report "Net Zero: The UK's contribution to stopping global warming"[6]. The UKCCC's advice for Wales is that the Welsh Government should legislate for at least a 95% reduction in all GHG emissions against the 1990 baseline by 2050 and that the aim should be to meet the target through domestic effort, without relying on international carbon units, or "credits".

The UKCC Net Zero report sets out the challenges across sectors must be tackled vigorously and in tandem, beginning immediately. The importance of tackling energy efficiency in buildings is specifically referenced.

Following this, on 12 June 2019, Welsh Ministers declared the ambition for Wales to achieve net zero emissions no later than 2050.

Along with housing, Welsh Ministers made decarbonisation one of their top six cross-government priorities in "Prosperity for All: the national strategy"[7]. Wales already has ambitious legislation driving action. The Environment (Wales) Act 2016 set a target of reducing GHG emissions by at least 80% from their pre-1990 levels by 2050 and this has now been overtaken by the decision to adopt a 95% reduction target and an ambition to achieve net zero carbon.

Homes in Wales

In the light of legislative commitments and the global challenge, it is imperative that Wales takes action now to reduce emissions produced in Welsh homes.

The condition of the Welsh housing stock, prevalence of older homes, current low energy efficiency of many homes and unacceptably high levels of fuel poverty create particular challenges for Wales.

A programme of large-scale demolition and construction of new homes to replace existing poorly performing stock would be inappropriate, not only because it would

[5] https://gov.wales/welsh-government-makes-climate-emergency-declaration
[6] Committee on Climate Change, (2019). *Net Zero – The UK's contribution to stopping global warming.*
[7] Welsh Government, (2017). *Prosperity for All: the national strategy.*

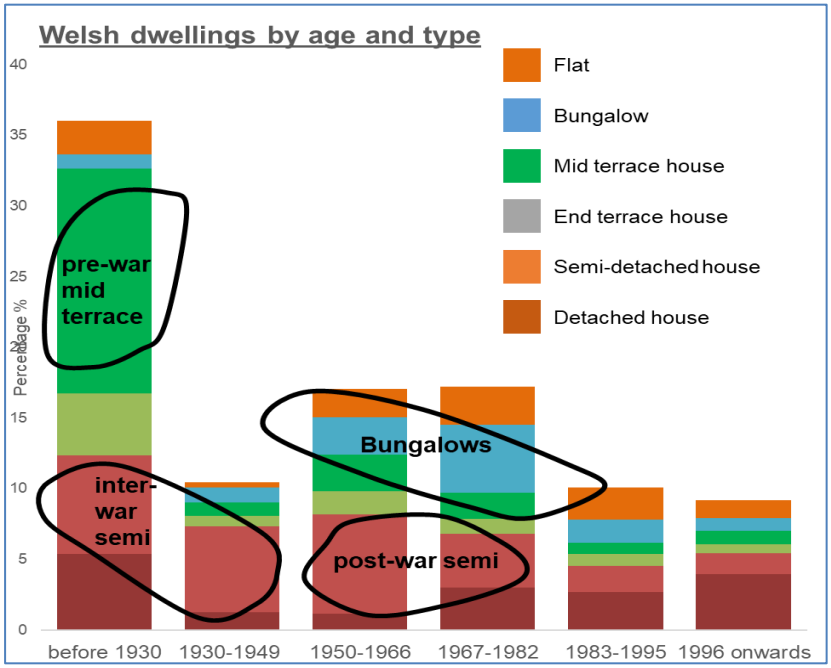
significantly increase GHG emissions, due to the carbon embodied in building materials, but also it would cause the dispersal of established communities.

Stock condition

Wales has some of the oldest and least thermally efficient housing stock in the UK and Europe. 32% of the Welsh housing stock was built before 1919, when there were no construction standards in terms of thermal performance. Just 10% of Welsh homes were built in the last 18 years, during which time energy performance requirements have changed dramatically.

80% of Welsh homes can be categorised into 14 housing types with over half being categorised by just 4 housing types, all built before 1965.

Figure 1: Welsh Dwellings by Type and Age[8]

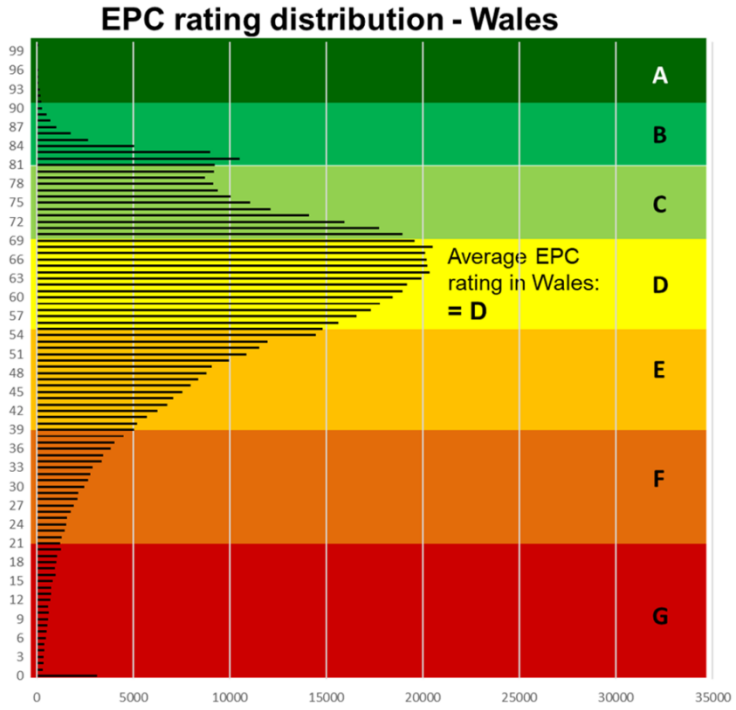


Lower average energy efficiency (EPC / SAP) ratings

The analysis of Energy Performance Certificate (EPC) data by researchers from the Welsh School of Architecture (WSA) at Cardiff University showed the average Welsh home to have a Standard Assessment Procedure (SAP) energy rating of 61 points, equivalent to an EPC Band D.

[8] Green, E., Lannon, S., Patterson, J. and Variale, F., (2018). *Homes of Today for Tomorrow: Decarbonising Welsh Housing between 2020 and 2050.* Cardiff: Cardiff University, p.33.

Figure 2: SAP / EPC Distribution in Wales[9]



The Welsh House Condition Survey 2019 (WHCS) shows Welsh homes have an average SAP rating of almost 61. The WHCS also showed social rented dwellings had the highest average SAP rating of 68. Owner-occupied and the private rented sector (PRS) dwellings were both SAP60. Houses in the PRS have improved the most, by 13 points over the last 10 years, demonstrating that investment in energy efficiency measures can make significant efficiency improvements

High levels of fuel poverty

Latest Welsh Government figures published in May 2019 show fuel poverty levels have improved over the last 10 years, but they still remain unacceptably high at 12%. The geographical spread illustrates that fuel poverty is most prevalent in areas of low incomes and general economic depression. In addition, the prevalence of off gas grid properties in rural areas often results in high fuel costs for LPG, oil or direct electric-based heating. The low EPC / SAP ratings for Welsh homes raise the incidences of fuel poverty. 43% of people living in private rented accommodation are living in houses built before 1919.

The Welsh Government is currently reviewing its fuel poverty strategy and the recommendations in this Report seek to provide a contribution to this work.

[9] Green, E., Lannon, S., Patterson, J. and Variale, F., (2019). *Presentation to Decarbonisation of Homes in Wales Advisory Group, 05/03/2019, Slide 4.*

1 Strategic Commitment

Recommendation 1 – Political parties in Wales should make a strategic commitment to national residential decarbonisation and stick to it

Action 1.1 – The Welsh Government should publicly commit now to pursuing a 30-year residential decarbonisation programme

Civil society, especially young people, is increasingly aware of the climate emergency and is urging public bodies to be more ambitious.

The Advisory Group believes that the Welsh Government should now make a 30-year commitment to ensuring that the decarbonisation of homes happens. This will require working with a wide range of organisations because this is not a commitment it can deliver alone. These organisations include the UK government, local authorities, third sector organisations, banks, building societies, builders, training and accreditation bodies, social and private landlords, and homeowners.

The Advisory Group has begun to identify what will be required of these and others, but further detailed work is needed to complete the picture. It is for the Welsh Government to provide leadership over time. A new programme will need strong, unequivocal leadership, certainty about continuing government commitment, long-term support and systems to deliver high quality outcomes.

There have been plenty of UK government initiatives to improve homes through retrofitting energy efficiency measures, but these have not delivered change at the scale needed[10]. One of the biggest reasons for this has been the frequent changes to residential energy policy. These policy fluctuations have led to a significant lack of trust which has deterred both investment and action from homeowners and industry.

The Welsh Government has much to be proud of in terms of its work to improve energy efficiency and tackle fuel poverty through the Warm Homes Programme - Arbed and Nest - and the Welsh Housing Quality Standard (WHQS). Since 2011, more than £265m has been invested in nearly 55,000 homes through the Arbed and Nest schemes. Since 2003, over £1billion has been spent on improving over 220,000 social homes through WHQS. These schemes continue to receive long-term cross-party support and demonstrate that it is possible to retrofit homes and deliver wider benefits including jobs, training and supply chains in local communities.

[10] Brown, D., Kivimaa, P., Rosenow, J. and Martiskainen, M., (2018). *Overcoming the systemic challenges of retrofitting residential buildings in the United Kingdom. A Herculean task?* In: Jenkins, Kirsten and Hopkins, Debbie (eds.) Transitions in energy efficiency and demand: the emergence, diffusion and impact of low-carbon innovation, pp. 110-130.

Action 1.2 – All political parties at the national and local level should make a clear commitment to supporting the achievement of the targets in Recommendation 2.

Current and future Welsh Ministers will need cross-party support from successive generations of Assembly Members and local politicians if the programme is to succeed. The costs will be very significant, but so will be the benefits, at a time when the pressure on public sector budgets is increasing. The impact of not improving the energy efficiency of homes will grow year on year across all aspects of Welsh life. Inaction brings its own costs as well as adding to the cost of acting later.

Expressing commitment to supporting a long-term programme does not mean that its development and delivery should be exempt from ongoing scrutiny and challenge. Indeed, the opposite is true. Effective scrutiny will be needed to ensure progress is made in light of budgetary pressures in health, social care and education. It should not be forgotten that a well-designed programme will provide very significant benefits for Wales and these are discussed in the Recommendations that follow.

Action 1.3 – No later than 2025, all new homes in Wales must be built to be low carbon, energy and water efficient and climate resilient. Independent checks must be made to ensure these higher standards are delivered. This will prevent the challenge to retrofit homes becoming larger and more expensive. All homes built with public sector funding should meet these standards no later than 2021.

This action is simple. We, in Wales, must stop increasing the size and costs of the retrofit challenge.

In February 2019, the UKCCC reported to the UK government and devolved administrations that UK homes were not fit for the future. It said:

> *"…new homes must be built to be low-carbon, energy and water efficient and climate resilient. The costs of building to a specification that achieves the aims set out in the report are not prohibitive and getting design right from the outset is vastly cheaper than forcing retrofit later.*
>
> *From 2025 at the latest, no new homes should be connected to the gas grid. They should instead be heated through low carbon sources, have ultra-high levels of energy efficiency alongside appropriate ventilation and, where possible, be timber-framed. A statutory requirement for reducing overheating risks in new builds is needed, alongside more ambitious water efficiency standards, property-level flood protection in flood risk areas, and increasing requirements for green space and sustainable transport in planning and guidance."*[11]

[11] Committee on Climate Change, (2019). *UK housing: Fit for the future?,* p. 9.

The Advisory Group supports the UKCCC's view and strongly recommends that the Welsh Government takes urgent action to deliver on this recommendation. New homes built with Welsh Government or public sector support, for example new social homes, should be built to this higher standard no later than 2021. All new homes built privately in Wales should also meet this standard from 2025.

Additional cost is frequently cited as a factor for not taking this action, but we must recognise the much higher cost of having to retrofit these homes to meet higher energy performance standards at a later date. The UKCCC report indicates that it will cost four times more to retrofit measures at a later date than to design and build them in from the beginning.

Requiring higher build standards is not enough. Long standing performance gap issues must be addressed urgently and this will require, among other things, an effective, independent building control system.

Action 1.4 – The Welsh Government should urgently start developing the recommendations and actions in this report into an ambitious programme of action which is ready for implementation in 2021. This must be underpinned by behaviour change principles and a communications plan reflecting them.

This report provides the framework for a new programme. Urgent work is now required to develop the detail, in partnership with those who will be responsible for delivering it on the ground.

The Advisory Group has considered the challenges of delivering a major, long-term, energy efficiency programme through the lens of behaviour change with the help of experts from the University College London (UCL) Centre for Behaviour Change.

Evidence shows that encouragement alone will not be enough to change behaviour on energy efficiency. To identify what is required, three questions must be answered and acted upon so that people choose to make improvements to their homes:

- Capability: what do people need to know to make the most appropriate energy efficiency improvements to their homes?
- Opportunity: how can we make it easy to make these improvements and create the expectation that this is a socially and morally desirable thing to do?
- Motivation: how do we encourage people to want to make these improvements, believe that it will be worth it and feel good about it?

The influence of behaviour change is considered more fully in later chapters and the Advisory Group recognises that it must form a basis for long-term action and be accompanied by a long-term communications plan.

The target date reflects that a new Welsh Government will be elected in May 2021 and will need to sign off any new programme and approve budgets in the Autumn of that year, before implementation begins in 2022.

2 Set Ambitious Targets

Recommendation 2 – The Welsh Government should set ambitious housing targets to meet its ambition of achieving net zero carbon by 2050

Action 2.1 – By 2050 the housing stock must be retrofitted to beyond SAP90 to achieve an EPC Band A rating, recognising that not all homes will be able to achieve this.

An approach that supports and encourages all homes to achieve appropriate performance standards by 2050 is essential for achieving greater than the 95% decarbonisation target, including the assumed decarbonisation of future energy grid supply.

It is acknowledged that the challenges of heat and the energy performance of homes will involve the decarbonisation of energy grids, improvements and replacement of building systems, or improvements to the fabric (walls, floors, roofs, windows and doors) of homes themselves. In Wales, the costs of this will be tens of billions of pounds by 2050.

In March 2018, the Welsh Government commissioned the WSA to carry out a review of the effectiveness of known measures to decarbonise homes, with particular reference to Wales[12]. This was followed, in October 2018, by a second study to understand the degree to which the nature of the existing Welsh housing stock could inform the development of a pathway to decarbonisation and give consideration to capital and energy costs[13]. The WSA concluded that:

> *"Some houses have constraints around retrofit, mostly related to character and historic features...All other housing must be retrofitted beyond SAP90, to achieve an EPC A rating."*[14]

A retrofit programme must overcome performance gap issues and the results should be measured as delivered and not as predicted. The need for this must be built into programmes and be supported by a quality regime, as considered in Recommendation 3.

[12] Green, E. et al., *Homes of Today for Tomorrow: Decarbonising Welsh Housing between 2020 and 2050*.
[13] Green, E., Lannon, S., Patterson, J. and Iorwerth, H., (2019). *Homes of Today for Tomorrow: STAGE 2, exploring the potential of the Welsh housing stock to meet 2050 decarbonisation targets.*
[14] Green, E. et al., *Homes of Today for Tomorrow: STAGE 2,* p. 1.

Use of EPCs in the report

The Advisory Group considers that EPCs have a role in understanding and assessing the energy performance of the stock as a whole, and in helping to set targets for parts or sectors of the stock.

The Group, however, recognises that there are some concerns over the use of EPCs as a baseline tool for identifying properties and guiding potential improvement actions. A different approach to guide improvement actions is known as the "Whole House Approach". This "considers that the whole house, its age, construction and systems installed in the house, needs to be assessed at the beginning of a retrofit project".[15]

Overall, it was agreed that EPCs are useful, useable and well understood by the public but that the EPC structure should be amended to more closely aligned to our aims, particularly by improving the focus on the environmental impact section of the certificate.

Action 2.2 – Lobby the UK government to support and encourage the further decarbonisation of the energy supply grids because Wales will not achieve the carbon reduction target without it.

Most energy consumed in Welsh homes is supplied from the electricity and gas supply grids. The cost of the continued decarbonisation of these grids may well be met by raising customer bills in the future and this will impact levels of fuel poverty.

Wales and West Utilities advocates a "whole system approach" to considering energy supply grids. This considers all energy demands, all energy supplies, and the networks that join them together. A whole energy system includes renewable generation such as wind power, tidal power and green gases. It also includes provision for developing technologies such as charging for Electric Vehicles and local energy storage in homes. The network will include storage, flexibility and needs to connect everything together in a reliable way.

The Energy Systems Catapult[16] considers that a whole systems approach helps determine the "*best mix of building improvements, low carbon heating technologies, and power, gas and heating networks to deliver low carbon and affordable energy.*"[17]

The focus of the Advisory Group has been on outlining a national strategy for Wales; however, Energy Systems Catapult points out that a whole systems approach also requires a deeper understanding of conditions at a local level. It is concerned with building stock, energy network capacity and other local characteristics, such as

[15] Sustainable Traditional Buildings Alliance, (2016). *What is Whole House Retrofit,* p.1.

[16] An independent, not for profit Centre of Excellence.

[17] Energy Systems Catapult, (2018). *Local Area Energy Planning: Supporting clean growth and low carbon transition,* p.9.

urban density - for the suitability of district heating - or local opportunities such as geo-thermal heat. This needs to be addressed in future work.

The second WSA study included an understanding of how energy grids influence the development of pathways to decarbonisation. Since 1990, carbon emissions from homes are estimated to have reduced by more than 40%. This improvement mostly comes from cleaner primary energy supply[18]. Three future energy supply scenarios were considered by the WSA.

- Scenario 1 – minor future improvements to the national grids (40% clean energy supply);
- Scenario 2 – significant future improvements to the national grids (60% clean energy supply); and,
- Scenario 3 – transformational change to the national grids (80% clean energy supply).

Assumptions around the energy costs are included in the WSA's modelling to create an understanding of different outcomes for the dwelling types at different points in time - 1990, 2018 and 2050.

The report concludes that a 90% or higher decarbonisation in the housing sector can only be achieved when the energy grids decarbonise by 60% or better, as outlined in Scenario 2.

The study notes that if the energy supply was to undergo a "transformational change", resulting in more than an 80% clean energy supply, the need to make significant changes to homes themselves would be unnecessary. In a scenario, however, where the energy supply became fully decarbonised but with less capacity than at present, it would still be necessary for homes to reduce their demand so as not to exceed the smaller grid capacity.

The WSA study also indicates that if heavy reliance is placed on grid decarbonisation, with little improvement works done to the homes themselves, and if the costs of producing a cleaner energy supply are passed onto householders:

> *"there could be considerable increases in householder energy costs, and corresponding increases in fuel poverty."*[19]

The Welsh Government must ensure that decarbonisation of the homes of the poorest people in Wales is not left solely to the energy supply grids.

[18] Green, E. et al., *Homes of Today for Tomorrow: STAGE 2,* p 7.
[19] Green, E. et al., *Homes of Today for Tomorrow: STAGE 2,* p 13.

Action 2.3 – The Welsh Government should urgently commence a 10-year programme to prioritise the retrofit of certain homes.

(a) The Welsh Government should set a target of EPC Band A for homes in social ownership and homes in fuel poverty.

(b) The Welsh Government should incentivise early adopters to retrofit homes to a target of EPC Band A.

A ten-year programme

It is vital that the Welsh Government focusses on action to tackle the difficult issues around the decarbonisation of homes, beginning with an immediate 10-year programme. Demanding and ambitious targets are necessary to ensure consistency across tenures and to establish and normalise a standard for 2030-50. This programme will create a market for companies in Wales, support and build a skilled workforce and drive innovation and investment to help to reduce costs. Recommendations and Actions supporting this are discussed as part of Recommendation 3.

Setting an ambitious target

In addition to recognising potential improvements to clean the energy supply, the WSA Stage 2 report defined potential improvements to the housing stock through four narratives. In summary, these are:

- *Good practice* – improvements driven by best value, including currently available skills;
- *Best practice* – improvements driven by long-term potential to reduce carbon emissions and quality, over cost concerns;
- *Heritage* – homes where improvements are constrained by conservation;
- *Rural* – off gas grid homes where improvements dictate a focus on energy conservation and local renewables.

In addition to the limitations of decarbonisation related to improvements in grids, the WSA concluded that decarbonisation levels above 90% can only be achieved when homes are retrofitted to a "best practice" narrative:

> *"In the context of 60% clean energy supply, 95% decarbonisation of the housing stock is tenable, but requires retrofit that goes beyond current building regulations throughout the housing stock. This is best represented by achieving an EPC A rating…Retrofit strategies that upgrade services must also uplift dwelling fabric to an acceptable standard, to diminish increases in energy costs and fuel poverty."* [20]

It is clear from this that, together with the contribution of grid decarbonisation, there will also be a significant contribution from improving the thermal efficiency of the fabric of homes, from decarbonisation of heating systems, and from renewable

[20] Green, E. et al., *Homes of Today for Tomorrow: STAGE 2,* p.14.

technology installed in homes. The WSA research considers pathways towards achieving a greater than 90% reduction in GHG emissions. In the "best practice" scenarios, the fabric improvements contribute around a 20% reduction in heat demand.

This level of fabric improvement is fully supported by the work of UKCCC. The "Buildings" chapter of the Net Zero Technical Report describes a "core" scenario for domestic buildings. The purposes of this were, *"low-cost low-regret options that make sense under most strategies to meet the current 80% 2050 target"*[21]. The "core" measure, including fabric improvements, contributes to a 21% reduction to heat demand[22].

The WSA notes that retrofitting some parts of the Welsh housing stock will be constrained. This includes pre-1919 housing which has an established character that may be diminished by extensive retrofit. We would not wish to exclude insulating homes just because they are older properties, but rather to ensure that the right, locally acceptable measures are used. Any justification for "acceptable fails" must be carefully defined so that decarbonisation targets are not jeopardised. It is important that flexibility is a part of any overarching target and that set targets reflect the best that can be sensibly achieved for different property types. This ensures that good value and efficiency are maintained.

We acknowledge the opportunities that simple building maintenance and repair present for improving energy efficiency.

The Advisory Group stresses that it is vital to consider both the cost and the benefit of the investments in decarbonisation. We recognise that there are different strategic approaches to decarbonising homes in Wales, and there is a still discussion around the likelihood of improvements to energy supply grids, their costs and the costs and challenges of improving homes. While we agree that substantial investment in energy supply grids is necessary, we also note that this investment is focussed on large companies who are usually based outside Wales. Retrofit works, carried out by trusted local SMEs, substantially improves the energy efficiency of people's homes and can deliver wider benefits, outlined in Action 3.4.

We recommend that the Welsh Government sets a firm, ambitious target for 2050, rather than targets for 2030 and 2040 as stepping stones. Stepping stone targets for the retrofit of the entire housing stock may appear to offer a pathway for decarbonisation but whole-house retrofit will be more cost-effective if only undertaken once.

Fuel Poverty

People who struggle to heat their homes are often on low incomes and are the most vulnerable people in our communities. 155,000 (12%) of households currently live in fuel poverty in Wales. Fuel poverty is an interaction between income, energy prices and poor quality, inefficient homes. Improving the energy efficiency of the fabric or the services of a property can make a big difference to a householder's energy bills and also helps build resilience to future energy price rises.

[21] Committee on Climate Change, (2019). *Net Zero – Technical Report,* p. 119.

[22] Committee on Climate Change, *(2019). Net Zero – Technical Report,* p. 80.

This action aims to help those in fuel poverty by focussing on homes with low EPCs and where households are on low incomes. Solid wall and off-grid homes are likely to have a higher prevalence of fuel poor occupants and these should be a priority for retrofit.

The new targets should replace the existing energy performance requirement in WHQS[23]. This also aims to help tackle the fuel poverty challenges faced by tenants in social housing.

To ensure a representative cross section of homes in Wales, the Welsh Government should also encourage early adopters in the privately-owned sector to upgrade homes to this target. Recommendations 3 and 4 provide more detail about how this should be done.

[23] Welsh Government, (2008). *Welsh Housing Quality Standard – Revised Guidance for Social Landlords on implementing and achieving WHQS,* p. 18.

3 Ensure Quality and Delivery across Tenures

Recommendation 3 – The Welsh Government should put in place the right quality system and delivery mechanisms across all tenures to help achieve the targets

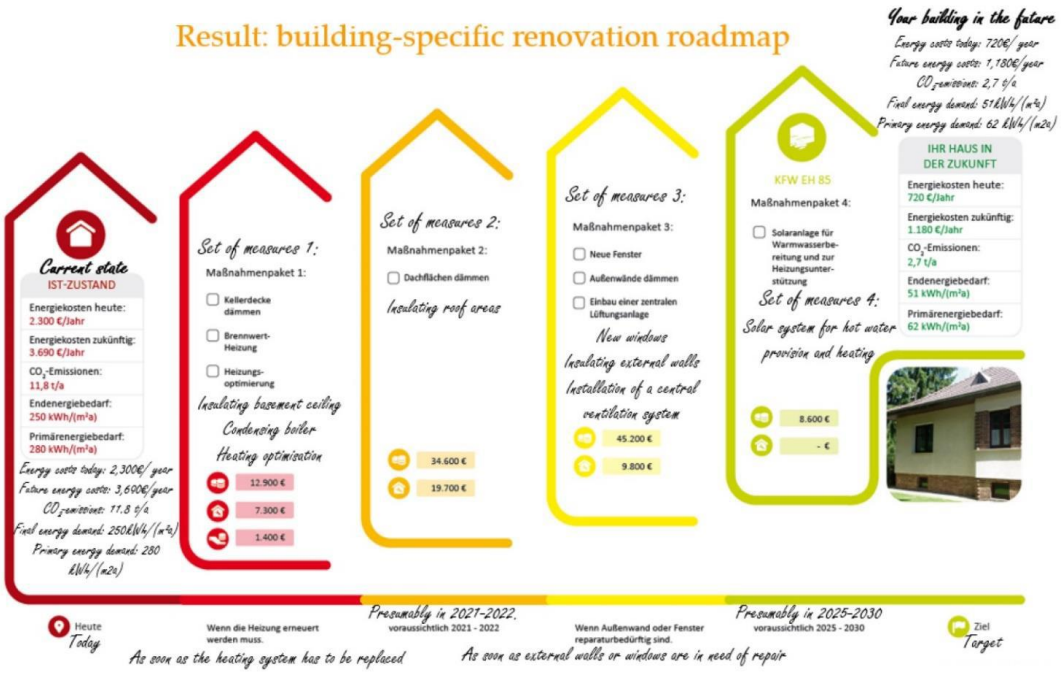
Action 3.1 – The Welsh Government should fund the creation of and publicly promote a "Home Log book" for every home to guide energy efficiency decisions and investments.

Most homeowners lack detailed information about their homes, including its current condition, when and how it was built, what subsequent improvements were made and what the potential is to improve comfort and energy efficiency.

The purpose of the Home Log book would be to provide a set of actions, sequence and estimated costs, to inform improvements towards more energy efficient homes.

A solution to this problem has been previously identified elsewhere in Europe in projects such the Building Renovation Passport[24]. This provides a systematic approach for the production of a customised, building specific route towards deep renovation.

Figure 3: Example of a 'Building Renovation Passport' to improve a home[25]



[24] Building Performance Institute Europe (BPIE), (2016). *Building Renovation Passports – Customised roadmaps towards deep renovation and better homes.*

[25] BPIE, (2016). *Building Renovation Passports,* p.16.

The Welsh Government should introduce a robust regime for Home Log books for all homes from 2025 which will be produced for the sale of a property, during the letting process, when applying for planning permission, or when installing an energy efficiency measure. The Home Log book regime must be integrally linked to the EPC regime and incentives and disincentives offered to homeowners, as described in Recommendation 4.

UK Finance report that work is already underway in some areas to develop standardised property information forms. Home Log book proposals will need to build on this. Access to independent advice and information services, including those relating to income maximisation and benefit uptake support, will be vital.

Action 3.2 – The Welsh Government should work with stakeholders and other interested organisations to create and fund an independent quality assurance regime that is appropriate for single homes as well as multi-property projects.

Previous reports have stressed the importance of a robust quality regime, most notably in "Each Home Counts" (EHC)[26].

The EHC review proposed 27 recommendations aiming to ensure that the right retrofit products and systems are installed correctly, for the right reasons, to the right standards, in the right order, and using the right knowledge, skills and application, and with a clear mechanism for redress in the event of problems.

EHC is being taken forward in a number of initiatives, including the setting up of technical codes of practice and standards for the installation of home renewable energy and energy efficiency measures. The British Standard is known as PAS 2035: 2018 Specification for the energy retrofit of domestic buildings. PAS2035 maps out how retrofit services will be delivered to assess, design, coordinate and evaluate the retrofit works to ensure these achieve the EHC goals. A quality regime for Wales, based on PAS 2035, should be developed by 2022. Two principles should underpin this new Welsh quality system:

1. only properly accredited organisations should be allowed to build, install and commission energy efficiency improvements to homes; and,
2. only properly accredited individuals should be allowed to survey, design, specify, project manage, monitor and sign-off the installation of energy efficiency measures in homes.

The Advisory Group hopes that most of the 1.4 million homes in Wales will be improved through the actions of SMEs already active in the Repair, Maintenance and Improvement (RMI) market. The challenge is that much of the work in the RMI market is carried out by firms who do not necessarily have the knowledge and skills for deep retrofit. A particular challenge will be to provide SMEs with the necessary training quickly and effectively, at least cost. Action 3.3 addresses this.

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[26] Ministry of Housing, Communities and Local Government, (2016). *Each Home Counts: Review of Consumer Advice, Protection, Standards and Enforcement for Energy Efficiency and Renewable Energy.*

The Advisory Group recommends that only homes that are retrofitted using the independent quality assurance regime and have a Home Log book are able to receive public funds, including government backed loans. Financial and support options are discussed in Recommendation 4.

Action 3.3 – Ensure the new quality regime is appropriate and accessible to SMEs in Wales as well as larger firms and that all have access to the skills and training they need to take advantage of a 30-year retrofit programme.

The nature of the SME retrofit sector at the local level can be a significant barrier to achieving a co-ordinated solution for each home. A project that seeks to tackle this barrier is “HomeWorks Retrofit - Coordinated Retrofit from the Local Supply Chain”, which is funded by the Department for Business, Enterprise & Industrial Strategy (BEIS) and currently being undertaken by partners which include the Building Research Establishment (BRE) and Trustmark.

This project aims to overcome the fragmented nature of the SME retrofit sector by developing a coordinated approach for home energy retrofit measures. The tradespeople, through the network, acquire knowledge and tools to support making appropriate household level recommendations. The outcomes of this project will help to inform the development of the Home Log book and quality regime in Wales.

SMEs working on RMI projects must be supported in delivering energy improvements in response to the opportunities arising in the course of their work by clear guidance and good training, and a well–resourced local authority building control function with a clear mission to support the low carbon transition of the housing stock.

General builders are vital players in meeting the 2050 target. At the moment there is currently no clear educational pathway or qualification for the RMI general builder working on residential properties, and this needs to be remedied urgently, including a strong sustainability focus. The Advisory Group supports the current Federation of Master Builders (FMB) campaign for builder licensing and the work underway with Qualifications Wales.

The skills sector councils and bodies, working in partnership with the Welsh Government and others, should consider what improvements are needed to current training schemes and accreditation systems in order to enable SMEs and larger firms in Wales to take full advantage of the opportunities presented by a major 30-year decarbonisation retrofit programme.

Action 3.4 – Encourage and support businesses in Wales to deliver projects that will result in the best community benefits.

A new retrofit programme is a major opportunity to build a key part of Wales’ Foundational Economy - in alignment with priorities set out in Prosperity for All -

where high quality, well paid and low carbon, skilled jobs will become a long-term feature in local communities, exactly where they are needed most.

To achieve this, procurement arrangements under a new programme must be based on the seven Well-being Goals.

There are potentially significant and widespread benefits of a well-designed and managed national residential energy efficiency programme. These include:

- enhanced skills base;
- higher employment and higher incomes;
- improved energy security, with a more resilient economy that relies less on fossil fuels and imported gas;
- improved air quality;
- improved learning, because children learn better in warm homes;
- improved quality of life;
- increased economic activity;
- increased tax revenues;
- less investment needed in generating capacity and future grid or network reinforcement;
- lower social and private rent arrears;
- neighbourhood improvement;
- opportunity to future-proof homes against overheating;
- opportunity to improve home security;
- physical and mental health benefits with the reduction of fuel poverty (particularly for children, the disabled and elderly people);
- reduced benefit payments;
- reduced demand on the NHS and social care;
- regeneration of public housing estates; and,
- substantial market for Welsh firms supplying innovative energy efficiency products and services.

The Welsh housing sector's long commitment to a community benefits approach has been very successful in developing local supply chains, jobs, training and apprenticeships over many years. The new retrofit programme must build upon this approach and lessons learned.

Action 3.5 – Encourage and support social landlords to extend their residential upgrade activities beyond their own portfolios to help deliver improvements to homes owned by their occupiers and by private sector landlords.

The social housing sector has had huge success in delivering large-scale, quality improvement programmes to their tenants. The WHQS is an example of this.

Figure 4: Examples from Cartref Cymunedol Gwynedd's WHQS programme taken in 2013

A key feature of the WHQS is the opportunity that it offers landlords to address issues at scale. In 2010, for example, Cartrefi Cymunedol Gwynedd (CCG) undertook £136 million investment programme, which allowed the complex upgrade of CCG's stock to be carried out in just five years[27].

The quality system described above anticipates the need for trusted advisors and delivery agents if homes are to be appropriately improved by people and organisations that are known in their communities. The Advisory Group believes that the experience of social landlords in undertaking large-scale quality improvement programmes means they are well placed to undertake the work for other owners.

This does not call into question the effectiveness of others already carrying out such work and it does not preclude others from taking on such roles. But an advantage of social landlords taking a lead, should they wish, is that they are well placed to drive the development of apprenticeships, skills, supply chains and knowledge of new technologies at scale in the communities in which they operate.

Social landlords should be able to access all new funding streams available to homeowners, as detailed in Recommendation 4, on an owner's behalf. Social landlords will be subject to the same requirements as any others operating under the quality regime.

[27] Savill, (2013). *Cartrefi Cymunedol Gwynedd WHQS Investment Programme – Health Check 2.*

4 Incentivising and Supporting Action

Recommendation 4 – The Welsh Government, working with others, should develop a holistic package of support across all tenures to incentivise and facilitate action

Substantial resources will be required to ensure Welsh homes are improved to meet the country's decarbonisation target. This does not mean that the Welsh Government should bear this cost alone - it is neither realistic, nor sensible. A variety of resources and measures can be used by the UK and Welsh governments, including grants, loans, taxation, regulation and programmes to encourage investment and action. This includes bodies such as local government, social landlords, banks, building societies, pension funds, investment companies and householders. Community development finance initiatives like credit unions will be important too as will the proposed new Community Bank for Wales. Different measures will be needed, and used in combination, to reflect tenure and ability to pay.

On 24 June 2019, Stephen Jones, Chief Executive of UK Finance[28], said

> *"Achieving net zero carbon by 2050 is a difficult but critical target that we must all work together to address and as an industry we stand ready to respond."*[29]

There is an emerging market in structured financial products to support decarbonisation. Financial institutions are innovating and beginning to develop products that respond to customer needs in decarbonising their homes.

As part of this, within firms' commercial and risk appetites and regulatory requirements, access could be offered to low interest rate finance to undertake energy improvement works. Importantly, these loans could be available not just directly to individual homeowners, but also at larger scale to public and private property owners and retrofit companies. Any scenario will require compliance with the new system and necessary quality checks to ensure the works undertaken are appropriate and completed to a good standard. The Welsh Government could use existing grants, loans and Financial Transactions Capital (FTC)[30] in a very powerful way to stimulate action.

The Actions sitting under Recommendation 4 explore some potential ideas but the list is not definitive. Other options exist, for example, those explored by the Green Finance Taskforce[31]. The Welsh Government must help create a suite of measures to underpin the delivery of a retrofit programme. As part of the next phase of work to develop a programme, the Welsh Government should establish an independent

[28] UK Finance is the collective voice for the banking and finance industry.

[29] https://www.ukfinance.org.uk/press/press-releases/uk-finance-responds-shadow-chancellor-john-mcdonnell-speech-climate-change. Accessed 02/07/2019.

[30] FTC is a form of capital investment which is also sometimes referred to as 'net lending' or 'policy lending'. It forms part of Welsh Government's overall capital spending power but can only be used for loans and equity investment. A proportion of the funding must be repaid to the Exchequer.

[31] Green Finance Taskforce, (2018). *Accelerating Green Finance.*

Finance Group to make recommendations on what that package of support should be.

Social Homes

Action 4.1 – The Welsh Government must urgently undertake detailed modelling of the costs associated with the targets set out in Recommendation 2. This will inform priority early action according to tenure, archetype and geography and specifically to verify the 10-year targets.

The WSA research has indicated a range of costs associated with retrofitting socially-owned and fuel poor homes in Wales. This suggests expenditure of between £0.5 billion and £1 billion per year for the next 10 years. As a matter of urgency, more detailed modelling against stock information must be done to give a clearer picture of total costs by tenure and archetype, where resources should be targeted and how best costs can be met.

For this reason, potential targets and costs should be kept under regular review. Many factors could influence this including the reducing costs of retrofitting at scale, new technologies and the decarbonisation of the energy grids. For example, BEIS has just launched a "Whole House Retrofit Innovation Competition", aimed at social landlords, exploring options to halve the cost of energy efficiency upgrades to homes.

Action 4.2 – Continue the WHQS for social landlords and the £108m per year funding associated with it, on the basis that they deliver against the stretching targets set out in Recommendation 2.

There are over 226,000 social homes in Wales, 16% of all homes, provided by registered social landlords (RSLs) and local authorities who still have their housing stock. All of these properties are required to meet the WHQS by December 2020, which includes achieving an energy efficiency standard of SAP65 or higher. Currently 201,140 (89%) social homes have achieved SAP65 or higher, improving the average energy efficiency band from an EPC Band E in 2008[32] to Band D in 2017-18[33]. Work will continue on this up to the end of 2020.

The new targets set out in Recommendation 2, and informed by the modelling required in Action 4.1, should replace the existing energy performance requirement in WHQS. The current energy performance of the stock as a whole will not be enough to support the Welsh Government's ambition to achieve net zero emissions or help tackle the continuing fuel poverty challenges faced by tenants.

[32] Welsh Government, (2008). *Living in Wales.*
[33] Welsh Government, (2019). *Welsh Housing Conditions Survey.*

The Independent Review of Affordable Housing Supply[34] recently considered the future use of the resources given to social landlords to achieve WHQS after the conclusion of the current programme. The Review concluded that large-scale voluntary transfer (LSVT) organisations and local authorities should be required to deliver an accelerated programme of decarbonisation of existing homes in return for a continuing funding commitment. The Advisory Group agrees and believes that landlords must reassess their housing stock and develop business plans to identify how they will meet any new energy efficiency target set by the Welsh Government. This will allow them to demonstrate the need for the continuing Welsh Government funding to invest in the improvement of their homes.

The Advisory Group understands that the Welsh Government and social landlords will have legitimate concerns about raising energy performance standards further. It has required a huge effort and large amounts of money to improve social homes from their poor condition in 2003, when the Standard was set, to the position they are in now. The WSA research indicates that, although achieving these targets is a significant challenge, it is not only achievable using tried and tested measures, but essential. Costs of making these improvements may well be high, particularly when considering challenges around house building targets and rents. These costs, however, should be placed in the context of planned and responsive maintenance expenditure, rising tenant fuel bills, impacts of inaction on tenants' health and well-being, low incomes and ability to pay rent.

Action 4.3 – Provide guidance and support to social landlords to enable them to meet the challenging new targets in Recommendation 2

The Welsh Government must work with social landlords on the modelling referred to in Action 4.1 and also offer support and develop guidance for the sector. This will need to cover, for example, how to improve homes based on how they are constructed and the carbon reductions arising from this activity. Social landlords will need to use this information to develop their new business plans for their stock post December 2020 by which date they must have achieved WHQS. There may not be acceptable solutions now for some types of homes but this should be kept under constant review, as detailed in Recommendation 6.

Action 4.4 – Find a financial solution for traditional RSLs who do not currently receive WHQS resources to enable them to meet the stretching targets described in Recommendation 2.

Traditional RSLs are also required to meet WHQS, but they have not been given financial support by the Welsh Government to do so. This is because traditional RSLs had invested in and maintained their housing stock to a good standard, in comparison with the poor quality of council housing at the turn of the century.

[34] Independent Review of Affordable Housing Supply, (2019). *Final Report.*

A residential decarbonisation programme sets an entirely new challenge to the sector in terms of the ambition and volume of retrofit required to meet stretching targets within a tight timeframe. The Welsh Government must, therefore, provide long-term financial support for the traditional RSLs. This support will be determined by the detailed modelling work required under Action 4.1.

Action 4.5 – Ensure existing public sector funding programmes that support the improvement of homes are amended to align with the outcomes and targets recommended in this report.

The Welsh Government and other public sector bodies, including local authorities, already provide substantial resources to support home improvement programmes such as Arbed, Nest, Home Improvement Loans, and Houses into Homes. They will all need to appraise their current programmes and plans in the light of the net zero commitment and modify them accordingly. Urgent consideration needs to be given to which households are supported, on what terms and for what work.

Enabling and encouraging people to take action to decarbonise their homes can be difficult. Giving conflicting messages and making differing offers could significantly undermine a new programme of action and the outcomes needed.

Private Homes

Decarbonising 1.4m homes regardless of tenure will be financially impossible simply by spending public sector funds. To achieve the targets set out in Recommendation 2, Wales needs to mobilise the spending capacity of the private sector, including owner-occupiers, private landlords and investors. For the Welsh Government to demonstrate its commitment to reduce carbon emissions and improve the uptake of energy efficiency measures, it needs to take a leadership role to support the accelerated development of the market.

In the paragraphs that follow there are recommendations for actions that need to be developed in the next phase of the work. Developing a broader suite of fiscal measures, using regulation and taxation where necessary, will not happen overnight. Measures need to be thoughtfully planned and be a careful mixture of prudence and pace. New measures should only be adopted once they have been first evidenced and tested rigorously.

Action 4.6 – Make resources available to fund the development of Home Log books, detailed in Recommendation 3, and the funding of uptake by homeowners.

The design and creation of Home Log books will require resources. Homeowners will need to be shown how to use them and the Welsh Government will need to consider providing them for free for an initial period, perhaps as part of a package of incentives. As explained in Recommendation 3, public funding for energy efficiency

measures will not be accessible to homeowners without a Home Log book because this may be a useful lever for action.

Data from the Home Log book which will contain not only construction information but also before and after energy consumption data, which will provide invaluable evidence for progress towards carbon targets and inform future policy and investment decisions.

Action 4.7 - The process for homeowners applying for financial support should be as straightforward as possible, and be linked to the need for a Home Log book described in Recommendation 3.

For homeowners to take up financial incentives it is essential that the process of getting support is as simple and easy as possible. Regardless of who is offering support, no-one wants to have to apply to several pots of money or fill in numerous forms to get it. That is off-putting to the keenest applicants, let alone those who are undecided about whether to apply or not, or do not have the necessary to skills needed to complete an application. This process needs to be developed as part of the quality system approach described in Recommendation 3.

Action 4.8 – Urgently create financial support mechanisms to enable owner-occupiers and private landlords who wish to improve the energy efficiency of their properties. Press the UK Government for financial support.

The Advisory Group recommends that there should be finance available from early 2021 tailored to the particular needs of different groups, to support the development of the energy retrofit market.

The UKCCC's report "UK housing: Fit for the Future?"[35] concluded that there are urgent funding needs which must be addressed now with the support of Her Majesty's Treasury and wants it to implement the Green Finance Taskforce recommendations[36]. This includes green mortgages, green loans and fiscal incentives to help finance upfront costs, as well as improving consumer access to data and advice.

The UK Government has just launched its Green Finance Strategy[37] which recognises the requirement for unprecedented levels of investment in green and low carbon technologies, services and infrastructure. Green finance will be central to providing the flows of capital we need. A Green Finance Institute has been established to lead this work. The Welsh Government has indicated it intends to press the UK Government for funding support and the Advisory Group fully supports this because Welsh targets will not be met without it.

[35] Committee on Climate Change, (2019). *UK housing: Fit for the future?*
[36] Green Finance Taskforce, (2018). *Accelerating Green Finance.*
[37] HM Government, (2019). *Green Finance Strategy.*

There is an emerging market in structured financial products to support decarbonisation. Financial institutions are starting to develop new products that respond to customer needs in decarbonising their homes.

An independent "Green Finance" group should be established by the Welsh Government to make recommendations for the financing solutions needed and this needs to work in tandem with the Green Finance Institute. The Welsh Government may wish to ask the Development Bank of Wales[38] to lead this, working with lenders and investors to maximise resources and uptake. This will also include the Welsh Government's support through grants, loans and FTC.

Support should be available not just directly to individual homeowners but also at larger scale to public and private property owners and retrofit companies. Any support will require compliance with the new quality system described as part of Recommendation 3.

Action 4.9 – Longer term and/or more innovative non-financial solutions need to be quickly identified, piloted, field-trialled and, if successful, rolled out.

It will be essential to test regulation and process measures in conjunction with financial and taxation measures to minimise any unintended consequences before a national roll-out. Recommendation 6 explains the importance of testing new approaches before scaling up. Two potential options listed below should be considered, alongside other measures, by the Welsh Government during the next phase of the work.

a. Quickly explore how levers such as legislation and regulation e.g. Minimum Energy Efficiency Standards (MEES) can support the uptake of energy efficiency measures in homes from 2030

Money is not the only lever which the Welsh Government and its partners can use to enable the transition to more energy efficient homes. The implementation of MEES is starting to drive improvements in the less efficient homes in Wales because it is not permissible to let a property that is below EPC Band E.

Enforcement of minimum efficiency standards, combined with ways of financially supporting landlords to meet and exceed them as outlined in Action 4.8, could be a very powerful lever for achieving the desired change.

b. Consider how Council Tax can be used to encourage action

Re-grading Council Tax in 2030, based on a home's performance against its optimised potential - as identified in the Home Log book. It could encourage people to make energy efficiency changes to their homes. If Council Tax could be aligned to the energy efficiency of homes, it would require a very significant lead-in time in advance of implementation to allow time for piloting and field trials, for

[38] A wholly owned subsidiary of the Welsh Government which enables the Welsh Government to deliver its policy objectives across Wales by directing public funds to where they can have most impact.

getting people used to the idea and giving them enough time to plan for the change.

Alongside this, the public sector would be required to provide financial support, in the form of grants or low interest loans. This would help those in, or at risk of, fuel poverty or other deprivation by ensuring they are not penalised by both high energy costs and high Council Tax bills.

At the moment improving energy efficiency of homes is the responsibility of the current property owner although subsequent owners take a benefit too. This can be off-putting where improvement costs are high, incomes and/or equity are low and there is uncertainty about the owner's future plans. Finding a way of spreading costs over much longer periods of time could alleviate this difficulty. Council Tax could potentially be used to do this with energy savings used to offset increased costs.

5 Data and Knowledge

Recommendation 5 – The Welsh Government should collect data and knowledge about the status and condition of the housing stock to inform future decisions and measure progress towards targets

Action 5.1 – All relevant information, including energy consumption data from before and after retrofit activities, should be used to inform the measurement of progress, policy development and investment. The data collection process will need to inform the Low Carbon Delivery Plan.

The data currently available to support a national residential decarbonisation programme includes EPCs for Welsh homes that have been bought, sold or rented in the last 10 years. This covers around 60% of all properties. Together with the 2018 WHCS and other statistical data held by the Welsh Government, work by the WSA has created a good overall understanding of the types of homes and their energy efficiency.

The challenge will be to better understand each home in more detail including its own energy consumption. This can then be used to target support and policy where it is most needed, measure the effectiveness of work carried out to improve the energy efficiency of each home and provide overall progress towards meeting targets.

While the WSA research shows that Wales' housing stock is mainly composed of a small number of construction types, it also showed that the 1.4 million homes are all individual and an understanding of each one through the Home Log book is needed to establish the actions best suited to decarbonising that home.

For this reason, the size of the challenge may be understood on a macro level, but the granular detail remains unclear at this time. As detailed information about more and more homes is collected, a more accurate picture of the challenge will develop. Recording this in a Welsh Government-owned central database, which could feed into the Welsh Government's Housing Stock Analytical Resource (HSAR), will enable Wales to track progress towards achieving carbon targets and provide an up to date picture of the condition of Welsh homes.

The Log book would provide useful information for the homeowners themselves to underpin long-term confidence in the low carbon actions in which they have invested. They would have a record of works for future reference or warranty issues, a clear plan for any further future improvements, a record and evidence of works that could be transferred to new occupiers on sale or rent which better reflects the condition of the home and lists any necessary work that might still be remaining. The database would also include records of who did the works for quality assurance or warranty purposes.

Where public money has been provided to fund the home improvements, it would also provide an evidence base of effectiveness and value for money, and the

feedback needed to identify where changes may be needed to improve outcomes.

6 Test and Rollout

Recommendation 6 – The Welsh Government should continue to monitor and test new solutions to decarbonise homes

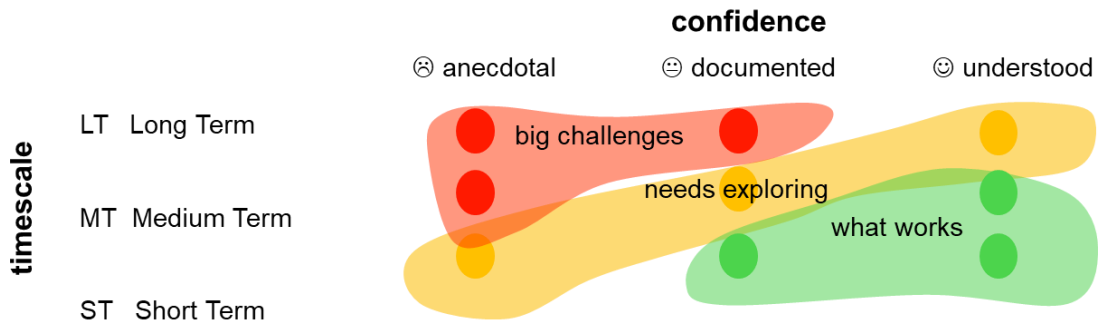
Action 6.1 – Establish a fund of at least £100 million to continue until 2030 to pay for the development of small and large-scale testing of innovative solutions, not limited to technical issues, which will help to decarbonise Welsh homes. The Welsh Government's successful Innovative Housing Programme (IHP) provides a model for this.

The research carried out by the WSA[39] demonstrates that the 2050 target can only be met through the whole system approach whereby fabric, heating system, energy supply and people's behaviours are all considered. The research classified ideas with the potential to accelerate and increase decarbonisation against two parameters:

- timescale for applicability - short / medium / long term; and
- confidence that the ideas will work as intended - anecdotal / documented / understood.

This approach is illustrated below, using a traffic light model.

Figure 5: Traffic light model[40]



[39] Green, E. et al., (2018). *Homes of Today for Tomorrow: Decarbonising Welsh Housing between 2020 and 2050*.

[40] Green, E. et al. (2018). *Homes of Today for Tomorrow: Decarbonising Welsh Housing between 2020 and 2050*, p. 12.

Green: What works

This area encompasses what is well known in literature and case studies to be effective “no regrets” actions, such as loft insulation, eliminating draughts maintaining equipment and repairing defects. These are well understood, proven actions with well-documented benefits. There is also market capacity and capability to deliver quickly and at scale.

Amber: Needs exploring

The amber category covers well-documented case studies and literature, but they often relate to pilot schemes or low volume trials with early adopters, such as the Freedom hybrid heat pump project in Bridgend.

The benefits of these actions are documented for small scale, but they require larger trials to better understand complex interactions or volume-related problems that may occur, improve confidence in the outcomes and better understand the benefits. Amber actions are those for which the ability of the market to deliver at scale may still be in its infancy.

Red: Big challenges

This area covers ideas that look promising but have not been tested and perhaps where continued research and development is an imperative.

The need to evolve our knowledge by moving ideas from red to amber to green must be a continuous activity. In some cases this may require development of the market’s ability to deliver, in others it may be cost reduction activity to make a potential solution commercially viable. A lot of work may be needed to get an idea from the laboratory to reality.

Wales needs to become be a place where:

- green light actions take place every day as a matter of course through skilled and informed delivery agents;
- amber light ideas are being piloted and trialled; and
- organisations have the confidence to invest and innovate, with support available for developing red light ideas.

This will raise the capability and capacity of Welsh businesses to decarbonise Welsh homes, bring economic benefits to Wales and help Wales lead in meeting carbon targets.

Another of the major challenges is to tackle the behavioural aspects of decarbonisation, which go beyond homeowners to all the organisations that influence whether and how energy efficiency improvements are made.

One of the key outcomes of the UCL behaviour workshops, as outlined in “The Influence of Behaviour Change” section later in this report, was the importance of trust. Homeowners need trusted advice from trusted independent bodies. How to create a retrofit system that people trust must be tested.

People are naturally wary of change if it affects their home or the way they might be expected to live in it. The larger scale trials of amber and red actions will serve not

only to prove ideas but also to introduce an environment over time in which improving a home's energy efficiency becomes socially normal. The larger scale trials will be designed to identify any trust issues not previously seen in small trials with smaller segments of society.

New approaches could be tested in urban, valleys and rural communities with active communities of practice created to rapidly share in real time the learning and accelerate roll out or the scaling-up of projects.

The "Next Steps" section of this report lists some ideas to be explored as part of a systematic research and development programme.

7 The Importance of Communities

Recommendation 7 – The Welsh Government and its partners should make maximum use of communities, networks, associations and third sector organisations in helping to decarbonise homes

Action 7.1 - Encourage and support community involvement in the development and delivery of a new programme.

Whatever the final programme looks like it will mean that all homeowners need to understand the size of the challenge ahead and take part in meeting it. Some people will not be able to do this without assistance. Others will be able but not willing. At a later date it is possible that the Welsh Government will need to consider a set of disincentives for inaction; however, during the early years, there should be a focus on encouraging and supporting action through a range of financial and other types of support.

Creating an environment in which improving the energy performance of homes is the societal norm will require a number of complementary and connected actions. It is clear that using an approach based on a proper understanding of human behaviour must be at the heart of that.

The importance of the strength and depth of Welsh communities, geographical and virtual, to help shape, develop and then implement a new programme on the ground, will be vital. It will be important to:

- make the best use of community anchor [41], Third Sector and other organisations in helping people understand the challenges of, and opportunities for, improving the energy efficiency of their homes. Modest funds may be needed to help bring community groups on board;
- ensure people can access quality support and services including independent financial advice to help them make informed decisions and make the changes needed. This is because endorsement from trusted sources, especially at the local level local, will be vital for people to have the confidence to proceed with significant levels of work to, and investment in, their homes;
- build momentum around the energy retrofit agenda. It will be essential that existing support services, and groups, regardless of their purpose, are helped to understand - the decarbonisation of homes, its importance to individuals, communities and businesses - and that they are willing and able to direct people to the help and support they need;
- ensure the quality service and support system described in Recommendation 3 is operating effectively because it will be central to gaining trust;

[41] Bodies who listen to the needs and views of local people, championing and advocating on their behalf and providing services and activities for the community, working closely in partnership with public, private and third sector organisations.

- ensure the assessment of individual homes and the recommendations for what needs to be done and when, reflects the needs and situation of the current residents and not just the need to reduce the carbon emissions of the property; and,
- put in place support services for people who find it difficult to cope with the upheaval involved in a major refurbishment.

The experiences of previous large-scale refurbishment, including the Warm Homes programme and the WHQS, demonstrate that enabling people to manage the process of home improvement is vital to obtaining buy in when carrying out the work. Other opportunities may arise too, for example, emptying lofts in areas with large scale refurbishment programmes could potentially create waste management problems. With proper planning and engagement with local groups, there is potential to create schemes to reuse, repair and recycle items for people within that community. The Warm Homes and WHQS programmes have demonstrated that people are much more inclined to agree to a housing decarbonisation programme if they and those in their neighbourhood have been involved in its development and can see clear benefits for their families, friends, neighbours and local businesses.

Next Steps

This report describes actions that need to be carried out by the Welsh Government and a wide range of other organisations. There are three in particular that require urgent attention as they will be the foundation of a new programme in the next term of Government.

A systematic research and development programme

To successfully assist the decarbonisation of the Welsh housing stock, the research and development programme should be collaborative and open access. Tasks should include:

- detailed modelling of the costs associated with the targets set out in Recommendation 2. An understanding of capital cost is urgent, particularly to inform social landlords' business plans;
- collecting all available data about the construction and energy consumption of Welsh homes, including recent and current retrofit projects, in order to establish the most accurate baseline against which progress can be measured;
- disseminating the resulting understanding of how costs relate to house types and retrofit approaches;
- continuing the assessment of "what works" when considering action to decarbonise homes. This is not just about technology but other areas, including finance and community approaches;
- identifying how to simplify and shorten the path from research to the more widespread deployment of ideas that will reduce residential energy consumption;
- research to understand how best to support the many SMEs active in the RMI market to help deliver energy efficiency upgrades to Welsh homes;
- identification of networks and associations already active in improving residential energy efficiency and tackling fuel poverty, as well as others which have complementary goals and who may be able to play a useful role; and,
- the continuation of behaviour change studies to identify the actions which different organisations must undertake to provide homeowners with the necessary capability, opportunity and motivation to undertake whole house retrofits.

The Quality System

This is at the heart of creating trust with householders and achieving the outcomes we need. Focus must be on:

- the development and delivery of an effective quality assurance regime including the Home Log Book; and
- identification of the support needed for SMEs, including skills and training.

Resources

Urgent action on this includes:

- securing resources to commence work on the early actions above; and,
- setting up a “Green Finance” group to identify and recommend funding routes, building on the work already done by the Green Finance Task Force and others. This should include how to provide access to low cost finance for all tenures in order to speed the decarbonisation of Welsh homes.

What we did and how we did it

The Decarbonisation of Homes in Wales Advisory Group

Welsh Ministers issued a Written Statement on 16 November 2017 entitled "Increasing the Scale and Rate of Residential Energy Efficiency Retrofit in Wales"[42]. It set out their intention to reduce carbon emissions in homes through retrofitting energy efficient measures. Identifying the right cost effective, targeted, clear actions, based on evidence of what works, reflecting for example construction types and geography, was considered a necessity.

The Decarbonisation of Homes in Wales Advisory Group, chaired by Christopher Jofeh of Arup, was established in Spring 2018 by Rebecca Evans AM, the then Minister for Housing and Regeneration. The purpose of the Advisory Group was to make recommendations to the Welsh Government on how best to deliver a long-term programme of housing improvements in order to meet the decarbonisation targets, which included:

- considering the current and long-term evidence needed to develop and deliver a programme;
- assessing any gaps in the evidence base and how they could be filled;
- recommending appropriate types of action and support that might be taken by all key stakeholders, and not just Government, to deliver a programme in the short, medium and long-terms;
- analysing the costs, value, levers, incentives/disincentives, challenges and opportunities represented by individual and collective sets of action;
- recommending appropriate types of support and interventions needed to achieve the aims of the programme;
- considering how actions might be implemented e.g. by tenure, area, income or construction type or a combination of all these approaches;
- engaging with other relevant organisations that are able to provide advice, support and input on these issues;
- ensuring all activities and recommendations made have clear links to the Welsh Government's Nation Strategy "Prosperity for All" and the Well-being of Generations (Wales) Act 2015; and
- consideration of any other issues requested by the Welsh Government.

The Advisory Group set up five subgroups to consider technical and infrastructure, governance, community benefits, customer confidence and financial issues. Each subgroup was asked to make recommendations for a housing decarbonisation programme based on available evidence and research.

[42] https://gov.wales/written-statement-increasing-scale-and-rate-residential-energy-efficiency-retrofit-wales Accessed: 02/07/2019.

It was quickly seen that there were many common issues and areas of overlap between the sub groups. Links and interdependencies were shared which helped ensure the development of a set of coherent recommendations.

Membership

The Advisory Group and subgroups' membership comprised the following:

- Ateb Housing Association
- Building Research Establishment
- Cadwyn Housing Association
- Cardiff Council
- Catrin Maby, Independent Consultant and Researcher
- Community Housing Cymru
- Constructing Excellence Wales
- Design Commission for Wales
- Development Bank of Wales
- Energy Savings Trust
- Federation of Master Builders
- Fusion 21
- Grwp Cynefin
- Institute of Welsh Affairs
- Melin Homes
- Mid Wales Housing Association
- National Energy Action
- National Landlords Association
- Office of the Future Generations Commissioner
- Residential Landlords Association
- Royal Institution of Chartered Surveyors
- Royal Society of Architects Wales
- Royal Town Planning Institute
- Sero Homes
- SPECIFIC at Swansea University
- Sustainable Traditional Buildings Alliance
- Taff Housing Association
- UK Finance

- Valleys to Coast Housing Association
- Wales & West Utilities
- Warm Wales
- Welsh Local Government Association
- Welsh School of Architecture at Cardiff University

The Advisory Group engaged with the Affordable Housing Review Panel which was considering the supply of new affordable housing in Wales, the UKCCC and the UK Green Finance Task Force. At the back of this report is a list of the reports, papers and other documents used by the advisory group. The Advisory Group Chair also spoke at conferences and briefed Political Party spokespeople, to ensure wider engagement and an understanding of the Advisory Group's role and recommendations.

The Advisory Group's Scope

While the overall aim is to decarbonise every aspect of energy consumption relating to homes and their occupants, the primary and direct task for this group was to deal with the "regulated" energy used in homes i.e. that used in space heating, water heating and lighting, as this is the biggest demand. The levels of unregulated energy use are entirely due to the behaviours of the people living in their homes and the way they use those homes and the Advisory Group was not asked to consider that.

Creating an environment where people have opportunities and the tools needed to help them to reduce their regulated energy consumption is likely to help make energy efficiency the norm and lead to further reductions in unregulated energy use. Recommendation 1.4 refers to the need to put in place a coordinated communications plan using behaviour change principles. One function of the plan will be to let people know about the challenges, opportunities, and benefits of moving towards a new energy efficient way of living and the support available to help them achieve it.

The Influence of Behaviour Change

Successfully tackling "wicked"[43] problems such as the decarbonisation of existing homes requires a better understanding of behavioural change by policy makers. This is important because behavioural change is at the heart of many such problems and influencing human behaviour can be very complex. Traditional policy tools such as legislation and regulation, taxes and subsidies, will form a part of the overall strategy to achieve widespread, sustainable behavioural change. Their effectiveness, however, can be limited without a better understanding of how to engage citizens and organisations in cooperative behavioural change.

Influencing choices

In Wales, 84% of all homes are owner-occupied or privately rented. It is clear that to succeed, policy and delivery must be designed with homeowners and private landlords in mind: the customer journey is paramount.

For homeowners and private landlords to change their behaviours, it will be necessary for energy advisers, manufacturers, builders, builders' merchants, financial institutions, local authorities and others to change theirs as well.

Actors

Figure 6 below lists actors within the domestic energy regime and their key functions, from an English perspective. The Welsh Government and the Development Bank of Wales are also potentially important actors. Research[44] has identified the important roles played by SMEs and builders' merchants active in the RMI market.

Figure 6: Actors within the domestic energy regime and their key functions[45]

Regime	Actors	Key Functions
Government	DECC (now BEIS) Communities and Local Government Local Government	The development of policy and appropriate legislation and regulation. Processes to ensure the application and enforcement of regulation. Tax and subsidy frameworks.

[43] A "wicked" problem is a problem that is difficult to solve because different stakeholders have different versions of what the problem is, it has many interdependencies and is often multi-causal and not stable, is socially complex, it does not sit conveniently within the responsibility of any one organisation, it involves changing behaviours, attempts to address it often lead to unforeseen consequences and it may have no clear solution.

[44] Owen, A., Mitchell, G. and Gouldson, A., (2014). Unseen influence - The role of low carbon retrofit advisers and installers in the adoption and use of domestic energy technology. In: *Energy Policy*, (73), pp. 169-179 and Killip, G., Owen, A. and Topouzi, M., (2017). Governance of Low-carbon Innovation in Domestic Energy Retrofits in the UK. In: The International Refurbishment Symposium: Conference Papers*. The International Refurbishment Symposium*, pp. 19-24.

[45] Swan, W., Ruddock, L., Smith, L. and Fitton, R., (2013). Adoption of sustainable retrofit in UK social housing, in *Structural Survey*, 31.

	Planning Authorities Building Control Regulators	
Infrastructure	Energy Supply Companies Infrastructure Companies	Provision of effective infrastructure and energy supply.
Non-Governmental Institutions	Insurance Companies Valuation Companies Certification Bodies Professional Bodies Warranty Providers Finance Companies Energy Advisory Services	Development of frameworks to provide insurance and legal cover, protection of standards, consumer advice and financial models.
Markets and User Practices	Owner Occupiers House Builders Social Landlords Private Landlords Residents	Various markets for products and services to provide energy efficient new and existing homes.
Technical Regime	Equipment Manufacturers Materials Manufacturers	Development of physical products and materials to be applied to new and existing homes.
Knowledge Regime	Universities Other Research Bodies Consultants Manufacturers Training Providers	Development of knowledge with regards to the whole socio-technical regime.
Production Regime	Contractors Installers Manufacturers Resellers	Delivery of products as applied into new and existing homes.

Influences on renovation decisions

Figure 7: Influences on homeowners' renovation decisions[46]

Table 1
Influences on homeowners' renovation decisions in applied behavioural research on energy efficiency.

		Commonly identified	Occasionally identified
Drivers (also: motivations)		Cost savings Thermal comfort Environmental benefits	Draughts, condensation, air quality, health Property value Aesthetics, appearance
Barriers (also: constraints)	Finances	Capital availability, interest rates Delayed gains	Irreversibility
	Information	Uncertain cost savings Contractor reliability & quality	Uncertain comfort or health outcomes Low salience of energy, misperceptions of energy use
	Decision making	Disruption, hassle	Cognitive burden, transaction costs, information search costs
Attributes of efficiency renovations	Technical	Energy savings	Complexity
	Financial	Capital cost, cost savings, payback period Relative advantage	Financing mechanisms
	Other	Comfort	Compatibility, observability, trialability
Personal influences	Information & awareness	Expert advice or recommendations, energy audits or assessments Expected cost savings	Availability and credibility of information sources Peer (interpersonal) advice, communication Behaviour, social learning
	Attitudes & beliefs	Beliefs and understanding of energy-environment issues Attitudes towards specific energy-environment issues	Future energy prices Implicit rates of time preference Attitudes towards renovating and homes
	Experience, skills		DIY, technical skills, know-how Past experience with renovating or efficiency measures
Contextual influences	Household characteristics	Size, composition, lifecycle (e.g., number of children)	Gender, decision making roles Routines, habits Room occupancy profiles
	Socio-demographics	Age, education, income, employment	Location (e.g., urban–rural)
	Home tenure	Status (own, mortgage)	Duration (current, expected)
	Property characteristics	Size, age heating system, insulation	Number of different types of room Infrastructure availability (e.g., gas network)
	Salient events	Moving home	Triggers or disruptions to routine (e.g., boiler breaking down, tenants moving in or out)
	Policy incentives	Amount	Ease of access, timing, salience

Situating renovation decisions within domestic life

Wilson et al point out that:

> *"An explicit understanding of renovation decisions by homeowners is important because they directly influence decisions about efficiency improvements. Situating an applied understanding of renovation decisions within a broader context of home ownership, households and domestic life is necessary to help address the ultimate influences that drive and shape the decision process.*
>
> *A situated approach to renovation decision making has three key features. First, renovation decisions are processes. Second, these processes emerge from, and take place within, the conditions of everyday domestic life. Third, influences on renovation decision processes vary in their urgency, for example replacing a broken boiler in mid-winter will require a hurried or limited*

[46] Wilson, C., Crane, L. and Chryssochoidis, G., (2015). Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy, in *Energy Research and Social Science* (7), p. 15.

decision in contrast to the deliberate decision making process about a planned house extension project.

For energy efficient renovation decisions, 'proximate' influences (influences that are are closer to an observable outcome) explain what renovation decisions are made and how (for example with what products, at what cost, with which contractor). 'Ultimate' influences explain why homeowners are deciding about renovating in the first place. Proximate influences act on renovation intentions once formed; ultimate influences explain the initial formation of intentions. A boiler breakdown is an example of a proximate influence on a renovation decision. The recommended models and costs of replacement boilers offered by an emergency callout contractor are corresponding examples of immediate influences. The role of the boiler in providing thermal comfort, differentiating the use of rooms and spaces, and enabling patterns of social activity in the home, are all examples of ultimate influences."[47]

Figure 8: Examples of immediate, proximate, and ultimate influences on renovation decisions [48]

Table 2
Examples of immediate, proximate and ultimate influences on energy efficient renovation decisions.

	Immediate influences (informing or influencing point of decision – e.g., *which renovation products?*)	Proximate influences (strengthening or shaping decision intentions – e.g., *how and what to renovate?*)	Ultimate influences (originating or explaining emergence of decision process–e.g., *why renovate?*)
Attributes of efficiency renovations	Financing options	Energy savings	Experience of previously installed measures
Personal influences	Energy saving motivations	Awareness of energy/environment issues	Stage of life course
Contextual influences	Emergency repair	Age of property	Physicality of ageing
Differentiated households	Risk-aversion of financial decision maker	Competing opinions on preferred renovations	Roles and relationships within household dynamics
Amenity home improvements	Financing package	Contractor skill set and industry relationships	Conditions of domestic life creating tensions
Renovating and everyday domestic life	Renovation industry marketing and advertising	Habits and routines	Objects and skills used in DIY activities
Homes as emotional and social places	Aesthetics of renovation measures	Environmental and comfort objectives	Meanings of home

The science of behaviour change

Given that reducing GHG emissions from existing homes in Wales will require both people and organizations to change their behaviours, interventions drawing on the science of behaviour change are needed to understand and promote the necessary changes.

Researchers at UCL have described a rigorous approach to intervention development[49] that provides a systematic approach that can be used to inform the

[47] Wilson, C., Crane, L. and Chryssochoidis, G., (2015). Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy, in *Energy Research and Social Science* (7), pp. 17-18.
[48] Wilson, C., Crane, L. and Chryssochoidis, G., (2015). Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy, in *Energy Research and Social Science* (7), p. 19.

development of public policy where behaviour is critical to the outcomes. A series of tools are used to identify those critical behaviours, to understand the influences on those behaviours, and options for bringing about change that can be applied at the individual and policy level.

The Advisory Group was assisted by behavioural experts at UCL to identify:

- the key actors in residential energy efficiency and their desired behaviours; and
- actions needed to ensure that these actors have the capability, opportunity and motivation to act to decarbonise the Welsh housing stock.

[49] Gainforth, H., Sheals, K., Atkins, L., Jackson, R. and Mitchie, S., (2016). *Developing Interventions to Change Recycling Behaviors: A Case Study of Applying Behavioral Science.*

Alignment with the Well-being of Future Generations' Ways of Working and Well-being Goals

Members of the Advisory Group shared the emerging recommendations with the Future Generations Commissioner for Wales to check alignment with the Well-being of Future Generations' five Ways of Working and seven Well-being Goals. An overview of short, medium and long-term benefits can be found in the tables below.

The mapping demonstrates that a new 30-year retrofit programme offers enormous opportunity to deliver widespread and profound benefits including:

- reducing fuel poverty;
- creating sustainable growth, substantial numbers of jobs, training schemes and supply chains particularly in local communities;
- promoting good health and well-being for everyone; and
- building more cohesive communities with better environments.

From the outset of its work, the Advisory Group recognised the imperative of placing the decarbonisation of housing within the context of the Well-being of Future Generations Act's five Ways of Working and seven Well-being Goals. The following tables map out how a long-term programme to decarbonise the housing stock in Wales will align with the Ways of Working and contribute to driving the Well-being Goals.

Ways of Working	Retrofit Programme to Decarbonise Homes in Wales
Long Term: Balancing short term needs with safeguarding ability to meet long term needs	• 30-year programme to deliver immediate and long-term benefits
Integration: Considering impacts on Well-being Goals and other objectives	• Reduced GHG emissions • Increased economic activity and prosperity • A more resilient housing stock • A healthier population • Reduced inequality • More cohesive communities
Involvement Involving people who reflect the diversity of Wales	• Making best use of local communities and community groups • Using existing national and community networks • Important role for SMEs • Engagement with stakeholders and public • Enhanced roles for planning and building control
Collaboration Acting in collaboration with people and other public bodies	• Joint working within housing sector – housing associations and local authorities - around supply chains / procurement / contracts • Public Bodies collaborating on commitment, leadership, funding • Opportunities for joint pilots and trials across Wales
Prevention Preventing problems occurring or getting worse	• Tackling fuel poverty and providing improvements to the health and well-being of citizens • More cohesive communities enabled by improving the housing stock

Goals	Short Term (0 – 5 Years)	Medium Term (5 -15 Years)	Long Term (15 – 30 Years)
A Prosperous Wales ✓ Low-Carbon Economy ✓ Local Jobs for Local People ✓ Welsh Supply Chains ✓ Lower Fuel Bills ✓ Decent Jobs	• Investment in pilots and skills • Raising awareness of solutions through trials • Exploring opportunities to source natural products in Wales	• Developing local technologies and innovations to provide lower cost solutions • Skilled local workforce • Lower fuel bills	• Thriving low carbon local economy • Reduced fuel poverty • Cleaner local energy generation
A Resilient Wales ✓ Strong Communities ✓ Confident Citizens ✓ Healthy Economy ✓ Green Wales	• Early adopters drive longer-term change • Taking measures to counteract effects of climate change within localities • Investment in community networks	• Wider roll out of solutions • Pleasant and bio-diverse communities • Lower fuel bills	• All homes fit for the future • Increased biodiversity and resilience to effects of climate change • Reduced fuel poverty and its effects
A More Equal Wales ✓ Good Quality Homes for All	• Set ambitious targets across all tenures • Drive programme with initial focus on social housing	• Raise general standard of housing in Wales • Spread learning and solutions to private households	• Reduced fuel poverty and affordable warmth for all • Better standards of homes across all tenures
A Healthier Wales ✓ Healthier society ✓ Greater sense of well-being	• Raising awareness of importance of good quality homes for health and well-being • Reducing hazards in homes	• Safer and more efficient homes	• Realignment of health budgets as a result of reduced strain on public services • Increased well-being of citizens

A Wales of Cohesive Communities ✓ Attractive communities ✓ Community led projects	• Communities working together to focus on most vulnerable • Understanding the need for change and the benefits • Better advice to citizens	• Communities proactively taking action • Roll out of trials on place-based model • Maximising local income	• Community Energy Assets • More money being generated and used within communities
A Wales of Vibrant Culture and Language ✓ This will be supported by helping to achieve the other six goals	• Social Landlords taking responsibility for impact of works on communities	• Strong and safe neighbourhoods where people want to live	• Retaining character and identities of communities • Localised housing needs met • Distinctive places
A Globally Responsible Wales ✓ Wales meets Carbon Reduction Targets	• Housing sector contributes to successfully meeting Welsh Carbon Budgets	• The carbon footprint of homes in Wales is largely reduced	• Wales meets net zero target for carbon emissions produced by homes in Wales

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