

Green Home Finance

Expert Analysis from a Behavioural Perspective

Prepared by Basis Social, London Economics, Cambridge University, and
University College London for the Department of Energy Security and Net Zero

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Executive summary

Background

Decarbonising buildings is central to the UK Government achieving its Net Zero ambitions. Research estimates that up to £65bn of investment will be required to upgrade the UK housing stock to an average EPC band C rating by 2035,¹ and stimulating the market for private green finance may present an opportunity to achieve this goal.

Project aims

Green Home Finance (GHF) refers to a range of financial products made available to finance or re-finance the retrofitting, purchase, or self-build of properties to improve their energy efficiency or carbon emissions. This project aimed to explore the appetite for GHF products amongst consumers, the barriers and enablers to GHF delivery, and how behavioural science can be used to deliver effective green finance programmes. It also aimed to identify key evidence gaps in the literature where primary research with consumers is required.

Methodology

The project involved:

- a rapid evidence assessment of 45 academic research papers and related publications on GHF
- eight stakeholder interviews with academics, representatives from green and other finance organisations, and consumer advice organisations.

Findings

Consumer demand for GHF products

Evidence from two consumer surveys indicates that c.15% owner occupiers are willing to borrow money to finance retrofit measures. Despite relatively weak demand for GHF products currently, the eight stakeholders interviewed for this project believed consumer demand was likely to increase over the coming years. For stakeholders, consumer interest in GHF products is motivated by (1) the potential to lower energy bills; (2) wider benefits such as making the home warm and comfortable; and (3) longer-term outcomes such as improving the property value and helping the environment. Stakeholders said that communicating these wider

¹ BEIS. (2022). Green Home Finance Accelerator (GHFA). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1111585/green_home_finance_accelerator_competition_guidance.pdf

benefits, in addition to energy bill cost savings, was needed to drive demand. Survey evidence also indicates that 66% of consumers plan to make improvements to the environmental sustainability of their property over the next 10 years.

Barriers to GHF uptake

The research identified two sets of barriers related to stimulating demand for GHF products.

Barriers which relate to retrofit and low carbon heating measures in general, from which a demand for GHF will emerge include:

- there was limited awareness of the retrofit measures available to consumers to decarbonise their homes and their cost, especially low-carbon heating measures
- the benefits of investing in these measures relative to other home upgrades was not clear which means consumers have no reason to explore funding options.

Barriers which specifically relate to stimulating the demand for GHF products include:

- many households are not currently able or willing to take on additional debt
- there was not a wide variety of GHF products available on the market to meet different consumer needs, and innovation was needed to unlock this potential
- GHF innovation by financial institutions is hindered due to uncertainty over levels of consumer demand and future government policies.

GHF product features²

Unsecured loans

Stakeholders generally saw unsecured loans as potentially effective at financing simple and lower cost retrofit measures, and measures which provide immediate savings on energy costs. However, stakeholders saw several barriers to the uptake of unsecured loans, namely relatively high interest rates, and monthly repayments that may exceed savings from installing such measures. There was some evidence suggesting households can be attracted by zero interest loans to fund energy efficiency upgrades, for example the Home Energy Scotland Loan has been influential and cost-effective in encouraging the installation of renewables systems.

Secured loans

Stakeholders identified secured loans with preferential rates as having a variety of advantages over non-secured loans, including longer payback periods, smaller month repayments and comparatively low interest rates. Stakeholders particularly discussed 'green mortgages',³

² There was limited direct evidence of consumer views on specific product features.

³ The term 'green mortgages' was used in interviews to refer to GHF secured loans, where the asset used as security is the property. There are a variety of green mortgage products on the market, and the specific features of different products was not discussed in interviews. It should be noted that green mortgages can focus both on the purchase of properties with high energy performance ratings (e.g., EPC A or B) as well as the installation of retrofit measures. A range of different green mortgages and their features are summarised here: <https://www.greenfinanceinstitute.co.uk/programmes/ceeb/green-mortgages/>

whereby lenders offer buyers preferential terms on their mortgage as a reward for purchasing a property that meets certain environmental standards or making energy efficiency improvements. These preferential terms tend to be lower interest rates or cashback.⁴

Stakeholders saw green mortgages as changing consumer perceptions of the loan's value, with such products associated with a long-term investment in the value of a property, rather than a short-term investment to reduce energy bill costs. Green mortgages also provide the opportunity to engage consumers at effective moments to drive retrofit behaviours (e.g., buying or re-mortgaging a home).

While stakeholders saw green mortgages as relatively attractive GHF products, they are unlikely to meet the needs of all consumers. Specifically, more research needs to be undertaken with consumers who own their property outright (which is the most common tenure category in England and Wales) and for whom secured loan products may be less appealing.

Property-linked finance

Property-linked finance (which supports homeowners to fund the upfront costs of energy efficiency improvements in their home by linking the loan to the property, rather than the owner) was discussed in four stakeholder interviews. These stakeholders believed property-linked finance was a potentially promising way to overcome the barriers of large upfront costs and a long return on investment associated with other loans. However, to encourage uptake, stakeholders also believed it was necessary to demonstrate that property-linked finance did not impact on the ease or value of the resale.

Range of GHF products needed

Despite the perceived relative advantages of secured loans and property-linked finance products, overall, stakeholders felt a range of GHF products will be needed to fit different consumer needs. Attractive interest rates or ways to offset payments such as salary sacrifice or energy bill reduction, will be vital to drive word of mouth and uptake. Furthermore, wider policy initiatives, such as reductions on stamp duty or council tax, could also help to drive consumer demand.

Enablers needed alongside GHF products

As well as refining GHF products, the research identified a wide variety of external enablers which need to be in place for the market to flourish. They include the need for:

- Clear policy signals and a 5–10-year roadmap from government concerning the plan for retrofit and low-carbon heating, and how the market will be supported in this context.
- Better access to advice and information, which includes:

⁴ Green Finance Institute (2022, May) Green Mortgages.
<https://www.greenfinanceinstitute.co.uk/programmes/ceeb/green-mortgages/>

- intermediaries to advise consumers both on measures that are right for their property, and where to get access to finance. A nationally led, locally delivered, impartial service was viewed as central in this context.
- energy companies or independent advisors to support the process by conducting home energy audits: a detailed report on home energy usage, complete with advice on how to save money and energy. This would be accompanied by information on GHF products.
- estate agents, together with those involved in the conveyancing process, signposting consumers to information and advice on GHF products at critical moments in their property purchase journey.

Limitations

It is important to note several limitations of the methodology:

- The methodology did not involve any primary research with consumers. Consumer needs and motivations are understood indirectly from the existing evidence or expert perspectives.
- Several individuals and organisations declined to take part due to availability or because they did not feel well placed to discuss the topic of GHF.

Basis also identified the following evidence gaps:

- Limited evidence on consumer demand for GHF products in general, and no evidence of demand for specific GHF product features across different consumer segments.
- Limited evidence on how the costs of living crisis may have affected demand.
- Limited evidence on what consumers specifically want in the context of GHF products.

To overcome these limitations and evidence gaps, we recommend primary research be conducted with consumers to understand appeal of specific GHF product features.

Introduction and scope of the project

Government has set a Net Zero carbon emissions target by 2050, as laid out in the Net Zero⁵ and Heat and Buildings strategy,⁶ and has a statutory fuel poverty target for as many fuel poor homes as is reasonably practicable to achieve a minimum energy efficiency rating of B and C by 2030 in England. Government set out an aspiration in the Clean Growth Strategy for as many homes as possible to reach EPC Band C by 2035 were cost-effective, affordable & practical. Achieving this will require mobilising up to £65bn of capital investment,⁷ and a diverse portfolio of private green finance products will be required to meet a range of market needs.

Green Home Finance (GHF) is defined by the Green Finance Institute as any type of retail financial solution made available to finance or re-finance, in whole or in part, the following:

- the retrofitting of domestic buildings (single-family or multifamily) to achieve verifiable improvements in their energy efficiency, carbon emissions, material use or climate resilience; or
- the acquisition of domestic buildings (single-family or multifamily) that meet or exceed relevant market standards on energy efficiency, carbon emissions, material use or climate resilience; or
- the self-build construction of domestic properties (single-family or multi-family) that meet or exceed relevant market standards on energy efficiency, carbon emissions, material use or climate resilience.⁸

In December 2022, the Department for Energy Security & Net Zero (DESNZ) commissioned Basis Social, London Economics, Cambridge University, and UCL (hereafter Basis) to explore the appetite for GHF products amongst owner occupiers, which products are likely to be most effective, and potential challenges with GHF delivery. The research also aimed to identify key evidence gaps which DESNZ might address going forward via primary research.

Research questions

This research seeks to address the following research questions:

⁵ DESNZ and BEIS. (2021). Net Zero Strategy: Build Back Greener. Available at: <https://www.gov.uk/government/publications/net-zero-strategy>

⁶ DESNZ and BEIS. (2021). Available at: Heat and buildings strategy. <https://www.gov.uk/government/publications/heat-and-buildings-strategy>

⁷ BEIS. (2022). Green Home Finance Accelerator (GHFA). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1111585/green_home_finance_accelerator_competition_guidance.pdf

⁸ Green Finance Institute. (2020). Green Home Finance Principles. Available at: <https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2021/09/GREEN-FINANCE-GREEN-HOMES-REPORT-NEW-a.pdf>

- Based on existing evidence and expert views, what is the appetite for GHF products amongst owner occupiers?
- Which GHF mechanisms, and related intermediaries, are more or less able to promote home upgrades, and what are the related challenges to GHF delivery?
- How can policymakers use behavioural science to deliver effective green finance programmes for owner occupiers?

Method

Basis used the following three-staged research methodology to explore GHF.

Stage 1 involved a rapid evidence assessment (REA) to understand the current evidence base around GHF and develop hypotheses around consumer appetite and GHF challenges that can be tested in the stage 2 expert interviews. Basis conducted the REA in January 2023. The REA search identified 390 academic papers. Through abstract screening, 33 academic papers were included in the analysis. Basis reviewed an additional 12 papers from the grey literature (identified directly via web search and from DESNZ rather than screened). It should be noted that 'green home finance' was not a term was not used in the scientific and academic literature in a generalised way, and a range of other terms were used in the search protocol (see appendix for details on the search protocol).

Stage 2 involved eight in-depth interviews with stakeholders with expertise in GHF.

Basis identified three groups of stakeholders to inform the research, with a minimum quota of two interviews per group. The groups were:

- Green and other finance organisations (three interviews were achieved).
- Consumer representative organisations (three interviews were achieved).
- Academics working on green home finance (two interviews were achieved).

DESNZ and Basis identified the stakeholders, and contacted them via email to take part in an interview.

Basis conducted interviews online during February and March 2023 and each lasted one hour. Basis structured the interviews to explore respondents' views and experiences surrounding GHF and sought to stress test some of the findings from the REA.

Topic coverage included:

- Opportunities and barriers to the development of GHF products and services in the UK.
- Current and future demand for GHF products by consumers.
- Specific GHF products and features, and the extent to which these were attractive to consumers.

- The interplay between GHF products and government policies and incentives.
- The role of intermediaries to support GHF uptake.
- The role of a long-term strategy and a stable policy environment to create confidence to develop GHF products and services.

Basis used the COM-B model⁹ to analyse and interpret findings from the interviews and literature. The COM-B model identifies three factors that need to be present for any behaviour to occur: capability, opportunity, and motivation. The start of each section of this report, the barriers and enablers that need to be addressed to increase the uptake of GHF are summarised in terms of COM-B.

The full methodology, including more detail on the COM-B model and how it can be used to develop interventions, can be found in the appendix.

⁹ Robert West, Susan Michie (2020). A brief introduction to the COM-B Model of behaviour and the PRIME Theory of motivation. Qeios. doi:10.32388/WW04E6.2.

Limitations of the research

It is important to note that the methodology did not involve any primary research with consumers. Consequently, consumer needs and motivations have only been indirectly understood through existing evidence or expert perspectives. The interviews with experts were undertaken in February and March 2023, and findings from two surveys on consumer demand were also conducted during the cost-of-living crisis. These circumstances may have limited consumer willingness to take on debt, so caution should be applied when considering findings more generally.

Further, several individuals and organisations declined to take part in all or some of the research. This was because they were either not available to participate during the fieldwork period (for example, academic experts) or, did not feel well placed to discuss GHF products (for example, some consumer advice organisations did not feel they could meaningfully contribute given the market was immature). One financial sector organisation that did take part chose to decline to answer many of the questions, as they did not have current policies related to GHF. Another financial sector organisation declined to take part altogether for this reason. Consequently, the range of experts and depth of views contributing to the research was limited.

Moreover, a lack of differentiated GHF products currently available meant it was challenging to identify how specific product features may be refined and improved, and how policymakers can help create the environment to drive consumer up-take at scale.

Despite these limitations, a range of behavioural and contextual insights have been identified through this project that can be used to help stimulate the market for GHF products and provide a foundation for future research in this area.

Consumer Appetite for Green Home Finance

In this section we explore:

- Evidence on the consumer appetite for retrofit measures and GHF products.
- Factors affecting consumer demand for GHF products.
- Behavioural factors affecting demand for GHF products.

Levels of consumer demand for GHF products

There is currently very limited evidence related to consumer demand for GHF products and the findings on demand identified through this research are mixed.

Several stakeholders interviewed felt that there is an appetite amongst consumers for GHF products; however, they had little direct evidence to support this. Other stakeholders indicated that the current uptake of GHF products is low, though they also had limited direct evidence concerning why.

Basis identified three studies that directly explored consumer appetite on GHF. A recent study by Citizens Advice found that, out of homeowners who reported that they were interested in energy efficiency improvements, only 16% were willing to borrow to fund them.¹⁰ This was slightly higher than those who reported that they were interested in low-carbon improvements, where 14% said they would be willing to borrow to fund them. For both types of improvements (energy efficiency and low-carbon measures), respondents were more willing to take out mortgage borrowing than unsecured borrowing.¹¹

A second study surveying 1,000 owner occupiers also found that there is limited appetite for using loans to finance retrofit measures. The study found that 15% of the surveyed owner occupiers would either be 'definitely' or 'probably' open to taking out a loan to finance energy efficiency upgrades in their home, with 61% saying they would definitely/probably not.¹²

Thirdly, a recent study conducted by Nesta involved a Randomised Control Trial of 7,500 homeowners from Wales, Scotland and England to better understand consumers' willingness

¹⁰ Citizens Advice (2023) Financing Net Zero: Emerging findings

¹¹ More properties are owned outright in England than those which have a mortgage, loan, shared ownership or are rented. There was no evidence on the GHF preferences of different cohorts of homeowners, and there may be less appetite for secured loans amongst consumers who have paid off their mortgage. For a breakdown of housing ownership, see: ONS (2023) Housing in England and Wales: 2021 compared with 2011.

¹² Behavioural Practice for Department for Energy Security and Net Zero (2023) Great British Insulation Scheme Willingness to Cofund: A Discrete Choice Experiment. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1145476/great_british_insulation_scheme_willingness_to_pay_a_discrete_choice_experiment.pdf

to take up GHF products to pay for a range of home decarbonisation measures.¹³ The experiment tested seven different GHF product types against a control (a commercial loan or no loan at all). Overall, government-backed products tended to outperform the control. However, advice, consumer protection and recommendation for tradespeople was seen as equally important as financial support. Interviews found that motivations for home upgrades tended to be the 'liveability' and comfort of the home; participants did not spontaneously mention improving the resale value of their home, ROI or payback periods. Equity release proved very unpopular with participants. A further option for the government to add 20% to a low-interest loan had no or negative effect on GHF take-up, suggesting that barriers to take-up could be due to perceptions of GHF loans in general, rather than mechanisms of specific loans.

There was some evidence identified of a growing consumer demand for energy efficiency measures more generally, rather than specifically GHF products. For example, a consumer group reported that, based on related pieces of research they have undertaken and talking to consumers, there is interest in making energy efficiency improvements to homes, but consumers need support to make the right choices. As well as the potential to lower energy bills, environmental benefits were reported as motivating for consumers.

'So that is something that consumers do have an interest in. Consumers also do care about the environment, maybe more than I thought. They do actually abstractly care about their impact, and I think it's just that element of confusion [about what to do]. So I suppose an opportunity is capitalizing on the interest that is around and trying to really push it forward. I think people are also very interested in the potential of new technology to lower their energy bills.'
(Consumer organisation, Interview 2)

A NatWest Greener Homes Attitude Tracker survey collects data on consumer behaviour and attitudes towards making energy efficiency home improvements and other energy efficiency behaviours.¹⁴ Out of 4,500 UK individuals, 22% stated that they had plans to make improvements to the environmental sustainability of their property over the next 12 months and 66% over the next 10 years. While those planning to make a change over the next 12 months has decreased compared to the previous quarter (which may be due to the rise in the cost of living), overall trends have been growing since 2021 and indicate an increased interest in making energy efficiency improvements to the home.

Notwithstanding this interest, in interviews, several stakeholders indicated that the current uptake of GHF products, such as green mortgages is low, suggesting there are other significant barriers to financing retrofit or low-carbon heating measures.

¹³ Nesta (2023). All the things I could do: testing options to help owners decarbonise. Available at: <https://www.nesta.org.uk/report/all-the-things-i-could-do-financing-green-home-upgrades/>

¹⁴ NatWest (2023) Greener Homes Attitude Tracker – January 2023. Available at: <https://www.natwest.com/mortgages/greener-homes-attitude-tracker.html#download-the-survey>

Factors affecting consumer demand for GHF products

Based on evidence gathered through the REA and interviews, Basis completed a COM-B analysis to understand the consumer barriers to take-up of GHF products through a behavioural lens. This is summarised below before findings are explored in more depth:

Table 1: COM-B analysis of consumer barriers to the uptake of GHF products

COM-B factor	Components	Analysis
Capability	Psychological capability	Consumers lack awareness of retrofit or low-carbon heating measures available, and their associated benefits
Capability	Psychological capability	Consumers lack awareness of the existence of GHF products to finance retrofit and low carbon heating measures
Capability	Psychological capability	Consumers do not know where to get advice on GHF products
Opportunity	Physical opportunity	There is not a diverse range of GHF products available on the market which either drive or meet consumer needs
Opportunity	Physical opportunity	Due to the cost-of-living crisis, consumers do not feel able to take on extra debt
Opportunity	Physical opportunity	There is a lack of advice around GHF products
Opportunity	Social opportunity	Consumers do not know others (such as friends and family) who have taken out GHF products
Motivation	Reflective motivation	Consumers do not see sufficient benefits from investing in decarbonising their home, relative to other ways to invest in their property.
Motivation	Reflective motivation	It will take many years for consumers to see a return on investment from installing certain measures
Motivation	Reflective motivation	A lack of stable and long-term strategy and policy can lead to consumers holding off on investing their own money if they think grants may come further down the line
Motivation	Automatic motivation	Consumers are anxious about the cost-of-living crisis, and express negative feelings towards debt.

Overall, stakeholders felt that the current offering of GHF products is insufficient to drive demand. Based on the interviews, this stems from several routes.

There is not a diverse range of GHF products available on the market, which creates a demand vs supply cycle dilemma

Findings from interviews with stakeholders suggested that there is currently a demand and supply cycle dilemma, whereby limited supply of GHF products feeds into limited demand (as products are not available and visible in the market) which in turn reduces the willingness of providers to develop new products. Stakeholders disagreed on whether increasing the number of products on the market or finding other ways to stimulate customer demand is more important for increasing GHF uptake.

For example, when asked in the interviews if the lack of consumer uptake of GHF products stemmed from limited demand or supply, one stakeholder felt that the appetite amongst consumers had increased, but it was limited by the supply of credible GHF products.

'I don't think there's been any really credible green finance housing products on the market that really incentivize behaviour and give you a really good customer journey all the way through.' (Academic 4)

However, another stakeholder held the view that, in order to stimulate supply, the financial market needs to see greater consumer demand for GHF products. In this context, it was mentioned that innovation in GHF products will stall if demand does not pick up.

'We are in a very unique position at the moment where, for instance, mortgage lenders have designed and brought to market green mortgage products with the full recognition that very few people are going to use them at the moment...But I think you could anticipate a moment when that innovation either loses momentum, people start to lose support for this unless consumer demand is driven.' (Finance group 7)

Consumers lack awareness of retrofit and low-carbon heating measures, as well as GHF products

Another barrier to consumer demand for GHF products is linked to psychological capability, which relates to consumers not having the sufficient knowledge to drive demand.

Consumers lack awareness and understanding of what energy efficiency or low-carbon heating measures are available, what is best for their home, and where to get advice on how to finance such measures:

'a lot of people don't know what the opportunity is from a consumer point of view, from public engagement point of view, that's a whole untapped market that doesn't even know that it's out there. So I think if you can improve public awareness of it, that's an opportunity for banks to offer products a drive incentive to actually drive behaviour change' (Academic – 4).

Consumers can lack interest in GHF products

Additionally, consumer beliefs about the value of installing energy efficiency or low-carbon heating measures (reflective motivation) can prove a significant barrier to the uptake of GHF products to fund upgrades.

GHF products are a means to an end – they provide finance to install a measure. Therefore, to stimulate demand, first consumers need to be convinced of the benefits of retrofit or a low-carbon heating measure itself. The extent to which consumers are driven by mainly the financial costs and benefits associated with home retrofits was a contested point in the literature.¹⁵ While several studies cite cost drivers as of paramount importance,¹⁶ others stress that creating a comfortable and warm home, aesthetics, and environmental concerns are key motivators for consumers,¹⁷ and that too much emphasis is placed on the economic framing of retrofit or low-carbon heating measures. Furthermore, energy efficiency or low-carbon heating measures may compete unfavourably against other ways to improve a property (a new kitchen, for instance).

‘we also have been advocating for more advice for consumers to really help them to understand what it is they could do to their homes... Even if there is the finance, people might not necessarily still not have the confidence to really go ahead and put something on the line to get these changes done’ (Consumer Representative – 2)

In this context, several stakeholders stressed that investing in retrofit and/or low-carbon heating needed to ‘make sense’ to consumers, as access to GHF finance is not a sufficient motivator on its own to drive adoption at a large scale. While GHF product features need to be attractive, for certain stakeholders, the emphasis should be on the ability of consumers to save money on their energy bills.

‘If you frame it to them in a sort of carbon reduction point, no one's going to really take it up. But when it's in improvement of home and energy cost reduction, then you'll get a lot more uptake.’ (Academic 4)

One academic felt that, to drive demand for GHF products, the wider benefits of the investment need to be clearer.

‘Finance is very important...But you need to be careful to ask the right question, which is what, in addition to finance, is needed in order to get [...] this fixed from a band G to a C or whatever.’ (Academic 3)

In this context, a limitation of the Green Deal (the UK government's 2013 initiative to encourage households to make energy efficiency improvements – see box 1) is that it had a

¹⁵ Kerr, N., & Winskel, M. (2018). Private household investment in home energy retrofit—reviewing the evidence and designing effective public policy. *ClimateXChange, Edinburgh*.

¹⁶ Aravena, C., Riquelme, A., & Denny, E. (2016). Money, Comfort or Environment? Priorities and Determinants of Energy Efficiency Investments in Irish Households. *Journal of Consumer Policy*, 39, 159–186. <https://doi.org/10.1007/s10603-016-9311-2>

¹⁷ Galvin, R. (2014). Why German homeowners are reluctant to retrofit. *Building Research & Information*, 42(4), 398–408. <https://doi.org/10.1080/09613218.2014.882738>

‘narrow economic framing’, and failed to leverage wellbeing benefits when promoting the scheme.¹⁸

Box 1: The Green Deal (UK)

The Green Deal was a government scheme launched in 2013 in the UK with the objective of improving the energy efficiency of the existing building stock in the UK by offering new financing mechanisms to remove the barrier of high upfront costs.¹⁹

The financing was in the form of a government-backed loan which households repaid through electricity bills over a period of up to 25 years. The ‘golden rule’ was that loan repayments would be no higher than the energy bill savings made from installing energy efficiency measures, however this was not guaranteed.²⁰

There was low demand for Green Deal loans. There was low awareness amongst the general public for the Green Deal,²¹ and some perceived the interest rates as too high.

The government ended the scheme in 2015 due to low uptake for the ‘Green Deal’ loans (around 1% of households),²² and amid concerns about scheme complexity and issues in the supply chain to install measures.²³

It was the view of several stakeholders that no single GHF product or service will be the ‘silver bullet’ to drive demand. Rather, a portfolio of different product offerings should be made available according to households’ circumstances and needs, for example household income levels and the types of measures suitable for the property.

Consumers are not willing or able to take on extra debt

Another barrier limiting consumer demand was linked to the physical opportunity of consumers to finance an energy efficiency or low-carbon heating measure in the current economic environment. Stakeholders saw reduced levels of disposable income due to the cost of living crisis as limiting consumer’s willingness and ability to finance measures which involve repayment or upfront costs, for example. One stakeholder noted the ‘able to pay’ market,

¹⁸ Bergman, N., & Foxon, T. J. (2020). Reframing policy for the energy efficiency challenge: Insights from housing retrofits in the United Kingdom. *Energy Research & Social Science*, 63, 101386.

¹⁹ Gillich, A., Sunikka-Blank, M., & Ford, A. (2017). Lessons for the UK Green Deal from the US BBNP. *Building Research & Information*, 45(4), 384-395.

²⁰ Which? (2022) The Green Deal. Available at: <https://www.which.co.uk/reviews/home-grants/article/the-green-deal-afMJp3S8hrqc>

²¹ YouGov (2013) “Brits worried about energy bills”. Available at: <https://yougov.co.uk/topics/consumer/articles-reports/2013/02/13/brits-worried-about-energy-bills>

²² Institute for Public Policy Research (2013) Help to Heat: A solution to the affordability crisis in energy. Available at: https://www.ippr.org/files/images/media/files/publication/2013/11/Help-to-heat_Nov2013_11562.pdf

²³ House of Commons Committee of Public Accounts. Green Homes Grant Voucher Scheme. Twenty-Seventh Report of Session 2021–22. <https://publications.parliament.uk/pa/cm5802/cmselect/cmpubacc/635/report.html>

identified in literature as comprising 58% of all English households,²⁴ was likely to have decreased in this context.

'The able to pay market is small and reducing because cost of living is going up' (Green and other finance group – 1)

²⁴ Sustainable Energy Association (2022). Energy Efficiency – a policy pathway. Addressing the Able to Pay sector. https://sustainableenergyassociation.com/wp-content/uploads/2022/05/SEA_Energy-Efficiency-A-Policy-Pathway_Final.pdf

Different GHF products and features

In this section we explore:

- A range of different GHF products and their features.
- Evidence on the potential attractiveness and risks of different GHF products.
- Behavioural factors affecting the demand for different GHF products.

Loans

Literature which explored the use of loans to fund home decarbonisation measures focused primarily on government loans rather than commercial loans. This provided some useful insights into the consumer appetite for loans to finance energy efficiency measures more generally. Loans provided by the private sector and the broad features of such loans (i.e., low interest rate, payback period) were explored in the stakeholder interviews.

Different loan types are now explored in more depth.

Unsecured loans

Overview

Unsecured loans are loans that do not require any type of collateral, compared to a secured loan where money is 'secured' against an asset, such as a home. Stakeholders generally saw unsecured loans as more effective at financing simple and lower cost retrofit measures, and measures which provide immediate savings on energy costs. For example, this could include energy efficiency measures such as loft or cavity wall insulation, or measures such as solar PV. There was no clear evidence on the appeal of different unsecured GHF loans to specific segments of homeowners (beyond the 'able to pay' market), and this is recommended as an area for further research.

Behavioural analysis of unsecured loans

Basis completed a COM-B analysis to better understand the barriers to the take-up of unsecured loans through a behavioural lens. This is summarised below:

Table 2: COM-B analysis of consumer barriers to the uptake of unsecured loans

COM-B factor	Components	Analysis
Capability	Physical opportunity	Due to the cost-of-living crisis, homeowners have less disposable income which limits their ability to take on any extra debt, even at a zero-interest rate.
Motivation	Reflective motivation	Behavioural biases such as risk aversion, loss aversion and present bias (see box 2) may affect consumers' willingness to take on debt. For example, consumers may focus on the financial costs and disruption that occurs from taking out a loan to finance improvements and place less value on the future savings. Making these future benefits immediate and tangible, such as discounting an energy bill or salary offset, could be helpful features to address these barriers.

Evidence from the literature suggests that, when financing home decarbonisation measures, unsecured loans are less attractive to households than grants and tax incentives.²⁵ This may be because interest rates are typically higher for such loans and monthly repayments may exceed savings from installing such measures. The length of time for someone to see a return on their investment (e.g., via energy bill savings) was a factor in this context.

There was mixed evidence on whether households can be attracted by low or zero interest loans to fund energy efficiency upgrades. For example, in a survey of consumer attitudes towards different home energy financial incentives undertaken in the United States, Zhao et al. (2012) found that 30% of respondents reported that they would be 'very likely' to take up a loan for wall insulation if it was offered at 0% interest rate.²⁶

One stakeholder mentioned zero interest loans for measures such as low-carbon heating, and retrofit have been successful in Scotland. For example, interest free loan funding of up to £38,500 per property is available to owner occupiers (through the Home Energy Scotland Loan) and eligible registered private sector landlords (through the Private Rented Sector Landlord Loan). Evaluation shows these loans have been influential and cost-effective in encouraging the installation of renewables systems, with 89% of funded actions at least partly attributed to the loan and 56% fully contingent on the loan.²⁷

²⁵ Kerr, N. and Winskel, M. (2018) Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy. ClimateXChange

²⁶ Zhao, T., Bell, L., Horner, M. W., Sulik, J., & Zhang, J. (2012). Consumer responses towards home energy financial incentives: A survey-based study. *Energy Policy*, 47, 291–297

²⁷ https://energysavingtrust.org.uk/wp-content/uploads/2022/01/Energy-Saving-Trust-programmes-in-Scotland-Report-2021_FINAL_24Jan22.pdf

However, stakeholders indicated that due to the cost-of-living crisis, many homeowners are currently neither able nor willing to take out unsecured loans, irrespective of interest rates.

'We found a third of homeowners have £150 or less remaining after essential bills are paid. So even if you've got like a no interest loan, you're still going to have to pay back some element and if it's 15 grand, that's pretty much going to wipe out all of that sort of discretionary income that people have.' (Consumer group 2)

In this context, an academic said that zero-interest loans will potentially be attractive to consumers who have a high disposable income. The literature also finds some evidence that households who are averse to debt are more likely to focus on the debt repayment than potential energy savings.²⁸

Stakeholders suggested a range of ways of making unsecured loans more attractive to consumers, such as offsetting the costs of unsecured loans against energy bills or through a salary sacrifice scheme. One stakeholder also mentioned that loans may be more suited to measures such as solar PV or insulation as they are relatively cheap (e.g., compared to heat pumps), the benefits are more widely known and the benefits of installing the measures (e.g., lower electricity bills, warmer home) should be seen immediately.

Box 2: Behavioural biases influencing willingness to take on debt to fund energy efficiency and/or low-carbon heating measures

Present bias: Refers to the tendency of people to give stronger weight to payoffs that are closer to the present time when considering trade-offs between two future moments.²⁹ Individuals with present bias may not account for the future energy cost savings, which affects their willingness to take on debt to fund improvements.

Risk aversion: Refers to the tendency of people to prefer certainty to uncertainty.³⁰ Risk-averse individuals would prefer to choose the option they perceive as lower risk and therefore may be less likely to adopt measures that are new to them (e.g. low-carbon heating).

Loss aversion: Refers to the tendency for people to feel losses more strongly (about twice as much) than gains of an equal size.³¹ Individuals may perceive the initial investment in an energy efficiency/low-carbon heating measure as a loss, which has more impact on their decision than the potential gains (e.g., energy bill savings).

Secured loans

A secured loan is one in which a borrower attaches an asset (e.g., their property) as collateral for the loan, which are owed to lenders if a borrower defaults on their repayments. Mortgages

²⁸ Schleich, J., Faure, C. & Meissner, T. (2021) Adoption of retrofit measures among homeowners in EU countries: The effects of access to capital and debt aversion. *Energy Policy*, Elsevier, vol.149.

²⁹ Fehr, E. (2002). The economics of impatience. *Nature*, 415(6869), 269-272

³⁰ Werner, Jan (2008). Risk Aversion. *The New Palgrave Dictionary of Economics*, 1–6

³¹ Kahneman, D.; Tversky, A. (2000). *Choices, Values, and Frames*. Cambridge University Press.

are the most common example of a secured loan. Stakeholders generally saw secured loans as more effective at financing more expensive and disruptive retrofit measures, such as solid wall or floor insulation, and low carbon heating measures such as heat pumps. There was no clear evidence on the appeal of different secured GHF loans to specific segments of homeowners, and this is recommended as an area for further research. It was also not possible to ascertain the size a loan would need to be, for consumers to consider it worth adding to a mortgage.

Behavioural analysis of green mortgages

Secured loans were perceived as potentially effective GHF products. Basis completed a COM-B analysis to better understand the main enablers and barriers to the take-up of green mortgages through a behavioural lens. This is summarised below:

Table 3: COM-B analysis of consumer barriers to the uptake of green mortgages

COM-B factor	Components	Analysis
Opportunity	Physical opportunity	Secured loans (both those which reward the purchase of homes with better EPC ratings and those which reward energy efficiency improvements) engage consumers at the right moments (e.g., buying or re-mortgaging a home) to consider such measures. These 'trigger points' disrupt behaviour and therefore provide an opportunity to influence consumers to take certain actions.
Opportunity	Social opportunity	Salient and appealing GHF products could drive word of mouth and widespread adoption.
Motivation	Reflective motivation	Attaching the loan to a consumer's home was seen to change the way in which consumers perceive the value of the loan, by associating it more clearly as a long-term investment in value of their property. This may be particularly relevant to green mortgages which reward energy efficiency improvements to homes.

In the UK, several lenders have made a commitment to supporting homeowners improve the energy efficiency of their homes through offering 'green mortgages'.³² This demonstrates an

³² As noted earlier, 'green mortgages' cover a wide range of products and features. Due to a lack of published evidence, it was not possible to analyse the appeal of specific features of different green mortgage products for different groups of consumers.

increase in appetite from lenders in the retail banking market.³³ Under a green mortgage, lenders offer buyers preferential terms on their mortgage as a reward for purchasing a property that meets certain environmental standards or making energy efficiency improvements. These preferential terms tend to be lower interest rates or cashback.³⁴

Green mortgages which reward energy efficiency improvements may be a particularly powerful tool to increase take-up of home decarbonisation measures, as they could leverage key moments of change in consumers' lives where they may be more open to making changes to their home – these moments are also known as 'trigger points'. Lenders are well-placed to influence owner-occupiers and landlords in the take-up of green mortgages at key trigger points e.g., point of sale or re-mortgage.³⁵ The influence of installing decarbonisation measures on property values is especially likely to be salient at the point of securing a mortgage or re-mortgaging a home.

Box 3: Trigger points

Trigger points are moments of opportunity where people are most open to change and can be motivated to act. In the context of GHF, they are moments when people may be motivated to invest in energy efficiency and/or low-carbon heating measures for their homes. For example, trigger points can include 'emergency' or one-off events such as the current heating system breaking down and the need to replace it. They can also include transitional points in time such as moving house, having a child or retiring.

Green mortgages may also be appealing to lenders. In relation to green mortgages which reward energy efficiency improvements, emerging evidence shows a link between installing energy efficiency or low-carbon heating upgrades and higher property values and lower risk of default,³⁶ which may drive lenders' motivation to provide green mortgage products.³⁷

Several stakeholders thought that the mortgage industry was especially important in driving GHF as there are many distinct incentives, or 'hooks', for consumers, particularly the financial incentive of the preferential terms attached to the mortgage e.g., lower mortgage repayments due to lower interest rates. Related, attaching the loan to a government policy such as a reduction in stamp duty or council tax was also cited in several interviews as attractive for consumers and likely to promote word of mouth marketing. Cashback was mentioned in one stakeholder interview; this stakeholder felt that cashback is not particularly effective at driving

³³ BEIS (2021a) Heat and Buildings Strategy. London: HMSO. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044598/6.740_8_BEIS_Clean_Heat_Heat_Buildings_Strategy_Stage_2_v5_WEB.pdf

³⁴ Green Finance Institute (2022, May) Green Mortgages. <https://www.greenfinanceinstitute.co.uk/programmes/ceeb/green-mortgages/>

³⁵ Ibid.

³⁶ Guin, B. & Korhonen, P. (2020) Staff Working Paper No. 852 Does energy efficiency predict mortgage performance? Bank of England. Available at: <https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2020/does-energy-efficiency-predict-mortgage-performance.pdf>

³⁷ BEIS (2021a) Heat and Buildings Strategy. London: HMSO. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044598/6.740_8_BEIS_Clean_Heat_Heat_Buildings_Strategy_Stage_2_v5_WEB.pdf

consumer demand. Overall, there was a lack of robust evidence on the efficacy of cashback schemes.

Moreover, the duration of mortgages means they are more likely to be viewed as a long-term investment in the property. This in turn shapes how homeowners perceive the value of the loan, with less of a focus on an immediate payback from the measure, and more on the asset value.

'So when you attach [retrofit energy efficiency measures] to the mortgage you change the economics, you change the way that the householder perceives it. They're now seeing it as an investment which is being tied to the price and value of the house...If you then say for that little bit of your mortgage we will cut the repayment by 60% or something, that makes it even better because you can see that in terms of reduced bills[...] So it's a very strong driver because[...] of the fact it's linked to the value of your property and therefore the sums are much easier to live with.' (Academic 3)

However, several stakeholders also highlighted some concerns with green mortgages, including the consequences of incentivising mortgage providers to 'green their portfolio'. This could create a system where favourable mortgage rates are only given to those buying homes with a better EPC rating³⁸ or can afford to get to a better EPC rating quickly. This was believed to disproportionately benefit higher income groups who can afford more energy efficient housing or are more able-to-pay for energy efficiency measures to get to a better EPC rating. This may result in lower income groups having less favourable mortgage rates or possibly not being able to get a mortgage. It should be noted that it may be possible to address this issue by building safeguards into policy design.

'[My] concern...regarding mortgages and incentivizing mortgage providers is that do you then create a system where people who are not in a position to improve the energy efficiency of their homes are cut in bad rates or potentially even aren't getting access to mortgages at all [...] I think that's the only concern I have about that kind of approach is does it reward people who already actually are able to and are willing to make these changes?' (Consumer group 2)

'A lot of green mortgage products at the minute are not really incentivizing any change in behaviour, but are actually just rewarding people who have an EPC rating of B or A' (Academic 4)

Stakeholders also questioned lenders' ability to monitor whether homeowners had installed energy efficiency measures or carried out the retrofits as required, and whether this would be the responsibility of industry or government.

Stakeholders also raised challenges in terms of the role of mortgage brokers in advising on green mortgages. A consumer representative group noted that brokers typically offer the cheapest option to consumers and may only look to suggest other options, such as green

³⁸ 'Better' EPCs referring to B or A, and 'poorer' EPCs meaning G and F

mortgages, if borrowers have expressed a preference for certain product features. A finance group also raised that mortgage brokers may lack knowledge of green mortgage products and lack experience speaking to their customers around sustainability and green mortgage options. Additionally, there is no requirement for lenders to report on GHF products specifically, so collecting data on demand is difficult.

Finally, as noted above, owned outright is the most common tenure category in both England (32.6%) and Wales (38.0%).³⁹ While there was no evidence of the appeal of secured GHF products for this group of consumers, it is likely demand will be much weaker than for homeowners who require a mortgage.

Property-linked finance

Property-linked finance (PLF) supports homeowners to fund the upfront costs of energy efficiency improvements in their home by linking the loan to the property, rather than the owner, which results in repayment obligations being transferred to the new owner when the property is sold.⁴⁰ There was less discussion of PLF loans by stakeholders (arising only in four interviews), and consequently the type of retrofit and low carbon heating measures that were most suited to this type of product was limited. However, PLF was seen as more suitable to finance expensive retrofit measures a long return on investment. Additionally, there was no clear evidence on the appeal of PLF loans to specific segments of homeowners, and this is recommended as an area for further research.

Behavioural analysis of property-linked finance

Basis completed a COM-B analysis to better understand the main enablers and barriers to the take-up of property-linked finance through a behavioural lens. This is summarised below:

Table 4: COM-B analysis of consumer enablers and barriers to the uptake of PLF

COM-B factor	Components	Analysis
Opportunity	Physical opportunity	PLF loans can engage consumers at the right moments (e.g., buying or renovating a home) to consider such measures. These 'trigger points' disrupt behaviour and therefore provide an opportunity to influence consumers to take certain actions.

³⁹ ONS (2023). Housing in England and Wales: 2021 compared with 2011.

⁴⁰ Green Finance Institute (2023). Property-linked Finance. Available at: <https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2023/02/Property-Linked-Finance-RFP-for-Banking-Partner-February-2023.pdf?v=2>

COM-B factor	Components	Analysis
Motivation	Reflective motivation	PLF can enable the installation of energy efficiency or low-carbon technologies by influencing how consumers weigh up the costs versus the benefits of the loans - specifically it removes barriers associated with the time taken to see a return on investment.
Motivation	Reflective motivation	The potential impacts on the ability to sell the property may be a barrier when homeowners are considering PLF.

PLF may help consumers to overcome motivational barriers to installing energy efficiency or low-carbon measures in their homes, such as the high upfront costs of upgrades, and the number of years taken to see a return on their investment via energy bill savings. Some homeowners may move out of a property before ‘breaking even’ on an energy efficiency measure via energy bill savings. Linking the loan to the property itself, rather than the person who took out the loan, can address this issue:

‘On many green home technologies, installation can have 20 to 30 year payback time scales. So people are put off because they’re not going to reap the full economic benefit of their upfront investment that property finance addresses. [If you use property-linked finance] you’re only repaying or paying for the installation of those technologies whilst you’re living in the building. Once you move, the subsequent homeowner is now the one who is responsible for those repayments and benefiting from the warmer, more comfortable home.’ (Finance group 7)

This type of financing mechanism has seen some success in the United States in the form of Property Assessed Clean Energy (PACE) loans.

Box 4: The Property Assessed Clean Energy (PACE) programme

The PACE programme was developed in 2007 as a financing incentive to encourage energy efficiency upgrades for homes and commercial buildings across the US.⁴¹ The programme offered loans for retrofits which were repaid through property taxes. While originally funded by local governments, PACE funding now mostly comes from the private sector.⁴² As of 2021, over 250,000 homeowners made energy efficiency improvements or investments in renewable energy through PACE financing, amounting to over \$7 billion.⁴³

A qualitative study involving interviews with energy efficiency experts and a review of grey literature explored how the design features of different energy efficiency financing mechanisms

⁴¹ Brown, Donal, Sorrell, Steve and Kivimaa, Paula (2019) Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit. Energy Policy.

⁴² Kerr, N. and Winskel, M. (2018) Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy. ClimateXChange.

⁴³ PACE Nation (2022) “PACE Market Data”. <https://www.pacenation.org/pace-market-data/>

influenced their success.⁴⁴ The authors note that a successful element of PACE loan design was its ease and convenience, as it was offered at the point-of-sale of the retrofit measure. Consequently, customers could procure retrofit measures and financing on the same day. Convenience and ease have been found to be important in purchasing decisions, particularly when those decisions would involve more information-seeking.⁴⁵

In terms of the UK, one green finance stakeholder mentioned that their own research found that a 32% of homeowners across the whole sample (of 1,800 of homeowners) would be 'likely to consider' PLF (it should be noted that this figure is more than double the consumer appetite for GHF products in general, cited on p.14, and further research is recommended here). This figure increased to 84% when considering the group of respondents who stated that they were open to using third-party finance for energy efficiency measures.⁴⁶

However, stakeholders also mentioned several barriers and considerations in the roll out of property-linked finance. For example, they thought that PLF should be delivered at the local level as opposed to the national level to tap into local supply chains and messaging. This is a similar approach to the United States Better Buildings Neighbourhood Program, which was seen as relatively successful (see 'Blending public and private finance' section for details).

Another consideration was the impact of PLF on property values and the housing market. The prospect of taking on a loan along with a property may act as a disincentive for prospective buyers. However, not all stakeholders considered this to be a major concern.

'A survey or a valuer doesn't look at those items, they only look for if there's a material outgoing of more than something like 50% of the property value [...]. That's the only time they would take a payment like that into account and down value of the property. So our view and our research indicates there wouldn't be an impact on the property values and all of this would get picked up in the classic conveyance in process.' (Finance group 7)

Blending public and private finance

Behavioural analysis of public and private finance

Blending public and private finance can help stimulate the supply of loans. Basis completed a COM-B analysis to better understand the main enablers and barriers around public and private finance through a behavioural lens. This is summarised in table 5 below:

Table 5: COM-B analysis of public and private finance

⁴⁴ Brown, Donal, Sorrell, Steve and Kivimaa, Paula (2019) Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit. Energy Policy

⁴⁵ Connaway, L., Dickey, T. and Radford, M (2011) "If it is too inconvenient I'm not going after it." Convenience as a critical factor in information-seeking behaviors, Library & Information Science Research, 33(3), 179-190

⁴⁶ Green Finance Institute (2022) "Properly Linked Finance: Rising Consumer Demand for Energy Efficiency and the Need for Financial Innovation". <https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2022/09/GFI-PLF-SUMMARY.pdf>

COM-B factor	Components	Analysis
Motivation	Reflective motivation	Public and private finance reduces the risk liability of private sector lenders.
Motivation	Reflective motivation	While lower interest features of loans can be attractive, other factors need to be in place to drive adoption

The combination of public and private funding was identified in the literature as an attractive way to boost the supply of GHF products. This is due to the incentives it provides to the private sector, by the public sector sharing the risk and thus reducing the risk to the private lender, which in turn stimulates supply.⁴⁷ Furthermore, mobilising private funding is seen as crucial to finance schemes that could not be met by public funds alone.⁴⁸

An example of blended public and private finance is government-backed loans. These are loans that could be issued by private institutions (e.g., retail banks), but are financially backed by the government to offer more preferential terms (e.g., low interest rates, longer repayment period).⁴⁹ These loans typically involve either using public funding to subsidise the loan by ‘buying down’ the interest charged by a private lender, or by providing a guarantee to lenders to reduce the risk associated with the loan, with the intention for lenders to offer reduced interest rates.⁵⁰

The Better Buildings Neighbourhood Program (BBNP) in the US (see Box 5, below) and the Green Deal in the UK (see Box 1, pg. 17) are examples of schemes that used blended public and private financing to encourage retrofits.

Box 5: Better Buildings Neighbourhood Program (BBNP) (US)

The BBNP operated from July 2010 to September 2013. The Better Buildings Neighborhood Program provided federal funds in the form of one-time grants to states and localities in order to subsidise loans of energy efficiency improvements.⁵¹

An evaluation of the BBNP found that, by 2014, BBNP-backed projects met most of the program’s original objectives, including upgrading around 120,000 homes and buildings,

⁴⁷ Kerr, N. and Winskel, M. (2018) Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy. ClimateXChange

⁴⁸ Brown, Donal, Sorrell, Steve and Kivimaa, Paula (2019) Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit. Energy Policy

⁴⁹ Kerr, N. and Winskel, M. (2018) Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy. ClimateXChange

⁵⁰ Ibid.

⁵¹ <https://www.energy.gov/eere/better-buildings-neighborhood-program/history>

and saving \$850 million in energy costs.⁵² The evaluation also found that the program's community presence led to increased activity in the energy efficiency upgrade market, including increased sales of energy efficiency equipment and higher levels of consumer awareness.⁵³

One study compared the BBNP and the Green Deal and discusses the relative successes and drawbacks of both schemes.⁵⁴ The Green Deal was delivered through private sector lenders and loan repayments were made through energy bills (known as 'on-bill repayment'). The BBNP used multiple touch points and trusted messengers both to engage homeowners and the retrofit workforce. The study found that the conversion rate (percentage of loan applications that lead to retrofit) was 9.1% for the BBNP and 2.8% for the Green Deal.

This suggests that when considering the role of government support, focusing on factors beyond preferential rates are important. The study sets out key lessons for the design of loan programmes based on the relative success of the BBNP.⁵⁵ Two lessons of note are:

1. Personal engagement and communication can stimulate consumer demand

The BBNP took a more active and personal approach to stimulate demand from consumers compared to the Green Deal.⁵⁶ For example, for BBNP, 'word of mouth' was cited as the most common means through which participants heard of the scheme. For the Green Deal, 'word of mouth' was ranked fourth behind direct sales, leaflets, and utilities.⁵⁷ Homeowners also cited the 'lack of communication and follow-up assessments' as the top reason for not continuing with a home energy upgrade under the Green Deal.⁵⁸

2. Supporting the supply side can help to assure success

BBNP placed more emphasis on building relationships with those who would be supplying home energy upgrades (e.g., contractors) through providing sales and technical training. Boosting the supply side of home energy upgrades through providing training and incentives to contractors and installers may be an effective way for public funding to leverage the private sector.

In stakeholder interviews, there were mixed opinions on the need for public finance to subsidise the private sector. One academic mentioned that the role of the British Business

⁵² U.S. Department of Energy Office of Energy Efficiency and Renewable Energy; Research into Action, Inc (2015) Evaluation of the Better Buildings Neighborhood Program Final Synthesis Report, Volume 1. <https://www.energy.gov/eere/analysis/articles/evaluation-better-buildings-neighborhood-program-final-synthesis-report>

⁵³ Ibid.

⁵⁴ Gillich, A., Sunikka-Blank, M., & Ford, A. (2017b). Lessons for the UK Green Deal from the US BBNP. *Building and Environment*, 45(4), 384–395

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ Ibid.

Bank and the UK Infrastructure Bank could be considered to offer guarantees and lower the risk of loans.

'You want to blend on the interest rate, maybe some public finance, and then it'd be good to look at the role of the British Business Bank and the UK Infrastructure Bank can [...] lower the risk of loans as well and that might make it more appetizing to banks.' (Academic 4)

However, another academic mentioned they were not convinced that the government needs to underwrite the risk given current market conditions. They held the opinion that government funding is better spent on those in fuel poverty.

'I could see the government maybe underwriting some of the risk. I'm not entirely convinced of that because the differential between lending and borrowing and mortgage industry is four and a half percent at the moment. What risk? But that's a personal view.' (Academic 4)

Challenges with GHF delivery

In this section, we discuss three key challenges identified by stakeholders to the development and delivery of GHF products:

- The need for long-term policy stability.
- The lack of trusted intermediaries that can talk to consumers about GHF (estate agents, energy suppliers, advice services).
- The unpredictability of energy bill savings and return on investment for consumers (the specific amount of energy bill savings can fluctuate depending on individual circumstances and behaviour).

These challenges, together with low awareness around various energy efficiency and low-carbon heating measures and their benefits, and consumer reluctance to take on additional debt, all contribute to a lack of consumer appetite for GHF products.

The importance of long-term policy stability

Behavioural analysis of policy stability

Basis completed a COM-B analysis to understand the importance of long-term, stable policies to energy efficiency uptake and demand for green home finance, as shown in table 6.

Table 6: COM-B analysis of the behavioural factors influenced by policy stability

COM-B factor	Components	Analysis
Opportunity	Physical opportunity	Policy certainty is important for supporting lender confidence to develop GHF products, which can in turn stabilise consumer demand..
Opportunity	Physical opportunity	Policy certainty encourages investment in expanding the supply chain of skilled tradespeople to undertake retrofit measures. This can in turn improve consumers' willingness to take out GHF products.
Motivation	Reflective motivation	A stable policy environment makes it easier for consumers to make decisions. In some instances, consumers may expect additional financial help to come from government in the future and hold off from seeking private sector finance to retrofit their properties.
Motivation	Reflective motivation	Policy certainty means suppliers and installers of energy efficiency and low-carbon heating measures can make informed decisions around investing in training and equipment.

A common theme throughout the REA and the interviews was that policy stability, linked to a long-term strategy, is needed to stimulate the supply of GHF products and related services, and also drive demand. Stakeholders generally defined this as providing a five-to-ten-year roadmap and not having a series of 'stop-start' schemes.

'If you had a scheme that was longer in its scope, so if it was running for five years, ten years, more than one parliament, then you give a really good long-term signal to the market' (Consumer Representative – 8)

In discussing the US's Better Buildings Neighborhood Program (BBNP), Gillich at al. conclude that 'successful loan markets are established over many years and require clear and steady political support to avoid a boom and bust cycle that forces the market to chase subsidies rather than build a retrofit market in the long-term'.⁵⁹

⁵⁹ Gillich, A., Sunikka-Blank, M., & Ford, A. (2017). Lessons for the UK Green Deal from the US BBNP. Building Research & Information, 45(4), 384-395.

In comparing the energy efficiency policy packages in the UK and Finland, Kern at al. note an excessive churn in UK energy retrofit policy between 2000 and 2014 resulting in uncertainty for households and stakeholders.⁶⁰

In the following sections, we set out the importance of policy stability for lenders, consumers, and the supply chain.

Importance of policy stability for lenders

Interview participants noted that financial products can take a long time to develop (up to 18 months) and so they need to develop for an assumed demand. It was felt that lenders may be reluctant to spend significant resources developing a product, in case new government grants are introduced in the future which would render that product unnecessary.

'And the real blocker is uncertainty in terms of what's going to come down the line from a government policy point of view. So I was speaking to a lender the other day. They said, we don't want to spend 18 months to develop a really good proposition. Then the government come out and announce a grant, that's hundreds of thousands of pounds worth of system and upgrades we've done for no reason. So one of the things I'd call for is a bit of certainty around that, if possible' (Green and other finance group – 1)

A paper also found that policies with expiry dates and frequent revisions are received negatively by investors.⁶¹ For example, the repeated expiration and renewal of the federal production tax credit in the US have caused a boom–bust cycle in the wind power industry, with developers rushing to close projects before the scheme's expiration.

Importance of policy stability for consumers

One academic felt that people will not invest their own money if they anticipate grants coming down the line:

'If you think there's going to be more grants coming down the line or a new program going to be coming, you won't invest your money now actually waiting for the grant to come if you're a consumer. So even in that able to pay section of the market, you might see some hesitancy because they're waiting for a better grant program to come through' (Academic – 4)

Frequent changes to government policy can be a barrier for consumers. One consumer representative group talked about the closure of the Green Homes Grant as a concern that consumers would reference when calling up for advice on energy efficiency or low-carbon heating measures.

⁶⁰ Kern, F., Kivimaa, P., & Martiskainen, M. (2017). Policy packaging or policy patching? The development of complex energy efficiency policy mixes. *Energy research & social science*, 23, 11-25.

⁶¹ Tongsopit, S., Mungchareon, S., Aksornkij, A., & Potisat, T. (2016). Business models and financing options for a rapid scale-up of rooftop solar power systems in Thailand. *Energy Policy*, 95, 447-457.

'So when schemes stop and start, it just erodes confidence generally and then also when schemes get a bad reputation [...] So I think having stable policy environments that things happen and if there are issues they can be tweaked, but they don't just disappear or like pop out of the air and then disappear. Really helpful in sort of maintaining confidence' (Consumer Representative – 2)

Importance of policy stability for the supply chain

Stability is needed for installers to invest in new training and equipment to carry out installation of energy efficiency or low-carbon heating measures. This also has consumer benefits, by reducing the price, due to more competition, and increasing choice.

'But if you don't have the certainty of policy so if you think about a supply chain, then you're not going to devote workers to retraining or upskilling that's needed to do retrofit work if you're a construction company. Because you have no guarantees that this policy this policy status is going to be overcome and you're going to see much more policy over the next year. So even if we got the financing right, the demand right, from a consumer side, you wouldn't have the supply chain to match it.' (Academic – 4)

A lack of stable policy can have long-term consequences on other actors in the retrofit and low-carbon heating supply chain. Challenges facing the Green Deal had a significant effect on the suppliers and companies responsible for energy efficiency retrofits which may prevent them from investing in the future:

'There will be a lot of people who went through that training who now have skills that are not being used and will make other members of the profession much less likely to engage in that kind of upskilling in the future.' (Academic – 4).

This creates issues for lenders or government as they may create GHF products or policies that fail due to supply chain issues. If the supply chain is not prepared or robust enough (due to previous experiences or a lack of policy stability), GHF products will fail even if consumer demand is there, as consumers simply will not be able to install the measures.

'Government needs to provide as much certainty as it can to the market. That lowers risk in itself and provides the ability for both the supply chain [...] but also people on the finance side to realize that you've got long term measures so they can plan for the measures that they design. [...] Plus the more stable the programs are to deliver measures and also the more robust the supply chain is, that in itself derisks the measures that are going to people's homes. So it's sort of a real virtuous circle in there' (Consumer Representative – 8)

A lack of trusted intermediaries to advise on GHF

Behavioural analysis of intermediaries

Stakeholders saw intermediaries as playing a very important role helping consumers in their journey to install energy efficiency and low-carbon heating measures. As well as providing advice on measures, importantly they can help signpost consumers to GHF products to increase uptake. Financing typically happens once consumers have decided to do something about the energy efficiency or heating in their home. Failure to utilise intermediaries at this moment could lead to consumer demand not being capitalised on, and consequently a lack of trusted intermediaries to advise on GHF was identified as a barrier to demand. Basis completed a COM-B analysis to understand the role of intermediaries in driving GHF uptake, as shown in table 7.

Table 7: COM-B analysis of the role of intermediaries

COM-B factor	Components	Analysis
Capability	Psychological capability	Consumers lack the cognitive bandwidth to consider the range of measures and GHF products available. Intermediaries can play a role in increasing awareness of both energy efficiency and low-carbon heating measures, as well as GHF products, and hence build psychological capability
Opportunity	Physical opportunity	Intermediaries can also be easily available at key points in the consumer decision journey, such as buying a home
Opportunity	Social opportunity	By discussing what other consumers have done, intermediaries provide social proof that taking out a GHF product is a popular thing to do
Motivation	Reflective motivation	Intermediaries can help consumers navigate a complex set of decisions around retrofit and low-carbon heating measures, and build trust that people are making the right choices

Advice services

Stakeholders saw the range of retrofit and low carbon heating measures available to consumers, together with the variety of GHF products, as complicated and a potential barrier to their uptake. Specifically, consumers lack the psychological capability to make good decisions on what measures and GHF products are right for them.

In this context, stakeholders identified impartial and tailored advice as vital to drive demand for GHF products. As property circumstances can vary drastically, the energy efficiency or low-carbon heating measure and finance instrument best for each household also varies.

'So that role more generally, of signposting of trusted intermediaries like banks, the health service, local authorities, Martin Lewis, which some of whom will provide their own advice, others can signpost to people, like sitting as a device who will have no skin in the game. So just sort of your impartial gatekeepers is really valuable' (Consumer Representative – 8)

The idea of a national advice service linking the type of measure to the best GHF product and hand holding people through the installation process was raised. This process could also take advantage of digital tools, with France mentioned as a market where consumers can shop for GHF products by inputting data on their property:

'France has this digital tool, which basically, when you go into the digital tool, you give it the right data. It understands your financial situation and just links you with all the available green finance options at that initial stage, which is just phenomenal I think' (Consumer Representative – 8)

Further, the Cosy Homes Grant (a partnership between Low Carbon Hub and RetrofitWorks aiming to make retrofit simple)⁶² was mentioned as a scheme which enabled the easy comparison of GHF products:

'Cosy homes have a platform where you can put in your housing type and you can literally click on wall insulation, click on this payback period, what's it going to look like? And this is the kind of interactive but easy user-friendly tool that you would need to do with kind of easy comparison' (Academic – 4)

These examples demonstrate that reducing friction and decision complexity (reflective motivation), by making it as easy and convenient as possible for consumers to engage with advice on GHF and different product features (physical opportunity) is important to drive demand.

Energy suppliers

Energy suppliers represent a potentially important intermediary in the energy efficiency or low-carbon measure customer journey. They are familiar to people and so do not represent an additional channel consumers have to engage with. While there is mixed evidence concerning levels of trust in energy suppliers,⁶³ one interviewee stated that people tend to trust their energy supplier, even if they may not trust other energy suppliers.

⁶² There are many Cozy Homes initiatives across the UK. For example, see: <https://cosyhomesoxfordshire.org/>

⁶³ The National Home Energy Survey 2023 states that 49% of consumers said their energy supplier was untrustworthy, up from 34% in 2022. Available at: <https://www.theecoexperts.co.uk/blog/national-home-energy-survey-2023>

'So people trust their energy suppliers, despite everything that goes on with energy supplies. Actually, when you look at the data, on the whole, people genuinely think that energy suppliers are doing the right thing by them, particularly their energy suppliers. So there's a difference between trust in the market and trust in their supplier. And so actually, energy suppliers are still in a really good place to bridge a conversation' (Consumer Representative – 8)

Energy audits, coupled with attractive financing, has been shown to be successful in increasing the uptake of energy efficiency measures. Almost all major gas and electric utilities in the US offer on-site home energy audits for residential customers. The primary goal of these audits is to identify where energy efficiency can be improved and suggest cost-effective solutions to do so. When these energy audits are combined with offers of low/zero interest loans (compared to no loan offer at all), households install more energy conservation measures, install measures more quickly, and install measure with longer lifetimes.⁶⁴

Evidence from the US shows that energy audits coupled with attractive financing can increase the likelihood of households installing energy conservation measures. This suggests that energy suppliers, and energy audits, may be a good intermediary for helping consumers to adopt energy efficiency measures.

Estate agents and those involved in conveyancing

Estate agents, solicitors and others involved in the process of purchasing a property were also mentioned as potential intermediaries to advise and educate on GHF products. They are necessary touchpoints when buying a home, and therefore are well-placed to educate people.

'So let's say the estate agents would be required if the house is...an F or a G [energy efficiency rating], to say to the potential buyer, well, are you aware that there is this service that X Company will provide you who are sponsored by the Nationwide or Halifax, [...] they will do the retrofit for you. A to z complete service. It will cost 20 grand. And if you do it and get to see within two years, we will keep you on base minus five⁶⁵ for that period of time. You see the sort of product which I've just made up at the top of my head, we don't have that. It seems to me a no brainer if you're buying a house' (Academic – 3)

Community-based marketing and messengers

The REA identified the importance of marketing a financial policy or scheme effectively and at a local level. A key difference between the US's Better Buildings Neighborhood Program and the UK's Green Deal was the level of active approaches to drive thermal retrofit demand.

"The BBNP demonstrated that mass media marketing was useful for generating awareness of the programme brand, but that the most effective means of generating

⁶⁴ Hirst, E. (1985). The effects of loans on residential retrofit: Extent, pace, and longevity. *Journal of Environmental Systems*, 14(4).

⁶⁵ Base interest rate minus 0.5%

*participation was through personal outreach and Community Based Social Marketing principles leveraging trusted messengers [e.g. pre-existing community groups]”.*⁶⁶

The Better Buildings Neighborhood Program was more successful in converting thermal assessments into actual retrofits, primarily due to this active marketing approach with households contacted at multiple touch points via trusted messengers. The authors mention that who is trusted depends on the relationship between the audience and the messenger. They also discuss that specific BBNP grantees (e.g., BBNP Michigan and Efficiency Maine) found that door-to-door canvassing was less effective at driving uptake than using ‘pre-existing community groups’ and that a positive impression of the canvasser increased homeowner’s participation in the scheme.

The paper concluded that “the workforce are critical actors in driving demand for a retrofit programme and can be effective messengers in communicating the benefits of energy efficiency and selling upgrades to interested homeowners.”

Examining abandonment rates for retrofit grants in Ireland, Collins and Curtis found that applications were less likely to be abandoned if they were made via an obligated party (i.e. an energy supplier), suggesting that a third party may be a useful go-between for households, installers and the funding body.⁶⁷ However, they offered no analysis as to why the rates of abandonment may be different.

Concerns over energy bills savings and return on investment

Behavioural analysis of energy bill savings

Lower-than-anticipated energy bill savings, which can be hard to calculate reliably, can create challenges for GHF delivery in terms of negative word of mouth. Basis completed a COM-B analysis to understand how lower energy bill savings may impact on demand for GHF products, as summarised in table 8.

⁶⁶ Gillich, A., Sunikka-Blank, M., & Ford, A. (2017). Lessons for the UK Green Deal from the US BBNP. *Building Research & Information*, 45(4), 384-395.

⁶⁷ Collins, M., & Curtis, J. (2017). An examination of the abandonment of applications for energy efficiency retrofit grants in Ireland. *Energy Policy*, 100 (October 2016), 260–270. <https://doi.org/10.1016/j.enpol.2016.10.030>

Table 8: COM-B analysis of energy bill savings

COM-B factor	Components	Analysis
Opportunity	Social opportunity	Word of mouth concerning lower than anticipated returns from retrofit and low-carbon heating measures, relative to the cost of the GHF product, is likely to weaken demand.
Motivation	Reflective motivation	It is very challenging to calculate the ROI from energy efficiency and low-carbon heating measures, given the variety of factors that influence energy use.

One challenge around GHF delivery, identified through the REA, is the reliability of estimated bill savings post energy efficiency or low-carbon heating installation. People like certainty and with the high up-front cost of some measures, they will want to know what savings they can expect on their energy bills, and, ideally, have the savings be greater than or equal to their repayments on any loans. This is known as energy bill neutrality or the ‘golden rule’.⁶⁸

The golden rule

The ‘golden rule’ was part of the Green Deal and established to protect consumers and investors from overextending themselves financially⁶⁹. However, one paper noted that it may restrict possible CO2 savings because “it limits the size of a Green Deal loan to the amount that can be repaid by savings generated.” Further it is difficult to predict the annual energy savings from different retrofit packages without “fully understanding the technical performance of the building and the energy usage patterns of its inhabitants, including any rebound effect with improved comfort conditions”.⁷⁰ This is especially true for heat pumps. Alongside potentially needing extra measures such as new radiators, it’s hard to guarantee savings as bills may increase or decrease depending on the efficiency of the boiler being replaced.⁷¹

Moreover, the ‘golden rule’ has been criticised for restricting the focus to carbon and energy savings since “customers value funding for general renovation work and aesthetic improvements, restricting funding to efficiency measures alone limits the appeal of the finance package”.⁷²

⁶⁸ Brown D., Sorrell S., Kivimaa P. Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit

⁶⁹ While not covered in papers evaluating the Green Deal, higher energy prices will also significantly affect the pay back period and relative cost savings.

⁷⁰ Dowson, M., Poole, A., Harrison, D., & Susman, G. (2012). Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal. *Energy Policy*, 50, 294-305

⁷¹ Carbon Trust. (2020). Heat pump retrofit in London. Available at:

<https://ctprodstorageaccountp.blob.core.windows.net/prod-drupal-files/documents/resource/public/Heat-pump-retrofit-in-London-v2.pdf>

⁷² Brown D., Sorrell S., Kivimaa P. Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit.

Consumer rebound effect

A key reason for consumers to invest in energy efficiency and low-carbon heating measures is lower energy bills. If the expected level of savings fail to materialise relative to the cost of the loan, this has the potential to severely undermine confidence in the need to take out GHF products.

Consumer rebound effect (also known as thermal take-back) is where consumers heat their homes to a higher temperature after energy efficiency measures are installed compared to pre-installation. This can reduce the anticipated bill savings as calculations of what bills will be post-installation do not account for this increase in home temperature.⁷³ Thermal take-back is especially true for low-income households that tend to heat their homes to lower temperatures than higher income homes. Therefore, they typically see less of the anticipated energy savings from refurbishment as they may use the increased efficiency to increase the warmth in their homes rather than to save money on their bills. However, this is an area that requires further study.⁷⁴

As a solution, stakeholders suggested not simply relying on financial incentives to sell GHF products, and instead focusing on the wellbeing benefits to consumers (increased comfort in the home and reduced climate impact).

⁷³ Dowson, M., Poole, A., Harrison, D., & Susman, G. (2012). Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal. *Energy Policy*, 50, 294-305

⁷⁴ Clinch, J. P., & Healy, J. D. (2001). Cost-benefit analysis of domestic energy efficiency. *Energy policy*, 29(2), 113-124.

Evidence gaps

The GHF market in the UK is in its infancy and so the literature, particularly on the private market, was limited. Academic papers primarily focussed on government initiatives rather than what can be done to increase consumer demand or stimulate the private market to offer GHF products. Only a very limited proportion of research reviewed consumer behaviours in response to GHF product features.

We identified the following evidence gaps:

- Limited evidence on consumer demand for GHF products in general, and very limited evidence of demand for specific GHF product features across different consumer segments (other than for the 'able to pay' market).
- Limited evidence on how the costs of living crisis may have affected demand.
- Limited evidence on what consumers specifically want in the context of GHF products.

We recommend that primary research with consumers should be undertaken to address these gaps.

Conclusions

Through interviews with experts and analysis of the existing literature, this research identified the following findings.

First, consumers need access to a range of attractive GHF products tailored to different needs. However, while increasing the supply of GHF products is of fundamental importance, alone it is not sufficient to stimulate demand among consumers. Rather, increased supply needs to be undertaken in tandem with increased awareness of low-carbon heating and energy efficiency measures, as well as the benefits of the measures. These benefits should be multifaceted, covering financial benefits (such as energy bill savings), wellbeing benefits such as a warm, comfortable home, and be compelling relative to other investments the consumer can make to their property.

Second, consumers need to not only understand the measure that is best for their home, but also the type of finance that is best for their circumstances. While the current cost of living crisis is believed to have reduced consumers ability or willingness to take on extra debt, and current demand is weak, stakeholders believed that consume demand for GHF will grow in the coming years. Demand will be stimulated by the potential to lower energy bills, wider benefits such as making the home warm and comfortable, and long-term outcomes such as improving the property value and helping the environment.

Third, secured loans are likely to be more attractive to many consumers than unsecured loans, due to longer payback periods, lower monthly repayments and comparatively low interest rates. Secured loans were also more readily associated as a long-term investment in the value of a property and are available for consumers at point of purchase or re-mortgage (a trigger point when retrofit and other measures to improve a property may be considered). However, given owned outright is the most common tenure category in England and Wales, and secured GHF products may be less appealing for these consumers, more research is needed to understand the needs of this group.

PLF was also seen as a potential way to overcome consumer inertia due to large upfront costs and long payback periods associated with loans for retrofit measures, however the potential impact of such loans on the resale value of a property may be a barrier to adoption.

While lower interest rates were the foundation to any attractive loan, some interviewees felt that government would need to implement other policies that these could link to – such as reductions in stamp duty or council tax (for secured loans) or salary sacrifice to energy bill reductions (for unsecured loans). Overall, there is a need for a variety of attractive GHF products which meet different consumer needs.

Fourth, there are a series of significant challenges with delivering market led GHF products.

- Overall, a stable policy environment is vital to create certainty for lenders, encourage the low-carbon heating and energy efficiency supply chain to invest in training and recruitment, and ultimately drive consumer demand.
- Related, a lack of common standards and limited means of assessing whether retrofit measures have been undertaken in line with loan terms could open the market to abuse.
- The capability of intermediaries will need to be built to advise consumers on measures that are right for their property, and where to get access to finance and the right products for them in this context.
- Finally, the return-on-investment needs not only to be clear but met over time to maintain consumer confidence.

Overall, ensuring consumers are clear about the benefits of various low-carbon heating and retrofit measures, developing distinctive and attractive GHF product features, and providing market assurance through long term planning was believed to provide the necessary stimulus to develop the scale of GHF necessary to decarbonise the UK's housing stock.

Appendices

A) Rapid Evidence Review Methodology

REA – Dates

Basis conducted the REA's stages in the following time frames:

- Development of search protocol – 16th – 19th January 2023.
- Abstract screening – 20th – 23rd January 2023.
- Analysis of 45 screened papers – 23rd – 27th January 2023.

REA - Purpose

The mini-REA's⁷⁵ purpose was to understand the current evidence base around GHF and develop hypotheses around consumer appetite and GHF challenges that could be tested in the expert interviews.

The overall research questions for the project were as follows:

1. Based on existing evidence and expert views, what is the appetite for GHF products amongst owner-occupiers?
2. Which GHF mechanisms, and related intermediaries, are more or less able to promote home upgrades, and what are the related challenges to GHF delivery?
3. How can policy makers use behavioural science to deliver effective green finance programmes for owner-occupiers?

REA – Search protocol

Basis explored the potential for bibliometric analyses through the extraction of information on several main electronic databases: Web of Science, Scopus, ScienceDirect, the Cochrane Library for reviews and trials, and Google Scholar among others. Each of them offers specific advantages and disadvantages, but Scopus is characterised by great flexibility in terms of available filters and disciplines. Additionally, Scopus is the largest abstract and citation database of peer-reviewed literature. These are the main two reasons Basis used Scopus as the reference database for the REA. To select the relevant literature, Basis searched for peer-reviewed articles and high-level policy or institutional reports – i.e. grey literature- published in English. Basis used three complementary processes to this end: (1) a Scopus search; (2) a

⁷⁵ Mini-REA was defined by the short time and limited number of bibliographic databases integrated in this project, compared to standard REA. For gold standard protocols, see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/560521/Production_of_quick_scoping_reviews_and_rapid_evidence_assessments.pdf

review of references in pre-selected articles, based on key authors, conferences and reports identifications; and (3) a complementary separate search on grey literature.

Basis applied the following rules:

- Acronyms were not part of keywords search strings. The search was based on a title, abstract and keywords search. Traditionally, unlike other disciplines as medical sciences, in social sciences acronyms were defined the first time they appeared in the text. The first explanation of an acronym e.g., GHF, should appear in the title and/or abstract. In addition to that, following this rule avoided large amounts of unrelated papers in medical sciences studying the GHF-1 protein.
- Keyword search strings avoided the term 'green home finance' as a search term: An initial exploratory search confirmed that 'green home finance' as a term was not used in the scientific and academic literature in a generalised way. However, 'green finance' has been widely used in the context of macroeconomic effects at the country level i.e. not in our contextual target. In order to generate the proper keyword search string, the closest synonyms to the term 'green home finance' were used in the context of low-carbon solutions and energy efficiency measures in the residential building sector.

To identify grey literature, Basis conducted an electronic search using Google search engine. Basis used the search string below for the search. Basis limited the Google search results for screening to the first 7 pages. Basis used the same screening criteria for academic papers to screen grey literature:

finance mechanisms residential retrofit consumer filetype:pdf

Basis searched each database using terms related to four broad categories of the CIMO framework: green home finance, AND energy efficiency measures AND adoption AND consumer. Proposed search terms related to each category and Boolean operators for combining search terms are summarised below. One criterion paper that met the inclusion criteria specified below was originally identified. Basis then piloted the search strategy to ensure the criterion paper(s) was retrieved.

Search terms used

Green home finance

- Finance; OR
- Financial incentive; OR
- Economic instrument; OR
- Loan; OR
- Rebate

Energy efficient heating measures

- Energy; OR

- Efficiency; OR
- 'Low-carbon'; OR
- PV; OR
- 'Double glaz*'; OR
- Insulation; OR
- 'Heat pump'

Adoption

- Adoption; OR
- Retrofit

Consumer

- Consumer; OR
- Household; OR
- Domestic; OR
- Residential; OR
- Home

The global search string for this REA was:

(finance OR 'financial incentive' OR 'economic instrument' OR 'financial instrument' OR loan OR rebate) AND (energy OR efficiency 'Low-carbon' OR PV OR 'Double glaz*' OR Insulation OR 'Heat pump') AND (retrofit OR adoption) AND (household OR consumer OR domestic OR residential OR home)

The strategy led to a list of an initial search of 390 pre-selected articles. Additionally, the search included relevant references in the set of selected articles to avoid omitting relevant documents. This included grey literature policy reports and WP from key researchers in the field.

REA – Eligibility criteria

To detail the set of inclusion and exclusion criteria needed to narrow down our search to a set of relevant papers, Basis included studies that report the impact on energy efficiency and low-carbon heating measures adoption i.e., changes in behaviour, in response to the implementation of a particular green home financial instrument and/or a set of financial instruments. This included financial instruments provided at the national, regional and/or international level with impacts in households. As aforementioned, geographic exclusion criteria were implemented at this stage.

Design: Basis did not impose restrictions related to study design at the search string level. Yet, eligible studies included primary research to explore consumer experiences and behaviours associated to the implementation of a particular green financial instrument or a set

of them i.e. evidence on the ground and ex-post evaluations (either experimental, quasi-experimental, quantitative and/or qualitative) as opposed to ex-ante modelling scientific simulations. Basis included any available systematic reviews and evidence syntheses.

Date: Basis placed no restrictions related to the date which a study was conducted.

Language: For the purpose of this REA, the focus was scientific evidence and grey literature written in English.

Geographical location: Basis placed no restrictions related to the country where a study was conducted.

REA – Papers reviewed

1. Aarakit S.M., Ntayi J.M., Wasswa F., Buyinza F., Adaramola M.S., Ssenono V.F. The role of financial inclusion in adoption of solar photovoltaic systems: A case of Uganda
2. Alastair McFarlane, U.S. Department of Housing and Urban Development The Impact of Home Energy Retrofit Loan Insurance: A Pilot Program
3. Alejandro Fernández et al Comparing the financial impact of housing retrofit policies on Dutch homeowners
4. Aravena, C., Riquelme, A., & Denny, E. (2016). Money , Comfort or Environment? Priorities and Determinants of Energy Efficiency Investments in Irish Households. *Journal of Consumer Policy*,39, 159–186.<https://doi.org/10.1007/s10603-016-9311-2>
5. Barry Malone, Active Building Centre Research Programme Finance for domestic decarbonisation-led retrofit
6. BEIS Improving home energy performance through lenders
7. Bergman N., Foxon T.J. Reframing policy for the energy efficiency challenge: Insights from housing retrofits in the United Kingdom
8. Berry L. The role of financial incentives in utility-sponsored residential conservation programs: A review of customer surveys
9. Bonacina C.F., Maserà G., Pavan A. Investment Grade Energy Audit: A Financial Tool for the Cost-effective Renovation of Residential Buildings
10. Borenstein S. Private net benefits of residential solar pv: The role of electricity tariffs, tax incentives, and rebates
11. Brown D., Sorrell S., Kivimaa P. Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit
12. Carbon Trust Heat pump retrofit in London
13. Chersoni G., DellaValle N., Fontana M. Modelling thermal insulation investment choice in the EU via a behaviourally informed agent-based model
14. D’Orazio P., Dirks M.W. Exploring the effects of climate-related financial policies on carbon emissions in G20 countries: a panel quantile regression approach

15. Dowson M., Poole A., Harrison D., Susman G. Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal
16. Edling L., Danks C. Supporting actors: The role of state policy and private programs in advancing local and renewable heating technology
17. Gillich A., Sunikka-Blank M., Ford A. Lessons for the UK Green Deal from the US BBNP
18. Giraudet L.-G., Petronevich A., Faucheux L. Differentiated green loans
19. Gooding L., Gul M.S. Achieving growth within the UK's Domestic Energy Efficiency Retrofitting Services sector, practitioner experiences and strategies moving forward
20. Government of Ireland National Retrofit Plan
21. Green Finance Institute Financing energy efficient buildings: the path to retrofit at scale
22. Harish S.M., Iychettira K.K., Raghavan S.V., Kandlikar M. Adoption of solar home lighting systems in india: What might we learn from karnataka?
23. Hirst, Eric. The Effects of Loans on Residential Retrofit: Extent, Pace, and Longevity.
24. Hirst Eric, Goeltz Richard, Thornsjo Mark, Sundin Debra. Evaluation of Minnesota utility home energy audit and retrofit loans programs.
25. Hughes J.E., Podolefsky M. Getting green with solar subsidies: Evidence from the california solar initiative
26. Ibañez Iralde N.S., Pascual J., Salom J. Energy retrofit of residential building clusters. A literature review of crossover recommended measures, policies instruments and allocated funds in Spain
27. Kastner I., Stern P.C. Examining the decision-making processes behind household energy investments: A review
28. London Councils Retrofit London Housing Action Plan
29. Meles T.H., Ryan L. Adoption of renewable home heating systems: An agent-based model of heat pumps in Ireland
30. Mlecnik E., Hidalgo-Betanzos J.M. Policy instruments for energy-efficient renovations at district level
31. Niall Kerr and Mark Winskel, School of Social and Political Science, University of Edinburgh, Household investment in home energy retrofit – designing effective policy
32. Niall Kerr and Mark Winskel, School of Social and Political Science, University of Edinburgh, Private household investment in home energy retrofit: reviewing the evidence and designing effective public policy
33. Nichols G.L., Greschner S.L. Successful solar incentive programs grow solar penetration within low-income communities #203
34. O'Shaughnessy E., Barbose G., Wiser R., Forrester S., Darghouth N. The impact of policies and business models on income equity in rooftop solar adoption

35. Pablo-Romero M.P., Sánchez-Braza A., Pérez M. Incentives to promote solar thermal energy in Spain
36. Podes R. Financing LED solar home systems in developing countries
37. Prashant Vaze, Lionel Mok, Mathilde Bossut, Abhinaya Chandrasekaran and Eduard MacLean, Climate Bonds Initiative & GNE Finance Feasibility study for a financial instrument and a review of existing retrofit loan schemes
38. Sanderford A.R., Overstreet G.A., Beling P.A., Rajaratnam K. Energy-efficient homes and mortgage risk: crossing the chasm at last?
39. Schleich J., Faure C., Meissner T. Adoption of retrofit measures among homeowners in EU countries: The effects of access to capital and debt aversion
40. Shen X., Qiu Y.L., Liu P., Patwardhan A. The Effect of Rebate and Loan Incentives on Residential Heat Pump Adoption: Evidence from North Carolina
41. Snape J.R., Boait P.J., Rylatt R.M. Performance comparison of UK domestic renewable incentives
42. Stern P.C., Wittenberg I., Wolske K.S., Kastner I. Household production of photovoltaic energy: Issues in economic behavior
43. Sun B., Sankar A. The changing effectiveness of financial incentives: Theory and evidence from residential solar rebate programs in California
44. Tongsovit S., Mounghareon S., Aksornkij A., Potisat T. Business models and financing options for a rapid scale-up of rooftop solar power systems in Thailand
45. Zhang H., Hewage K., Karunathilake H., Feng H., Sadiq R. Research on policy strategies for implementing energy retrofits in the residential buildings
46. Zoe Jankel, Arup Delivering and Funding Housing Retrofit: A Review of Community Models

REA – Codeframe for reviewing papers

General study characteristics (Year/ Country/Methodological Design/Sample Size) to be coded at the paper level (not at the transcript level)

Key:

BOLD ALL CAPS = Parent label

- **Bold lower case bullet-point** = child label

Italics = description of how to use the label

CHALLENGES WITH GHF DELIVERY

TYPE OF GHF PRODUCT - *Description and classification of type of Green Home Finance Instrument*

- Payback tariff

- Leasing
- Grant
- Subsidy/tax rebate
- Loan/mortgage
- Use charges
- Debt relief
- On-bill financing - financing repayments are made monthly through an existing utility bill
- Revolving fund - capital raised being circulated and used more than once: loans are repaid with interest, replenishing the fund and allowing for further loans
- Tax credit

DESIGN OF GHF PRODUCT – *please add details to tag (e.g. tag temporal period and in tag say '12 months')*

- **Temporal period**
- **<6 months**
- **6-12 months**
- **1-2 years**
- **3+ years**
- **Rate**
- **Conditions**

OUTCOME

- **Increased intention to adopt desired behaviour (e.g. installation)**
- **Adoption of desired behaviour (e.g. installation)**
- **Unintended negative outcome (e.g. adopting an undesirable measure)**
- **Consideration set of efficiency measures decreased**
- **Consideration set of efficiency measures increased**

EFFECTIVENESS – *in relation to the intended objective of the product / scheme / policy*

- **Very successful**
- **Moderately successful**
- **Unsuccessful**

WHY THE GHF PRODUCT WAS EFFECTIVE (MECHANISM OF ACTION) - *What about the GHF product made it work or not work?*

- **Motivation** - *Reflective and Automatic* - *did the GHF product change their pros/cons calculation or affect their habits/emotions? Did it add a competing priority?*

- **Opportunity** - *Physical and social - did the GHF product change their physical environment or the way in which they perceive others to think/act? Did a friend or family member have a bad experience?*
- **Capability** - *Physical and psychological - did the GHF product change what they can do physically or change their knowledge/skills? Did the GHF product prevent them from knowing where to go for efficiency measures?*

POPULATION

- **Larger households**
- **Owner occupier**
- **Tenant**
- **Landlord**
- **Family**
- **Vulnerable household**
- **Low income household**
- **Higher income household**
- **Higher education household**
- **Younger households**

EFFICIENCY MEASURE

- **Heating**
- **Windows**
- **Solar PV panels**
- **Double glazing**
- **Boiler**
- **Heat pump**
- **Insulation**

PAPER SUMMARY

B) Stakeholder interviews

Sample and recruitment

Basis undertook a total of eight stakeholder interviews. Below, we set out the minimum quotas and interviews achieved across each stakeholder group:

Green and other finance organisations

- **Minimum quota: 2**
- **Interviews achieved: 3**

Consumer representative organisations

- **Minimum quota: 2**
- **Interviews achieved: 3**

Academics working on green home finance

- **Minimum quota: 2**
- **Interviews achieved: 2**

Basis identified stakeholders to take part based on existing networks at DESNZ and the research team, together with desk research to identify suitable organisations.

Basis invited participants by email and no monetary incentive was provided for their time.

At the point of recruitment, Basis asked stakeholders to provide written consent for the interviews to be video and audio recorded, for analytical purposes. As part of the consent process, it was agreed that any quotes from the interviews would be anonymised, and that no organisation would be named in the report. Basis verbally reconfirmed consent at the start of the interview.

Interviews and topic coverage

Basis conducted interviews during February and March 2023. Interviews lasted one hour and Basis conducted them online via Zoom.

Basis structured the interviews to explore respondents' views and experiences surrounding GHF and sought to stress test some of the findings from the REA.

Topics covered the following issues:

- Opportunities and barriers to the development of GHF products and services in the UK.
- Demand for GHF products by consumers, including any impacts from the cost-of-living crisis.
- Specific GHF products and features, and the extent to which these were attractive to consumers.

- The interplay between GHF products and government policies and incentives.
- The role of intermediaries to support GHF uptake.
- The role of a long-term strategy and a stable policy environment to create confidence to develop GHF products and services.

Interview analysis

Basis auto transcribed the interviews and coded them using a proprietary qualitative analysis platform. Basis labelled text and video content with various codes for analytical purposes. Basis developed these during the REA and included 'bottom-up' codes, using a grounded theory approach to identify emergent themes from the research.⁷⁶ Basis also developed codes via 'top down' methods, using existing thematic frameworks, for example the COM-B behavioural model (discussed in more depth below). Once interviews were coded, Basis explored thematic areas both within and across interviews. Basis also compared findings to themes from the REA.

COM-B

The COM-B model is a 'behavioural system'. It identifies three factors that need to be present for any behaviour to occur: capability, opportunity and motivation.

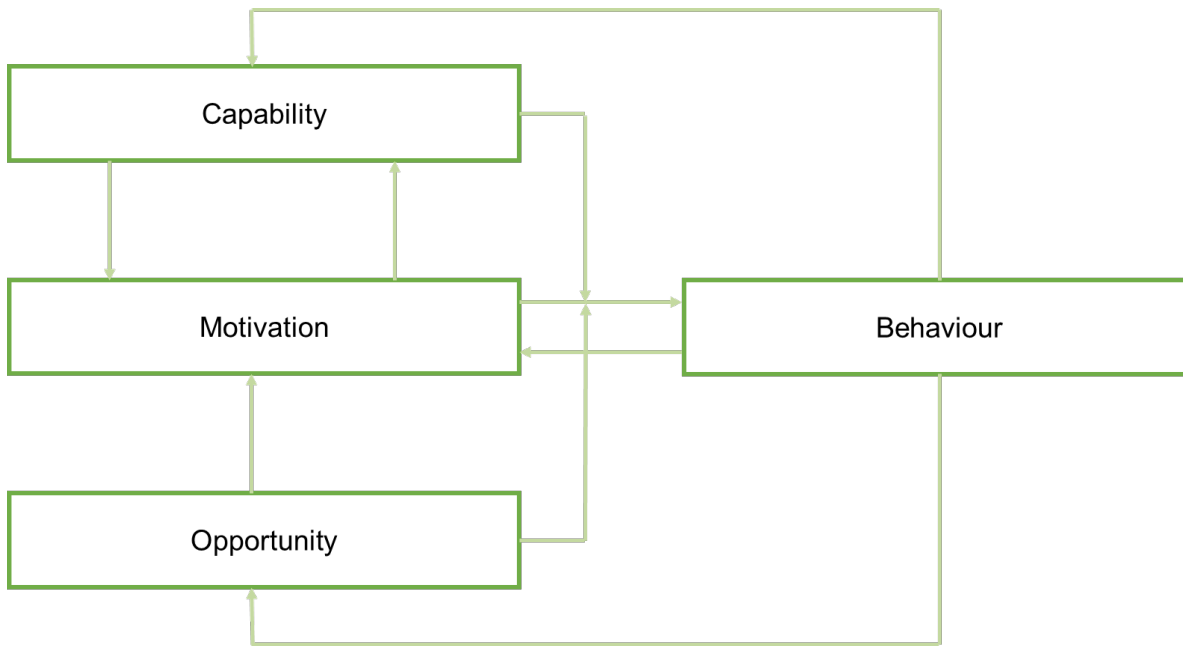
Capability refers to whether a person has the knowledge, skills and abilities required to engage in a particular behaviour. It is split into psychological capability (knowledge, skills) and physical capability (the physical ability to carry out a behaviour)

Opportunity refers to the external factors which make the execution of a behaviour possible. These includes physical opportunities provided by the environment, such as time, location and resource, and also social opportunities as a result of social factors, such as cultural norms and social cues.

Motivation refers to the internal processes which influence our decision making and behaviours. This includes reflective motivation (our values, beliefs, and cost-benefit analyses) as well as automatic motivation (processes such as our desires, impulses and inhibitions).

⁷⁶ Glaser BG, Strauss AL. The discovery of grounded theory: strategies for qualitative research. New York: Aldine de Gruyter, 1967.

Figure 1: The COM-B behavioural model⁷⁷



These factors interact over time so that behaviour can be seen as part of a dynamic system with positive and negative feedback loops (see figure 1). For example, not having the capability or opportunity to perform a behaviour can make it more difficult to perform, decreasing a person’s motivation to perform the behaviour. Similarly, engaging in a behaviour is a form of practice, and as such can lead to increased capability and reduced time and energy costs (a form of opportunity) associated with performing that behaviour.

⁷⁷ Adapted from Public Health England 2020. ‘Achieving behaviour change: A guide for national government’. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/933328/UFG_National_Guide_v04.00_1_1_.pdf

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