



Financing Wales' Housing Decarbonisation

Written by: Dr Donal Brown, Christian Jaccarini, Chaitanya Kumar, Cathy Madge, Eurgain Powell

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New Economics Foundation
www.neweconomics.org
info@neweconomics.org
+44 (0)20 7820 6300

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1.Executive Summary

Climate change is one of the biggest challenges facing current and future generations. Wales has made world-leading pledges to significantly decarbonise housing stock by 2030 to support our goal to be net zero by 2050. In 2020, I highlighted that developing an economic stimulus package which leads to job creation and supports the decarbonisation of homes, should be a priority for Welsh Government as part of a Green Recovery to the pandemic. The hosting of a global climate change conference (COP 26) by the UK later this year is an opportunity for both the UK and Welsh Governments to commit to making this a reality.

Overcoming levels of fuel poverty that remain stubbornly high (12%) sits at the heart of Wales' decarbonisation and social justice objectives, and the decarbonisation of homes must be seen as a fundamental part of a green and just recovery from the pandemic in Wales.

Managed well, a retrofit programme could be a game changer for the Welsh economy helping to meet decarbonisation and fuel poverty objectives where 10% of Wales' greenhouse gas emissions come from the residential sector with 155,000 homes in fuel poverty; eradicate fuel poverty and reduce needless energy costs - 12% of people in fuel poverty could save up to £613 per year on energy bills if retrofitted to EPC 'A', saving a total of £8.3 bn by 2040; generate cost saving to the NHS - £4.4 bn by 2040; create new industries, skills and jobs, based on local supply chains - 26,500 new jobs and support the foundational economy with potentially millions of local spend.

Housing is an area within Welsh Government control and therefore must be prioritised if the Government is serious about meeting their legally binding climate change targets. Wales has some of the oldest and least efficient housing in Western Europe and so action to improve the quality of this stock will be essential. Decarbonisation is a challenge, and an opportunity, for organisations and communities across Wales which can no longer wait.

The focus of our work has been to estimate the total funding needed for the decarbonisation of homes in Wales, identify funding gaps and suggest approaches to addressing these gaps. We have worked closely with several organisations and stakeholders, building on previous work including 'Better Homes, Better Wales, Better World' report, the work of the Welsh School of Architecture (WSA), the Altair report commissioned by Community Housing Cymru (CHC) and Welsh Government's Optimised Retrofit Programme (ORP) which is testing approaches to decarbonising homes in Wales.

Decarbonising Welsh housing stock at the scale needed will require significant investment along with increased coordination of all actors in the system. Welsh Government needs to lead the way but will be unable to 100% grant fund the programme. The challenge of funding this shift must be balanced across the UK Government, Welsh Government, registered social landlords, local authorities, landlords and homeowners, with many other organisations playing their part.

Investment in optimised retrofit across Wales' housing must be seen against the backdrop of significant benefits to well-being, cost savings in services and local economic growth. Investment in millions of homes has the potential to generate large economic returns as well as reducing our emissions and levels of fuel poverty.

We estimate a national programme will require £14.75bn of investment over the next decade (to 2030)¹:

- £5.5bn for social housing,
- £4.8bn for homes in fuel poverty, and
- £4.4bn for homes in the owner occupied and private rented ('able to pay') sectors respectively.

The total government investment required is around £5.3bn over ten years.

Of the £14.75bn of investment needed to decarbonise and improve the quality of Welsh homes, £3.6bn should come from UK and £1.7bn from Welsh Government, with 64% of total investment coming from private finance, energy companies or self-funding by property owners.

Tenure/ status	Number of units	Average investment required per home	Total Investment (bn)
Social housing	230,000 (~21,000 are in fuel poverty)	£24,000	£5.52
Fuel poor housing	155,000 (~21,000 are socially rented)	£35,984	£4.82
Private Rented Sector (PRS)	180,000 (~36,000 are in fuel poverty)	£4,700	£0.67
Owner Occupier	924,000 (~99,000 are in fuel poverty)	£4,525	£3.73
Total	-	-	£14.75

¹ Building on data from the Welsh School of Architecture, to achieve EPC A for social housing and fuel poor homes, and EPC C for all other homes.

In 2019 households in Wales spent £1.02bn on general renovation maintenance and improvement (RMI) works, an average of about £723 per home².

Based on existing investment plans and policy proposals there are currently large funding gaps for social housing (£2.7bn) and homes in fuel poverty (£3.9bn) which are privately rented, and owner occupied to meet the level of EPC “A” by 2030.

Key priorities for the Welsh Government:

1. The decarbonisation of homes must be a shared endeavour, with Welsh Government playing a leadership and coordination role, bringing all sectors together in a shared mission.

The challenge of financing decarbonisation is not for Welsh Government to undertake entirely. If both the Welsh and UK Governments are serious about a green recovery, and meeting their respective climate change commitments, they must work together to use all the financial levers available to them to fund the retrofit challenge. They should view this investment as support for essential infrastructure, like investment in other infrastructure such as road, rail, and power.

Likewise registered social landlords, local authorities, and over time private households, will also need to play their part in this shared endeavour. All these organisations should be focused on shared innovation and risk, collaborating, and learning at every stage.

Welsh Government should play a key leadership and co-ordination role with support and collaboration required from UK Government, local authorities, registered social landlords as well as education, training and private sectors to ensure concerted action across social housing, homes in fuel poverty and those in the private rented and owner-occupied sectors.

Welsh Government should:

- Lead the way by setting clear long-term commitments and targets for Wales’ housing stock in the second Low Carbon Plan.
- Fully recognise the interconnected challenges of the decarbonisation of homes and tackling fuel poverty and reflect these across the new programme for Government including linking policy action on skills, finance, foundational economy, and health.
- Prioritise investment in this area and emphasise the importance of this agenda for the people of Wales, when negotiating with the UK Government about post EU funding such as the Shared Prosperity Fund.

²<https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/outputintheconstructionindustry/subnationalandsubsector>

Registered social landlords and local authorities should:

- Consider how they can access private finance to supplement Government grant funding for the decarbonisation of their housing stock.
- View Renovation Maintenance Improvement (RMI) spend and investment in decarbonisation measures as interconnected with opportunities for further integration over time.
- Building on the successful ways of working under the Optimised Retrofit Programme, prioritise collaboration and continuous learning in the approaches taken to decarbonisation of their housing stock.

UK Government will have a critical role in supporting investment and regulation whilst **Local Authorities** should play a more proactive role in driving the decarbonisation of homes and the reduction of fuel poverty, particularly in relation to the Private Rented Sector. 11 of the 22 local authorities in Wales have retained their own housing stock, and 16 of the 22 have declared a climate emergency so must now demonstrate how they are prioritising decarbonisation of homes through an area-based approach using all the levers available to them. To support this their role should be strengthened and properly resourced.

2. There needs to be a longer-term plan for funding.

There is a clear need for a longer-term pathway to the decarbonisation of homes, if we are to meet decarbonisation targets, at the very least until 2030. This needs to illustrate the shared commitment between Governments, registered social landlords, local authorities and other players to develop a **long-term pathway** to the decarbonisation of homes, providing certainty and clarity about funding arrangements, anticipated job creation, procurement routes and skills pipelines.

But this long-term investment plan cannot be achieved alone or within current mechanisms. It will require new and innovative ways of leveraging other sources of funding and investment and potentially utilising the capacity of the Development Bank of Wales to develop a new Wales Energy Service Company to coordinate and support funding decarbonisation in the social housing sector (as outlined in section 4).

Welsh and UK Governments should:

- UK Government should commit to allocating an **additional £2.6bn of infrastructure investment funding** and **£1bn allocation of the Shared Prosperity Fund** which is needed by 2030 to tackle decarbonisation of low-income homes and address fuel poverty in Wales. These sources would be equivalent to other infrastructure programmes (e.g. road, rail, power) recognising the significant fiscal benefits of a retrofit programme to the UK Exchequer.

- **Welsh Government should increase its use of Financial Transaction Capital for retrofit** and UK Government should facilitate access to the new Green Sovereign Bond market, to enable around **£6.3bn of private investment** in the Welsh housing stock by 2030.
- Work with the UK Government Financial Conduct Authority (FCA) to stimulate £100m/year Green Mortgage market by requiring disclosure of how energy efficient a house is at “decision in principle” stage.

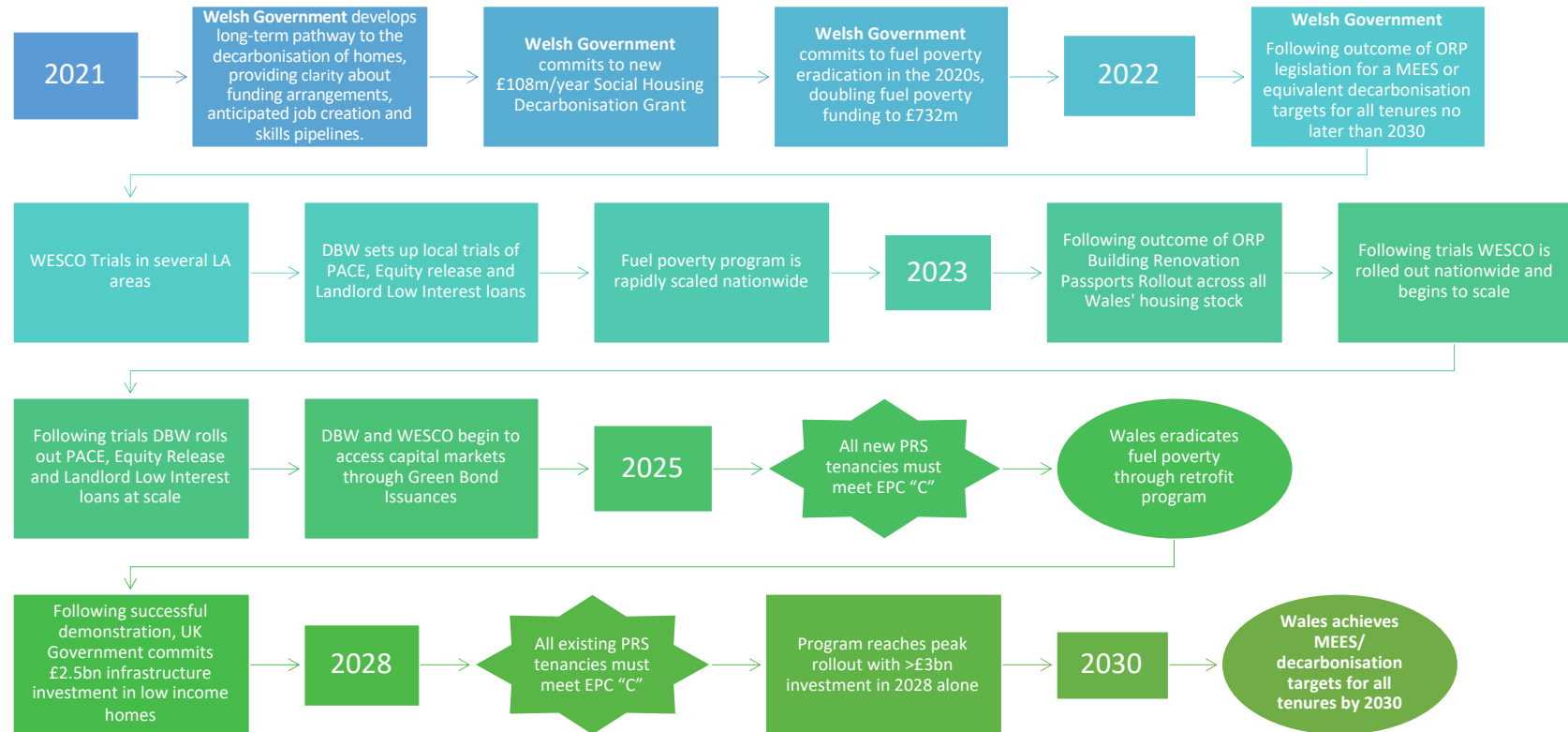
For social housing sector & homes in fuel poverty, Welsh Government should:

- **Double fuel poverty funding** to £732m by 2030 and supplement with grants for people on low-incomes which would be available from UK Government’s national infrastructure funding, with the aim of eradicating fuel poverty by 2030.
- Commit to a **new £108m/year Social Housing Decarbonisation Grant**, conditional on measured performance & cost reductions.
- Work with UK Government to offer **£158m/year low interest loans** to housing providers through the ‘Welsh Energy Service Company’ (WESCO) via Energy Saving Performance contracts.

For the private rented / owner occupied (able to pay) sector, Welsh Government should:

- Work with Local Authorities to trial the **Property Assessed Clean Energy (PACE) mechanism**, through a levy on council tax. PACE is a means of financing retrofit measures which attaches the debt to the property rather than the individual, secured by a property tax bill.
- Work with the **Development Bank of Wales** to trial equity release models and low interest loans to landlords for retrofit finance

Policy Roadmap to 2030



2. Why is funding needed?

2.1. Context

This report explores how Wales can fund its world leading pledge to significantly decarbonise its housing stock by 2030, towards the goal of complete decarbonisation by 2050. In 2019, the Decarbonisation of Homes in Wales Advisory Group (DHWAG) – led by Chris Jofeh - argued that ensuring Wales delivers on its climate change pledges requires a cross party strategic commitment to the complete decarbonization of the housing stock by 2050; with significant inroads to be made in social housing and homes in fuel poverty by 2030. These commitments recognise that over 80% of Wales' current housing will likely still be standing in 2050 [1]. Indeed, many argue that the decarbonisation of heat in existing homes is the UK's single greatest policy challenge for achieving net zero emissions [2]. In this report we follow the recommendations from the DHWAG Report to investigate how the targets to 2030 could be funded.

In 2015, the National Assembly for Wales passed 'The Well-being of Future Generations Act', committing our nation's sustainable development ambitions within legislation and creating the post of Future Generations Commissioner (FGC) to promote sustainable development; to act as 'guardian for future generations'. The FGC views housing as a foundational issue on which many other sustainable development goals depend. Ensuring that Wales' homes are affordable, warm, healthy and zero carbon is therefore a fundamental pillar of ensuring that future generations interests are protected. It is for these reasons that the FGC have commissioned the New Economics Foundation (NEF) and the Sustainable Design Collective (SDC) to investigate how the decarbonisation of Wales housing stock and the elimination of fuel poverty will be funded, with a specific focus on the next ten years to 2030.

To date, emissions from Wales' housing stock have reduced by more than 40% since 1990. However, three quarters of this improvement has come from a cleaner electricity supply, rather than improvements to homes themselves [3]. Indeed, the UK Committee on Climate Change (CCC) outline how, at a UK level, very little progress has been made in decarbonising buildings since 2012. The picture in Wales has been better with the Welsh Housing Quality Standard (WHQS) having delivered over £1bn of investment to 220,000 social homes since 2003 and the Warm Homes Programme- Nest and Arbed schemes - delivering more than £366m to 61,400+ low income homes [4].

However, despite this progress, much more remains to be done. The average home in Wales remains an Energy Performance Certificate (EPC) rating of "D", and the

deployment of low carbon heat remains <5%. To address this situation, DHWAG recommend that all homes in social ownership and fuel poverty should be brought to EPC “A” rating by the end of the decade. Further, England and Wales targets for homes in the Private Rented Sector (PRS) to meet EPC “C” by 2028 and all homes by 2035, will necessitate significant investment across all tenures through the 2020s.

Recent work by the Welsh School of Architecture (WSA) has provided outline estimates for the cost of meeting these targets [3,5]. They estimate average costs of improving Welsh housing to EPC “A” today to be ~£39,000 per home. Allowing for scale economies, we estimate the total investment to be in the region of £5.52bn for the social housing sector and £4.82bn for all non-socially rented homes in fuel poverty to 2030. Further an EPC “C” target for all other homes in Wales would require at least a further £4.41bn of investment, rising to ~£8.48bn with significant deployment of low carbon heat. This plan would constitute a total of £14.75bn investment by 2030.

Despite these large sums, this report identifies significant sources of capital which can be directed towards funding a major retrofit programme in Wales. We recognise that different funding models will be required across different tenures, and between different levels of need. While the level of investment is substantial, the potential benefits to the environment and Welsh society are likely to be enormous. Therefore, any discussion of costs, must be considered both with the costs of inaction, as well as the social, environmental, and economic benefits this plan will deliver. We estimate these undiscounted benefits to be at least £12.65bn by 2040 and an additional £19.32bn in economic growth by 2030.

2.2. How will this programme protect present and future generations?

The Well-being of Future Generations (Wales) Act aims to improve the social, economic, environmental, and cultural well-being of Wales. The Act is designed to make public bodies think more about the long-term, work better with people and communities and each other, look to prevent problems and take a more joined-up approach. To ensure key actors are working towards the same vision, the Act puts in place seven well-being goals. These goals include a Wales which is 1) more *prosperous*; 2) *resilient*; 3) *healthier* and 4) *more equal* with 5) *cohesive communities*, 6) *a vibrant culture and thriving Welsh language* and a Wales which is 7) *globally responsible*. Table 1 draws on contemporary research to identify how a nationwide retrofit programme would contribute to addressing each of Wales' seven well-being goals. Table 1 draws on contemporary research to identify how a retrofit programme would contribute to addressing each of Wales' seven well-being goals.

Table 1 The contribution of a retrofit programme to Wales' seven well-being goals

Goal	How an optimised retrofit programme will contribute to this goal
A prosperous Wales	Residential retrofit creates more jobs per £ than almost any other form of infrastructure spending [6]. Further, unlike road or rail investment, retrofit can create high quality jobs in every community, with a potential ~26,500 new jobs in Wales alone [7]. By leading the UK's decarbonisation drive, Wales can insource 1000s jobs in the supply chain, and deliver on foundational economy objectives.
A resilient Wales	There are opportunities for the broad approach to decarbonisation of homes to also consider benefits related to nature and biodiversity – for example through greening homes and communities, and creating spaces for nature and local food growing. Retrofitted, energy efficient homes can be more resilient to extreme weather expected through climate change [8]. By reducing energy imports, creating local jobs and economic development, retrofit also makes communities more resistant to external economic and environmental shocks [9].
A healthier Wales	A large review of academic studies has shown improved winter warmth and lowered relative humidity have proven benefits for cardiovascular, respiratory, and mental health [10], with homes in the Nest scheme having 11% fewer respiratory and 12.4% fewer asthma events since 2011 [11]. Indeed, every £1 spent on fuel poor homes an estimated £0.42 is saved in NHS spending [12]
A more equal Wales	A retrofit programme across Wales housing stock, could lead to an average energy bill saving of around £613 for each home retrofitted to EPC “A” [7], with savings even higher from homes taken from low bands or above. These savings would virtually eliminate fuel poverty in Wales and make a significant contribution to reducing economic inequalities.
A Wales of cohesive communities	Efficient, low carbon homes are more comfortable to live in, have a higher value and are less likely to incur rental void periods with EPC band “B” properties void for 31% less time than bands “E” & “F” [13]. These factors are likely to create more stable and prosperous communities.
A Wales of vibrant culture and thriving Welsh language	By investing in our housing stock, we can ensure the long-term prosperity of communities, generating wealth, jobs, and a sense of civic pride in Welsh industry and culture, leading to increased disposable income and leisure time.

A globally responsible Wales	A widespread decarbonisation of the housing stock will make a significant contribution to meeting Wales’ Net Zero ambitions, currently representing around 20% of carbon emissions. Implementation of this world leading programme will gain international recognition and place Wales as a global leader in the fight against climate change.
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Housing is therefore crucial to the seven well-being goals, underpinning Wales future sustainable development and prosperity. However, Wales’ old and energy inefficient housing stock requires significant investment to be fit for the 21st century. Although progress has been made, many homes in Wales remain cold, damp, and difficult to heat. This leads to a host of knock-on impacts not only for the climate, but for health and wellbeing, local resilience and hamper the desire for Wales to build a stronger foundational economy.

Wales has committed to reduce its emissions of greenhouse gasses to Net Zero by 2050 [14]. A comprehensive retrofit programme for Welsh housing is, therefore, an essential element in Wales journey towards Net Zero and the well-being goals. Recent work by the WSA has shown that this programme will require the installation of energy efficiency measures, low carbon heat systems such as heat pumps, and onsite renewables such as photovoltaic panels, to vast majority of Wales; 1.4 million homes by 2050 [15]. Further, a goal of raising homes in social ownership and those in fuel poverty to EPC “A” by 2030, will ensure that the benefits of this transition are fairly distributed to those most in need, developing the learning and supply chain capability necessary for the wider stock.

2.3. The case for investment now

A retrofit programme across Wales housing through the 2020s, has the potential to generate a large return on investment, and if structured correctly, lead to a net gain in government tax receipts. Numerous studies show that, although small in scale individually, investment in millions of homes has the potential to generate large economic returns from energy savings, increased wages and construction job creation, growth in regional supply chains and spill-over effects in the wider economy [9,16]. Indeed, leading economists now call for residential retrofit to be classified as a priority infrastructure investment ahead of traditional options like road or rail [17].

Infrastructure investment has long been viewed as an effective means of economic stimulus during periods of downturn, especially those characterised by suppressed demand and unemployment. It is for these reasons, that NEF [7] the Energy Efficiency Infrastructure Group (EEIG) [6] as well as leading economists from the London School

of Economics and University of Oxford [18] recent called for a “Green Stimulus for Housing” in response to the COVID-19 economic crisis.

Given Wales’ greater near-term ambitions in this space, a green stimulus could deliver a huge dividend for the Welsh economy, delivering a range of benefits for the newly elected Welsh Government. The EEIG estimates a programme to renovate all Welsh homes to only EPC “C” by 2030 would bring average annual gross value added (GVA) from construction sector output to the economy of over £180m to Wales, with a present value of £1.5bn by 2030³. Macroeconomic modelling by Cambridge Econometrics estimate an EPC “C” target has a value for money ratio of £3.20 to every £1 invested in energy efficiency by government, while delivering £1.25 of tax revenue for every £1 of public money, assuming 42% of the investment came from government [9]. Indeed, Germany’s federal energy efficiency programme has leveraged €6 of private energy efficiency investment for every €1 of public money spent on the programme, recouping its outlay through VAT receipts alone [6].

Recent research by NEF⁴ indicates that a commensurate ten-year programme as outlined in this report, would save Welsh residents an average of **£418 per year** on their energy bills annually, a total of **£8.26bn** by 2040. Using a methodology developed by the UK Energy Research Centre⁵ we estimate the **undiscounted** environmental and health benefits, at the Wales level. With benefits continuing through the 2030s, we estimate these benefits by 2040 to be:

- **£2,569m** for avoided CO₂,
- **£1,249m** in health and comfort benefits
- **£569m** in improved air quality

This is a combined total of **£12.65bn** by 2040 (undiscounted).

Investment in homes leads to a positive economic impact on industries supplying the construction sector with energy efficiency products. Recent bottom-up modelling by NEF and the cooperative Retrofitworks estimates that this programme would create and sustain an average of 15,144 construction jobs and 11,344 indirect jobs through the 2020s, a total of **26,500 new jobs in Wales**.

Changes in expenditure on energy affect consumption outlays and thus revenues of consumer-facing industries and their supply chains. Based on a review of GDP

³Using 3.5% Social Time Preference Discount Rate as per HM Treasury Green Book guidance.

⁴ https://neweconomics.org/uploads/files/Green-stimulus-for-housing_NEF.pdf

⁵ <https://ukerc.ac.uk/publications/unlocking-britains-first-fuel-energy-savings-in-uk-housing/>

multipliers for retrofit developed by Cambridge Econometrics⁶ and the University of Leeds⁷ we expect this programme of investment in housing decarbonisation to increase Welsh GDP by **£19.32bn by 2030**, versus the do-nothing scenario.

Delivering these benefits will require a well-funded, designed and executed programme, that delivers over the long term and is able to leverage private as well as public funding. In the following section we explore the scale of this challenge in Wales, describing the current state of the stock and the scale of Wales' policy ambitions.

⁶ https://www.housingnet.co.uk/pdf/Building-the-Future-Final-report_October-2014_ISSUED.pdf

⁷ <https://sri-working-papers.leeds.ac.uk/wp-content/uploads/sites/67/2019/12/SRIPs-120.pdf>

3. The scale of the challenge

3.1. Wales' current housing stock

Wales has among the oldest and least efficient housing in Western Europe, with 32% built before 1919 [4], and just 6% built in the last 35 years when building energy performance standards began to be introduced [3]. Most older homes are solid walled and have single glazed windows and doors. While many now have central heating systems, a large share have older inefficient boilers, with outdated or limited controls. These characteristics contribute to Wales having the highest energy efficiency investment needed to reach EPC "C" of any UK region, at around £1,450 per capita [6]. Wales also has the lowest gross disposable household income (GDHI) of the 12 UK regions at only £15,754 per head of population [19]. These demographic and housing stock factors combine to make Wales housing decarbonization goals the most important and challenging in the UK and perhaps the whole of Western Europe.

As shown in Figure 1, most Wales' 1.4 million homes are privately owned, with 70% owner occupied housing. Social housing represents a much smaller share (16%), with the bulk of the ~230,000 homes now operated by Registered Social Landlords (RSLs). Private rented housing has grown significantly in recent decades, now at 16% of the stock and expected to further increase. While there has been a 6% increase in the number of homes in recent years, very few homes have been demolished, meaning improvements to existing homes must provide the vast majority of carbon savings to 2050 [3].

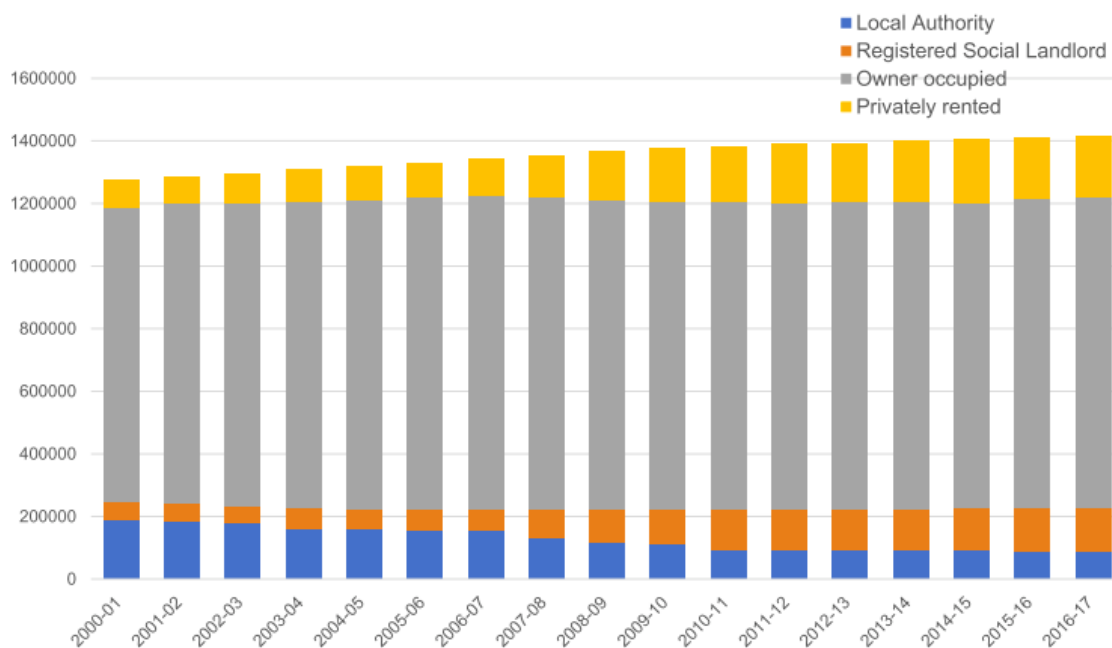


Figure 1 Wales dwelling stock by tenure. Source: [3]

The Energy Performance Certificate (EPC) system remains the backbone of domestic energy efficiency policy. EPCs are divided into two metrics, the Energy Efficiency Rating (EER) which reflects the cost delivering a home's fixed energy services, and the Environmental Impact Rating (EIR), which is based on its impact on carbon emissions. These metrics are based on a SAP score of 1-100, divided into an EPC range of A-G. The EER is the more commonly used metric, with the average home in Wales having a SAP (EER) score of 61 or an EPC "D" as shown in Figure 2. Social housing is the best performing tenure with an average SAP rating of 68 compared to 60 for privately owned homes. Despite criticism for its inaccuracy and poor reflection of the carbon content of grid electricity [20], the EPC/SAP system remains the UK's core methodology and most well understood concept for residential decarbonization.

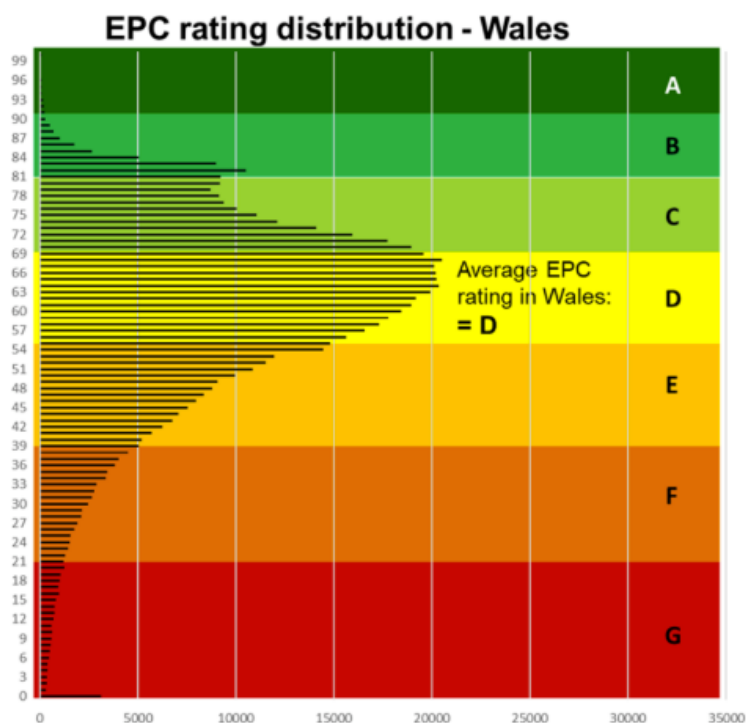


Figure 2 EPC EER distribution in Wales. Source:

Overcoming fuel poverty sits at the heart of Wales decarbonisation and social justice objectives. Although definitions have changed over the years, in Wales, a household is defined as being in fuel poverty if they would have to spend more than 10% of their income on maintaining a satisfactory heating regime, with those having to spend 20% defined as being in severe fuel poverty. While the WHQS, Arbed and Nest programmes have made significant inroads in reducing it, 155,000 (12%) of Welsh homes remain in fuel poverty. The average energy bill saving required to alleviate fuel poverty or the 'fuel poverty gap' stood at £431 in 2018 an overall £56.9 million annually in Wales [11]. 20% of the PRS, 11% of owner occupiers and 9% of social housing tenants live in fuel poverty, while 43% of homes in EPC Bands "F" and "G" are fuel poor

compared to only 5% in bands “B” to “C” [11]. Therefore, improving fuel poor homes to EPC “A” would likely eliminate fuel poverty in Wales.

3.2. Where do we need to get to?

The Better Homes, Better Wales, Better World (DHWAG) report recommends that as far as practical all homes in Wales should be brought to EPC “A” by 2050. The report recommends that this target should be brought forward for all social housing and homes in fuel poverty by 2030. When factoring for the overlap, this 2030 target amounts to around 364,000 homes or around 26% of the Welsh stock. By focussing on these most vulnerable households first, the aim is to develop the knowledge, learning economies and the supply chain capacity for the wider stock decarbonisation in the 2030s [4]. We believe this approach is correct one, as it will ensure the benefits of a zero-carbon housing stock will be felt first by those on the lowest incomes and in the lowest quality housing, whilst developing the learning required to reduce the cost of delivering these aims on the wider stock. For these reasons, we support the recommendations of the DHWAG report and use these targets to inform the cost modelling we apply in this document.

Alongside the EPC “A” targets for social housing and the fuel poor, we also propose an interim EPC “C” target for all homes in Wales by 2030. The UK government already has an ambition of EPC “C” for all homes in England and Wales by 2035 [21], with Scotland having similar targets [22]. The UK government is also currently consulting on proposals for Minimum Energy Efficiency Standards (MEES) of EPC “C” for all private rented housing in England and Wales from 2028. Given Wales’ greater long-term ambitions, and the likely need for many homes to receive gradual improvements over the coming decades, we believe Wales should adopt an interim target of EPC “C” across the stock no later than 2030. The targets adopted in this report are therefore summarised in Table 2

Table 2 EPC EER targets across sectors used in this report

Tenure/ status	EPC Target	Number of units
Social housing	EER “A” 2030	230,000
Fuel poor housing	EER “A” 2030	155,000 (~21,000 are socially rented)
Private Rented Sector (PRS)	EER “C” 2028	180,000 (~36,000 are in fuel poverty)
Owner Occupier	EER “C” 2030	924,000 (~99,000 are in fuel poverty)

3.3. Why are we proposing an interim target?

Without an approach that delivers improvement across all tenure types, there is a significant risk that the 2050 objectives will not be delivered, and the benefits of the programme will not be realised. Firstly, the sheer scale of the task will necessitate progress to be made across the whole housing stock during the 2020s. Delaying

action on the lower hanging fruit required to raise all homes to EPC “C”, will create supply chain issues by compressing these goals into a shorter timeframe. Secondly, the cumulative carbon and wider social and environmental benefits we outlined in Section 2.3 are contingent on savings being made across all tenure types in Wales during the 2020s. Thirdly, the economic benefits largely hinge on achieving widespread uptake of measures, and the generation of tax receipts from this economic activity. Without this wider adoption from the “able-to-pay” households and the mobilisation of private investment, there is a risk that the fiscal benefits of a retrofit programme would not be realised and could result in a net cost to government. These issues are explored in greater detail in Section 8.

3.4. What measures are needed?

Meeting these targets will require a widespread retrofit programme reaching the majority of Wales’ 1.4 million homes by 2030. This strategy will include the installation of energy efficiency measures to the building fabric of homes, low carbon heating systems such as heat pumps and smart controls, and onsite renewables such as PV panels and storage from batteries and electric vehicles. The Homes of Today for Tomorrow research by the WSA outlines the relative mix of these measures across a range of Welsh housing archetypes [3,3]. The research shows that the cost-effective mix of measures will be dependent on the type of property, its age, gas grid connection, heritage features etc.

The WSA research recommends a ‘fabric first’ approach which reduces energy demand as a first step, before the adoption of low carbon heat and renewables. As shown in Figure 3, the majority of homes in Wales have some form of loft insulation, although ~15% of dwellings have less than 150mm, while 2/3 of cavities have been filled⁸. The figure also shows that the large majority of solid walled properties have no insulation, with even fewer having floor insulation [23]. Further, only a small fraction of homes has renewable technology in the form of PV panels or heat pumps.

⁸ Noting that some existing filled cavities have significant performance issues and will require remediation works

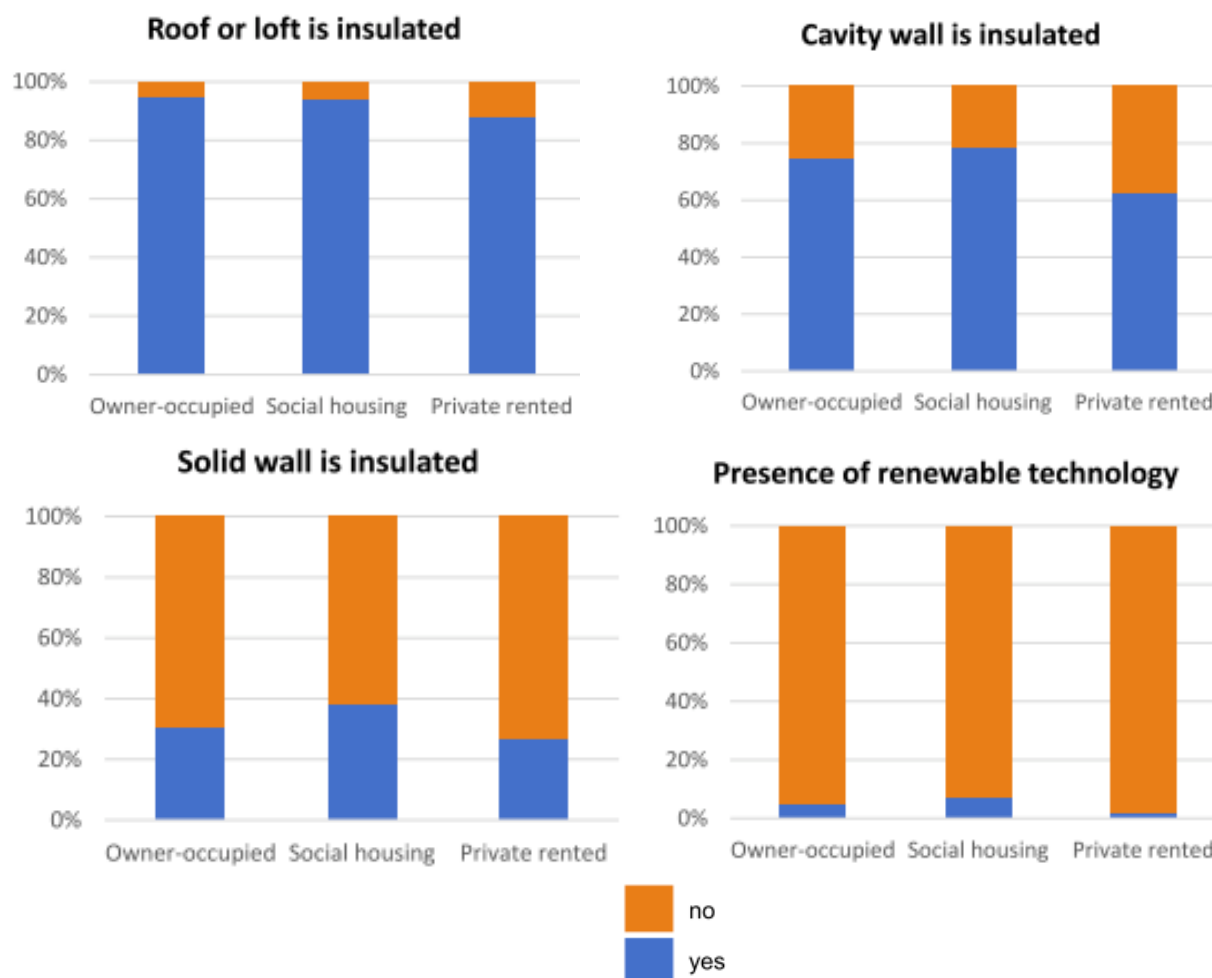


Figure 3 Deployment of retrofit measures in Wales by tenure. Adapted from: [3,3]

3.5. Are EPCs the right target?

While the SAP and EPC system currently provides the backbone of the UK's residential energy policy framework, it has attracted criticism as a tool for driving decarbonisation. The EPC EER rating is based on energy costs not carbon intensity, and many highlight the inaccuracy of the underlying SAP model and its fixed assumptions surrounding occupant behaviour. A further consideration is the carbon content of grid electricity assumed under the current SAP/EPC system.

In their recent report on the Sixth Carbon Budget (2033-2037), the UK CCC outline how in a Net Zero compliant trajectory, renewables will reach 60% of electricity generation by 2030, 70% by 2035, and 80% by 2050, meaning a grid carbon intensity of around 50 gCO₂/kWh in 2030 and 2 gCO₂/kWh in 2050 [24]. This suggests that the UK is on a more ambitious 2050 grid decarbonisation trajectory than the 60% assumed by the WSA. Thus, where deeper fabric improvements prove too costly, the

electrification of heat could allow homes to be 'net-zero' compliant, without meeting EPC "A".

As part of the consultation process for this report, many of our participants raised these issues, with some suggesting targets based on a building's energy demand (kWh/m²/year) or carbon emissions (kgCO₂/m²/year). However, at the time of writing there is no clear consensus on what, if any, new targets will replace the EPC system. Bottoming out this discussion is beyond the scope of this report; however, the Welsh Government Optimised Retrofit Programme (ORP) is currently exploring these issues in more depth.

We do however emphasise that the scale and scope of investment outlined in this report will need to be matched if a future decarbonisation programme is to meet its aims whilst also ensuring an equitable and just transition, especially for those on low incomes.

3.6. An optimised approach to retrofit delivery

While securing the financing to deliver on Wales residential decarbonisation agenda is critical, financing alone will be insufficient to delivering these goals. Meeting these targets, will need to overcome a widespread lack of information, engagement and trust with households on the options for, and advantages of retrofit; a perception that retrofit has uncertain benefits and low quality workmanship, without guarantees on performance; complexity, disruption and poor integration with the timing of wider renovation decisions; issues with the up-front capital cost of measures and split incentives, particularly between landlords and tenants, or those looking to move [25].

The Welsh Government's Optimised Retrofit Programme (ORP) is seeking to bridge many of the gaps that currently exist for the adoption of whole house retrofit at scale in Wales. The ORP will see more than 1,370 social housing units made more energy efficient, and using the lessons learnt from these 'pathway homes', will create the digital tools required to enable the decarbonisation of homes across Wales. The ORP aims to develop effective, practical pathways to take that home to its lowest achievable carbon footprint. Recognising that each home is unique, the ORP will develop a tailored plan which also enables scale economies, standardisation and show how data analysis can reduce costs, improve performance outcomes, and deliver key lessons for a wider programme. ORP recommends that properties are improved as far as possible, considering the current solutions available and the likely costs of the works. A detailed understanding of the works and likely costs of these through Building Renovation Passports [26] is the first key step in this journey. The Welsh Government. has announced £19.5m of funding for the ORP in the coming years. We expect that the ORP will contribute significantly to reducing the costs of the targets outlined in this report and have therefore factored this into our analysis.

The ORP will form a foundational part of addressing the challenges Wales' retrofit programme, requiring a sophisticated and multifaceted policy approach and leadership from government in creating this market. Although this report is focused on the financing challenge, Figure 4 and Table 3 show that achieving these goals will require a wide reaching and strategic approach, with a broad range of policy instruments and initiatives across six crucial policy areas. If any one of these is absent, the strategy may be liable to fail. We expect that the ORP will make significant contribution to this strategy, but that both Welsh and UK government will need to go further.

Table 3 Six dimensions of a successful retrofit programme

1. Strategy, engagement, collaboration and delivery
Such an ambitious programme will require strategic policy approach, at multiple levels of government. At its heart, we propose an 'area-based delivery' model, co-ordinated by local authorities, providing a single point of contact for information, marketing, financing, project delivery and quality assurance. This should also be accompanied by a nationwide system of Building Renovation Passports, along the lines of what is being proposed by the ORP. This strategy will also require the coordination of multiple govt. departments at both Cardiff and Westminster levels. Previous work by NEF has suggested this would be best coordinated by a National Retrofit Taskforce [7].
2. Regulations
The foundation of this strategy must be a regulatory approach that ensures all homes are brought up to a decent standard. This will include staged minimum EPC or energy efficiency (MEES), standards for the social, private rented and owner occupier sectors, as well as an eventual ban on new fossil fuel heating in all homes. This will also require fundamental reforms to the SAP and EPC system, so that they reflect the actual impact of retrofit measures and a building's energy performance.
3. Skills, supply chains and standards
Any credible strategy to upgrade the nations homes must ensure that the work is undertaken to the highest possible standards by competent and properly trained contractors. This will necessitate a nationwide training programme based on an increasingly professionalised industry. To avoid another Grenfell tower disaster this will involve a route and branch review of both retrofit standards and Building Regulations to ensure a joined-up approach to energy efficiency, product quality, fire safety, and disability access standards for new and existing homes. In addition, government will need to support innovation in Welsh supply chains and delivery processes to realise its Foundational Economy objectives.
4. Integrated business models
An optimised retrofit strategy will require integrated business models which appeal to broader motivations than financial savings. This will necessitate 'one-stop-shop' offerings providing an end-to-end service alongside traditional building/renovation work. The strategy also proposes an increasing move towards energy performance contracts.

5. Fiscal incentives

Alongside the cost of the measures, a range of fiscal incentives will be needed at key 'trigger points', such as when moving to a new house or undertaking wider renovation work. This may include variable stamp duty, council tax, a renewed Landlords Energy Savings Allowance (LESA) an energy efficiency feed in tariff or reduced VAT on wider renovation work when certain energy performance targets are met [27]. These incentives should be designed to 'nudge' renovation decisions towards energy retrofits. Although some examples like VAT will have a cost to the exchequer, others such as stamp duty can be made fiscally neutral [7].

6. Finance

Ensuring there is sufficient and appropriate finance is essential for this strategy to be realised. However, finance represents the final piece of this puzzle and will only have an impact, once the above issues are solved. The remainder of this document is focussed on where this funding might come from.

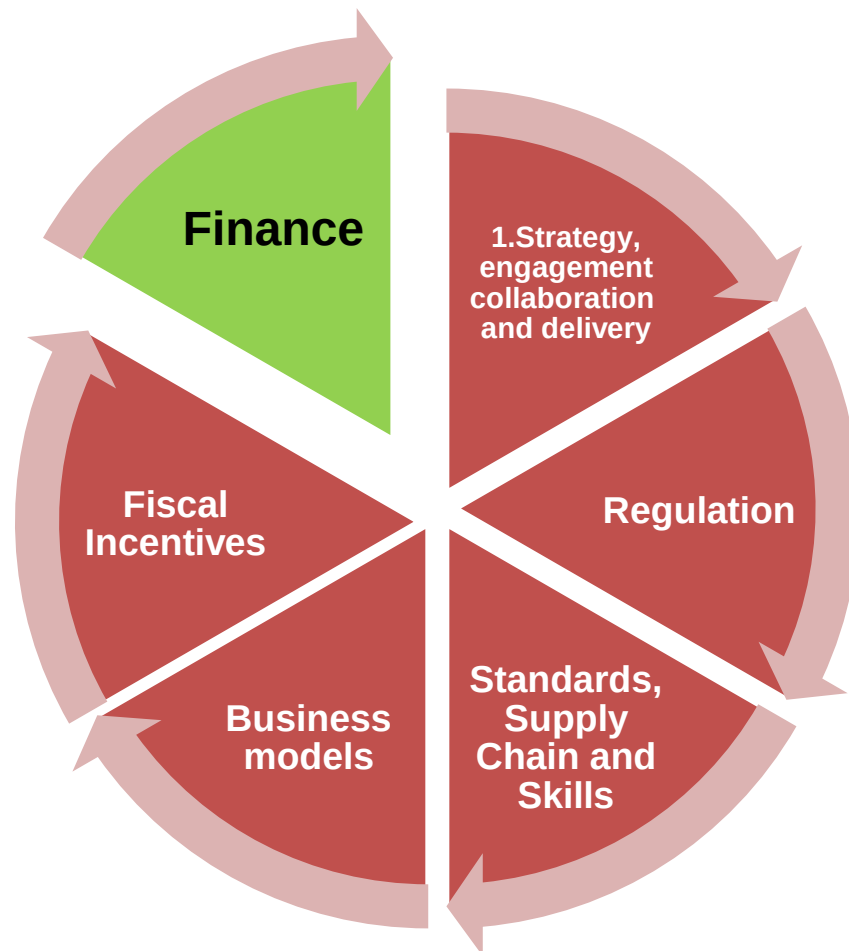


Figure 4 Strategic approach to housing stock decarbonisation

4. How much investment is needed?

Delivering the objectives outlined in the previous section will require an unprecedented level of investment in Wales' housing. Arriving at exact figures for this investment is not the purpose of this report. Indeed, any estimates are likely to be subject to significant uncertainty, surrounding the development of supply chains, innovation, learning and scale economies as well as broader factors surrounding the global economy and BREXIT. Acknowledging these caveats, this section draws on existing research which has attempted to quantify the cost of residential decarbonisation, both at the UK and Welsh level. This includes the work by the WSA on the cost of decarbonisation to EPC "A" by 2050 of Wales private [3] and social housing [5], alongside recent work by NEF [28], the Department for Business Energy and Industrial Strategy (BEIS) [29] and Verco and Cambridge Econometrics [9] on the costs of meeting EPC "C" across the UK.

4.1. Whole stock investment required by 2050

In their "Homes of Today for Tomorrow, Stage 2" report the WSA provide estimates of the investment required for decarbonisation of Welsh housing by 2050. The modelling (Table 4) involved a representative taxonomy of 14 recurring dwelling 'types' of the Welsh housing stock, using multiple data sources. In addition to these 14 types, four retrofit 'narratives' were created reflecting different economic, geographic, and heritage constraints on the retrofit pathway. The cost model adopts detailed estimates on the current costs of retrofit measures, as well as anticipated renovation maintenance and improvement (RMI) spend over 30 years. The model shows a large variety in capital expenditure (CAPEX) depending on the home age and type, with an average investment of £39,983 per home. The total investment, based on today's prices is estimated to be £55.96bn, reducing to £36.17bn when factoring in expected RMI spending on energy related measures.

Table 4 Investment to decarbonise Welsh housing by 2050, using 2020 costs.

Source: [3]

Description	Share of stock	Number of homes	RMI (30yr)	CAPEX for EPC A	Total CAPEX
End Terrace Pre 1919	3%	42000	£14,600	£35,355	£1,484,910,000
Mid Terrace Pre 1919	9%	126000	£11,000	£29,745	£3,747,870,000
Semi-detached Pre 1919	4%	56000	£14,000	£42,460	£2,377,760,000
Detached Pre 1919	7%	98000	£19,800	£56,265	£5,513,970,000
Semi-detached 1919-1944	5%	70000	£12,400	£36,820	£2,577,400,000

Semi-detached 1945-1964	10%	140000	£11,900	£35,360	£4,950,400,000
End Terrace 1965-1990	4%	56000	£10,600	£32,565	£1,823,640,000
Mid Terrace Pre 1965-1990	6%	84000	£9,300	£31,355	£2,633,820,000
Semi-detached 1965-1990	10%	140000	£12,200	£36,685	£5,135,900,000
Detached 1965-1990	9%	126000	£19,700	£54,080	£6,814,080,000
Flat 1965-1990	4%	56000	£16,500	£40,625	£2,275,000,000
Percentage					
Semi-detached post 1990	5%	70000	£11,800	£34,170	£2,391,900,000
Detached post 1990	7%	98000	£19,400	£50,850	£4,983,300,000
Flat post 1990	1%	14000	£14,000	£33,420	£467,880,000
Miscellaneous	16%	224000	£14,000	£39,275	£8,797,680,000
Total	100%	140000 0	N/A	£39,983	£55,975,510,00 0

4.2. Social housing decarbonisation by 2030

Wales' social housing stock currently stands at around 230,000 units of which around 164,281 are owned by registered social landlords (RSLs) and around 65,751 are in local authority ownership [30]. In their "Homes of Today for Tomorrow, Stage 3" report the WSA provide estimates of the investment required for decarbonisation of Welsh Social housing [5]. Again, the model is based on 10 case study dwelling archetypes which are deemed to be representative of the existing social housing stock. The WSA identified the current condition of each case study home, showing a considerable range in energy efficiency (SAP 42, EPC 'E' to SAP 84, EPC 'B'). In addition, the research explored the extent of any planned RMI activities with social housing providers. This resulted in a cost range across the archetypes for a) the planned RMI spend and b) the required spend to fully decarbonise these homes. This cost range and an average⁹ for the RMI and full decarbonisation spend are shown in Table 5.

Table 5 Investment required to decarbonise Wales Social Housing by 2030 using 2020 costs

Type	SAP Now	SAP RMI + Decarb	CAPEX RMI	CAPEX Decarb	Difference
End terrace Pre 1919	62	92	£22,000	£33,000	£11,000

⁹ The average's presented in Table 5 are based on the WSAs estimates of the relative % share of these different house types, rather than an equally weighted average of the preceding house types

Mid terrace 1945- 1964	60	96	£19,000	£31,000	£12,000
Semi-detached 1945- 1964	48	97	£18,000	£29,000	£11,000
Semi- detach 1945- 1964	42	93	£12,000	£31,000	£19,000
Semi- detach 1965-1990	84	94	£10,000	£27,000	£17,000
Semi- detach Post 1990	67	94	£7,000	£28,000	£21,000
Flats 1945- 1964	58	96	£8,000	£25,000	£17,000
Flats 1965- 1990	53	84	£8,000	£19,000	£11,000
Flats 1965- 1990	56	84	£8,000	£22,000	£14,000
Flats Post 1990	69	85	£2,000	£19,000	£17,000
Average	60	90	£11,755	£30,000	£18,445

The WSA research suggests an average decarbonisation spend of around £30,000, of which approximately £11,755 could be expected to come from planned RMI budgets. Clearly these figures are highly aggregated are likely to mask large ranges of both retrofit costs and planned RMI spends. However, these figures provide a useful ballpark for the CAPEX investment that is required to decarbonise Wales' social housing using today's costs of measures.

As described above, a core aim of the ORP is to reduce these costs through developing learning and scale economies and process efficiencies. To account for these improvements, we assume a 20%¹⁰ cost reduction for the social housing decarbonisation programme over the 10-year lifetime of the scheme. Using these crude assumptions, the estimated investment required for decarbonisation across the RSLs and council owned stock factoring estimated costs savings is shown in Table 6, amounting an estimated **£3.4bn** of additional investment over 10 years, or around £340m per year.

Table 6 Investment required for social housing decarbonisation, factoring planned RMI and innovation

2020/21 CAPEX	£6,900,000,000
Expected cost reductions to 2030	£1,380,000,000
Expected RMI	£2,703,650,000
Council owned stock	£970,221,756
RSL Stock	£2,424,130,436
Total additional investment by 2030	£3,394,352,192

4.3. Fuel poverty decarbonisation by 2030

¹⁰ This arbitrary estimate should be improved upon following the outcomes of the ORP

The Better Homes, Better Wales, Better World report also recommends all fuel poor housing in Wales is also raised to EPC “A” standards, recognising that not all homes can meet this standard. Here we can also likely expect cost savings through the 2020s, although perhaps with fewer scale economies, given that 86% of fuel poor homes are outside the social housing sector [11]. Extrapolating the WSAs average figure of £39,983 per property and allowing for a more modest cost reduction of 10%, raising the 134,000 homes in fuel poverty (not in social ownership) to EPC “A” would require an additional investment **£4.82bn by 2030**. Although, these homes would also be subject to some planned RMI spending, we expect this to be much lower than for the homes in social ownership. There is also potential that these figures are an underestimate, as a large share of fuel poor homes are rated EPC “G-E”, requiring more investment than the average EPC “D” upon which the WSA model is based.

4.4. “Able to pay” homes in the private sector

There are roughly 1,044,800 non-fuel poor homes, not in social ownership in Wales [31]. While these homes are often referred to as the “able to pay” segment, in reality a large proportion of these households are on low incomes, have little spare capital to invest in retrofit or may have difficulty in accessing credit. Indeed, the Welsh Government [31] estimate a further 145,000 households are ‘at risk’ of being in fuel poverty, spending between 8% and 10% of their household income on fuel costs. As we outlined in Sections 0 and 3 we believe that Wales should target at least a minimum EPC “C” across the housing stock, also reflecting the likely MEES requirements for the PRS by 2028 [29].

Households in Wales spent £1.02bn on general renovation maintenance and improvement (RMI) works in 2019, an average of about £723 per home¹¹. Investment required per home to meet EPC “C” is lower than the “A” target for social housing (PRS 4,700 and OO £4,525) at **£4.41bn up to 2030**. While still significant this represents **only 23% of the wider RMI spend** expected this decade. We also expect many homes to require additional lending with the new PRS MEES EPC “C” cap of £10,000¹² and the increased adoption of heat pumps and solar, with the UK Government targeting 600,000 heat pumps a year by 2028¹³. Work by Univ. Leeds, NEF and Parity Projects suggests a 2030, net-zero compliant trajectory, with a 25% penetration of heat pumps and significant rooftop PV, would require average investment of £8,112 per household or **~£8.42bn** in Wales. Clearly then, any financing options should allow for greater lending for those who wish to go further.

¹¹<https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/datasets/outputintheconstructionindustrysubnationalandsubsector>

¹²https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/946175/prs-consultation-2020.pdf

¹³https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOO_KLET.pdf

The total estimated investment of **£14.75bn** between these different targets and tenures is therefore summarised in Table 7.

Table 7 Total cost estimates of 2030 EPC targets across tenures

Tenure/ status	EPC Target	Number of units	Assumed cost reduction by 2030	Total Investment	Average investment required per home
Social housing	"A" 2030	230,000 (~21,000 are in fuel poverty)	20%	£5,520,000,000	£24,000
Fuel poor housing	"A" 2030	155,000 (~21,000 are socially rented)	10%	£4,821,890,361	£35,984
Private Rented Sector (PRS)	"C" 2028	180,000 (~36,000 are in fuel poverty)	10%	£676,800,000	£4,700
Owner Occupier	"C" 2030	924,000 (~99,000 are in fuel poverty)	10%	£3,733,125,000	£4,525
Total	-	-	-	£14,751,815,361	-

4.5. Uncertainties on the costs of decarbonisation

The figures presented in Table 4 should not be viewed as a definitive prediction of the final cost of Wales decarbonisation programme by 2050. These estimates are based on arbitrary reductions from today's prices for technologies and measures that are expected to come down in cost significantly in the coming years. For example, heat pump technology and solar photovoltaic systems, are both expected to reduce in cost substantially [32]. Equally, it is anticipated that projects such as the ORP and the scale economies of a nationwide retrofit programme, may further contribute to cost reductions and process efficiencies, especially if an area-based, street-by street approach is adopted. Further, over the 30-year timeframe of this programme new technologies may emerge which radically alter the chosen pathway for home retrofit. For these reasons, we adopt the WSA modelling as a near term guide to the cost of the programme in the coming years and expect a variation in costs for the 2030-time horizon adopted in this report.

5. What existing funding is available?

Delivering on Wales net zero housing ambitions will require an unprecedented level of investment. We believe Wales' net-zero strategy should focus on improving the homes of the most vulnerable to an exemplary standard - in a 'worst first' approach. However, without a strategy for the 2020s which improves all homes in Wales to a minimum EPC "C" standard, there is a risk that some will be left behind, unnecessary carbon will be emitted, and the economic benefits of the programme may not be realised.

This will mean multiple funding sources will need be leveraged and that a one size fits all approach will not work. Depending on the condition of homes, their tenure and the financial means of households, a range of grant funding and loan finance options will be needed, while some may self-fund elements of this work. As shown in Figure 5 we adopt the principle that for those with the lowest incomes and highest fuel costs, this work should be entirely grant funded. For the majority of households, loan finance will play the largest role, with those on higher incomes able to self-fund some of the lower cost measures.

		Income ----- Low-----High		
Fuel Costs ----- Low-----High		Low Income, High Cost - in or close to fuel poverty	High Income, High Cost	
		Low Income, Low Cost	High Income, Low Cost	

Fully Grant Funded

Mostly Grant Funded

Mostly Loan Funded

Mostly Self-Funded

Figure 5 Affordability matrix for fuel costs and retrofit funding, Adapted from National Energy Action

The eventual funding mix may therefore be a blend of loans and grants depending on a household's financial circumstances and the homes current condition. Further, it is crucial is that this funding mix is designed to avoid a 'cliff edge' for those at the threshold of fuel poverty and is properly coordinated to avoid the complex, fragmented and piecemeal funding environment of the past.

We firstly focus on the existing sources of grant funding for across the range of tenure types, drawing on the historical funding that has been available for retrofit and housing stock improvement in Wales.

5.1. Social Housing

Since becoming a devolved issue in 1999, Wales has invested significantly in its social housing stock. Since 2002 the Welsh Housing Quality Standard (WHQS) has sought to improve the condition of all social housing in Wales to a decent standard. The WHQS has a range of criteria for improvement, although includes a target SAP rating of 65 - a mid-range EPC "D". Alongside some contribution from housing providers, the WHQS is funded by the Major Repairs Allowance (MRA) to local authorities and the Dowry Gap funding to Welsh Large Scale Voluntary Transfers (LSVT) stock. These grants recently amounted to around £108m per year, with an additional £500m invested by social landlords in achieving the WHQS since its inception. As of 31 March 2019, 93% of social housing was compliant with the WHQS (including acceptable fails). Given the objectives of the WHQS have largely been achieved, there is a strong case for a new funding settlement for decarbonisation objectives.

As described in Section 4.2 social housing providers also have committed to significant investment in their stock as part of planned RMI spending. The WSA research suggests a decarbonisation spend of around £2,704m could be expected to come from planned RMI budgets, however this scale of planned funding may not be available for many social landlords. The extent to which any continuation of MRA and Dowry funding for decarbonisation could be considered truly additional to the RMI spend and whether this funding is available is beyond the scope of this paper.

Historically, the UK has delivered the majority of its energy efficiency funding through the energy supplier obligation schemes. Here, energy suppliers are mandated to find energy and carbon savings from homes, passing the costs on to all electricity bill payers through a levy. The most recent scheme, the Energy Companies Obligation 3 (ECO3) is delivering around £640m of investment a year in England and Wales to 2022. The Home Heating Cost Reduction Obligation (HHCRO) element of ECO is aimed specifically at social housing. However, uptake of this funding in Wales has been fairly low, due in part to the fact that the funding is available only for premises with an EPC of E, F or G of which there now are less than 10,000 social units in Wales [5].

We therefore expect ECO and its successors to make a relatively modest contribution to Welsh social housing decarbonisation, perhaps at most £100m over the decade. Other smaller programmes such as the ORP (£19.5m) may add a further £50m at most.

Consequently, our best estimate as to the currently committed funding is shown in Table 8, with a **funding gap for EPC “A” of ~£2.67bn to 2030.**

Table 8 Potential existing funding for social housing decarbonisation to 2030

£2,704m	Registered social landlords: Expected RMI The anticipated RMI (Renovation, Maintenance and Improvement) spend from registered social landlords is based upon figures from the WSA.
£100m	UK Government funding: ECO and successors Historically the UK has delivered the majority of its energy efficiency funding through the energy supplier obligation schemes – most recently ECO3 (Energy Companies Obligation 3). Uptake of this funding in Wales has been fairly low, due in part that it is only available for homes with a very low efficiency rating.
£50m	Small programmes Other programmes such as Welsh Government’s ORP (Optimised Retrofit Programme) will make a modest contribution to the capital cost.
£2,666m	Funding gap Our best estimate of the funding gap for EPC “A” (based on currently committed funding) is £2,666m to 2030.

5.2. Fuel Poverty

Fuel poverty reduction in Wales can be viewed as an ongoing, if incomplete success story. For years Wales was seen as the poster child for fuel poverty in Western Europe, with a shocking 26% (332,000) of Welsh households in fuel poverty in 2008. Since that time the Welsh Government has invested over £366m in fuel poor housing and has more than halved the rates of fuel poverty. As a baseline, we assume that Wales continues this level of investment in the Warm Homes programme through the 2020s.

As outlined above, raising all the fuel poor homes in Wales to an EPC “A”, would require an order of magnitude increase in funding through the 2020s. As we outline elsewhere, funding these aims is likely to be beyond the Welsh Government alone, and will also require more than just money. However, whilst new funding will be needed; we also argue that Wales must capitalise on the full range of existing funding sources outlined below.

The ECO 3 programme is currently the most significant funding source for fuel poverty reduction in Great Britain, providing around £640m a year (although there is evidence to suggest Wales does not capitalise on its share¹⁴ of around £32 million a year). In their “Ten Point Plan for a Green Industrial Revolution” [33], the UK government announced

¹⁴ There is currently no specific allocation of ECO funding for Wales, nor any requirement for Wales

plans for a continuation of ECO funding through a new round from 2022 to 2026, once the current ECO 3 scheme expires, with a funding increase to £1bn/year. Combining these two schemes would deliver around £296m for improving Welsh homes at EPC “E”, “F” or “G” through the 2020s. Other policies such as the proposed Clean Heat Grant, the replacement domestic Renewable Heat Incentive are expected to make a smaller contribution, with the current proposals likely amounting to only around £5m of funding for the fuel poor in Wales.

A further source of funding to reducing fuel poverty is likely to come from RMI spending. The WSA estimate an average residential RMI spend of around £5,150 in private homes in a 10-year period. Clearly, owner occupiers in fuel poverty are among the least likely group to invest in RMI works. However, assuming a 2030 EPC “C” target for all homes in Wales is introduced, we might optimistically assume the natural churn of home sales ensure these homes receive 50% of this anticipated spend, amounting to only £25m over the decade.

A final substantial funding source is likely to result from the EPC “C” MEES in the PRS from 2028. The UK Government consultation outlines an average cost estimate of £4,700 per home to meet this standard, with a likely maximum spend capped at £10,000. Given that ~50% of Welsh fuel poor households are in EPC band “E” or worse, we can perhaps expect a higher than average spend of £7,500 for the 36,000 PRS homes in fuel poverty, generating an additional £270m. However, there is a significant risk that without access to cheap credit for landlords, this policy may simply shift this burden onto increased rents.

Based on discussions with industry experts including National Energy Action (NEA) we therefore estimate the existing funding available in below, leaving a large **funding gap of ~£3.86bn for achieving EPC “A” for the 134,000 fuel poor homes not in social ownership.**

Table 9 Potential existing funding for social housing decarbonisation to 2030 in £m

£96m	UK Government funding: ECO3 The ECO3 programme is currently the most significant funding source for fuel poverty across the UK, although evidence suggests Wales does not capitalise on its share of c£32 million a year.
£200m	UK Government funding: ECO4 Plans for a continuation and increase of UK ECO funding (£1bn/year) have been announced, through a new round from 2022 – 2026.
£5m	Other UK Government funding The proposed Clean Heat Grant and the replacement domestic Renewable Heat Incentive are expected to make a relatively small contribution.
£366m	Welsh Government funding: Warm Homes Programme

	Since the start of the Warm Homes Programme in 2009/2010, to March 2020, more than £366m has been invested through the scheme to improve more than 61,400 homes. Here we assume this funding is continued through the 2020s.
£270m	Private Landlords contribution A substantial amount of funding is likely to result from the MEES EPC "C" requirement in the private rented sector from 2028. There is a significant risk that without access to credit for landlords, this policy may shift this funding burden onto tenants through increased rents.
£25m	Owner occupiers: RMI spend Clearly owner occupiers in fuel poverty are amongst the least likely group to invest in RMI works, however we optimistically assume through a 2030 EPC "C" target for all homes in Wales, the natural churn of home sales could ensure these homes receive 50% of the average spend.
£3,859m	"Funding gap": required to achieve EPC "A"

6. What are potential forms of alternative finance?

While grants will play an important role for those on low incomes and in fuel poverty, the majority of retrofit funding is likely to come from repayable debt financing, due to constraints on government funding. Although a large range of alternative retrofit ‘financing mechanisms’ exist in different countries, they have only recently been given significant attention in policy and academic circles [34,35]. While these mechanisms deploy a range of innovative features which can help overcome some key barriers to adoption, they should not be viewed as a panacea. Repayable debt typically requires cashflows to be generated (usually from energy bill savings) and can also place constraints on individuals or organisations who are indebted or have poor credit history. Retrofit financing also tends to work best when combined with regulations, allowing for a low or zero cost of compliance. Debt finance must therefore be viewed as just one part of a much broader strategy.

The appropriate financing mechanism will depend on the tenure type and the specific circumstances of a building, individual or organisation. In this section we review the menu of alternative financing mechanisms, drawing on international examples. To make sense of the complexity of these different options we adopt a framework developed by researchers at the University of Sussex Business School [34]. This framework breaks these different mechanisms into their component features, namely the **Source of Capital**; the type of **Financial Instrument**; requirements surrounding **Project Performance**; the **Point of Sale** of the finance; the nature of the **Security and Underwriting**; and the **Repayment Channel**. The details of these features are described in Table 10 and shown in Figure 6.

Table 10 The features of retrofit finance mechanisms

Source of capital 	Investment in may come from single or multiple sources. Banks, institutional investors, firms, governments or even citizens may provide financing.
Financial instrument 	Finance may take the form of debt or equity, or a combination of the two. Some instruments such as bonds allow the creation of secondary markets, e.g. where bond securities can be traded.
Project performance 	Lenders may place a range of requirements on project performance. This may include requirements that finance repayments are less than or equal to energy bill savings, requirements for measured

	energy performance outcomes, such as kWh savings, guaranteed cost reductions or even guaranteed room temperatures.
Point of sale 	The point of sale is the interface through which the customer accesses finance. For example, this can be through the retrofit contractor, a retail bank or another third-party lender.
Security and Underwriting 	Mortgages are secured by the financial institution's ability to repossess the home should a customer default on their loan. Other forms of security include property taxes or energy bills, meaning the threat of court proceedings or disconnection can be applied. The underwriting process is how financiers determine the underlying creditworthiness of the asset or borrower and insure against default on payments.
Repayment Channel 	The repayment channel is how funds are repaid to the lender or shareholders. Repayments can be made through conventional personal or corporate loan repayments, through energy bills, service charges, collected via property taxes or through rent or mortgage repayments.
Customer Journey 	The customer journey is defined as the full sequence of events that customers experience to learn about, purchase and interact with a financing product.

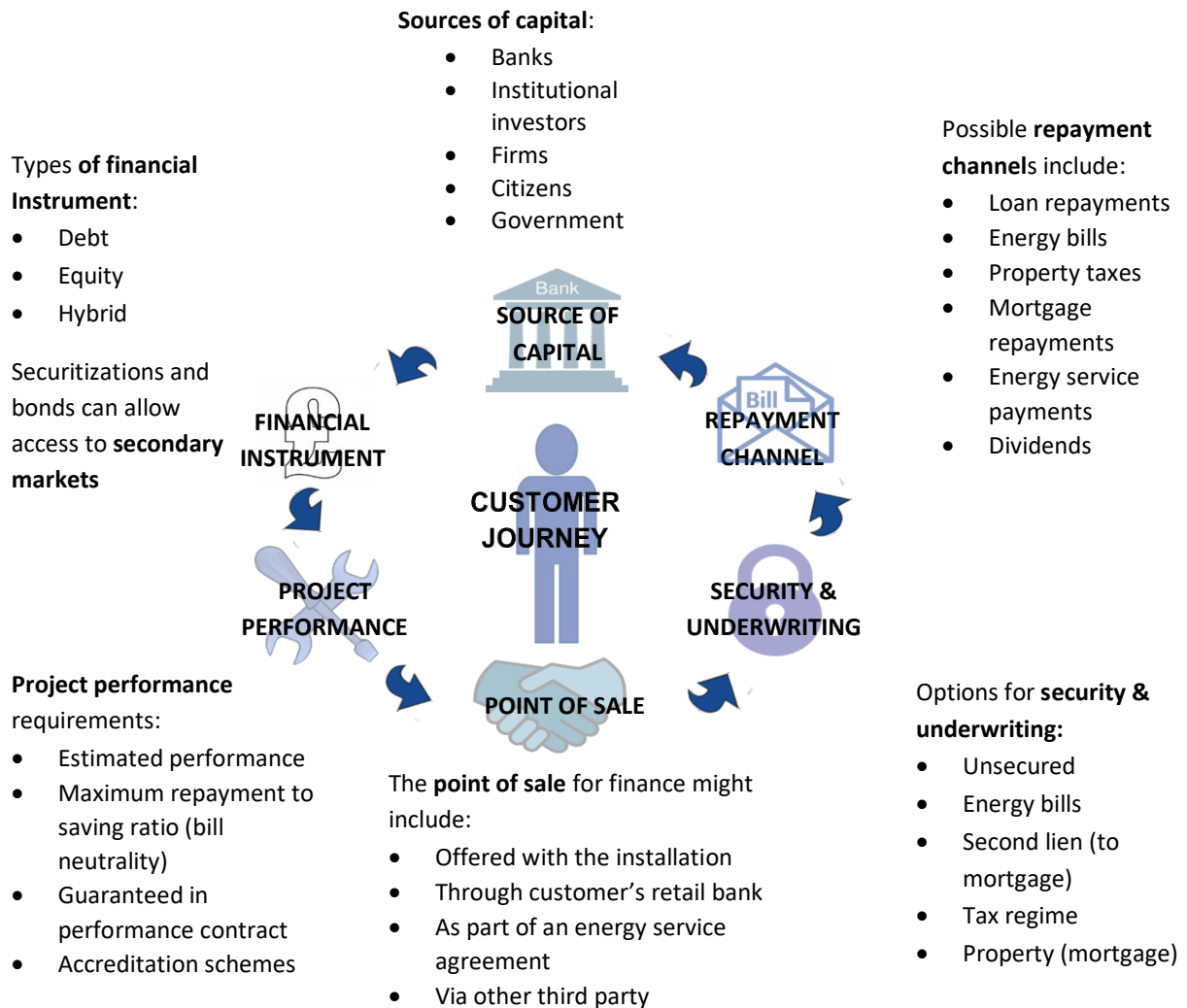


Figure 6 The features of retrofit finance mechanisms

In the following section we explore finance mechanisms that could be suitable in Wales. Here we draw on a large body of literature including recent publications from the Green Finance Institute [35], the Energy Efficiency Finance Group [36], and EEIG [6] amongst others. While some of these options are mutually exclusive, other may be combined. As we show, some of these options are likely to be suitable for only a subsection of tenures, while others may be more universally applied. As we discuss in Section 7 the different features of these mechanisms lead to different affordability outcomes, which directly implicate the viability of a retrofit programme and the relative impact of grants vs loans on delivering key policy objectives.

6.1. Government Low Interest Loan

Government Low Interest Loans typically are provided by central governments or public development banks. The most prominent example is Germany's CO₂ Building Rehabilitation Programme (CBRP). Germany's state bank, the KfW, provides loans to households arranged through commercial banks. Funds are raised on capital (bond) markets and offered at very low rates of interest (<2%). The bank can offer these low rates primarily due to its AAA credit rating; a product of its government backing, with additional state funding to further subsidise interest rates down to 0%. In 2016, KfW's programme cost the federal government €1.7bn unlocking €8.4 billion from building owners and nearly covering its own cost through the resultant VAT revenue alone (€1.6 billion) [6]. Crucially, higher capital subsidy levels were contingent on renovations achieving higher energy performance standards that are more costly to achieve, requiring building owners to spend more.

Less well-known schemes are the Home Energy Scotland (HES) loan and Home Energy Efficiency Programme for Scotland (HEEPS) equity release loans, directly funded by the Scottish government and managed by the Energy Saving Trust. Both programmes offer 0% interest loans, with the HEEPS equity loan is repaid upon the sale of the property. However, it is more common for public funded programme, such as the HES and KfW loans, to be unsecured and linked to the individual rather than the property [37]. Both the CBRP and the HEEPS equity loan schemes allow funding for wider renovation measures, with the HEEPS equity loan allowing 45% of the maximum £40,000 to be spent on non-efficiency measures (EST, 2017).

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
GOVERNMENT LOAN/ EQUITY RELEASE	HES and HEEPS equity loan (Scotland)	Government Departmental spending/	Debt (Scottish govt. operating budget)	Usually, minimum saving CO ₂	Third party finance provider agrees deal with household	No security for household, basic credit check. Govt. underwrites risk	Unsecured Loan/ Equity release
DEVELOPMENT	KfW CBRP	Public Bank	Debt (public)		Household	No security - basic	Unsecured

BANK LOAN	(Germany)		bank bonds)		accesses finance through retail banks	credit check	Loan
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How might this work in Wales?

The option for a UK wide government low interest loan scheme has until recently seemed unlikely. However, the recent announcement that the UK Treasury intends to launch a green sovereign bond or 'green gilt' [38], combined with the planned National Infrastructure Bank (NIB) having a remit for buildings decarbonisation, suggests this option may be increasingly viable. Various configurations exist, including channelling funds through the Development Bank of Wales. However, one of the core strengths of the KfW programme is its degree of independence and ability to raise funds directly into capital markets, without appearing as government debt. Many of the options surrounding Project Performance and Repayment Channels explored in subsequent examples could also be paired with a government low interest loan scheme.

6.2. Property Assessed Clean Energy (PACE) finance

PACE was developed in 2007 and allows municipalities in the USA to fund home and commercial retrofit attaching the debt to the property, rather than the individual, linked to a specific geographical area and secured by land or property [39]. Originally in PACE, local governments funded retrofit measures and attached a tax lien¹⁵ (a form of security that allows claims on tax payments) to properties that benefit from the improvement works. Most US PACE funding now comes from the private sector, although still uses the tax collection powers of municipal or local governments [39]. PACE financing is secured as a senior lien on the property and is re-paid along with other municipal charges and assessments, on the property tax bill - which provides investors with robust repayment security¹⁶ [40].

¹⁵ A lien is a legal right granted by the owner of property to a creditor to claim rights to or seize an asset that is the subject of the lien. The lien guarantees the underlying obligation to repay the creditor, such as claims against residential property for repayment of a loan.

¹⁶ "Subject to the structure of a state's PACE statute...the PACE obligation may result in a property tax lien on the property. If applicable...the failure to pay property taxes, including PACE assessments, could trigger foreclosure and property loss even if the property owner is current on other mortgage lien(s)" [40][40]

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
PROPERTY ASSESSED CLEAN ENERGY (PACE)	RE: NEW Financial (US), EuroPACE (Spain)	Municipal bond -> private capital	Debt (bonds)	None - approved contractor schemes	Contractor	Lien on property & tax bill-based underwriting	Property taxes (i.e., council tax)

Most residential PACE projects have been concentrated in California; with private providers such as RENEW Financial securitising PACE debt for re-sale to capital markets, facilitating more than \$4 billion in clean energy investments [41], and achieving an average 28-27% reduction in home energy use (RENEW Financial). Recently, PACE is also being trialled in Europe as part of the EuroPACE project, with several emerging examples in Spain¹⁷.

How might this work in Wales?

Translating PACE to a Welsh/UK context would require several modifications, due to the different tax regime and financial regulations. Firstly, the UK/Welsh council tax regime is less well suited to adding additional charges on individual properties than in the USA. Further, one of the core advantages of PACE in the USA is that it can be sold by the retrofit contractor alongside the retrofit measures. However, the UK's Financial Conduct Authority (FCA) requires that any organisation selling financial products must meet fairly onerous licencing requirements. For these reasons, the EuroPACE scheme's readiness index outlines how the UK is only 'moderately' suitable for the PACE concept [42]. However, these challenges are not insurmountable, with the GFI now investigating the feasibility of PACE in the UK. One further advantage is that Wales may have more powers to adopt a PACE type model, without involvement from Westminster

6.3. Retrofit Investment Fund/SPV

Investment funds are a common vehicle for private and institutional investors to diversify their investment portfolios, pooling risk between multiple projects. With investment funds, individual investors do not make decisions about how a fund's assets should be invested. They simply choose a fund based on its goals, risk, fees and other factors. A fund manager oversees the fund and decides which investments to make, in what quantities and when the securities should

¹⁷ <https://www.europace2020.eu/>

be bought and sold. There are now many examples of investment funds with a specific green focus, with several specifically funding building renovation and energy efficiency projects.

The Joint European Support for Sustainable Investment in City Areas (JESSICA) programme, administered by the European Investment Bank, mobilises grants from European structural funds¹⁸ [43]. Such mechanisms typically involve the low cost public capital occupying the junior (high risk) tranche¹⁹ of a fund, which is then blended with private sources [44]. This reduces risk for the private providers, with the public money absorbing the first losses should customer's default. A prominent example is the London & Mayors EE Funds (LEEF & MEEF) [45]. Such schemes aim to leverage high ratios of private to public capital for EE investments with LEEF and MEEF raising £100m (50:50 private/public ratio) and £1bn respectively (70:30 private/public ratio). Other examples may include loan loss reserve funds and guarantees²⁰ or direct interest rate subsidies [46], with government underwriting the risk of investors losing their investment .

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
LOAN GUARANTEE FUND	JESSICA LEEF & MEEF	Hybrid – EIB, LEEF & Private lender (UK)r	Debt (some equity options)	CO2 savings	Housing provider	Varies	Revolving phase then full repayment
PUBLIC REVOLVING FUND	SALIX (UK)	Government	Debt	Energy Savings	Public sector	Project based	Revolving loan repayments

How might this work in Wales?

These models may show promise for Wales as a means of aggregating different grant and debt funding sources into a single fund which can be managed and disbursed centrally. The SALIX funding mechanism is already providing 0% loans for energy efficiency measures to non-residential buildings and is fully capitalised by the UK government. These

¹⁸ The European Structural Funds are a set of financial tools designed to address inequalities in income, wealth and economic opportunities within the Member states of the EU

¹⁹ Tranches are different portions of debt within the capital structure of a fund or project finance structure that are designed to divide risk or group different characteristics such as rewards, maturity and size in ways that are marketable to various classes of investor. This typically includes equity components, junior and senior debt but may also include mezzanine and other hybrid forms of finance.

²⁰ A loan loss reserve or guarantee sets aside a limited pool of funds from which financial institutions can recover a portion of their losses in the event of borrower defaults. Several examples exist in the US including the Michigan Saves single family loan loss reserve scheme [46][46]

funds have a further advantage that they are usually revolving, allowing capital to be recycled, with funds operating over several years or decades.

6.4. Conventional HA / LA Borrowing

Assuming social housing providers are willing to take on additional debt to cover the retrofit, they may fund the work through their conventional borrowing channels. Local Authorities usually raise capital funding through the Public Works Loan Board (PWLB) – a credit facility provided by HM treasury, at relatively low <2% rates of interest. While this route can be used for council owned stock, a large share of social housing is owned by registered social landlords a range of sources of private finance including equity investment, bank loans and corporate bonds. It is this latter option that could be of particular promise for larger RSLs, with recent bond issuances achieving <2% interest rates, although typically requiring £100m+ in a single issuance.

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
PUBLIC WORKS LOAN BOARD (PWLB) FINANCING	Typical route for UK Local Authorities	PWLB (UK Treasury)	Government loan	None	Local authority makes loan request with treasury	Loan is secured by the solvency of the council (on balance sheet)	None (Council could add levy to tenants)
BANK LOAN	Typical for smaller works/registered social landlords	Bank	Loan	None	RSL increases loan facility with bank	Debt is secured to RSLs assets and remains on balance sheet. Lenders may require	RSL services debt payments with cashflows from rents
REGISTERED SOCIAL LANDLORD BOND	Less common although examples from larger registered social landlord	Capital markets (institutional investors)	Corporate Bond	Bond must be >£2m	RSL raises bond with the help of financial intermediaries	Bond is secured by the solvency of the RSL (on balance sheet)	None (RSL could add levy to tenants)

How might this work in Wales?

These routes are contingent on housing providers being willing to take additional debt onto their balance sheets. Many are already highly leveraged, and thus may be reluctant to take on additional debt, due to loan covenants with existing lenders. For many smaller registered social landlords, additional bank debt is also relatively expensive, and difficult to justify without a clear revenue stream or capital gain from these investments.

6.5. Municipal bonds/ Community bonds

Municipal bonds are a common way of raising money for public infrastructure projects in many countries. An LA or municipality requiring additional capital, may bundle a series of projects or simply raise bonds to fund ongoing expenditures, which can be bought by a range of investors. Municipal bonds have been less common in the UK, as the PWLB remains the dominant route to funding. However, in 2015 United Kingdom Municipal Bonds Agency (UKMBA) was created with a view that municipal bonds could provide a lower cost route than the PWLB and give LAs more financial independence. However, thus far few LAs have taken up the mechanism.

Unlike conventional municipal bonds, which are aimed at large and sophisticated investors, the model for Community Municipal Bonds – developed by Abundance Investments – utilises a crowdfunding approach to create an efficient, scalable and cost-effective alternative source of funding [47]. Small scale investors can participate with as little as £5 and can invest in low carbon projects in their community. The capital raised can be directed towards climate emergency activities, such as the retrofit of social housing.

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
MUNICIPAL BONDS	Lancashire County Council	Capital Markets	Municipal Bond	None	Financial Intermediaries (banks)	Bond is secured by the solvency of the council (on balance sheet)	None (Council could add levy to tenants)
COMMUNITY MUNICIPAL INVESTMENT	West Berkshire Council	Citizen Investors	Municipal Bond	Environmental/ Social benefit	Crowdfunding platform (Abundance)	Bond is secured by the solvency of the council (on balance sheet)	None (Council could add levy to tenants)

How might this work in Wales?

Community Municipal Bonds create a powerful new model for LAs to engage with citizens as investors, thereby raising capital and awareness among the local community. Widescale adoption of this model offers a financing route for the two-thirds of Local Authorities that have declared a climate emergency and could foster a new community investment culture for retail investors. However, it is early days for this model with only a handful of local authorities such as Warrington and West Berkshire having raised around £1m each for council owned solar farms²¹, while Bristol City Council are considering the model to fund social housing retrofit²². An interesting feature of this model is that it could potentially combined with a PACE type Repayment Channel to allow LAs to fund retrofits on non-council owned housing.

6.6. Energy Saving Performance Contracts

Energy Saving Performance Contracts (ESPCs) are a form of financing to specifically fund energy efficiency measures. In a ESPC²³, an Energy Service Company (ESCO) implements a retrofit and provides an energy performance guarantee and a commitment to maintain the assets under the contract for a given period. Energy performance contracts have been most common in the public sector, where public actors can access cheap capital and, thus, ESCOs typically provide engineering services without any financial component [48]. Recently energy performance contract and ESCO models have been growing in the small commercial and residential sectors [49]. Here, a private finance provider will arrange financing directly with the ESCO or Special Purpose Vehicle (typically 7-10% interest), with the end user or household paying for measured performance improvements - usually derived from a baseline of past consumption [39]. Known as an Energy Service Agreement (ESA), this effectively shifts the financing upstream from the household to provide an integrated offer of finance and measures through an energy service charge. In some models the ESCO will initially use its own funds and then sell on the cash flows or 'receivables' of proven projects to a third-party financier in a process known as 'factoring'²⁴ [36]. In a pure ESA, the third-party financier will fund projects from the beginning, usually via an SPV, where projects are aggregated and sold into secondary markets to institutional investors (SUSI Partners 2017).

²¹ <https://info.westberks.gov.uk/index.aspx?articleid=37060>

²² <https://baumaninstitute.leeds.ac.uk/wp-content/uploads/sites/134/2019/04/FinancingForSociety-Case-Study-Bristol-City-Council.pdf>

²³ In an energy performance contract without a financing package from the ESCO, the client will need to find other forms of capital to fund the retrofit. Therefore, this model is not considered a standalone finance mechanism and is not included in the study.

²⁴ Invoice Factoring involves the sale of project accounts and revenues (receivables) to a third party at a discount. This allows the issuing company to shift these projects with corresponding debt and future cash flows off their balance sheet - enabling them to deleverage and take on additional projects

The model has been gaining traction in Europe for apartment blocks. RENESCO provide an ESA for the retrofit and renovation of dilapidated eastern European housing, while Servizi Energia Ambiente (SEA) offers ESAs and energy performance contracts to the Italian multi-family housing market. RENESCO have invested over €4m in 15 Soviet-era blocks and are developing a factoring fund with the European Bank for Reconstruction and Development (EBRD) (RENESCO 2015). SEA are currently negotiating to refinance several projects, with financing partners [50]. Several large investment funds are now beginning to become involved in the ESA market, including the UK's Green Investment

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
Energy Saving Performance Contracts (ESPCs)	RENESCO (Latvia)	ESCO -> Public Bank	Debt & Equity	Energy Performance Guarantee	Contractor/retrofit	Based on ESCO	Energy performance contract
	SEA (Italy)	ESCO -> Institutional investor				Based on ESCO & bill payment history	

Group [51].

How might this work in Wales?

The Energiesprong initiative has been developing a deep retrofit business model based on energy performance contracts for the UK's social housing. Here customers are offered guaranteed savings through an insurance backed 'comfort plan' (a service charge) for key energy services including set room temperatures, hot water and electricity plug load over a 30-year period. Because the model delivers guaranteed savings, it could be paired with an ESA type structure, allowing the retrofit investment to be taken off the balance sheet of the housing provider. This model still faces challenges in terms of its commercial viability, although could be combined with some of the grant funding and public finance sources outlined above to improve its economic fundamentals. Various trials of ESPCs for social housing have been undertaken in Europe²⁵, while Bridgend council are currently trialing a municipal ESCO²⁶ along similar lines, which could be scaled up Wales-wide. However, this would likely require a strategic commitment from Wales to developing these models in tandem across several thousand housing units.

6.7. Green Mortgages

²⁵ <http://www.buildup.eu/sites/default/files/content/EPC%20in%20social%20housing%20-%20FRESH%20project%20-%202025-01-2011.pdf>

²⁶ <https://bidstats.uk/tenders/2021/W05/744358045>

Mortgage financing provides the mainstay of extension and renovation funding to existing homes, usually through a mortgage-extension or re-mortgage. Loans are secured to the property and typically have a duration of 25 years or more. However, some mortgage providers offer a range of Green or energy efficiency mortgage products designed to provide lending specifically for retrofit. Mortgage underwriting is based on the applicant's ability to repay. Whilst a significant proportion of outgoings relate to energy costs, current underwriting methods use arbitrary techniques to determine these costs. Initiatives including the UK LENDERS [52] and EU EeMAP [53] projects are seeking to promote actual energy usage data in these underwriting calculations. Thus, lenders may provide increased lending for more efficient properties at reduced interest rates—as the higher disposable income reduces the risk of default [53].

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL	FINANCIAL INSTRUMENT	PROJECT PERFORMANCE	POINT OF SALE	SECURITY AND UNDERWRITING	REPAYMENT CHANNEL
GREEN MORTGAGE	EMF Green mortgage project (EU)	Covered Bond market	Mortgage (equity & debt)	EPC improvement	Mortgage provider	Detailed credit check	Mortgage payments
	Ecology Building society (UK)	Member deposits					

How might this work in Wales?

The LENDERS project estimates that monthly savings equivalent to two Energy Performance Certificate (EPC)²⁷ bands, could equate to around £4,000 in additional mortgage finance [52]. Eventually this may create a modest 'green premium', increasing property values for the most efficient properties [53], also providing additional borrowing for retrofit measures. Whilst most mainstream European mortgage lenders are yet to offer Green Mortgage products, some specialist lenders such as the Ecology and Monmouthshire Building Societies offer additional lending for retrofit projects and also interest rate discounts of 0.25% for each EPC improvement level [54]. In the USA, the Fannie Mae mortgage company's Green financing for multi-family buildings reached \$3.6 billion in 2016, involving preferential interest rates and additional borrowing for energy and water efficiency improvements [41]. The UK government is now looking to promote 'innovative green mortgage products' as part of its Clean Growth Plan [21].

6.8. On-Bill Finance

²⁷ EPCs are a measure of a buildings energy efficiency and running costs, based on a standardised assessment procedure. Most EU member states employ some form of EPC and they are typically rated from A to G, with A being an exemplary dwelling.

On-bill mechanisms involve the repayment of loans via the energy bill (electricity, gas or dual-fuel). The investment is typically secured by the right to disconnect supply, if left unpaid [55]. These approaches are divided into two types, with different sources of capital. On-bill financing (OBF) involves energy bill-payer or public funds, whilst on-bill repayment (OBR) refers to the use of third party, private capital [44]. In the USA, UK and Canada over 20 on-bill programmes have provided over \$1.05Bn of financing to households for EE improvements, delivering \$76m in 2014 alone [55].

The UK's Green Deal is probably the most well-known example of OBR and included requirements for *energy bill neutrality* as part of its 'Golden rule', meaning savings had to be equal to or greater than loan repayments. The Green Deal also precluded non-energy measures from financing (7-11% interest rate). The scheme had very limited uptake. Of the 614,383 assessments undertaken, only 15,138 households adopted a Green Deal plan by October 2015 [56], far less than the millions of installations that were hoped for [57]. However, in many cases these assessments may have led to self-financing [58].

TYPE OF FINANCE MECHANISM	EXAMPLE SCHEMES	SOURCE OF CAPITAL 	FINANCIAL INSTRUMENT 	PROJECT PERFORMANCE 	POINT OF SALE 	SECURITY AND UNDERWRITING 	REPAYMENT CHANNEL 
ON BILL FINANCING/ ON BILL REPAYMENT	UK (OBR) Green Deal	Third party private Sector	Debt	Bill neutrality (Golden rule)	Third party finance provider	Energy meter & bill history	Energy Bills
	USA & Canada (OBF) schemes	Energy Utility & public/ credit enhancements	Debt (some securitised examples)	Often Bill neutrality	Energy utility		

How might this work in Wales?

While the Green Deal was considered a failure, the primary legislation that enabled the use of the energy bill as the Repayment Channel still exists. One option for Wales would be to divert new lower cost sources of capital through this route, also simplifying the customer journey for applying for the funding.

7. Which options are best for Wales?

In this section we evaluate the options for funding Wales' residential decarbonisation programme. Following the review of existing grant funding sources and alternative debt financing options in Section 4, and 5 we began an intensive programme of stakeholder engagement to understand which path would be best for Wales. This included two expert stakeholder workshops (table 1 attendees are listed in the Appendix), focussed on the social and private housing sectors respectively. This was followed by financial analysis by the NEF team of the impact of different financial variables - such as the share of loan vs grant, the cost of capital and loan term – on the economic viability of different options. Following this analysis, we establish a set of key principles upon which a future funding programme should be based. These principles are used to develop a set of policy recommendations in Section 9.

7.1. Social housing workshop

The social housing workshop was conducted virtually on the Zoom platform on the morning of the 9th December 2020. The 3 ½ hour workshop brought together key 30 stakeholders from registered social landlords, local authorities, Welsh Government and the financing sector. Participants were first asked to reflect on the options for grant funding before exploring how some of the financing options outlined in Section 6.

7.1.1. Grants

While there was recognition that new grant funding would be needed, there was broad agreement that grants alone would be unable to fully fund social housing decarbonisation. Recent research by the housing consultancy Altair has shown that for many registered social landlords any grant share <50% of the required investment is likely to result in significant financial difficulties, due to existing loan covenants and the maximum debt to equity ratios required by regulators [30]. However, many housing provider participants carried the assumption that little or no revenue stream would be generated by the retrofit programme representing a “pure cost” on their balance sheets. It was also noted that the industry has historically been heavily dependent on grant funding, and that future grants should be conditional on innovation and cost reductions.

Participants were also asked to reflect on potential new sources of grant funding for social housing decarbonisation. While there was the view that the Welsh Government should increase its contribution, many felt that additional funding at a UK level would be needed. As we outline in Section 8, a key issue raised was that most of the tax benefits from a deep retrofit programme would be captured by the UK Treasury,

providing a strong justification for increased central government funding. A further route that was raised across both workshops was the Shared Prosperity Fund – the UK governments replacement for the EU structural funds that will be withdrawn after BREXIT. There was consensus among participants that this funding could be a key means of funding housing decarbonisation especially for those on low incomes.

7.1.2. Debt

Workshop participants were then given four examples of alternative debt finance mechanisms with presentations from practitioners involved with: Conventional HA / LA Borrowing; Municipal/ Community Bonds; Energy Saving Performance Contract financing; and a Retrofit Investment Fund/SPV. Participants were asked to reflect on their feasibility, including across the different types of social housing provider, with simple feasibility denoted in **green**, moderate feasibility **orange** and challenging feasibility in **red** across some key areas. Detailed findings from this discussion summarised in the Appendix in Table 14.

Table 11 Feasibility of finance mechanisms for different social housing providers

	Local Authorities	Large Registered Social Landlord	Large Registered Social Landlord
Conventional / LA Borrowing			
Municipal Bonds/ Community Bonds			
Energy Saving Performance Contract (ESPC)			
Retrofit investment fund/ SPV			

The findings showed no option was without its problems, suggesting a hybrid approach may be needed. Participants were then asked to discuss in detail two further areas relating to the **Repayment Channel** and the **Balance Sheet Treatment** of different types of financing. The key findings on these topics are summarised below:

1. To what extent should households fund repayments & what are appropriate repayment channels for this?

- The majority models discussed above are debt based and thus would require some kind of cashflows to be created to service this debt, even at 0% interest

- An increase of £11 per week would fund the cost of a retrofit costing £18,445. If grant were applied at 50%, this 'rent' increase could be reduced to £5.50 a week (£286 per year) which is a one-off increase of under 6%
- This raised the question to what extent is it desirable and socially just to recover some of the costs of the retrofit from the tenants themselves
- The options discussed included: Increased rent; Service charge; Energy bills (flat rate); Measured energy savings (ESPC); Equity release; Council tax (PACE)

2. Given debt constraints on housing providers, should / can this funding be delivered 'off balance sheet'?

- Taking additional debt onto the balance sheet can create significant issues for HAs and LAs cashflows and levels of indebtedness
- The total cost of the programme would represent a 150% increase in major repairs spend for 10 years, based on the average annual cost in HA sector.
- This can create issues with existing financing agreements and lead to a breach of borrowing limits
- Off balance sheet financing can be a solution to these issues by placing the debt with a specific project or special purpose vehicle (SPV), Energy Service Company (ESCO) or through a lien on the property (PACE)

7.2. Private housing workshop

The private housing workshop was conducted virtually on the Zoom platform on the morning of the 1st December 2020. The workshop also brought together 24 key stakeholders from local authorities, Welsh government and the financing sector. The workshop was split into three groups based on the participants area of specialism, with one group focussing on fuel poverty funding, and the other two on financing for the 'able to pay' segment as outlined in Section 6.

7.2.1. Fuel poverty

The fuel poverty group were first asked to focus on expected fuel poverty funding already committed to as outlined in Section 5.2. Participants discussed how although Wales' Warm Homes programme had been relatively successful, it had not targeted EPC improvements or CO₂ savings, and had thus implemented some measures such as new gas boilers, which would be detrimental to decarbonisation objectives. There was also a view that Wales had not fully capitalised on GB wide programmes such as the ECO funding. This also shaped a feeling that the funding environment is currently very piecemeal and poorly suited to delivering the large leap required by the EPC "A" target. There were also concerns that the MEES regulations risked landlords simply passing on the costs of improvements in the form of higher rents. There was a common opinion that in future, stakeholders in Wales should act more strategically to combine different sources of fuel poverty funding to deliver deeper one-off interventions.

Subsequently, participants were asked to reflect on potential future funding to fill the large £366m a year funding gap, required to meet EPC “A”. There was a general consensus that delivering the EPC “A” target would be an unprecedented challenge, as targeting those in fuel poverty and take-up of free measures remains extremely challenging. Some participants raised the question as to whether an EPC “B” target would be more achievable and affordable, while others felt that it would be better to aim high and fail. In general, it was felt that these targets would be harder to hit than in the social housing sector, with fewer opportunities to take a strategic, ‘estate by estate’ approach.

Three main new funding sources were raised as possible ways of funding the gap. The first was for the Welsh Government to double funding for the Warm Homes programme through the 2020s, consistent with their aims to eliminate fuel poverty. In a similar vein to the social housing workshop, participants also felt that the fiscal benefits of retrofit investment justified a large share of this funding to come from the UK government. However, the fact that housing and fuel poverty are a devolved issue, would make this especially challenging politically. As in the social housing workshop, the potential for a contribution from the Shared Prosperity Fund was also raised. Key questions were whether the administration of the fund would be devolved to Wales or kept centrally in Westminster. While the Shared Prosperity Fund could make a ‘shovel ready’ and substantial contribution, it was also recognised that there will be multiple competing demands on this funding in future.

A final perspective was that there is a risk of focussing too narrowly on households who meet the strict fuel poverty definition, creating a cliff edge where some households receive extremely generous grants, while others receive nothing.

7.2.2. ‘Able to pay’

Workshop participants were presented with examples of alternative debt finance mechanisms including: Government Low Interest Loans; PACE finance; Green Mortgages; and On-Bill Finance. Participants were asked to reflect on their feasibility, including across the different tenures (Table 12), with simple feasibility denoted in **green**, moderate feasibility **orange** and challenging feasibility in **red**. Detailed findings from this discussion are provided in the Appendix in overleaf in Table 15.

Table 12 Feasibility of finance mechanisms for different social housing providers

	Private Rented Sector	Owner Occupiers
Government Low Interest Loan		
Property assessed clean energy (PACE)		

Green mortgages		
On-bill finance		

Again, the findings showed that no single mechanism would be ideal for all tenures, suggesting that that a one size fits all approach would not work.

Government Low Interest Loan

A government backed zero interest loan was viewed as an attractive option by many of the participants. Scotland and Germany already have similar schemes, with specific products tailored for the PRS and owner occupiers. Although uptake in Scotland has been modest, it was felt that, like other models, if the programme was paired with MEES standards, uptake could be significant. The workshop participants also discussed whether the loan scheme could be run by the Development Bank of Wales (DBW), or whether a UK wide scheme might be run by the new National Infrastructure Bank and capitalised by UK Treasury Green Gilts. Either option would require significant political will.

PACE finance

PACE financing was also viewed as an appealing route, solving the split incentive issue by linking the repayments to the property rather than the individual. The likely route for Wales and the UK would be adding a charge to council tax, requiring alterations to the tax code. This mechanism was generally viewed as more suitable for owner occupiers, as adding an additional council tax charge on private tenants was viewed as potentially unethical. Whether the capital for PACE style loans came from public or private sources was not explored in depth, although this could conceivably be from Government Loans or Municipal Bonds. A further advantage of PACE was that it could be trialled by a few LAs before being scaled up nationwide.

Green Mortgages

Green mortgages were viewed as an important funding route, particularly for catalysing the huge existing owner occupier renovation market. Green mortgages could either provide additional borrowing for works at the point of purchase, or as a means of justifying a greater lending for energy related home improvements. Crucial to achieving the uptake of Green mortgages was the inclusion of EPCs in mortgage affordability calculations and for higher EPCs to translate into increased property values, as outlined in the LENDERS project [52]. However, the group expected Green Mortgages to cover a fairly niche market and do little to solve funding needs in the private rented sector and for low-income owner occupiers.

On-Bill Finance

The option of reviving the Green Deal mechanism was not viewed favourably by the workshop participants. While the 'on-bill' repayment channel is still an available route,

many participants felt that the Green Deal had a toxic reputation and the complexity and high cost of the Green Deal's loans had put off many householders. Participants generally viewed the on-bill repayment channel as a useful innovation, but viewed PACE style repayment channel as more suitable.

7.3. Key workshop findings

The workshop showed that all of the options evaluated present challenges to being adopted in the current market. Further, no model is currently viable across all types of housing. These findings suggest policy changes will be needed to enable sufficient low-cost finance is available, and that different elements of these models could be combined to develop an optimal route for Wales.

Building on the findings from the workshop, we introduce the following ten principles for a future retrofit finance programme, reflecting the combination of loans, grants between different tenures and housing types.

Table 13 Key principles for a future retrofit funding programme

Source of Capital 	• Welsh & UK Government will need to provide £Bs of new grant funding in the coming decade • Private capital can play a significant role; however, it will need to be crowded in by government backed programmes • Public investment should be viewed as infrastructure investment which will be self-funding by generating tax receipts
Financial Instrument 	• Grants will be essential for those on low incomes • Bonds represent a liquid and proven route to accessing low-cost private capital, although significant scale and sophistication is required to access bond markets • Government can also amplify its role by providing loan guarantees and subsidised interest rate reductions
Project Performance 	• Energy saving guarantees are a crucial means of ensuring performance, building trust and ensuring fairness for social housing retrofits • Performance guarantees may not be possible for private housing due to their high transaction costs, although robust quality assurance remains essential
Point of Sale 	• Ideally, funding should be offering alongside the retrofit under area-based programmes providing a 'one-stop-shop- service • Home sales and conventional renovations also represent a key moment for retrofit funding

Security & Underwriting 	- Property secured financing will play a role for a share of the market - However, many households will require unsecured financing, who's risk profile will need to be subsidised by government
Repayment Channel 	- Energy performance contracts look to be an important route for social housing, opening up the potential for 'off balance sheet' financing - On tax repayment through council tax looks to be an important route for private households - Equity release models could also be effective for households who are 'asset rich and cash poor'

6.4 Financial modelling

Following the workshops, NEF economists modelled the detailed financial parameters of a future retrofit finance programme, with a particular focus on the social housing sector. The key unresolved issue that emerged from the workshops was the ratio of loan versus grant for social housing decarbonisation. Any future plan must balance the need to reduce tenants bills and mitigate fuel poverty, the financial viability for social landlords and the affordability for government. We therefore aimed to explore the question:

“What is the minimum share of Government grant that can meet the EPC “A” target”

To answer this question our analysis sought to test a range of assumptions:

1. The impact on different house types
2. The interest rate on 25-year debt
3. The share of savings kept by tenant
4. The impact of ratios of grant vs. loan on the balance sheet of a social landlord

6.4.1 Household level

In developing this analysis, we again relied on the WSA Stage 3 social housing decarbonisation data. As shown in Figure 7, combining the CAPEX and energy bill savings of EPC “A” across the range of house types, demonstrates a large variability in the affordability of meeting EPC “A”, with an average (undiscounted) payback of 49 years. Consequently, relying on 25-year debt finance and energy bill savings alone would be financially un-sustainable for most households.

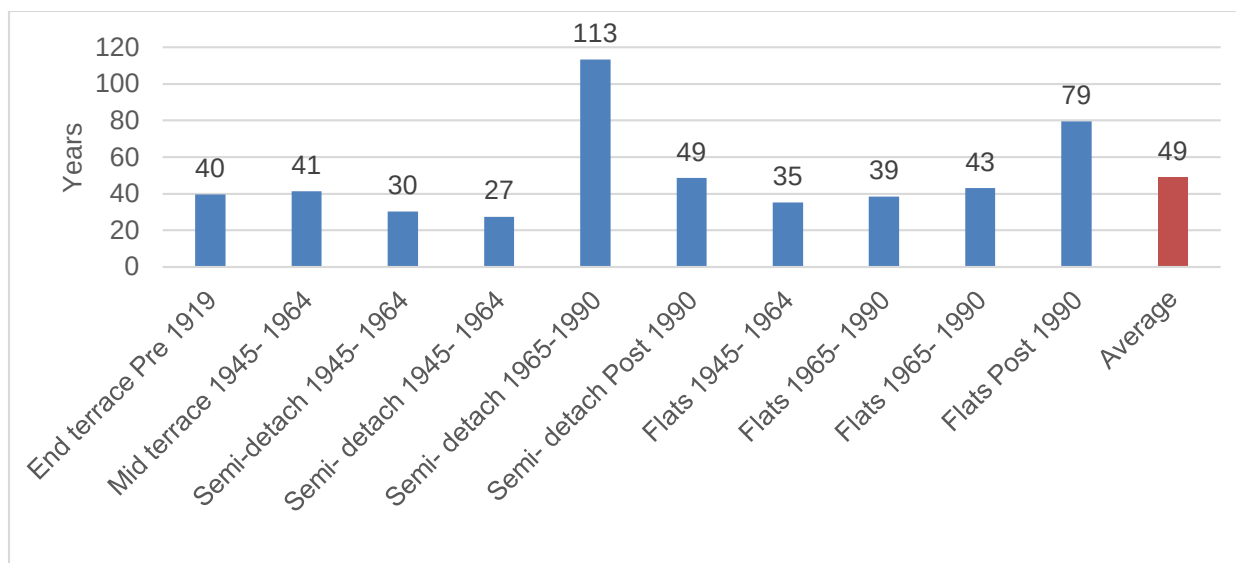


Figure 7 Payback periods for meeting EPC "A" in Welsh Social Housing. Source [5]

Subsequently, we modelled the impact of different interest rates (1-12%) on 25-year debt on the amount of grant required, using the 15 social housing archetypes from the WSA Stage 3 data. As shown by Figure 8, the required share of grant + RMI varies

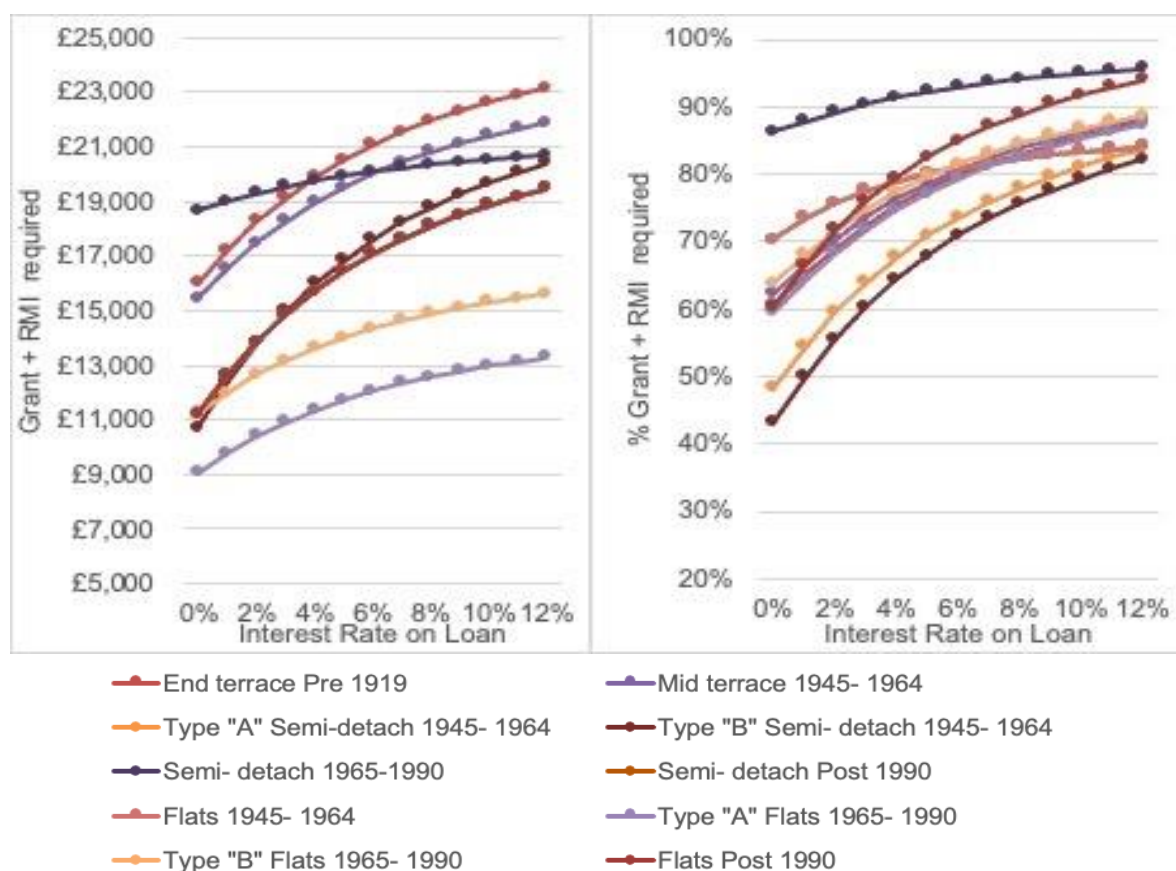


Figure 8 Grant & RMI required on different house types to meet EPC "A"

significantly between the house types, both in absolute terms but also as a % share. Further, the rate of interest on debt increased the total grant share required by £1.2bn (22%) from 0% to 12% interest. Here we assumed that the tenant would retain 50% of the savings in reduced bills, such that the measures are fully repaid over the 25-year lifetime of the programme. Adopting an APR of 1% we subsequently investigated the impact of tenants retaining either 50% or 75% of the bill savings on the amount of grant required (Figure 9).

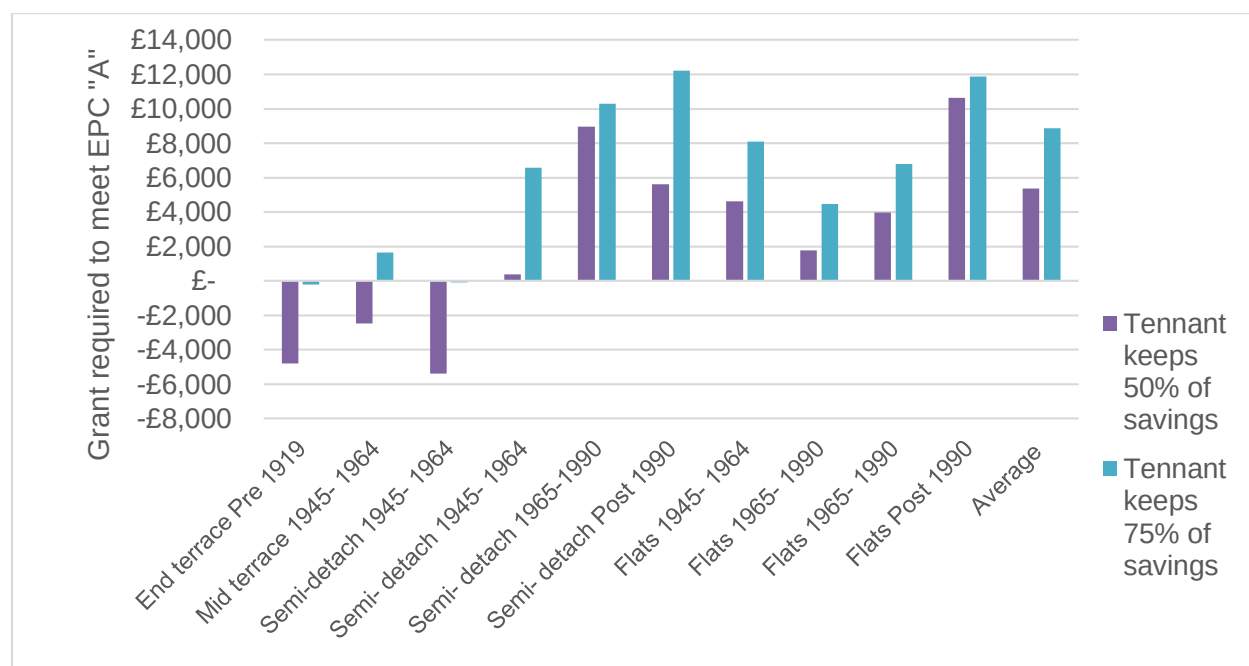


Figure 9 Grant required above RMI spend to meet EPC "A" with debt at 1% interest

As shown in Figure 9 the share of savings retained by the tenant had a large impact on the cost of the programme, with an additional ~£808m of government grant required to ensure 75% of savings could be retained by the tenant. Interestingly, in some house types, the required grant share was negative, suggesting that the planned RMI spend + 25-year debt at 1% would be sufficient to cover the cost of the retrofit.

6.4.2 Social landlord level

A crucial factor for our analysis was the impact of different levels of grant support on the social housing sector. The sector is known to be financially constrained and heavily indebted. A recent report for CHC [30] has indicated that without substantial grant funding and reliable revenue streams for their retrofit programmes, many social landlords would breach loan covenants and struggle to deliver their housebuilding targets.

We therefore developed three policy scenarios and tested them on a notional 10,000-unit social landlord. Here we assumed that tenants would retain 50% of the bill savings, and that the programme investment would follow an S-curve deployment, peaking in 2028. We also modelled the impact of three interest rates 1%, 6% and 12% on the balance sheet of the social landlord.

Scenario 1 - RMI only, 50% savings for tenant

In scenario 1 we assume no new government grant with only the existing RMI spend and 25-year debt funding contributing to the programme. Assuming that the social landlord would meet the funding gap to EPC “A”, all three interest rates produce a large net shortfall/loss over the 10-year programme (1% - £38.2m, 6% £68.7m, 12% £87.9m), with peak losses shown in year 2028 (Figure 10).

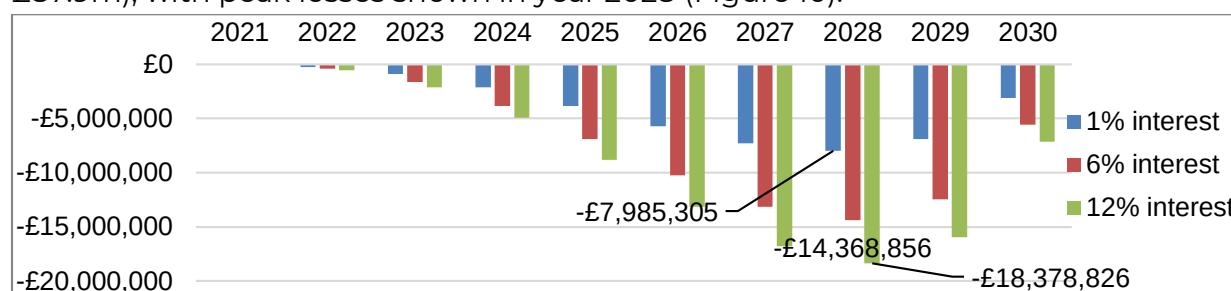


Figure 10 Balance Sheet Impact Scenario 1 - RMI only, 50% savings for tenant

Scenario 2 - Extension of existing policies, 50% savings for tenant

In scenario 2 we assume that the current level of WHQS funding is extended to 2030, with 50% available for retrofit investment, alongside existing RMI spend and 25-year debt. Assuming that the social landlord would meet the funding gap to EPC “A”, all three interest rates still produce a shortfall/loss over the 10-year programme (1% - £17.9m, 6% £44.6m, 12% £61.6m), with peak losses shown in year 2028 (Figure 11).

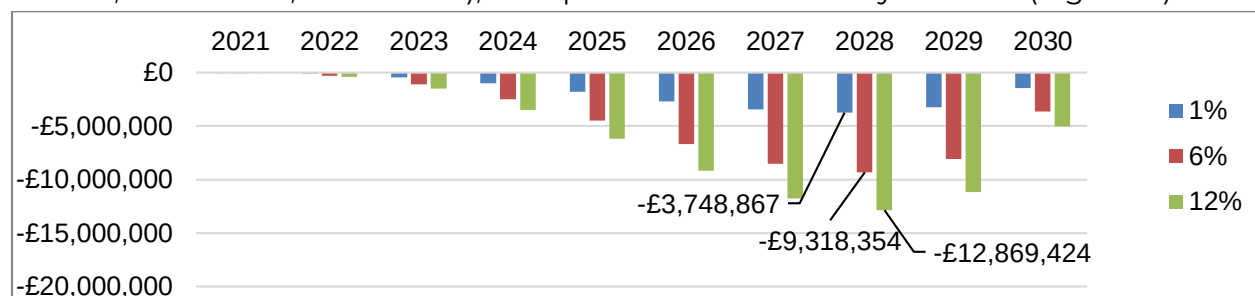


Figure 11 Balance Sheet Impact Scenario 2 - Extension of existing policies, 50% savings for tenant

Scenario 3 - Increased grant, 50% savings for tenant

In scenario 3 we assume that government grant covers the full cost of the programme (at 1% interest), alongside existing RMI spend and 25-year debt funding. This represents the most parsimonious route to meeting the EPC “A” target assuming no losses for the social landlord (1% - £0, 6% £23.5m, 12% £43.3m), with peak losses shown in year 2028 (Figure 11).

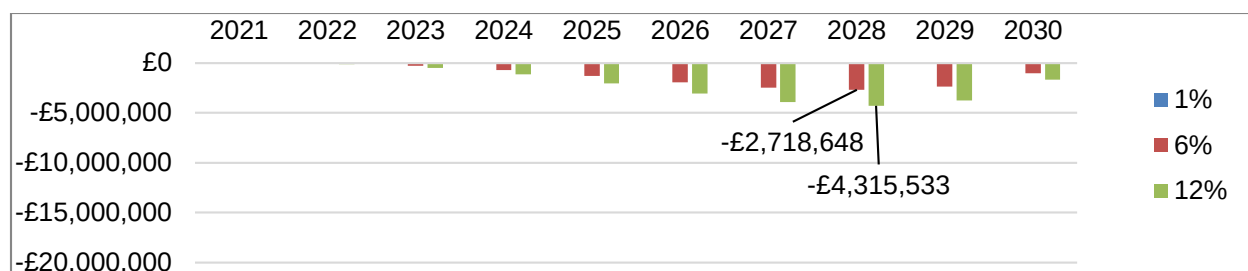


Figure 12 Balance Sheet Impact Scenario 3 - Increased grant, 75% savings for tenant

6.4.4 Central Scenario

Therefore, our central “no losses” scenario sees a 19% average contribution from a new decarbonisation grant with debt at 1% interest, assuming tenants keep 50% of savings and zero capital cost to the registered social landlord. This equates to an average bill saving of **£307/year** once loan repayments are factored in (Figure 13). At a Wales wide level this would equate to **£1.08bn** in new grants and access to **£1.58bn** of low cost (1%) 25-year debt through the 2020s. By guaranteeing that **tenants always keep 50% of the projected savings**, this model could ensure affordability and fuel poverty aims were front and centre of the programme.

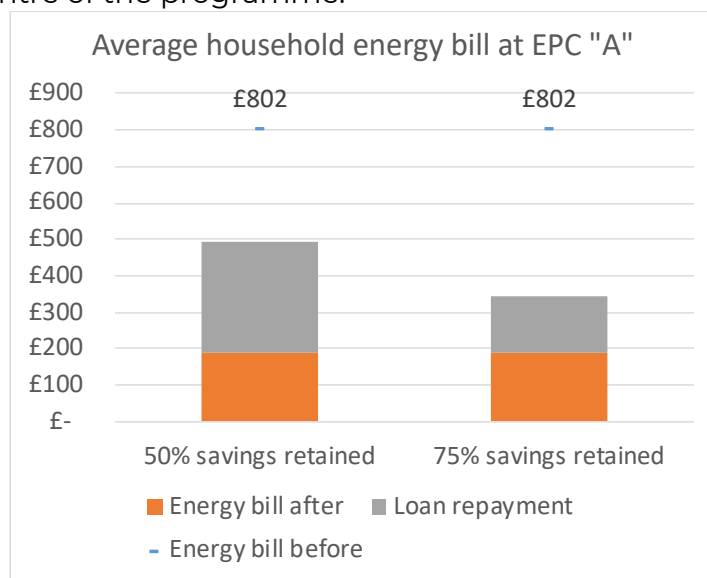


Figure 13 Tenant bill savings and loan repayments for 50% and 75% retained savings

8. How do we get there?

Decarbonisation is a challenge, and an opportunity, for organisations and communities across Wales. In terms of decarbonising our housing stock, the Welsh Government needs to lead the way but will be unable to 100% grant fund the programme. We have outlined how the challenge of funding this shift must be balanced across the UK Government, Welsh Government, social and private landlords and homeowners, with many other organisations playing their part.

Overcoming levels of fuel poverty that remain stubbornly high sits at the heart of Wales' decarbonisation and social justice objectives, and the decarbonisation of homes must be seen as a fundamental part of a green and just recovery from the pandemic in Wales. As we have demonstrated, if managed well, a retrofit programme could be a gamechanger for the Welsh economy - not only meeting decarbonisation and fuel poverty objectives whilst reducing needless energy costs, but creating new industries, skills and jobs, based on local supply chains and supporting the foundational economy.

As the scale of the challenges and opportunities of the decarbonisation of homes are realised, there will be a need for new roles and approaches. In the following sections, we suggest a key role for the Development Bank of Wales (DBW) in the coordination of funding for the private rented and owner-occupied sectors, and the development of a Wales Energy Service Company (WESCO) to manage energy performance contract financing for the social housing sector.

8.1. Social Housing

The retrofit of social housing must be the flag bearer of the wider housing decarbonisation agenda in Wales. Following the outcome of the ORP, we assume that the EPC "A" target as outlined in the "Better Homes, Better Wales, Better World" report is achieved with 20% cost reduction on the WSA's estimates by 2030. Our analysis of the WSA Stage 3 data, expected RMI spend and existing policy commitments in Section 5 suggests there is a **~£2.67bn** funding gap for meeting this target. Following our workshops and financial modelling we propose two new sources of funding to addressing this gap:

New Social Housing Decarbonisation Grant: £1,082m

We estimate there is a need for at least £1,082m in new grant funding to meet the retrofit objectives outlined in this report. Following the success of the WHQS model, this money would need to be ring-fenced for decarbonisation and made available to all social landlords.

Energy Saving Performance Contract Loan: £1,584m

We believe the best way of delivering debt finance for the programme is through the use of Energy Saving Performance Contracts (ESPC). This debt would need to be provided over a long period (25 years +) and attract very low rates of interest (<1%). Achieving these aims would require low-cost government backed debt and a new delivery model discussed in the following section.

These new and existing sources of funding are summarised in Figure 14.

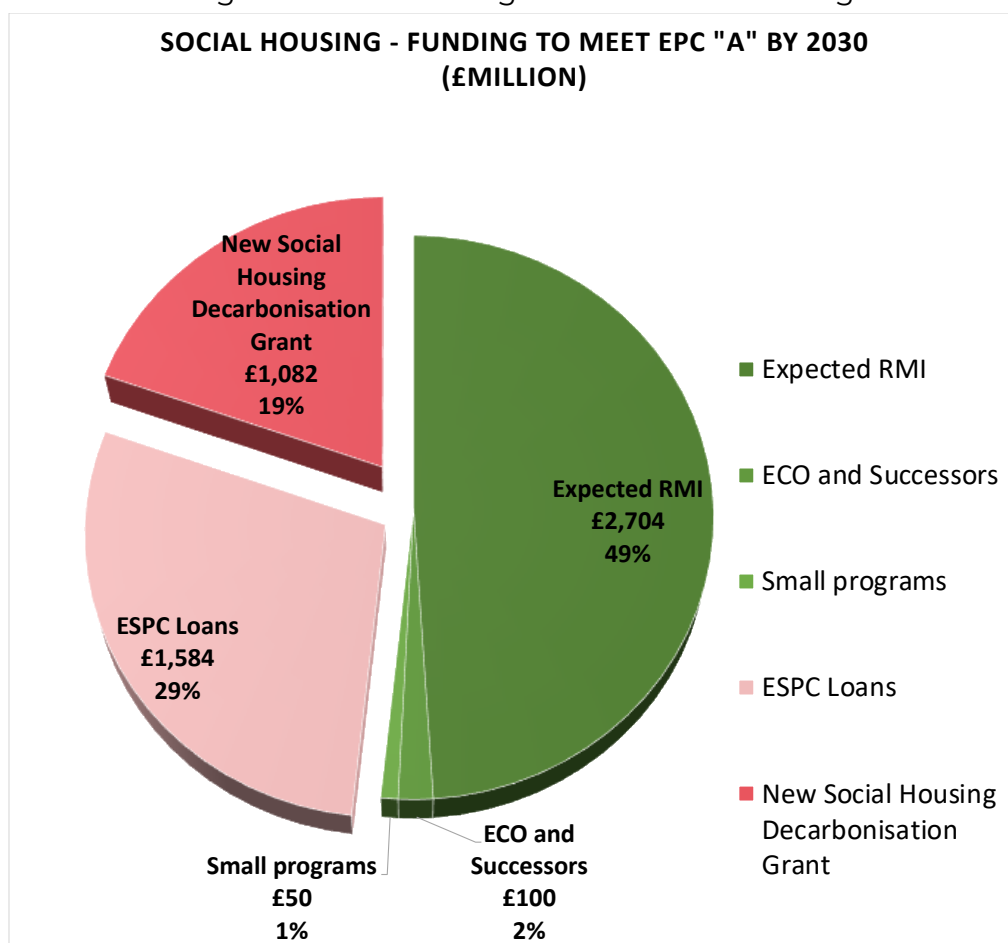


Figure 14 Social housing funding to meet EPC "A" by 2030

8.1.1. Social Housing Delivery model

A key finding from our workshops was that if tenants are expected to repay an element of the retrofit, their overall energy savings must be guaranteed. Supported by recent work by the Green Finance Institute on Metered Energy Savings [59] we recommend this should be achieved through Energy Saving Performance Contracts (ESPC). ESPCs involve a guaranteed energy savings contract, which can be taken off the balance sheet of the housing provider to create secure cashflows for finance

providers. Various trials of ESPCs for social housing have been undertaken in Europe²⁸, while Bridgend council are currently trialing a municipal ESCO²⁹ along similar lines, which could be scaled up Wales-wide.

We suggest that a hybrid delivery model combining ESPCs, On-Bill Financing and Low Interest Government Loans would represent the best delivery model for social housing. The proposed delivery model (Figure 15), is therefore based on the establishment of a **new Wales Energy Service Company or 'WESCO'** who would combine loans and grants into a single performance contract with guaranteed savings, repaid on the energy bill. 25-year debt financing would be secured on the WESCO's balance sheet and come from a government guaranteed source such as existing financial transition capital, green sovereign bonds or municipal/ community bonds. As an alternative to fixed income debt, long-term index linked debt could currently be issued at a 0% coupon, with the cost of funds being future inflation. This may create a better match to future energy saving cashflows and increase the initial amount of debt raised. We see the WESCO programme covering funding for all social housing, including those in fuel poverty.

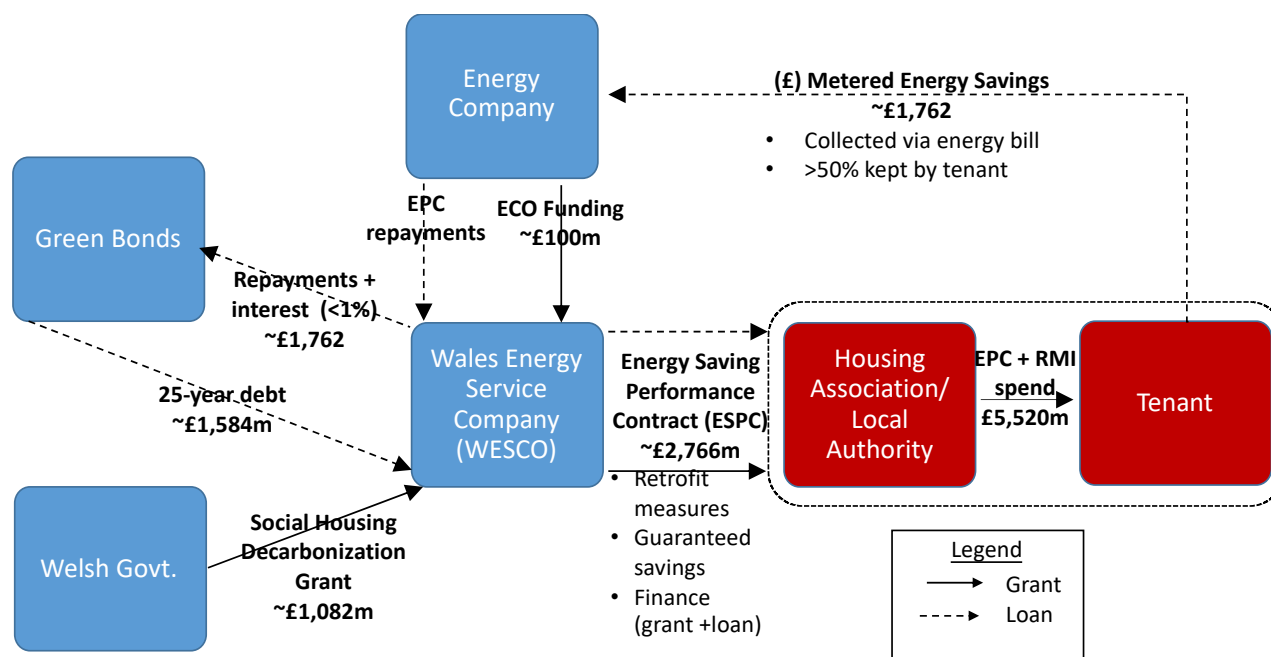


Figure 15 The financial model of a Wales Energy Service Company (WESCO)

The implementation of the WESCO would not be without its challenges. Currently, many tenants opt for a higher tariff pre-payment meter, so they can better manage monthly budgets. Having repayments tied to the energy bill would be a particular

²⁸ <http://www.buildup.eu/sites/default/files/content/EPC%20in%20social%20housing%20-%20FRESH%20project%20-%202025-01-2011.pdf>

²⁹ <https://bidstats.uk/tenders/2021/W05/744358045>

challenge using pre-payment meters. However, we feel that energy access is a fundamental right and that pre-payment meters and the risk of disconnection should be phased out for social housing tenants as part of the retrofit programme.

8.2. Fuel poverty and low-income housing

The funding gap for the fuel poverty EPC “A” targets is much larger than the social housing segment at **£3.86bn** and our research suggests it may be much harder to address. Given the scale of this challenge, we argue that meeting these targets will not be achievable by Welsh Government alone. Whilst the total amount of funding will be blended, measures for fuel poor households across private tenure should be 100% grant funded. We see the funding for this gap coming from three main sources:

Welsh Government funding - Warm Homes Programme: £732m

First a doubling of the existing Welsh Warm Homes Programme to £732m for the remainder of the 2020s, with this investment front loaded for the first half of the decade.

UK Government funding - Shared Prosperity Fund £1,000m

Second, Wales to draw down a significant share of the Shared Prosperity Fund and channel it into fuel poor and low-income housing decarbonisation. Whilst this fund could make a ‘shovel ready’ and substantial contribution to tackling fuel poverty, we recognise that there are likely to be multiple, competing demands for funding.

UK Government funding - Low Income Infrastructure Fund: £2,493m

This third source would be by far the largest and would be in recognition of the significant fiscal benefits of an optimised retrofit programme to the UK Exchequer, commensurate in scale with other infrastructure programmes in road, rail and the power sector in the coming decade. For example, whilst significant this infrastructure spend would represent only ~10% of the planned investment in the Wylfa nuclear power station.

These new and existing sources of funding are summarised in Figure 16 below.

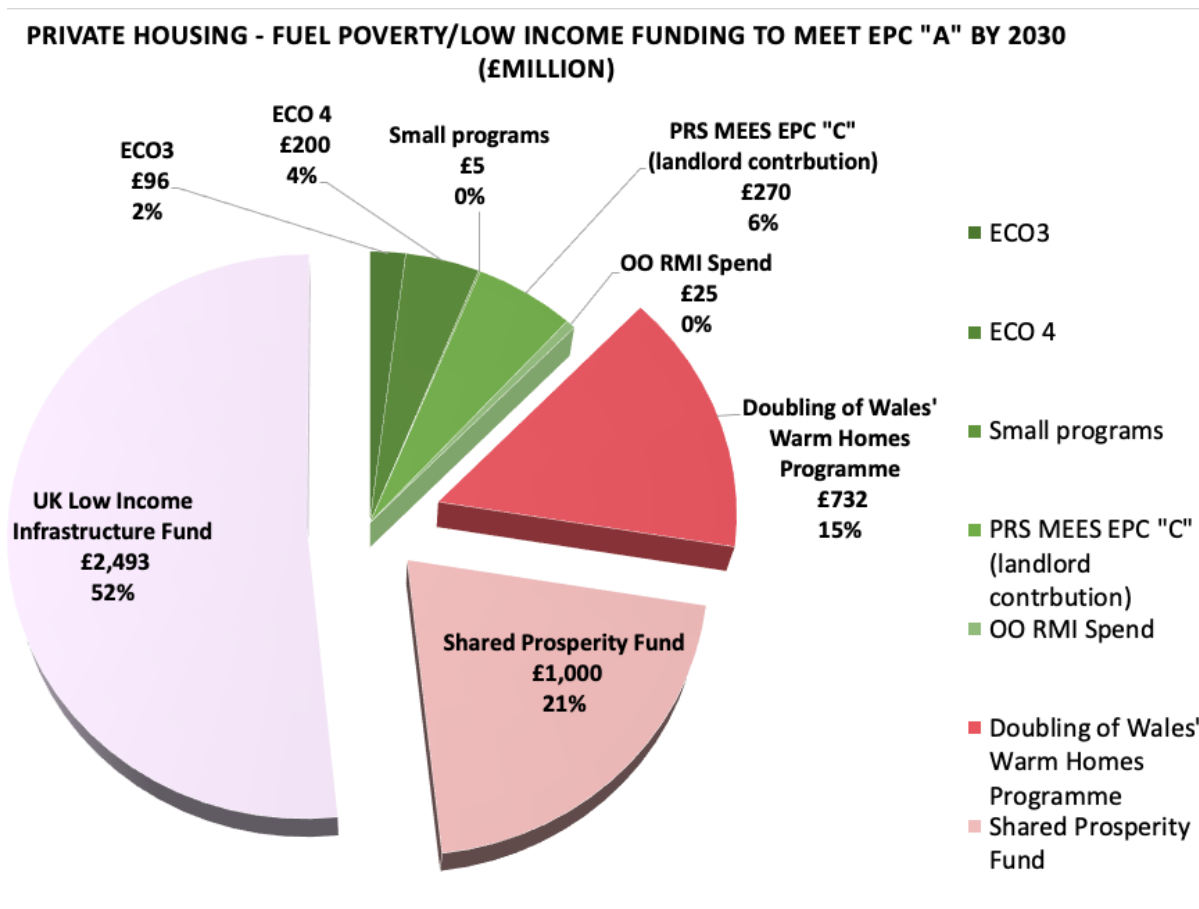


Figure 16 Fuel poverty and low-income funding to meet EPC "A" by 2030

8.2.1. Private Housing Delivery Model

Recognising that different funding mechanisms and levels of grant vs loan will be required, the currently highly fragmented funding environment is not fit for purpose. We argue Wales' housing decarbonisation programme would be best served by a central coordinating actor, or **"one-stop-shop"** (shown in Figure 17) who would coordinate the entire retrofit funding programme across PRS and OO sectors rather than households having to integrate multiple disparate funding streams and sources. We propose either the Development Bank of Wales (DBW) could fulfil this role, or a new institution could be created.

Able to Pay

Currently the DBW has access to the Financial Transactions Capital (FTC) allocation. We initially propose an increase in this capacity to cover lending to both private and social housing retrofits. Assuming cross tenure MEES targets are introduced, lending through this channel would increase to >£1bn/ year – a 10-fold increase on historical FTC allocation. One key area to capitalise this additional lending could be the Green Sovereign Bond being launched by the UK Treasury, providing access to tens of

billions of low-cost private capital. We subsequently propose that three key debt finance mechanisms are trialled at scale in Wales:

- **Low interest and Equity Release Loans** Offered by the DBW, with Equity Release Loans repayable on a property's sale.
- **Property Assessed Clean Energy (PACE)** DBW to trial this novel mechanism with debt attached to the property rather than the individual, with repayment on the council tax bill or another property tax
- **Green Mortgages** We also see a role for green mortgages of about £100m/year, with this lending coming from banks and building societies

Fuel poverty and low-income grants

We propose the new fuel poverty grants to adopt the existing delivery route but with a beefed-up role for Local Authorities in-coordinating area based retrofit programme alongside the scaled-up Nest and Arbed programme. Under recent announcements we expect the Shared Prosperity Fund to be centrally coordinated and therefore Local Authorities and area-based programme to be proactive in securing this funding.

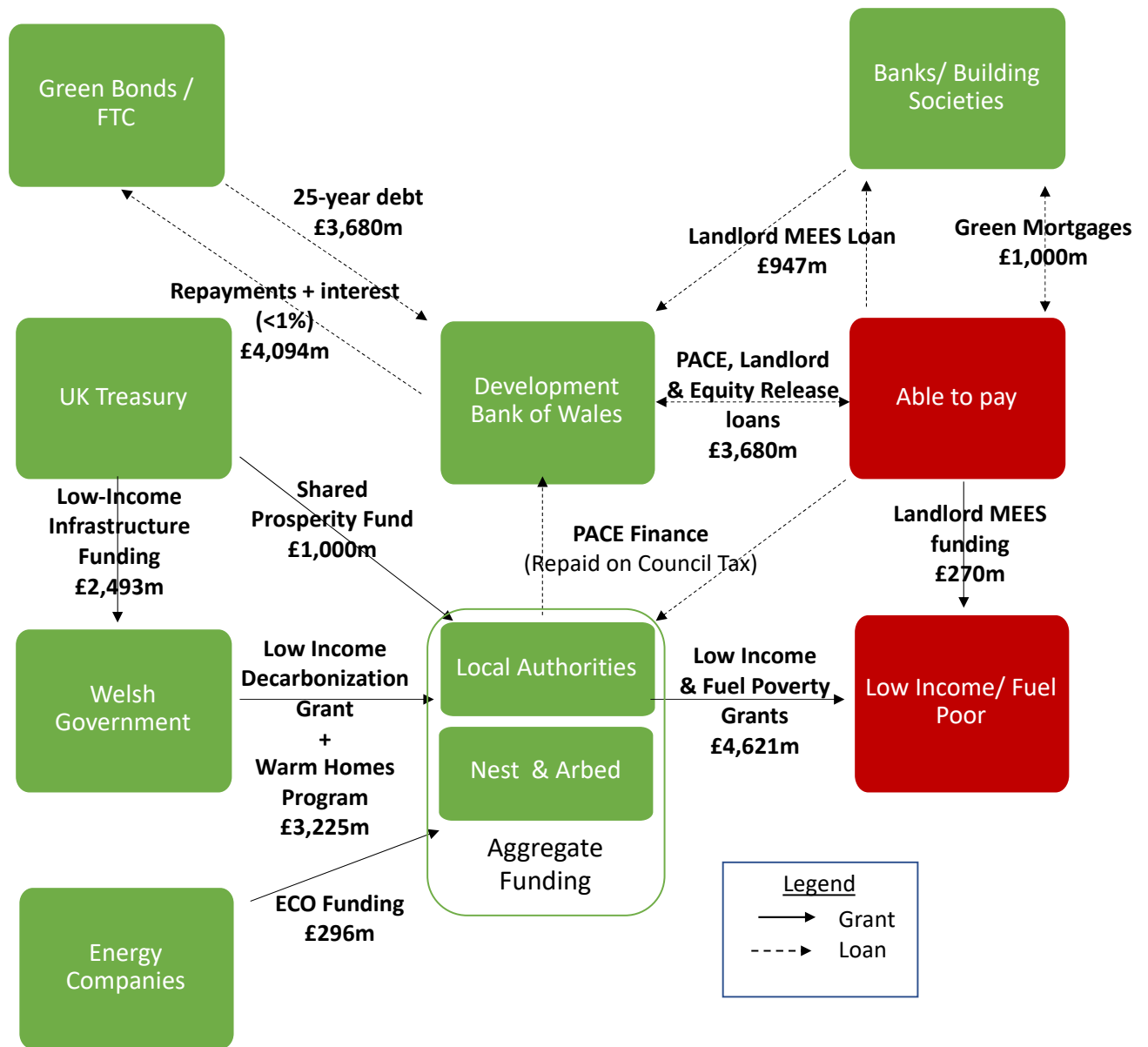


Figure 17 Private housing delivery mode

8.3. Wales fiscal impact

A Wales-wide retrofit programme across all tenures, which leverages large scale private investment, would generate a large fiscal dividend to the UK Treasury. As shown in the figure below, we assume a staggered S-curve deployment peaking in 2028³⁰, leading to a total capital investment of £14.75bn by 2030.

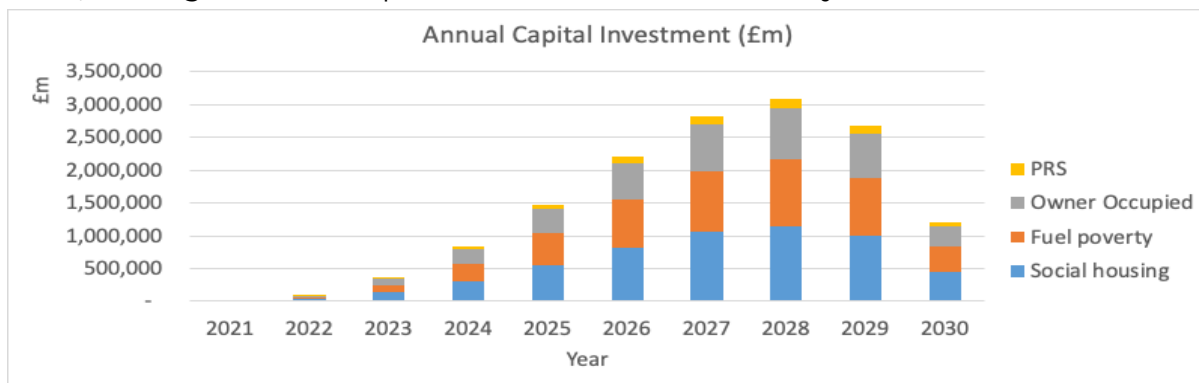


Figure 18 Wales wide deployment rate

Following the same trajectory, we see total government investment also peaking in 2028 with a cumulative government spend of £5.3bn, of which £3.5bn comes from UK and £1.8bn from Welsh Government. We therefore expect 64% of total investment to come from private finance, energy companies or self-funding by property owners. Figure 20 summarises these sources overleaf.

We explored two scenarios relating to the inclusion of a PRS & OO MEES at EPC “C” (Scenario A) and a scenario with no private housing MEES (fuel poverty & social housing targets only) (Scenario B). As shown in the figure below Scenario A generates a net tax benefit of £3.54bn (£8.85bn gross) based on the £14.75bn capital investment. Without these regulatory measures for private homes, Scenario B creates a tax benefit of only £0.90bn (£6.2bn gross) with only £10.34bn capital investment - **highlighting the importance of 2030 able-to-pay MEES targets for the government balance sheet.**

³⁰ Assuming future programmes for the decarbonisation of the wider stock we might expect deployment and jobs to continue through the 2030s

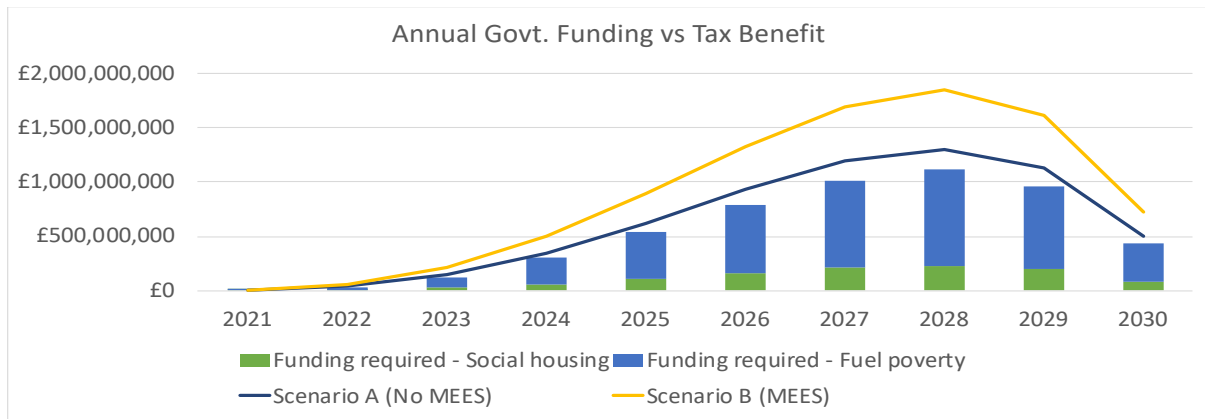


Figure 19 Fiscal impact of Scenario A (MEES) and Scenario B (no MEES)

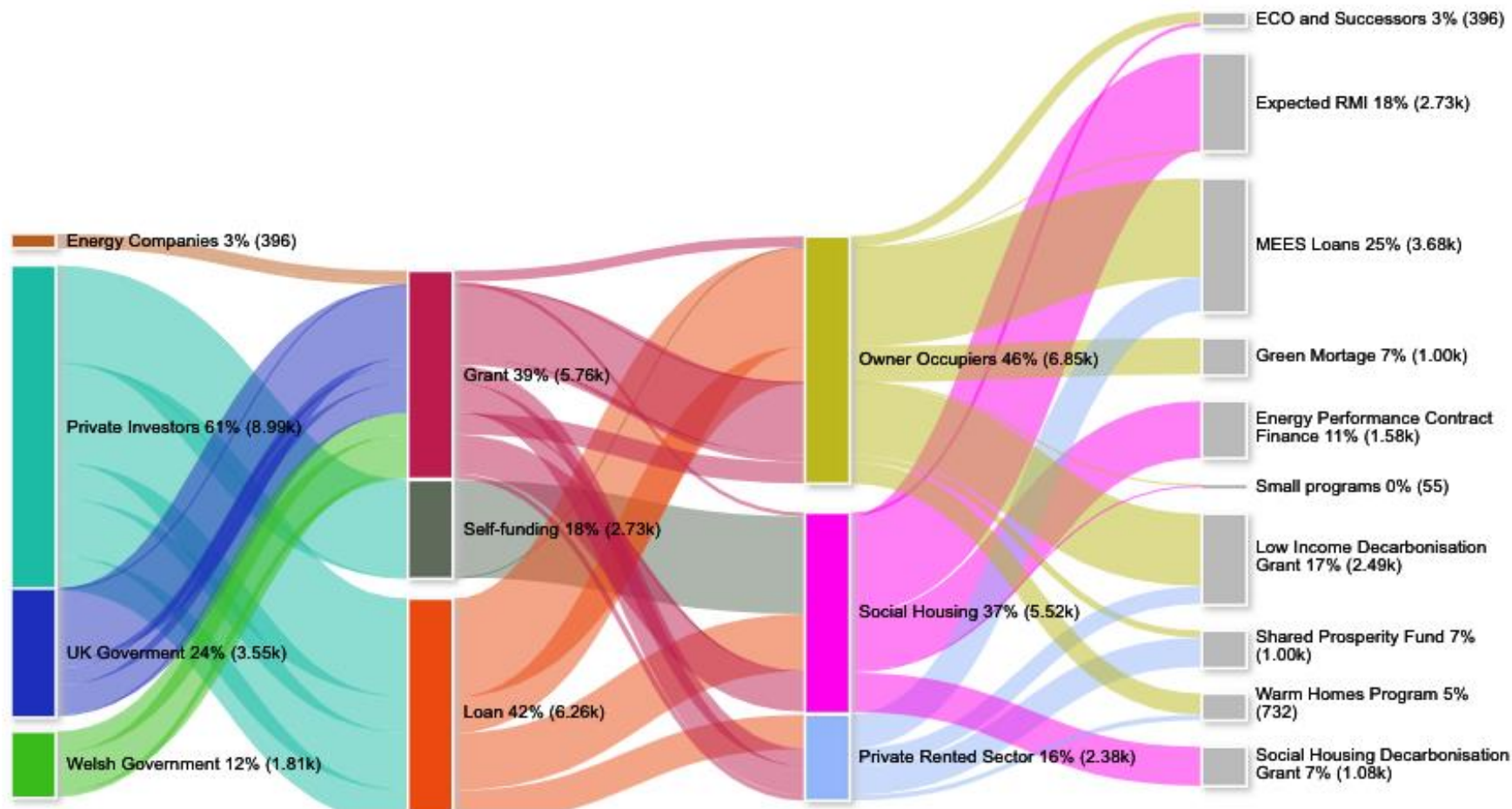


Figure 20 Sankey financial flow diagram of a 10-year Welsh retrofit programme (£millions)

9. Policy recommendations

Decarbonisation of Wales' housing stock will require policy changes at multiple levels of government. The majority will not directly relate to financing, but involve a set of enabling regulatory, supply and demand side conditions to drive the uptake of residential retrofit over the next decade. We therefore call for future work to identify policies focussed on developing the supply chain, household engagement, quality and performance standards as well as building capacity in local authorities and other bodies for the programme's delivery. Recognising the importance of these wider factors, in the following section we propose key policy recommendations which we believe will be essential to ensuring sufficient and appropriate funding is available to meet this challenge.

Here, we have retained a focus on core enabling policies to ensure investment is mobilised and long-term signals are provided to the industry and financial sector. Chief among these is a regulatory approach which will mandate minimum energy and carbon performance standards (MEES) for all Wales' homes within the next decade. Recognising the problems with the current EPC system and the future outcome of the ORP, we emphasise the need for MEES as key regulatory mechanism, given its salience with policymakers. We also have tried to identify the levels of government where these changes will be made and the implications for Wales' devolution settlement and an expanded role for LAs.

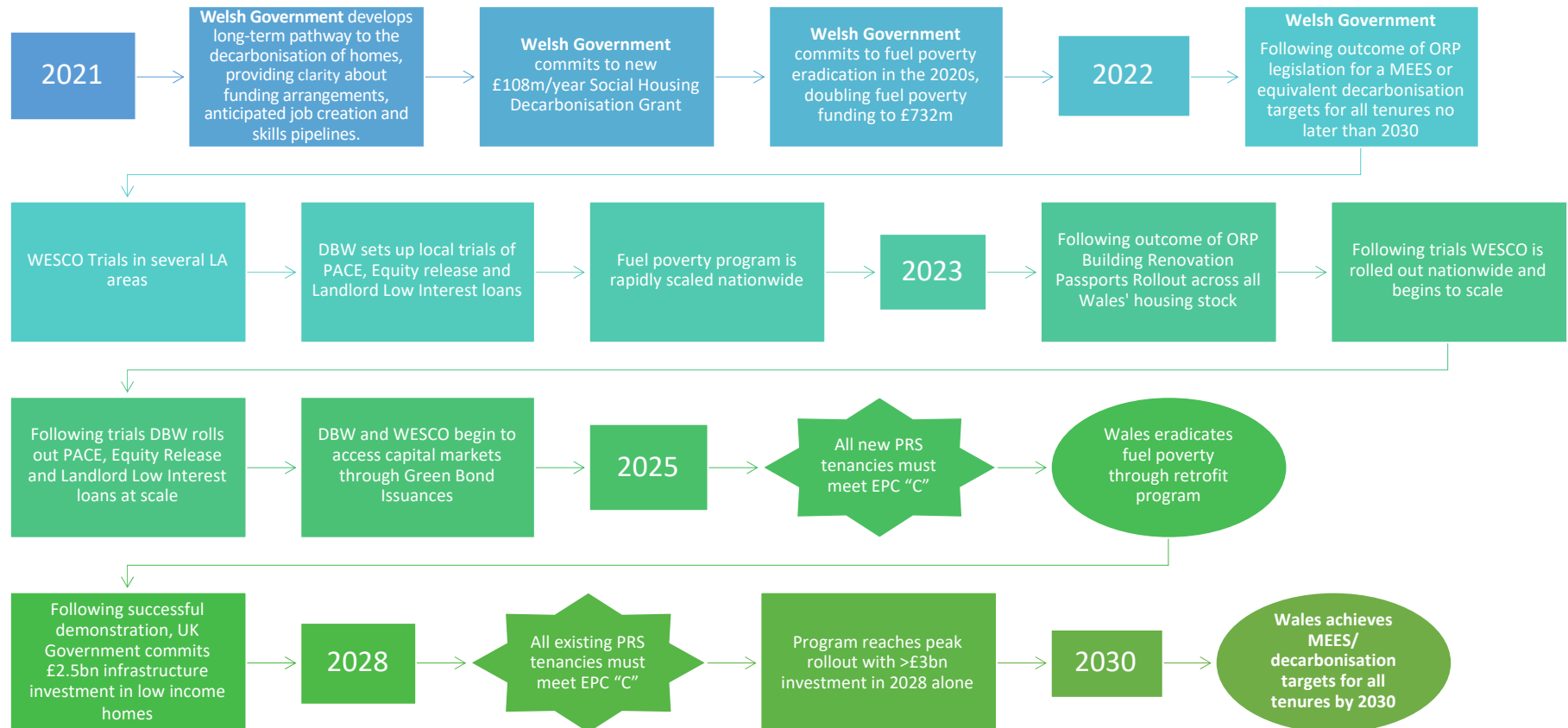
General Policy Recommendations	Local Authority	Welsh Govt.	UK Govt.
1) Welsh Government should fully recognise the interconnected challenges of the decarbonisation of homes and tackling fuel poverty and reflect these across the new programme for Government.			
2) Building on this report and the work of key organisations such as CHC, Welsh Government should develop a long-term pathway to the decarbonisation of homes, providing clarity about funding arrangements, anticipated job creation and skills pipelines.			
3) Building on the work of the ORP, Welsh Government should develop a cost model and 'Building Renovation Passports' for the entire Welsh housing stock.			
4) By 2030 UK Government should provide a total of ~ £2.6bn infrastructure investment and also allocate £1bn of the Shared Prosperity Fund to			

tackle decarbonisation of low-income homes and fuel poverty in Wales.			
5) Welsh Government should aim to eradicate fuel poverty in the 2020s, doubling fuel poverty funding to £732m by 2030 and supplementing with low-income grants from UK Government national infrastructure funding.			
6) Welsh Government should increase its use of FTC for retrofit and UK Government should facilitate access to the new Green Sovereign Bond market, to enable ~£6.3bn of private investment in the Welsh housing stock by 2030.			
7) UK Government should ensure the full devolution of Building Regulations powers to Wales.			
8) UK Government should cut VAT on all retrofit related measures to 5%.			
9) Local Authorities should play a more proactive role in driving the decarbonisation of homes and the reduction of fuel poverty, particularly in relation to the Private Rented Sector. Their role should be strengthened and properly resourced.			
Social Housing Policy Recommendations	Local Authority	Welsh Govt.	UK Govt.
10) Following the ORP Welsh Government should determine an ambitious MEES/ decarbonisation target for this sector then legislate for this target.			
11) Welsh Government should commit to a new £108m/year Social Housing Decarbonisation Grant , conditional on measured performance & cost reductions.			
12) UK/Welsh Government should offer £158m/year low interest loans to housing providers through the "WESCO" Energy Saving Performance Contracts .			
Private Housing Policy Recommendations	Local Authority	Welsh Govt.	UK Govt.
13) Welsh & UK Government should legislate for a MEES of EPC "C" ³¹ and ban the installation of new fossil fuel heating for all homes no later than 2030. Ensuring all fuel poor homes meet this target, regardless of tenure. This will require local authority enforcement of proposed and existing MEES which should be strengthened and properly resourced.			

³¹ Or equivalent decarbonisation target (KWh/m² or kgCO₂/m²)

14) Welsh Government should establish central role for Development Bank of Wales (DBW) or a similar coordinating actor to facilitate lending of around £1bn/year . This would need to be paired with an appropriate, area-based advice and retrofit procurement service to offer a 'one-stop-shop' to households.			
15) Welsh Government and Local Authorities should trial the PACE mechanism through a levy on council tax.			
16) Welsh Government and DBW should trial equity release models and low interest loans to landlords for retrofit finance.			
17) UK Government Financial Conduct Authority (FCA) should stimulate £100m/year Green Mortgage market by requiring EPC disclosure at "decision in principle" stage.			

Policy Roadmap to 2030



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11. Appendix

Table 14 Feasibility of finance mechanisms for social housing retrofit

	Conventional HA / LA Borrowing	Municipal Bonds/ Community Bonds	Energy Service Agreement (ESA)	Retrofit investment fund/ SPV
Financial -Would this create problems for other core activities?	While some HAs can access cheap capital, many are overleveraged, and the smaller ones are reliant on expensive bank debt. Without accompanying revenues streams, this source will have limited value.	Municipal bonds are likely to offer a cheaper borrowing route than conventional channels. However, questions as to where they could be used for non-LA stock, or the repayment channel that would be used.	Could be important route for "off-balance sheet" financing. These models could in effect help housing providers outsource the financing element of works and focus on core activities.	Developing a separate fund, which was government backed, could help overcome access to capital issues, especially for smaller HAs. Depending on its design this could also allow debt to be taken off the balance sheet.
Legal & Governance -How challenging and costly would this be to implement for housing providers?	Very simple to implement as uses existing borrowing routes, requiring limited new staffing and legal resources	While there are now some precedents for these instruments in the UK, there is a degree of legal work involved which may be off-putting for some councils	ESA type models would be extremely costly and complex to administer at the level of an individual organisation. These high transaction costs would likely require aggregating across multiple LAs/HAs	While in theory, a single large fund for Wales social housing decarbonisation could reduce the administration for individual providers, there would still be legal and transaction costs for housing providers
Political -How easy/hard to implement -Where would change be needed?	Minimal input from government required	Adoption of these models requires buy in from local government officials. While there are signs that some LAs are keen on these models, this is not universal.	While ESAs can in theory be developed without govt. involvement, they are only likely to become widespread with performance-based retrofits becoming mandatory. This will require policy changes in the compliance regime.	This model would require significant input from govt. Likely involving administering the scheme as well as providing a loss guarantee, the high-risk tranche of the fund, or fully capitalising it. This may therefore require input and funding from Westminster.
Social Justice -Share of financial burden	Concern that adding to traditional debt financing routes could lead to cutbacks in other areas such as new housebuilding or frontline services. Further concern that	One of the key advantages of these models is their generation of local value, with the proceeds of projects accruing to local small investors, also generating a	ESA and performance-based models have an advantage for users in that they will only contribute to real and measured savings. This eliminates the performance	Depending on its design these mechanisms costs may be passed on to tenants, although energy savings /performance may not be guaranteed.

-Who sees a return, is this felt in local economy?	rent increases may be required to offset cost of decarbonisation	sense of civic pride and shared responsibility	gap issue and is likely to be viewed as fairer by tenants	
Scalability - Can it be scaled to deliver £5bn in Wales alone?	Only scalable if above barriers could be overcome.	Few in the workshop thought that the model could be scaled for all social housing in Wales and would likely remain a more niche product.	Because of the complexities involved in performance-based compliance, there are concerns as to the scalability of this model for all homes in Wales within a decade.	By design this type of scheme would be at a large scale, and would therefore likely be a Wales wide programme

Table 15 Feasibility of finance mechanisms for private housing retrofit

	Central Government/ Public Bank Loan	PACE finance	Green Mortgages	On-bill Finance/ Green Deal 2.0
Customer Journey -How complex is it to access finance?	In both Scotland and Germany, the government is willing to waive onerous underwriting requirements. In Germany loans are disbursed through retail banks, while in Scotland this is managed by the energy saving trust. This makes the application process fairly simple with the majority of people eligible.	In the USA PACE financing is an incredibly simple process, as it can be offered by retrofit contractors. However, the transferability of this to the UK/Welsh context will not be straightforward as FCA consumer protection could make this more complex.	Mortgages involve a fairly onerous process of underwriting and credit checks. This is likely to deter less committed households, and therefore are likely to only be taken up in large numbers where wider cosmetic improvements are being made.	The Green Deal is infamous for its onerous Customer Journey, which was viewed as a hassle for both contractors and customers alike. Because it used private capital, lenders introduced fairly onerous underwriting requirements.
Split Incentive - Split incentive between landlords and tenants and those looking to move?	Neither of these schemes are designed to solve the split incentive barrier, although the Scottish scheme has a specific product for landlords, where landlords are expected to cover the costs of repayment.	Theoretically PACE financing solves the split incentive barrier, tying the repayment of finance to the property, meaning landlords or those looking to sell are not tied into repayments.	Green mortgages do not solve the landlord tenant dilemma. However, because the debt is secured to the property, it will be cleared upon the sale, potentially also opening up the shorter-term property developer market.	One of the key advantages of On bill financing is that it resolves the split incentive issue, although there are examples of buyers requesting these debts to be cleared prior to a properties sale.
Political -How easy/hard to implement -Where would change be needed?	These models both require significant political will to be implemented, also requiring large sums of publicly backed capital to be committed. Germany benefits from a pre-existing institution in the KfW, whereas a Wales or UK wide scheme would incur significant set up costs.	PACE financing will require several changes to the way council tax is estimated and collected. The extent to which this will require major changes to legislation remains uncertain.	Green mortgages do require some support from government to get going, however, we expect this market to be largely private sector led, subject to policy actions in other areas driving demand for retrofits.	While there would be limited changes to legislation required to resurrect a Green Deal 2.0, its toxic brand means that politicians will likely be reticent to being associated with its revival.
Social Justice -Share of financial burden -Who sees a return, is this felt in local economy?	Because these models mobilise public backed capital at 0% interest, they are viewed as correcting market failures and thus acting in the public interest, providing access to capital for groups who would otherwise not be deemed creditworthy.	Without regulation, there are risks that landlords could pass the costs of retrofits onto tenants without their permission. Private sector PACE loans also have a higher cost of capital, which could add a burden to future property owners or tenants.	Green mortgages are unlikely to create negative outcomes for disadvantaged groups. However, the model is only likely to be accessible to wealthier homeowners, doing little to solve issues at the bottom end of the market.	In a similar vein to PACE there are concerns surrounding landlords passing the costs of renovations on to tenants. Although the original green deal included safeguards, there is also the risk that total costs may increase.

Scalability - Can it be scaled to deliver £10bn in Wales alone?	There are questions as to whether the DBW could raise £10bn needed for this to be the dominant programme, without access to capital markets. This scale of funding would likely require capitalisation which exceeds Welsh departmental budgets.	While PACE style financing has the potential to be scaled, this may happen on a LA by LA basis, meaning not all households will have access to PACE finance.	As mentioned, while Green mortgages can be scaled across the mortgage market, this will cover only a subsection of the homes in Wales that will need retrofitting.	While a Green Deal style scheme could be scaled to all tenures, for the reasons outlined above this could be unlikely, with the original scheme achieving a fraction of its aims.
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Workshop 1 Attendees - Private Housing

Bethan Proctor	Alison Vipond	Chris Jofeh
Adrian Webb	Kristina Klimovich	Dr Joanne Wade/ Kelly Greer
Matt Wellington / Ryan Price	Lisa Dobbins	Tim Mann
Kevin Hammet	Ed Green	Prof Andy Gouldson
Peter Smith / Ben Saltmarsh	Andy Sutton	Ryan Jude
James Griffiths	Dr Mark Davis	Robert Hunter
Howard Toplis	Jack Wilkinson Dix	Matthew Kennedy
Kath Palmer	Catherine May	

Workshop 2 Attendees - Social Housing

Aaron Hill	Community Housing Cymru	Bethan Proctor	Community Housing Cymru
Chris Jofeh	Chair of Decarb of Housing Advisory/ Implementation group	Adrian Webb	Chair – Ministerial Board & Chair of Tai Calon
Simon Lannon	Wales School Architecture	Matt Wellington / Ryan Price	Welsh Government
Dr Mark Davis	Alternative Finance Mechanisms	Andy Sutton	Sero
Keith Edwards	Housing consultant	Robert Hunter	Development Bank of Wales
Ben Saltmarsh	Head NEA Cymru	Ian Hutchcroft	Energiesprong
Richard Mann	United Welsh	Mark McArthur	EST
Tim Mann	Welsh Government	Simon Jones	FD, Coastal Housing

Naheed Hussain	Welsh Government	Ryan Jude	GFI
Gerry Holtham	Cardiff Uni / WCPP	Catherine May	CIH
James O'Connor	Pobl	Solitaire Pritchard	Pobl
Sian Ross	Director of Finance at Tai Tarian	Jo Atkinson?	Active Building Centre
Elizabeth Howard	Melin Homes	Cerys Gregory	Family Housing Wales
Alex Jenkins	Ateb Group	Sara Foster	RHA Wales
Amerjit Barrett	United Welsh Housing	Neil Chidgey	United Welsh Housing
Bill Brown	SDC	Alex Gilbert	TFL
Lisa Dobbins	Welsh Government		