Department for Energy Security & Net Zero

Green Home Finance Innovation Fund Impact Evaluation

Final Report: Annex A – Technical Methods Annex

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Acknowledgements

The Department for Energy Security & Net Zero commissioned Technopolis in collaboration with IFF Research, and EREDA Consultants to conduct a process, impact and economic evaluation of the Green Home Finance Innovation Fund (GHFIF) programme. This report follows on from the Process Evaluation completed in November 2021 and encompasses the final impact and economic evaluation of the GHFIF programme.

Contents

Chapter 1. Introduction

This annex was developed during the 2nd phase of the evaluation of the Green Home Finance Innovation Fund, as supplementary information to the impact evaluation report. This stage of the evaluation follows the phase 1 evaluation research on programme processes[1].

This annex sets out the methods and strands of data collection that the study followed during this stage of the evaluation. This includes the evaluation purpose, and the primary and secondary data collection and approaches to analysis, including process tracing and case studies, value for money assessment, consumer research and the state of the market review.

Evaluation overview

The Department for Energy Security and Net Zero (hereafter referred to as the Department, formerly the Department for Business Energy and Industrial Strategy, BEIS) appointed Technopolis in collaboration with IFF Research, and EREDA Consultants to conduct a process, impact and economic evaluation of the Green Home Finance Innovation Fund (GHFIF) programme. The Invitation to Tender (ITT) presented four aims of the evaluation:

1. Determine how well the GHFIF programme objectives, as described in the Business Case, have been delivered.
2. Provide evidence to understand the barriers to delivery of benefits the programme failed to overcome and/or things that could have been done better in design and delivery of the programme to deliver benefits going forward.
3. Trace the different innovations that have taken place in the development and piloting of green home finance products and generate evidence on how the design and implementation of financial products influenced the scale and nature of outcomes achieved.
4. Provide evidence of the outcomes and impacts achieved by the programme, to support both benefits reporting and the design of future green finance programmes.

As a result of a preceding scoping study, the Department established a series of high-level evaluation questions that the study will need to answer. A full list of sub-questions was included in the ITT and scoping report accompanying the ITT.

In summary, the four high-level evaluation questions the evaluation aimed to address were:

[1] Green Home Finance Innovation Fund Process Evaluation. www.gov.uk/government/publications/green-home-finance-innovation-fund-evaluation

1. To what extent, and in what ways, have the activities and outputs of the three funded consortia translated into progress through the six outcome pathways and four impact pathways?

2. To what extent, and in what ways, have the outcomes generated by the GHFIF programme translated into wider impacts on the green finance for energy efficiency industry?

3. Has the GHFIF programme and the projects supported been implemented as intended, and was their design and implementation appropriate to achieving the intended objectives?

4. To what extent have the projects and the programme overall demonstrated value for money?

Chapter 2. GHFIF Programme overview

The section starts by introducing the background, rationale and objectives of the GHFIF programme before outlining the programme's main features and the nature of the projects that were funded under the scheme.

Background to the programme

The GHFIF was launched in July 2019 to support the development and piloting of green home finance products marketed to consumers to retrofit their houses with energy efficiency measures.[2]

The GHFIF was designed to test out practical delivery issues associated with a new concept/approach through an open competition providing grants for consortia that would allow lenders to develop their own innovative green finance solutions. It provided grants that allowed lenders to carry out the necessary internal exploration and learnings to develop the expertise, contacts, and infrastructure necessary to launch, pilot, and evaluate green home finance products and, ultimately, to make these products viable and sustainable without government support.

During the period since the Green Deal was launched in 2013, the requirement to improve the energy efficiency of the UK's existing housing stock has been recognised and reinforced as a key policy goal. The importance of improving energy efficiency in the owner occupier sector has become a particularly central issue. This sector accounts for 64% of homes in the England and 75% of these are below EPC band C.

The GHFIF programme was designed to support three separate but interlinked policy goals:

- The Clean Growth Strategy set out an aspiration to upgrade as many homes as possible to EPC C, where cost effective, affordable and practical, by 2035, and for all fuel-poor home to reach energy efficiency Band C by 2030, as far as reasonably practicable.
- The Buildings Mission ambition to at least halve the energy use of new buildings by 2030 and to halve the cost of renovating existing buildings to a similar standard.
- The Green Finance Taskforce recommendation for the financial sector to take a more active approach to stimulating innovation in green finance products and services.

The programme was funded through the Department's Energy Innovation Programme (EIP), under which it invested £90m in innovation funding to develop new energy efficiency technologies. The GHFIF Business Case defined barriers relating to financing the adoption of

[2] BEIS, Green Home Finance Innovation Fund Competition Guidance Notes, August 2019.

these technologies by homeowners that were recognised as requiring public intervention.[3] In 2021 the Department announced the launch of a successor to the EIP, the Net Zero Innovation Portfolio (NZIP), committing £1 billion to accelerate the commercialisation of innovative low-carbon technologies, systems and processes in the power, buildings, and industrial sectors.

Rationale of the programme

The focus of the programme was primarily based on the need to retrofit existing homes rather than new-build houses.[4] The GHFIF competition is designed to help overcome a number of barriers and market failures that have prevented the development of viable financial products to support energy efficiency retrofits:

- **Knowledge gaps required for development of new green home finance innovation:** Lenders providing debt finance to homeowners traditionally do not have energy efficiency expertise and knowledge about the types of products that households would find appealing. They also have a limited understanding of the types of customers who may be interested in these products. Their prospective partners for the development of these types of products are companies in the home energy efficiency supply chain which do not possess finance expertise.
- **Initial development costs of green home finance innovation:** Development costs associated with introduction of non-traditional products are high and include development of new processes, IT infrastructure, and new knowledge and skills. These costs are significant and may often require hiring staff with skillsets different to those associated with more traditional debt finance products.
- **Lack of confidence from homeowners that investing in energy efficiency measures can be easy and desirable:** Previous policies such as the Green Deal have shown that bill savings on their own are not enough to incentivise homeowners to invest in energy efficiency. Homeowners see their homes as both places to live and a financial asset so to become more desirable energy efficiency measures will need to demonstrate that they are adding value.[5]
- **Slow rate of product innovation and acceptance of risk**: The financial sector is more risk averse since the 2008 financial crash. The rate of innovation has been slow, in particular when considering the introduction of new products. Lenders have also been slow to understand the link between energy efficiency and lower default rates, or increased value of properties. The Department has recognised that finance providers such as mortgage lenders could potentially diversify their products and services to incentivise energy efficiency retrofits without government support. However, intervention

[3] GHFIF Business Case.
[4] GHF103 does include new builds.
[5] GHFIF Business Case.

is needed to stimulate product development and bring finance products to market faster than in the case of no intervention.[6]

- **Lenders are seen as crucial for prompting consumers to consider energy efficiency upgrades**: The Department commissioned customer research which showed that people trust lenders to offer advice on energy improvements to their homes.[7]
- **Collaboration and network failures:** The network of relationships between lenders and energy efficiency supply chain companies is currently underdeveloped. These collaborations are required for the introduction of green home finance innovation.

Aims and objectives of the programme

The aim of the competition was to help overcome the market failures and barriers outlined above by supporting the development and piloting of sustainable green home finance innovations (products, services and solutions).

The specific objectives of the GHFIF were[8]:

- For lenders to develop and pilot products with customers by the end of each project.
- For lenders to create new brand value through the development and introduction of new 'green' products.
- For lenders to develop relationships with the energy efficiency supply chain (focused on building relationships with energy efficiency service provider organisations and/or large energy efficiency service providers).
- To develop innovative green home finance products that have sustainable business models, that will incentivise energy efficiency retrofit, and which are supported and promoted effectively by the lender.
- For lenders to develop the necessary IT infrastructure to make decisions about energy efficiency investments.
- To establish the evidence base on customer demand for green home finance products, including marketing techniques, profiles of potential "green finance" customers, product design and the likely size and scope of the market.
- To contribute to the evidence base on what works for this type of financial product (exploring enablers and barriers) that can be used by industry actors to inform their product development and by the Department to further develop policy on green home finance.
- In July 2019 at the stakeholder information event the Department asked that by March 2021 the pilots cover approximately 1,000 loans per product (energy efficiency works

[6] GHFIF Business Case.
[7] Ibid.
[8] The objectives are based on the review of programme documentation and the interviews.

were not required to be actually carried out and verified in that period). However, following feedback from stakeholders that this was a feature that would detract from their participation, the target was not included in the Programme Guidance issued in August 2019.

Summary of the programme and the projects funded

The competition opened in August 2019 and closed in October 2019. In contrast to previous policy developments the GHFIF programme uses a grant competition model to directly fund the development and piloting of innovative green finance products by finance providers (lenders).

Lenders were encouraged to form partnerships with organisations from the energy efficiency supply chain. The competition was funded from the Energy Innovation Programme and started with an initial budget of £4.63 million to be made available to develop between three-to-five projects. The call for proposals generated 12 Expressions of Interest (EoIs) which developed into four full applications. One application did not meet the quality threshold and was therefore unsuccessful.

The three funded projects received a total of £1.8m of public funding. The size of the projects ranged between £965,000 and £1.8 million with Government contribution varying between 25% and 60% of the total project costs. Two of the projects were led by a lender and one by a software development company.

Table 1 GHFIF Projects

Name of project	Project Lead	Project aims	Nature of the product and target market
Add to My Mortgage, GHFIF 101	Home Infrastructure Technology Ltd.	The Add to My Mortgage project aimed to create an online platform that allows homeowners to search vetted Green retrofit vendors, and then at the point when they are wanting to proceed with the purchase of the goods and services they could click on an “add to my mortgage” button which will make the link to their existing mortgage with one of the main UK lenders. The vision was that it would be as simple as paying for it on a credit card today.	Developing a software platform that creates Point of Sale Finance for Green Vendors by linking potential customers to their existing mortgage lenders. The target market was existing homeowners and landlords who had a mortgage with a major lender.
Green Home Mortgage, GHFIF 102	Lloyds Banking Group	The aim of the Green Home Mortgage project was to develop an end-to-end customer journey that (a) identifies the most effective energy efficiency home improvements for their given budget through an innovative, interactive	Through Halifax, a Green Living Reward of £500 was offered to new or existing mortgage customers who use part of their

Name of project	Project Lead	Project aims	Nature of the product and target market
		customer tool; (b) provides guidance on how to source and get the specific suggested improvements installed; and (c) provides financial incentives to fund the improvements. The idea was that in a single process with a trusted high-street mortgage lender, customers could successfully install effective and cost-efficient measures to improve energy efficiency.	loan on a Trustmark registered installer to make energy efficiency improvements. The product was targeted at retrofit of existing homes.
VALUER, GHFIF 103	Monmouthshire Building Society	Following a previous research project called LENDERS, the VALUER project trialled a methodology to improve mortgage affordability calculations and develop two products: a ‘green’ mortgage product that estimates true energy costs and a ‘green’ further advance product pilot that potentially enables increased borrowing. In addition, new green ‘valuation’ tools would be developed as part of the project. A ‘green’ Surveyor Comparator Tool (SCT) with RICS and local estate agents, as well as a ‘green’ Automated Valuation Tool (AVT) with Rightmove.	Within two ‘geofenced’ areas in South Wales, new home purchasers would be offered pilot ‘green’ mortgage products that include assessments of energy efficiency. Covered both new-build and retrofit of existing homes.

Chapter 3. Methodology

Overview of the evaluation approach

The evaluation took a mixed-method, theory-based approach; specifically, a Contribution Analysis, using Process Tracing to test the programme's contribution claims, with an economic Value for Money (VfM) analysis alongside this.

The impact[9] evaluation aimed to assess the extent to which GHFIF has met its intended objectives and focusses on the short- and long-term impacts 1) related to policy effects, market transformation and diffusion of green mortgages, 2) related to the ultimate impact on energy consumption, bills, CO2e emissions and air quality caused by the retrofits funded by the scheme. The former type of impacts will be tackled through **contribution analysis and process tracing**. The latter type will be addressed by the economic evaluation.

The following components were designed to answer the key impact evaluation questions and set out the contribution of the programme within the context:

- **State of the Market Review:** Designed to determine the scope and details of the offerings of UK lenders for homeowners to invest in energy efficiency of their domestic dwellings at three points in time; the start of the evaluation, interim evaluation and final evaluation stages. The purpose was to provide information on the state of the lenders market in the UK in terms of the features of such products. It provided insights into how the market evolved over time and the proportion of change brought about by GHFIF. The State of the Market Review involved an online search of existing financial products from over 80 UK lenders, supplemented by interviews with green finance sector experts. The review focused on the listing of mortgage lending institutions as outlined by the UK Finance industry association of lenders.
- **VfM evaluation**: The VfM evaluation is part of the impact evaluation and will assess the extent to which government investment in GHFIF represents good value for money. The VfM evaluation will follow the 4Es approach: Economy, Efficiency, Effectiveness and Equity. One of the benefits of the 4E approach is that it provides a thorough analysis of how the scheme actually transformed inputs (assessed in the Economy stage) into outputs (Efficiency stage) and eventually into outcomes (Effectiveness stage)
- **Case studies:** While the CA and PT framework were the main method to assess the impact of the programme at the overall level, project level case studies have been used to explore specific causal mechanisms. They also demonstrate how outcomes within each of the projects were realised and for whom the projects worked well. All three projects were case studies and supplemented by three benchmark case studies.

[9] Process evaluation was delivered in the first phase of the evaluation and the published report is available online at: www.gov.uk/government/publications/green-home-finance-innovation-fund-evaluation

- **Consumer research:** To understand the role of green finance products in driving energy efficiency/low-carbon heating upgrades amongst homeowners, we captured homeowner perceptions and experiences through semi-structured qualitative interviews. The customer interview delivered 16 interviews with customers of the Lloyds Banking Group's Green Home Mortgage product.

The evaluation drew upon data from interviews with multiple stakeholder groups and analysis of secondary data sources. Data collection and analysis was organised across two main phases[10]:

Phase 1 (June 2021 – October 2021)

- Stakeholder interviews (Process and project progress focus)
- Process Evaluation
- State of the Market Review
- Project Progress Summary until October 2021
- Process Evaluation & Project Progress Report
- Presentation of findings / Lessons learnt workshop

Phase 2 (September 2022 – March 2023) – Impact and Value for Money Evaluation

- Stakeholder interviews (Impact and VfM focus) & Case studies
- Stakeholder interviews (Output and outcome focus) & Case studies
- Update to State of the Market Report in September 2022 and February 2023
- Consumer Research
- Analysis & Impact Evaluation
- Value for Money Evaluation
- Final evaluation report
- Presentation of findings / Lessons learnt workshop

Data Collection and Analysis

This section presents how the evaluation team collected evidence to support the evaluation of the GHFIF. This includes a high-level approach, considering the themes covered across the different elements of the evaluation.

[10] Originally the evaluation was to take place over 3 phases but due to delays relating to publication of the Phase one report, recruitment and data processing issues with arranging Consumer Research, the programme of work was reprofiled into two stages.

Stakeholder Interviews

Multiple groups of stakeholders were interviewed to meet the different forms of data collection required for assessment of impact and VfM aspects of the evaluation. Some stakeholders interviewed in phase two were previously interviewed in phase one (process evaluation) and evidence from both waves of data collection were used in drawing up conclusions.

Interviews were semi-structured in nature and carried out through video conferencing where possible (using a mix of either Skype, MS Teams or Webex, according to a respondent's preference). The conversations were structured around the evaluation questions but tailored to reflect the roles of the stakeholder interviewed. These interviews lasted between 30 and 90 minutes, depending on the scope of the discussion and the amount of information interviewees could contribute. The stakeholder evaluation interviews in impact evaluation phase focused on questions about realisation of outcomes (to feed into the CA & PT framework). Where possible, the member of the evaluation team who conducted the interview at the scoping stage or process evaluation stage conducted the main stage evaluation interview.

Table 2 below provides an overview of the sample of the achieved interviews in phase two of the evaluation. An original intention of primary data collection was to include interviews with Point of Sale Finance for Green Vendors and Mortgage Advisors however these did not materialise due to issues in obtaining a sample and consent to contacting these actors in the value chain. Despite flagging these risks early and working with DESNZ to resolve them, the efforts did not lead to any interviews. These interviews were to add value by providing a wider array of stakeholder perspectives in the analysis and provider deeper learnings. The loss of the Green Vendors had little effect on the impact evaluation results, as project participants working with vendors were able to provide their views on the topic.

Table 2. Split of interviews by group

Stakeholder group[11]	Sample size	Target	Achieved	Response rate
GHFIF programme delivery team (former and current) Includes programme leads, and MOs	5	3	3	60%
GHFIF policy team	2	3	2	100%
Competition winners (Senior reps within the lead project developer firm)	5	5	5	100%
Representatives from each consortium members involved in GHFIF projects (project developer wider consortium partners)	6	4	5	83%
Staff from organisations submitted an expression of interest but did not participate in the programme or non-applicants	10	5	10	100%
Mortgage/EE/green finance market sector experts	5	10	5	100%
Total	33	30	30	91%

[11] The original scoping plan included interviews with Point of Sale Finance for Green Vendors and Mortgage advisors. Research with both of these groups was planned but issues with access to a sample and permissions to conduct research with green vendors involved in ATMM and mortgage advisors in GHM did not result in any interviews.

Case studies

While the CA and PT framework help to assess the impact of the programme at the overall level, we proposed using project level case studies to explore specific causal mechanisms and demonstrate how outcomes within each of the projects were realised and for whom the projects worked well.

Interviews with representatives of the 3 projects were used to underpin the development of the case studies presented in Annex B. To gain an overall picture of the experience of each organisation engaging with GHFIF, other sources were used including, but not limited to: GHFIF programme documentation, any available analysis of EPC and equivalent data from bespoke online tools, insights from Consumer Research interviews, and a review of final reports developed for each project and their potential benefits (drawing upon EREDA's technical expertise). Each of the 3 GHFIF projects formed a bespoke case study. In addition to the project case studies we undertook 3 benchmark case studies on products sharing some features with the products launched by one of the three GHFIF projects. These are also presented in Annex B. Sampling was driven by findings from the State of the Market Review and interviews with non-applicants and market experts.

The project and benchmark case studies highlight how GHFIF accelerated product development of supported products, in comparison to lenders which didn't receive support. These allow for reflection on the success of a potential rollout and uptake of each product in light of broader contextual factors which can impact delivery.

State of the Market Review

The objective of the market review was to determine the scope and details of the offerings of UK lenders for homeowners to invest in energy efficiency for their domestic dwellings over the period of the GHFIF.

Method and approach

The review used an internet desk-based approach to identify relevant products available from lenders from the UK Finance members along with several others not a member of the Association. All available products were then described and classified according to a set of relevant mortgage features (described below).

The review made use of the UK Finance members list to identify relevant lenders. UK Finance is an association for the UK banking and financial services sector representing nearly 300 firms and contains the vast majority of lenders active in the UK. Several notable exceptions to membership of the UK Finance that were subsequently included were: BNP Paribas, India Bank, Bank of Ireland, and Ulster Bank[12].

[12] Note this is not a definitive list, but a list based on cross-reference to known lenders via the internet search for products.

The UK Finance Largest Mortgage Lenders 2022 lists were used to identify existing products, the objective being that lenders in the largest groups would cover the majority of both lending activities and also the type of products being offered to the market. This does mean that alternative lenders or those with only very local markets and their products are not included in this review.

The four UK Finance 2022 annual ranking lists by value were:

1. By value of mortgages outstanding (inc. 78 firms)
2. By value of gross lending (inc. 67 firms)
3. By value of Buy-To-Let (BTL) mortgages outstanding (inc. 73 firms)
4. By value of BTL gross lending (inc. 63 firms)

In total, as of 2023, 82 mortgage lenders were included in the review.

To conduct the review, the website for each of the 82 lenders was searched for products using key terms including: green, energy efficiency, retrofit, sustainable, and eco. Each term included a wildcard (*) in order to ensure broad inclusion.

In addition, a search of products that included the terms “green” or “energy efficiency” mortgage was conducted via Google UK and Google UK News, leading to the identification of further products. The news search also helped to add further information regarding product date and other features not described by the source lender.

Products were defined as those with different names and funding objectives (e.g., purchasing or retrofitting), having different interest rates, initial periods, Loan-To-Value (LTV) percentage, and energy performance criteria. If any products were identified through the different search strategies (i.e. company website or UK Google) that were described using different wording/names, but included the same features as another similar product with a different name, these were considered as the same product and only one was included.

All products included in the review were active on/before 28 February 2023.

Consumer Research

Original approach

The consumer research aimed to understand the role of green finance products in driving energy efficiency and/or low-carbon heating upgrades amongst consumers. The research aimed to explore consumer perceptions and experiences through semi-structured qualitative interviews.

The original plan was for IFF Research to conduct 13 interviews with consumers who had engaged with each of these three products, for a total of 39 interviews:

- Home Infrastructure Technology Limited – Add to my mortgage (ATMM)
- Lloyds Banking Group – Green Home Mortgage (GHM)
- Monmouthshire Building Society (VALUER)

The original timeline was for the consumer interviews to take place from April to July 2022.

To access consumers, IFF were reliant on securing buy-in from the three project leads. IFF anticipated strict data sharing agreement protocols, and knew it would be unlikely that project leads would be willing to share consumer contact details. Discussions to mitigate this took place with project leads at inception stage, to explore the feasibility of accessing consumers. IFF outlined the aims of consumer research and highlighted how the findings could benefit project leads' strategic decisions. IFF also outlined the rationale to customer engagement, explored any previous research with customers in case this should be considered in customer communications, and discussed what additional interview topic coverage would help their work. IFF also explored whether they could access customers either directly or indirectly.

Changes to the approach

In April 2022, the Consumer strand was redesigned to exclude VALUER product, because this project had not engaged public consumers.

From April to July 2022, the consumer research experienced challenges securing samples to be able to complete the planned qualitative research. Key challenges were:

- **ATMM project** – IFF briefed the project lead on the consumer research aims and requirements, had initial explanatory calls, and then weekly email exchanges over a few months. After initial willingness for the project lead to contact all consumers who had engaged with (whether they used it or not) the product, the project lead only emailed 23 consumers who had used the product (and did not email any consumers who had not used it). Since this action in early June 2022, none of these 23 consumers opted-into the research. Despite numerous efforts from IFF to recruit consumers via an opt in approach, these did not result in any interviews. After discussion with the Department, agreement was reached to cease contact to avoid overburdening of project lead who was extremely busy with other activities (and was committed to engaging in the evaluation in other ways).
- **Green Home Mortgage** – Since the initial meeting with LBG during the scoping stage (where IFF introduced the consumer strand, discussed opportunities, challenges and mitigations), IFF re-briefed four LBG representatives (each involving two or more meetings), revised all engagement and recruitment materials twice, and engaged in weekly email communications about progress, challenges and ideas to mitigate these. After this ongoing liaison with different representatives, 80 customers were identified as being in scope to take part in the research in late July 2022. Lloyds Banking Group

confirmed invites were sent out by lenders to 38 of these, which resulted in 18 opt-ins. 16 of these went on to be interviewed (2 did not take part due to changing their mind, or not being available until after the fieldwork and analysis period end). Part of the incomplete mailing was attributed by Lloyds Banking Group to lenders and customers being on leave during the summer holiday. These consumers were all from Halifax, and few had used HEST.

Sample and recruitment

IFF interviewed 16 consumers who had engaged with the Green Home Mortgage. The achieved sample is broken down below. The Green Living Reward (GLR) and Home Energy Saving Tool (HEST) were the two aspects which comprised the Green Home Mortgage product. The GLR was a £500 cashback available to claim when green home improvements had been made. The HEST required customers to input details about their home online. A dynamic engine behind the tool would then estimate their current energy bill and provide an action plan for how to make homes more energy efficient.

	Completed
Total	16
Used HEST - made improvements	2
Used HEST - no improvements	1
Used GLA - made improvements	14
Used GLA - no improvements	2

NB: All consumers used the GLR, 3 of these also used HEST.

All of the obtained sample came from Lloyds Banking Group, specifically via Halifax mortgage advisers who had sold GHM directly to consumers. Lloyds agreed to contact these mortgage advisers, to ask them to send the IFF recruitment emails and information leaflet directly to consumers to let them know about the opportunity to take part in research. The incentive of £40 was made clear on this invitation. Once consumers had made contact directly with IFF via a mailbox set up for this purpose, IFF followed up with consumers to book in interviews at a time convenient for them.

IFF monitored demographics, prior engagement with green home finance solutions and whether the consumer had used HEST or not, throughout the recruitment stage.

Fieldwork

Experienced qualitative IFF researchers conducted all interviews, which lasted up to an hour. Semi-structured, depth interviews took place, via telephone or video call, dependent on customer preference. These were a two-way dialogue, in which the interviewer actively listened to consumer feedback, took an initial view on the implications, and devised relevant follow-up questions, using the agreed topic guide.

The project director conducted the first interview, and the first few interviews were considered a pilot stage, whereby the guides were reflected upon, and some minor amends were made to aid consumer understanding and the interview flow.

Topic guide

IFF developed a topic guide, with input from the Department and Lloyds Banking Group. Questions were framed in an open manner (‘Why?’, ‘How?’, ‘In what way?’) to enable the research to uncover the depth of customers’ experiences and contexts. While core questions remain consistent across all customers, some sections were tailored for those who had or had not engaged with the GLR or HEST.

Data management and analysis

In accordance with the Market Research Society’s rules regarding data management, and data protection law known as GDPR, participants were asked to opt into research themselves, after being made aware of the opportunity to take part via an email from their mortgage provider. They sent an email to a mailbox IFF had set up for this project, after which IFF were able to contact them to arrange an interview. Throughout, contact details of respondents were kept securely, as were any recordings made of interviews. Findings from the interviews were reported on an anonymous basis.

The analysis process for qualitative interviews began informally during fieldwork. The interview team worked closely, feeding back findings as discussions were conducted, and updating their interviewing approach to explore emerging themes and ensure any gaps in data were covered by subsequent interviews. This way the team did not wait until the end of fieldwork to discover missed opportunities to add value to the data collection.

Interviewers wrote up each interview into an analytical framework, listening back to interview recordings to capture detail and nuance. The framework allowed interview data to be organised thematically. Themes were developed from the initial evaluation questions and expanded through analysis of early interviews to develop a bespoke analytical framework for the evaluation. This approach allowed for comparison of how individual interviewees’ views developed over the course of their product use, to systematically record data (including verbatim quotes) according to hypotheses and enabled comparison across interviews.

Team analysis of these framework entries followed. Interviewers separately examined selections of the data to understand product views and experiences (actual and expected) and what factors directly and indirectly influenced attitudes and behaviours. The data was analysed to search for themes and trends, looking specifically at identifying patterns or disparities across the sample and thematically grouping those identified. This approach benefited from multiple researcher perspectives, to mitigate any potential for individual-level bias. This activity informed the creative insight session, led by the project director. The purpose of the session was to brainstorm emerging findings. To interrogate the data fully and challenge ideas and assumptions, the research team identified key findings, the sentiment expressed by interviewees for each (e.g. neutral, negative, positive) and explored differences in views with interviewers and the wider evaluation consortium members.

The findings from research with Green Home Mortgage customers can be found in the Appendix to Annex B.

Contribution Analysis and Process Tracing

Our approach to developing, testing and refining a Theory of Change for the GHFIF was based around a synthesis of evidence from various strands of evidence using a Contribution Analysis (CA) framework. As outlined by John Mayne (2012) CA:

> *"…is based on the existence of, or more usually, the development of a postulated theory of change for the intervention being examined. The analysis examines and tests this theory against logic and the evidence available from results observed and the various assumptions behind the theory of change and examines other influencing factors [alternative theories]. The analysis either confirms – verifies – the postulated theory of change or suggests revisions in the theory where the reality appears otherwise. The overall aim is to reduce uncertainty about the contribution an intervention is making to observed results through an increased understanding of why results did or did not occur and the roles played by the intervention and other influencing factors".* [13]

In essence, CA aims to draw defendable conclusions on what contribution a programme has made to observed outcomes, over and above alternative explanations. For example, the contribution that GHFIF has made towards stimulating wider industry to invest in further green finance product development, over and above other market signals. This is achieved through an increased understanding of:

- **Why the observed results have occurred (or not)** – for example, why some lenders that are not funded through the GHFIF may have started to explore the green mortgages market.
- **The roles played by the intervention over and above other internal and external factors** – for example, the contribution claim is that government funding for GHFIF sends a signal to lenders, suppliers, and consumers that there will be continued efforts by the government to support the development of green mortgage products for newbuilt properties as well as the greening of the existing building stock. Competitor firms may be stimulated to undertake similar product developments to be ready for an uptake in consumer interest. However, there are pre-existing green finance products (in the UK and internationally) which may also contribute to lenders' decisions to develop new products. These external factors may have played more of an influential role than GHFIF.

CA helps to build a credible contribution story. The method is about making a well-reasoned case and drawing a plausible conclusion. This answers questions such as, "*Is it reasonable to conclude that policy X was an important influencing factor in driving change?*".

[13] Befani, B. and Mayne, J. (2014) 'Process Tracing and Contribution Analysis: A Combined Approach to Generative Causal Inference for Impact Evaluation', IDS Bulletin 45.6: 17–36.

CA is a useful approach in impact evaluations where experimental or quasi-experimental designs are often not feasible or practical, as is the case with the GHFIF programme. However, there is an interest in assessing whether observed outcomes can confidently be attributed to the intervention. CA is more commonly used to draw qualitative conclusions around the plausibility of attribution, rather than quantifiable levels of impact, such as the effect size of an intervention. However, it may be used to inform assumptions that underpin wider economic evaluation. For example, if we can reasonably demonstrate that green home finance products developed by the GHFIF played a role in stimulating the wider market for emerging green finance products.

CA is an iterative approach to developing, testing and refining theories of change on the contribution to outcomes that a programme has made. The lead proponent of the approach, John Mayne, recommends following a six-step process:

1. **Setting out the attribution problem to be addressed**: as outlined in the ITT for the evaluation, the 'attribution problem' the project seeks to address is the extent to which core intended outcomes (the changes in capability, motivation or behaviour in targeting stakeholders, which in the case of GHFIF includes energy efficiency product vendors, lenders, homeowners, and home valuation agents, amongst others) can be attributed to the programme, or would have happened anyway.

2. **Develop a Theory of Change (ToC)**: outlining the expected steps taken for the programme inputs to meet their intended outcomes and impacts, as well as postulating the role of other potential contributory factors (as shown in Chapter 2, and the accompanying Excel Framework of hypotheses and tests).

3. **Populating the Theory of Change with existing data and evidence**: this involves gathering existing evidence for the ToC and its pathways, with further consideration of the underlying assumptions, risks and other external influencing factors.

4. **Assemble and assess the intervention logic**: emerging evidence from Phase 1 will be used to revisit and revise the contribution claims in the CA Framework. The Phase 1 findings will also help to identify weaknesses in the current contribution stories and what additional data will be needed in the next phases to strengthen them.

5. **Seek out additional evidence**: based on the updated intervention logic Phase 2 will include further interviews with stakeholders to provide new insights on what outcomes each WP achieves by the end of Phase 2, the likelihood that these outcomes lead to future impacts, and the relative contribution of other external factors. In addition, the State of the Market Review will also be updated to inform our understanding of the potential contribution of external programmes to the impacts. In Phases 2 and 3, the VfM assessment will be conducted which will provide additional evidence on the impact of GHFIF.

6. **Revise and strengthen our understanding of the intervention logic**: stage 3 of the evaluation will provide an overall syntheses phase in 2023, which will triangulate results across all strands of the evaluation to test the programme contribution claims and provide a

final narrative on the extent to which GHFIF has met, or is on track to meet, its intended impacts.

Approach to synthesising evidence to assess strength of contribution claims

Whilst the CA approach developed by John Mayne provides a useful overall iterative process to testing and refining contribution claims, it is neutral on the precise methods that may be used to make judgements on the strength of evidence in support of causal claims. We used the Process Tracing methods within our overall CA framework, as a means of stating the causal claim test(s) that will be used in the evaluation and to assess the quality of evidence in support of these.

Process Tracing

Process Tracing makes causal inferences by identifying types of 'clues' that would either support or reject programme hypotheses if observed. This can be used in combination with Contribution Analysis to develop a series of clues (types of evidence) that would support contribution claims around whether observed outcomes (such as parallel green mortgage products and related services) may be attributable to aspects of GHFIF or other external factors. The approach also allows an evaluator to highlight evidence around which features of the programme have positively influenced results. Process Tracing frameworks provide transparency, in advance of fieldwork, of what criteria will be used to judge whether programme theories hold true or not and how conclusions will be drawn.

There are four types of causal tests commonly used in process tracing that relate to the above detective example: hoop, straw-in-the-wind, smoking gun and double decisive. These tests define the "clues" that we would expect to observe if the hypotheses are true.

- **Hoop tests** – this type of evidence weakens the hypothesis if not found. However, on its own it is not sufficient to confirm the hypothesis either. These are pieces of evidence that we would 'expect to see' if the given hypothesis is true. Although hoop tests may not provide strong evidence to support the theory of change, they are nevertheless an important first step, because if projects hypotheses cannot 'jump through the hoop' then it is highly unlikely that wider positive impacts will be observed.

- **Straw-in-the-wind** – this refers to a type of evidence that lends more support to the hypotheses but is not sufficient in itself to confirm the hypothesis if observed or to reject if not observed. For example, interviews with project leads claiming they would not introduce the mortgage products without the competition would count as 'straw-in-the-wind' evidence. These provide useful insights to explain how and why GHFIF projects were developed. However, evidence based on such 'straw-in-the-wind' tests alone may be considered 'shaky' given the potential for positive confirmation bias, such as project managers wishing to portray a positive picture to justify their funding.

- **Smoking gun** – this kind of evidence strengthens the hypothesis if observed but does not weaken the hypothesis if not observed. These are pieces of evidence that we would ideally 'like to see' if a given hypothesis is true but may in practice be difficult to uncover. For example, if after a successful demonstration of a GHFIF project, the lender firm scales up their capital for the solution and widens the rollout because they see commercial benefits, that would be categorised as a ‘smoking gun’.

- **Double-decisive** – this type of evidence strengthens the hypothesis if observed and weakens the hypothesis if not observed. These are pieces of evidence that are expected and confirmatory of the hypothesis. An example of double-decisive evidence would be if the lead developer firm shares their internal project documentation, which demonstrates that GHFIF funding was a core part of the business case. Alternatively, another example would be if historic project documentation suggests the project was at an advanced stage of planning and implementation prior to GHFIF, and alternative options to funding were feasible, as this would suggest the GHFIF funding may not have been necessary for the project to achieve its outcomes.

The tests are based on the principles of certainty and uniqueness; in other words, whether the tests are necessary and/or sufficient for inferring the evidence. Tests with high uniqueness help to strengthen the confirmatory evidence for a particular hypothesis, by showing that a given piece of evidence was sufficient to confirm it. Tests with high certainty help to rule out alternative explanations by demonstrating that a piece of evidence is necessary for the hypothesis to hold.[14] The completed Process Tracing (PT) framework can be viewed in Annex C, the method for synthesising the test results is situated in the framework document.

All phases of the evaluation included State of the Market Review and semi-structured evaluation interviews with a range of stakeholders and in phase 2 of the evaluation also interviews with customers of the lenders. Considering whether and why key findings are triangulated and expressed by all groups (as well as secondary data sources) provided another useful filter for considering their reliability in supporting the programme contribution claims. Similarly, considering whether a ‘hoop test’ or ‘straw-in-the-wind test’ finding was based upon an ‘authoritative source’ (such as peer reviewed publications) provided another factor to consider when making judgements on its likely ‘strength of evidence’.

The analysis of Process Tracing tests was carried out at a case-by-case level. In other words, each individual interview was coded to demonstrate whether they provide findings in support of the contribution claim or alternative hypotheses.

A credible ‘contribution story’

To draw conclusions from multiple strands of evidence, the core aim of CA is to make a reasonable and robust case that a program has indeed made a difference. Development of this ‘contribution story’ therefore entailed:

- Providing a well-articulated presentation of the context of the programme and its general aims, along with the strategies it is using to achieve those ends.

[14] Befani, B. and Mayne, J. (2014) ‘Process Tracing and Contribution Analysis: A Combined Approach to Generative Causal Inference for Impact Evaluation’, IDS Bulletin 45.6: 17–36.

- Presenting a plausible program theory leading to the overall aims - the logic of the program has not been disproven. In other words, there is little, or no contradictory evidence and the underlying assumptions appear to remain valid.
- Describing the activities and outputs produced by the program.
- Highlighting the results of the contribution analysis indicating there is an association between what the program delivered, and the outcomes observed.
- Pointing out that the main alternative explanations for the outcomes occurring, such as other related programs or external factors, have been ruled out, or clearly have had only a limited influence.

Value for Money Evaluation

This section provides an overview of the approach to the Value for Money (VfM) evaluation of the GHFIF programme. VfM is a balanced judgment about finding the best way to use public resources to deliver policy objectives (HM Treasury, 2022). One of the most widely used methods for assessing the VfM of policy interventions is cost-benefit analysis (CBA) where the discounted benefits (valued in monetary terms) of the policy are compared to the discounted costs. The applicability of the CBA, however, depends on the accuracy of the estimated costs and benefits, and the extent to which impacts and costs can be reliably quantified in the evaluation and therefore monetised. Given this the 4Es approach was found to provide framework to assess the VfM delivered by the Green Home Finance Innovation Fund (GHFIF).

This approach is commonly used by the National Audit Office[15] to assess the VfM of government spending along four dimensions:

1. **Economy**: Are inputs of the appropriate quality procured at the right price?
2. **Efficiency**: How well does the programme convert inputs to outputs?
3. **Effectiveness**: How well are the outputs from an intervention achieving the desired outcomes and impacts?
4. **Equity:** What is the extent to which the programme is available to and reaches all people that they are intended to?

While this approach provides a conceptual framework for assessing the VfM of the GHFIF, its main limitation is that it is too generic. Thus, one needs to specify how each aspect of the 4Es relates to the specific program under evaluation. Therefore, we operationalised the 4Es by developing VfM statements of what good looks like for each of the objectives of the GHFIF. These statements were then validated based on a set of indicators. Refer to tables 2-5 for the detailed framework for each ‘E’.

[15] www.nao.org.uk/successful-commissioning/general-principles/value-for-money/assessing-value-for-money/

The indicators were rated as follows:

- Green indicates the criteria has been met.
- Amber indicates the criteria has been partially met.
- Red indicates that the criteria has not been met.

An overall assessment of the VfM judgements were made based on the following criteria, adapted from King and OPM (2018)[16].

- Excellent means that the GHFIF met all reasonable expectations/targets (bearing in mind context) and is substantively exceeding some of these. There may still be room for incremental improvements.
- Good means that the GHFIF generally met reasonable expectations/targets, allowing for some minor exceptions.
- Adequate means that the GHFIF, may not have met all expectations/targets but fulfilled minimum 'bottom-line' requirements and demonstrated acceptable progress toward objectives.
- Poor means that the GHFIF, did not fulfil the minimum 'bottom-line' requirements and did not demonstrate acceptable progress overall.

[16] www.opml.co.uk/publications/assessing-value-for-money

Table 3a: VfM Evaluation Framework: Economy

Statement	Indicator (s)	Assessment Criteria	Required information/data source
Actual project spends aligned with the budget included in the original project proposal.	Variance between budgeted and actual costs	Actual costs should be at most equal to budgeted cost in the project proposals and deliver the same result	PMO report for Built Environment Theme
Any variance observed between actual and proposed costs is documented and justifiable	Contribution of various cost elements to total costs	Meaningful justification of budget slippage	Quarterly monitoring reports
DESNZ attempted to select projects using a fair, open and transparent competition	Criteria used in selecting bids	Guidance notes including eligibility criteria published in an open, and accessible format. Predefined assessment criteria and scoring methodology published in an and accessible format.	Process evaluation report
DESNZ assessed, scored, and selected projects based on a set of pre-defined criteria that include assessment of bid quality and cost	Criteria used in assessing bids	Actual assessment should align with predefined scoring methodology.	Process evaluation report
The scale and budget of project bids is in line with those expected in the programme business case	Variance between budgets submitted by bids and those in the business case	Total budget of bids should be at most equal to budgeted cost in the business case	Business case, PMO report
The programme was able to award funding because sufficient quality of bids was received	Scores awarded to bids	At least 60% awarded to the winning bid (s) as stated in the guidance notes.	Assessment documents
Enough projects were selected that used all the budget originally allocated to the programme	Number of projects and their actual spend	At least 3 projects selected as indicated in the business case	Business case and application forms of successful projects
All programme objectives are covered by the projects being funded	Objectives / KPIs of the three funded projects	Objectives of the funded projects should align with that of the program	Business case and application forms of successful projects and final reports of the projects

Table 3b: VfM Evaluation Framework: Efficiency

Statement	Indicator (s)	Assessment Criteria	Required information/data source
GHFIF enabled financial products or tools to be developed and piloted	Number of tools or new products developed and piloted	At least 3 products/ tools developed and piloted	Tools and products developed by each of the 3 grant recipients
Products and tools were marketed to homeowners.	Number of customers products/tools were marketed to	At least 1,000 customers marketed to	Project final reports
Product and tools piloted have been well received by homeowners.	Number of users of tools/customers of products per month and overall	At least 1,000 users	
	Number of customers/ loans per product	At least 1,000 customers	

Table 4: VfM Evaluation Framework: Effectiveness

Statement	Indicator (s)	Assessment Criteria	Required information/data source
GHFIF generated new evidence on green home finance that is of interest to DESNZ than would not have been the case in the absence of GHFIF.	Knowledge about state of the market before and after the introduction of GHFIF	All final reports of GHFIF projects contain relevant information for policy stakeholders at DESNZ	Summary of interviews with GHFIF program delivery teams on this subject
DESNZ staff use the findings from the GHFIF to shape emerging policy and future programs relating to green home finance.	New green home finance policies linked to GHFIF/ Policies changes enacted due to findings from GHFIF	At least one policy/program draws on lessons learnt from the GHFIF	Summary of interviews with GHFIF program delivery teams on this subject
GHFIF has increased the incentives **for vendors to offer new services and products to customers and reduce prices of services**	Products and services introduced by vendors.	Evidence on new services and products introduced. Perception of about the affordability of the new products and services	Information on vendors, sales volume, cost of goods and services (e.g. interviews with non-participants and market experts)
GHFIF improved participating lenders' ability and motivation to create green home finance products	Views and perceptions of participating lenders about the risk involved in creating and commercialising new products	Perceptions about lower risk compared to pre-GHFIF period Detailed understanding of the benefits and risk involved in creating green finance products. Breadth of seniority people who improved knowledge. Evidence on the translation of the acquired knowledge into actions (e.g., commercialisation of green finance products)	Summary of interviews conducted with, and other data collected from participating lender on their ability and motivation to create green home finance products

	New products developed/ share of new products that have been commercialized.		New products developed and commercialised. State of the market reports
	Average interest rate of new green home finance products	Competitive and affordable interest rate to homeowners	
GHFIF led to **an increase in homeowners' capability, opportunity, and motivation to install energy efficiency measures**.	Homeowners' knowledge and willingness to install energy efficiency measures, perception about affordability of green home finance projects	GHFIF improved homeowners' knowledge about the benefits of energy efficiency measures. Homeowners' perception of the green products as affordable.	Summary of related interviews and/or data collected from a sample of homeowners e.g., IFF consumer research
GHFIF **improved the ability and motivation of key agents involved in the valuation of houses in UK to take account of energy efficiency measures in valuation processes**	Changes made to existing valuation tools by Rightmove and RICS across the UK	Evidence on valuation tools should considering. energy efficiency measures	Summary of interviews with non-lenders and projects, case studies, state of the market report
	Percentage of properties valued by Rightmove and RICS that consider energy efficiency measures		
GHFIF **improved the relationships and networks between valuation agents, lenders, vendors and other actors in the energy efficiency supply chain**	Extent of interaction between actors in the green home finance markets before and after the introduction of the GHFIF	Improved relationship among the supply chain actors	
GHFIF has enabled non-participating lenders to initiate and speed up efforts to develop green home finance products	Number of non-participating lenders that have introduced or intend to introduce similar green finance products	GHFIF signalling product viability to non-participating lenders	

The green home finance market has grown quicker than it would have done without the GHFIF	Number of green finance products on the market before and after the introduction of the GHFIF	An increase in the number of green finance products on the market	
	Number of lenders and other supply chain actors using tools/services developed under GHFIF	An increase in the number of supply chain actors working with lenders	
GHFIF has led to an increase in the number of energy efficiency retrofits	Number of energy efficiency measures installed/expected to be installed under the GHFIF piloted and commercialised products/services	An increase in the number of energy efficiency measures (we need to assume these installations would not have taken place in the absence of GHFIF)	Energy efficiency measures installed under the programme, Final project reports and project participant interviews
	Indicative effects of the GHFIF	Indicative cost (£) per ton of carbon saved	

Table 5: VfM Evaluation Framework: Equity

Statement	Indicator (s)	Assessment Criteria	Required information/data source
DESNZ attracted bids from a range of organisations, including SMEs	Profile of bidding organisations	At least 5% of bids should come from SMEs	EOIs and bids submitted
The products/tools developed are accessible to a broad range of customers	Profile of customers	Tools are aimed at and suitable for a wide range of consumers.	Project final reports

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