Green Home Finance Accelerator Discovery Phase Evidence Report: HTC-Up led by Chameleon Technology

Final Report

Version 1.5

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Disclaimer

The views and opinions expressed in this report are those of the authors and do not necessarily reflect the official policy or position of the government. The information in this report is provided for informational purposes only and should not be construed as an independent review of the project.

Terms and Abbreviations

Term/Abbreviation	Meaning
BREDEM	Building Research Establishment Domestic Energy Model
Charger	Electric Vehicle Charger
DESNZ	Department for Energy Security and Net Zero
EVESO	Electric Vehicle National Grid Electricity System Operator
GHFA	Green Home Finance Accelerator
Green loan	Green lending refers to a lending dependent on environmental criteria for the planned use of funding
HaaS	Heating as a Service, a tariff model offering heating to meet designated temperature ranges at a fixed cost.
Heat Pump	A heat pump is a device that uses work to transfer heat from a cool space to a warm space by transferring thermal energy using a refrigeration cycle, cooling the cool space and warming the warm space.
HTC	Heat Transfer Coefficient - A measure of the amount of energy required to maintain a temperature difference of 1°C between the internal and external ambient measurements. Typically measured as Watts/°C.
ivie App	Chameleon's energy insights app made available through their ivie brand.
LCT	Low Carbon Technology, e.g., solar array, battery, heat pump or EV charger.
Phase 1	The Discovery Phase for the Green Home Finance Accelerator programme.
Phase 2	The Pilot Phase for the Green Home Finance Accelerator programme
SMETER	Smart Meter Enabled Thermal Efficiency Ratings Innovation Programme
Solar	Solar PV systems turn sunlight into electrical energy
THOM	Total Home Optimisation Management, an innovation project which aims to remove barriers to the adoption, efficiency and understanding ofheat-pumps.

1 Executive Summary

1.1 Introduction

The purpose of this section is to provide an executive summary of the findings of the Chameleon HTC-Up project. Linking back to the key objectives for the project, this section summarises and presents the results of the Discovery Phase setting out clearly the reasons for down-selection and where there is a net benefit for the consumers and partners. It sets the associated assumptions, as well as the expected boundaries required for technical and commercial feasibility of the proposition. The executive summary can be read in isolation to the rest of the document for a high-level overview of the project and its findings. Detailed sections can then be referenced if required. This project consortium comprised:

- **Chameleon Technology**: a pioneer in smart energy technology, providing consumers with actionable energy insights, enabling Low Carbon Technologies (LCTs) and optimising connected home solutions.
- **NatWest Group**: financial services provider offering finance products to consumers and businesses.

1.2 Aims and Objectives

HTC-Up researched and specified a green finance offer that helps domestic homeowners and landlords to have a complete solution to accurately assess their property. The HTC-Up solution encompasses:

- Real-life energy efficiency of the home.
- Recommendation of upgrades which have maximum impact on improving the efficiency (including the optimal order of installation where applicable).
- a flexible loan product to meet the customers' needs/budget.
- a clear and simple route to credible and approved suppliers who can install the low carbon technology/energy improvement measures.

The home improvement measure installation is verified, and any next steps which would improve the property are considered.

The home assessment relies on SMETER Heat Transfer Coefficients (HTC) which provide more accurate measures than current Energy Performance Certificate (EPC) ratings over the fabric losses. The legitimacy of the technology was tested under controlled conditions and validated as suitable for basis of next step retrofit recommendations. This HTC coupled with additional property data are used to offer a tailored solution for the individual property and verify the installations once complete.

The researched finance products offer users a flexible approach to their finance, enabling them to match the speed of installation and adoption of new technology to their budget while retaining preferential rates if they stay on the journey to improve the energy efficiency of their properties with NatWest.

To provide both customer and partner assurance over the quality, integrity and satisfaction within the supply chain, a supplier portal which had approved installers of green technology and energy efficiency improvement measures was researched and established.

1.3 Key Barriers and Challenges

1.3.1 Understanding the market

Pain-point research early in the project determined the key existing barriers to green finance uptake and ensured that HTC-Up provided a solution to help alleviate as many of them as possible. The finance product options were worked up and tested with a variety of user groups, primarily through survey. The flagship product was selected and subsequently refined based on the feedback. The user journey for the HTC product was explored and tested with users, alongside technical validation of the fabric assessment.

The original proposal for this project specifically targeted an initial market of landlords making the changes to comply with 2025 regulations for minimum EPC C rating by 2028 (proposed Minimum Energy Efficiency Standards), often without an understanding of what they need to do or who to buy from to meet the standard. This requirement has been officially softened as part of policy changes late in 2023, reducing pressure on a market that is difficult to motivate or incentivise into home improvements without external pressure. Consequently, the original business proposal for the project was revised as part of the Discovery Phase work to deliver the same benefits to resident homeowners first, with a complementary proposal for both landlord and tenants to follow to guarantee uptake. The product offer delivers more benefit to a resident homeowner as they are eligible for both the owner and tenant rewards.

1.3.2 Understanding the home

To properly evaluate the fabric energy performance of any home, measurements must be taken over the heat lost during times when the outside ambient temperature is significantly below that indoors alongside the energy put into providing heat. Due this limitation, trialling any measurement in real homes during summer months is not possible unless trials are conducted outside the UK. To overcome this challenge, fitness of this measurement and assessment was proven as part of controlled research over the effectiveness of the HTC in collaboration with projectTHOM, using the University of Salford Energy House testing results.

1.3.3 Establishing relationships

Trust is key to the adoption of any new technology or on-premises upgrade. The stakeholder research into a supplier portal and referrals established that all parties require some degree

of assurance over the technology, methodology and reputation taking part. To establish and maintain trust with any homeowner customer, existing financial institutions and low-carbon technology (LCT) installers invest heavily in establishing the reputation of their company and brand through a strong case history, certifications, accreditations and reviews. To mitigate this risk, the partner sought association with a third-party supplier portal provider with an established platform, system and brand.

1.3.4 Advising on the next best step

Presenting the cost benefits of high capital, low-carbon technologies such as a heat pump, insulation, glazing or electric vehicle, can be something of a challenge. The return-on-asset valuation and calculated payback periods do not always result in a genuine benefit to the consumer, particularly where the homeowner does not occupy the property, or intends to sell-up within the payback period. This is part of the challenge that the project seeks to address overall.

1.3.5 Reaching the market

Accessing a wide range of customers was a potential barrier, particularly given the spread of customers considered. Delivery time for the project limited the research possible once cleared through internal approval by the partners. By utilising the services of a subcontracted market research agency (KAE) for survey delivery,the project ensured a range of participants could be accessed.

1.4 Key Findings

Overall, the different concepts of the service were well received. The different features of the end-to-end journey align well to overcome the barriers to LCT uptake and offer excellent opportunities to grow the market.

The relationship building was important. It has given Chameleon and NatWest a far greater understanding of how the whole journey can be delivered. Feedback from the stakeholder review highlighted opportunities to bring in an installation supplier portal rather than need to build one, which will save time and cost while providing a ready pool of resources to start the installations.

Usability research conducted across 100 energy app users showed that 53% of respondents would trust and consider advice helpful, with 76% considering the features useful. This quantitative study covered 135 respondents from an energy engaged and interested demographic recruited within the ivie app user base.

The verification methodology testing through the HTC technology has also shown that efficiency improvements can be detected and evaluated. Step changes in energy performance of the fabric were detected when new measures were introduced as part of the upgrades.

1.5 Key Process Learnings

While the project has delivered against the planned objectives and achieved more than expected through this Discovery Phase, it is important to consider the learnings from the process of undertaking the project and determine the key learnings.

The tight delivery timescales alongside an ambitious project plan meant that robust project management practices were required. The timing constraints and dependencies between work packages meant that even small deviations from the plan would significantly impact other tasks. While delays were successfully navigated, for future projects it would be prudent to consider whether some tasks without dependencies and critical path activities could be started earlier. It will always be subject to team availability, but any opportunity to get ahead on tasks would be useful. Similarly, overall project set up and mobilisation should be streamlined in future projects to speed the delivery.

The complexity of the Discovery Phase project, requiring input from multiple teams to create a full end-to-end solution required regular engagement. Weekly team calls with project managers worked well, but ideally more face-to-face meetings with wider teams would help the information sharing and alignment on project goals or specific technical tasks. More frequent themed sessions will be a feature of future projects. The sessions in the Energy House and workshops made significant progress, so using these strategically in key points over video calls would be considered.

Working with a larger company partner means numerous teams have different perspectives on the solutions. While working with the core staff has helped the delivery of this phase, engaging all teams early in the process could provide a richer understanding of all the perspectives earlier, which would smooth the design process. This includes taking an earlier view on next stage and presenting to critical stakeholders earlier. It is a difficult balance to strike. Sufficient information to shape the scope for the next stage is required to make early engagement useful but keeping progress and likely direction of travel in the minds of senior teams will help the final shaping of the proposition for trials.

Documenting findings and information at the appropriate level of detail for sharing with various teams is vital for success. In hindsight, some of the information was presented in too granular detail, which made it harder to share with colleagues who had been less involved in that element of the project. For future projects, adding executive summaries or separate summary documents may make wider team updates/engagement easier.

The ability to have external resources to support delivery helped to overcome pinch points and ensure the project stayed on schedule. This is a practice which will be continued in future projects.

1.6 Reflections on key outcomes achieved

There were several key achievements in the Discovery Phase which will help us to develop the selected and future green finance products.

The research – first desk based and then through the primary research with potential customers (see Section 2.3) – provided a clear understanding of the barriers to uptake of low carbon technologies. Using this information, it has been possible to design an end-to-end solution to overcome the top nine barriers and articulate how this will be achieved in the marketing materials. This allows the assistance to be referenced in the language they were shared with the project, adding a familiarity to the end user.

The Heat Transfer Co-Efficient research and validation testing showed excellent results (see **Error! Reference source not found.** Annex G: HTC Testing), proving it's effectiveness in evaluating fabric performance. This provides the opportunity to utilise the data across numerous offers to support customer decision making and provide real-world assessments of the likely impact of measures in a customer's home. It provides confirmation of reliability which will mean validation of installation ofsome technologies can be delivered remotely.

Mapping the user journey and validating this with users has proved that the planned technology is easy to use and meets customer needs. Adjustments have been made based on the feedback to ensure performance is optimised.

The customer research into the finance product has proved vital to designing an effective product. The research highlighted that immediate reward offers, such as cashback, incentives and rewards were most attractive, so the final solution manages to combine these to meet the needs of the greatest number of potential customers.

2 Evidence Report

2.1 Product introduction

One of the purposes of this Discovery Phase was to propose a range of possible products to the market and ultimately select those that can be effectively trialled as a vanguard. By first identifying the key pain points for adoption of carbon technologies (see Section 5.1), structure of the HTC-Up product offer was established.

2.1.1 Simplifying information and providing the right resources

The ivie energy insights app (from Chameleon Technology) will support users with the energy efficiency measures, while the full end-to-end journey can cover everything from insulation and

windows to resolving fabric issues, before supporting EV charging, heat pumps, solar and battery solutions. The app collects information up-front from available sources and contextualising it with the in-home energy consumption and efficiency, the full portfolio of technologies is filtered and prioritised to ensure that the user gets the best advice over which to adopt and in what order.

2.1.2 Addressing high costs and long paybacks

By providing a zero-cost entry point to the advice and adoption journey, advice that would otherwise need to be sought is presented to the user in a friendly and appropriate way without interruption through either installer visit or bespoke activity on the part of the user. Additional benefits are provided from the start through behavioural insights and rewards, with promoted opportunities to investigate the next steps for improving the property efficiencies.

Where an expensive upgrade or work is considered, financial options are presented to fund through available subsidies and borrowing. By providing preferential borrowing rates and benefits to users that choose this support for their retrofit or efficiency measure, the initial outlay is significantly reduced.

2.1.3 Getting installations right

Advice will be provided to homeowners within the innovative ivie app and the HTC models, which also support verification activity. Once an upgrade is selected, the supplier portal provides access to a list of accredited installers in the area to undertake the work. A survey undertaken on the property confirms the findings from the in-life assessment and allows other factors (such as space, piping and radiator sizes) to be included.

In cases where it is not possible to provide the technological assessment of the building performance using HTC, access to surveyors and installers is provided via NatWest.

Once any work is completed, HTC measurements of the property should improve and confirm that the work undertaken is performing as expected. Combining this with the energy consumption data encompasses technologies which go beyond fabric improvements to the property, such as adoption of a new electrification technologies like electric vehicles (EVs) or an Air Source Heat-Pump (ASHP).

2.1.4 The User Journey

HTC-Up-Pilot creates a green finance offer which delivers property owners a complete solution to accurately assess their home energy efficiency and recommends products which achieve maximum impact on energy savings. It has a tailored loan product to meet their needs/budget and provides a clear and simple route to credible, approved suppliers who can install the low carbon technology/energy improvement measures. It will verify the home improvement measure that has been installed and recommend next steps to improve the property.

By providing first analysis and advice conveniently and at no cost, the solution reaches markets that are otherwise difficult to incentivise and motivate. Once an installation is complete, the users get live information, support and feedback on how much improvement their investment has delivered, keeping the homeowner engaged in the retrofit journey and maintaining their commitment to continuing it. By delivering the insights, advice and updates through the app and supporting web services, consumers have a convenient and accessible means to learn more at their own pace.

It provides all the information the user requires to make informed choices based on their own property needs and overcomes issues of finding installers by providing routes to accredited suppliers through the full end-to-end journey.

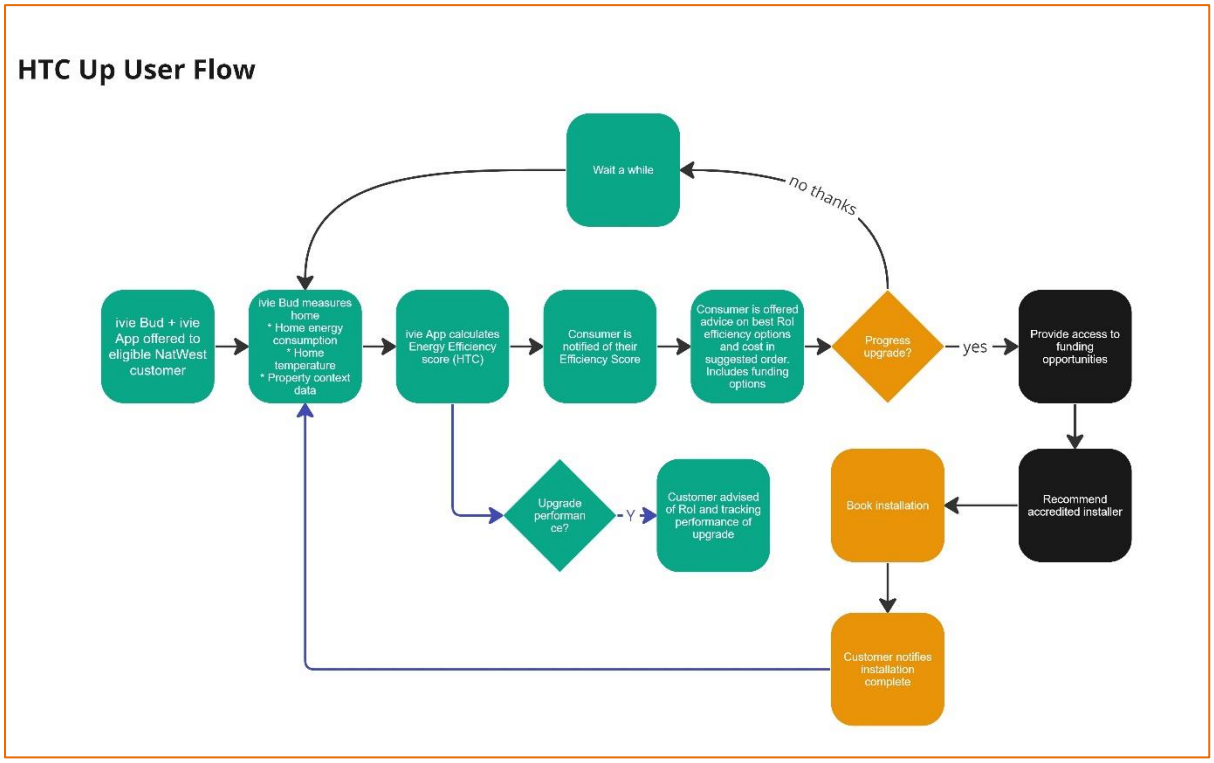


Figure 2.1: HTC-Up User Flow

2.3 General scoping research and other activities

2.3.1 Methodology

Initial research conducted was scoped to establish the spread and prioritisation of the barriers to LCT adoption across the UK. The research conducted considered existing research undertaken in the space along with prior research on the part of the project partners. The resulting list of pain points can be found in Annex A: The nine major pain-points for adoption of low-carbon technologies.

It was resolved to capture a wide pool of respondents across a large age, location, property type, EPC and income bracket to understand how these factors impact on green finance product choice.
Homeowners and first-time buyers were included in the research to understand the motivations of each.

Research was then conducted across a pool of 1000 survey respondents, giving a large survey size, 350 of these were NatWest customers and the remainder were non-NatWest customers. We also targeted a mix among homes built pre-1983 vs. newer homes, and detached, semi-detached, terraced, flats etc. Findings from this research can be found in Section 2.3.3.

To test a wide range of green home finance concepts with customers, workshops between Chameleon and NatWest were held to determine suitable prospects. It was important to identify and test concepts across a diversity of categories including: upfront incentives, longer term loan products and reward products. This included testing a varied complexity of products, to understand how complexity impacts on consumer choice. The team also wanted to understand how the concepts would affect consumer behaviour towards green initiatives and retrofitting their home; to understand if they would inspire action in this regard.

The list of resulting proposals were evaluated by experts across compliance, legal, commercial and operations departments within NatWest based on the following criteria:

- **Simplicity**: How easy it is to understand the product as a customer.
- **Attractiveness**: How appealing the product is based on the ease of enrolment,perceived benefit and consequent desirability.
- **Benefits**: Categorised across customer, social, commercial, strategic and financial,benefits are described and discussed.
- **Challenges**: A measure of how complex or difficult the solution is to deliver due to operational or technological factors.
- **Risks:** Exposure to liability, reputational damage or commercial insecurity through introduction of the product.
- **Technical ease:** Gauges the impact of technical and operational implementation of the product across partner organisations and teams.
- **Compliance**: Covers the expected and known legal and regulatory requirements thatneed to be considered.

- **Timescale** to launch based on internal processes and regulations.

Following this evaluation, seven products were taken forward for further research with prospective customers to survey. For further detail over the selected products and the research methodology see Section 2.5 Finance Product research.

To address issues over the quality of information and installations available, stakeholder interviews were conducted to understand considerations in the development and uptake of a supplier portal to fully engage and assure the installers. A semi-structured qualitative interview methodology was used for the research. The aim of the work was to get an overview of initial thoughts on the supplier portal and what users perceived to be important when introducing such a service. More information on the findings and outcomes of that research can be found in Section 2.4.

2.3.2 Competitor products

At the project initiation, NatWest conducted desk research over the existing market for green home improvements funding which showed most financiers do not currently offer a loan or financial incentives package to encourage low-carbon technology adoption by domestic customers. Lenders generally offer standard borrowing against the mortgage, a home improvement loan or another unsecured personal loan. No special rates are applied to those loan offerings based on their application to low-carbon, energy-efficiency technologies and expenditure. The products on offer at the time of researching are:

- Nationwide Home Improvement loans – Low APR (6.4%) personal loans of £10,000+ for members with current, savings or mortgage accounts. To be spent on any home improvements including retrofit.
- Santander Green Loans – Between £5,00 and £50,000 to spend on heating, energy efficiency or low-carbon technologies, secured against the property value repaid over a minimum of 5 years.
- HSBC Home Improvement Loans – unsecured personal loan for any home improvement

Based on the timing and scope of the project, within our knowledge there are no other providers looking to offer equivalent technical solutions to their customers as a way of:

1) engaging customers in the transition to greener homes.
2) channelling customers towards a supported retrofitting journey.
3) surfacing the concept of green finance with customers to improve their energy consumption behaviours.

This makes the selected product novel and unique, as we believe this technology forms a key part of the growing green home finance ecosystem with consumers, lenders, landlords and installers.

2.3.3 Findings

Information in this section of the report is taken from the survey of 1000 participants described in Section 2.3.1.

Across the participants, most of the homeowners are not familiar with the property's EPC rating, making it necessary to engage and educate consumers to make any green home finance offerings effective. Fuller details of the research conducted can be found in Annex C: Finance product research excerpts - Understanding of EPC. The majority of respondents were not familiar with the property's EPC rating, making it necessary to educate consumers around this aspect in order to make propositions around EPC improvements effective. Under 35s, first time buyers, those buying/owning properties built post 1983 and those with an EPC rating of C and above tend to be more aware and open to learn. Among those aware of their potential EPC rating, 84% stated they can reach rating C or above, compared to the 70% of properties with current EPC ratings in bands A-C, showing that a minimum 14% of properties would benefit from improvement and contribute to national targets.

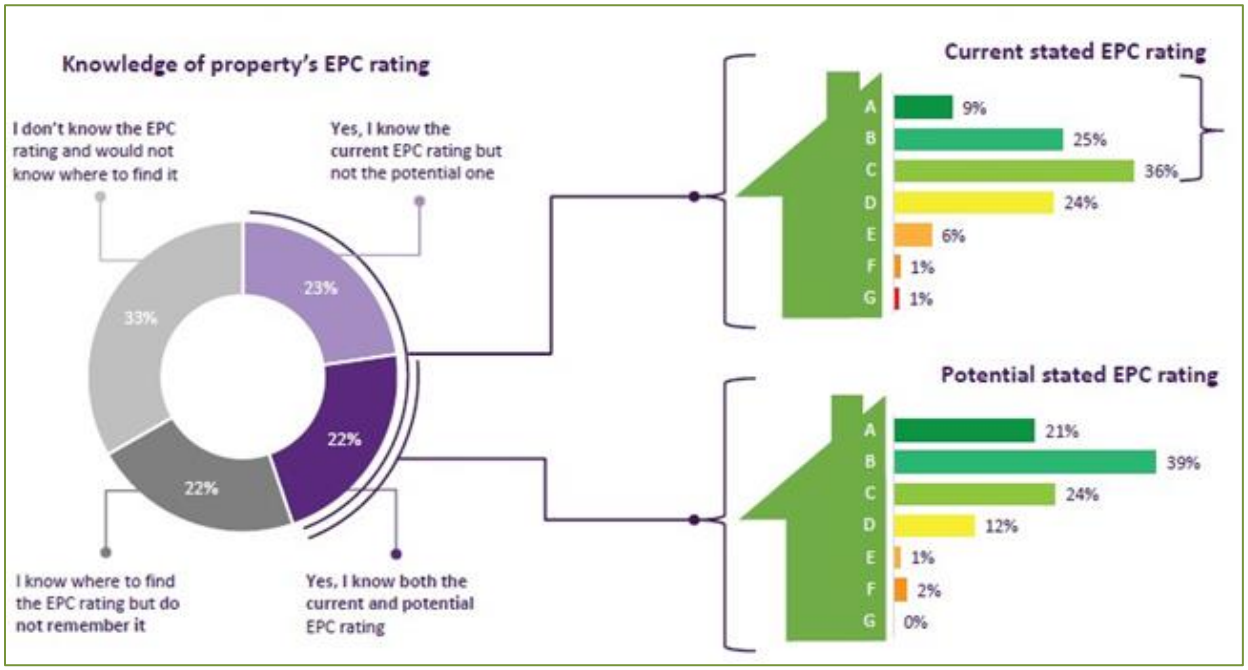


Figure 2.2: Spread of familiarity with existing and future EPC
Report commissioned by NatWest Group and research undertaken by KAE: Marketing Intelligence Limited.

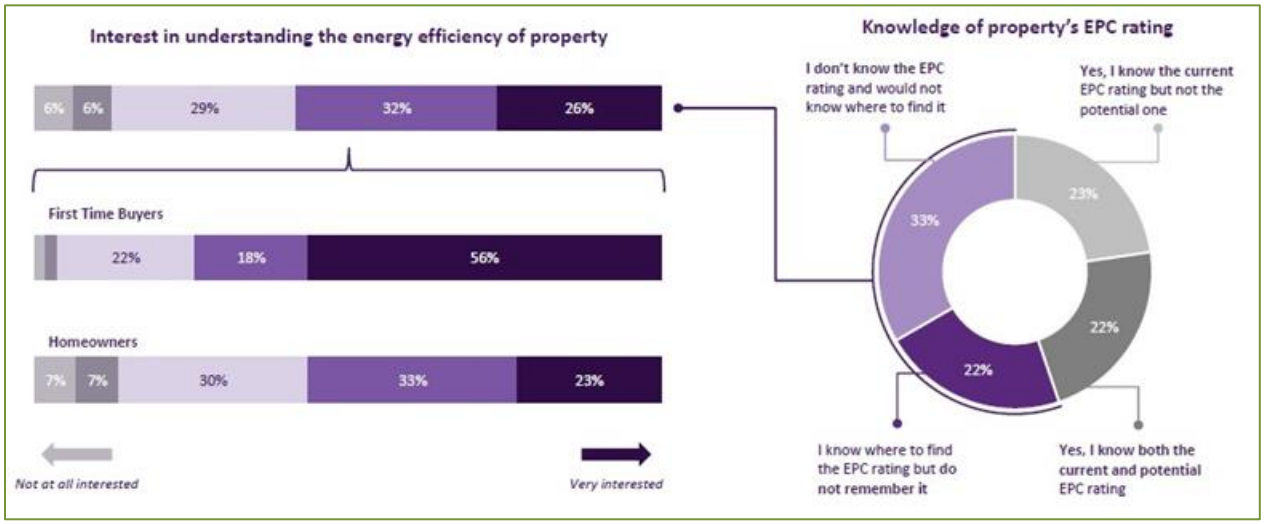


Figure 2.3: Interest from participants unfamiliar with the EPC
Report commissioned by NatWest Group and research undertaken by KAE: Marketing Intelligence Limited.

Most respondents (42%) plan to start or do more retrofitting works within 1 year, whereas 39% plan to do it soon but it won't be this year.

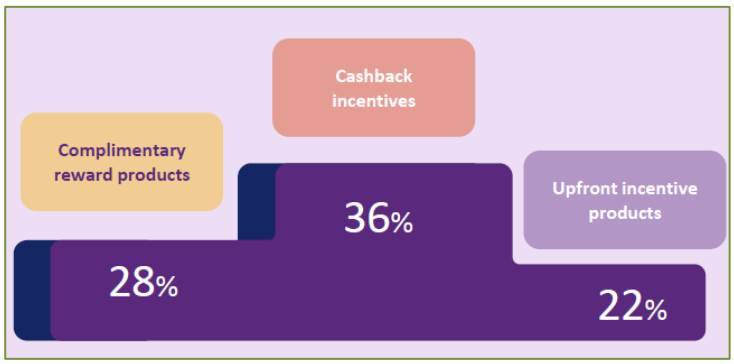


Figure 2.4: Ranked finance product categories
Report commissioned by NatWest Group and research undertaken by KAE: Marketing Intelligence Limited.

Error! Reference source not found. Figure 2.4 shows the top 3 categories of product tested in the research. Of these, standalone loan products tended to score lower than other concepts on appeal, relevance and likelihood to influence action. In particular, the idea of property linked finance was not favoured across the respondent pool. Respondents also found loan rates that were linked to EPC rating as being not relevant to them as they target very specific conditions. Most consumers suggest they would rely on savings to cover retrofitting work for smaller jobs, making finance an important contributor for larger installations.

When offering customers a smart energy monitor and app (ivie Bud) 54% found the concept appealing or very appealing, 48% found it unique or very unique, 53% found it relevant or very relevant,and 48% said it would make them likely or very likely to take retrofit action. This indicates that introduction and assessment of the retrofit journey through introduction of this

up-front technological solution is desirable.

Taking all of this into account, an effective education and engagement strategy with customers utilising the Chameleon technologies will encourage customers to consider retrofitting, and potentially, future green finance. This will be of interest to the majority of customers planning lighter retrofit measures as these are recommended through the tool. In addition, for those customers who are currently uncertain when they may undertake measures but have an intention to, they are provided enough information and support to establish the correct next step and take it in their own time.

2.3.4 Learnings

As part of a survey of 1000 participants consisting of current and future homeowners, participants were asked which retrofit measures they have considered for their property and when they plan to implement those measures. 81% of the participants were considering retrofit measures either within one year or soon but not this year. It is mainly those properties built post-'83, those under 35 and first time buyers that are looking to retrofit.

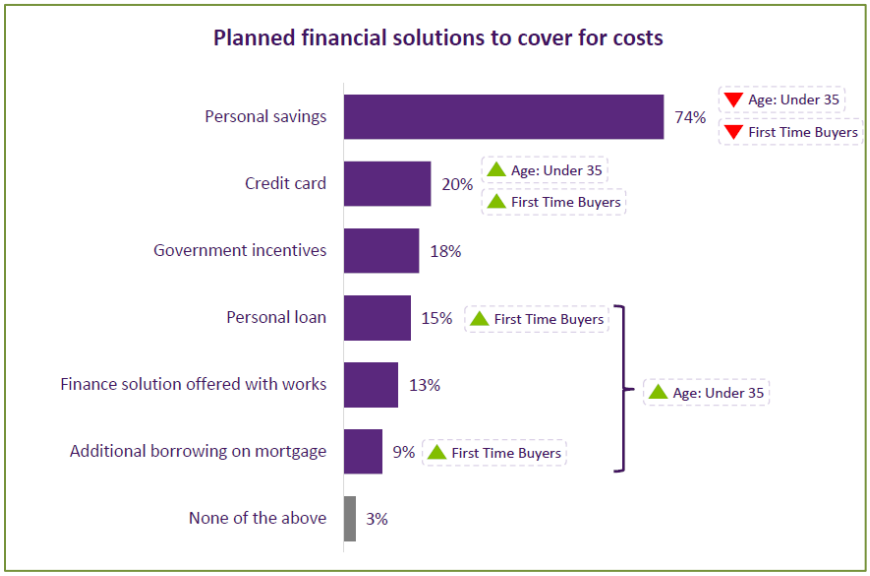


Figure 2.5: Expected retrofit funding routes
Report commissioned by NatWest Group and research undertaken by KAE: Marketing Intelligence Limited.

The survey showed that the average planned investment across all respondents was priced at £2,200. As Figure 2.5 shows, for those participants intending to conduct retrofit works, 74% planned to use personal savings to cover the cost. 20% planned to use a credit card. 18% planned to use government incentives. 15% planned to use a personal loan while only 9% plan to use additional borrowing on mortgage. The two personal borrowing options for works of this size were mostly popular with under 35s and first-time buyers as lower-income or lower-capital customers; personal savings options are popular with over 35s and non- first-time buyers. It is expected that introduction of an appropriate finance product will enable homeowners to adopt significantly more expensive works.

The two main drivers to adopting a low carbon technology (LCT) improvement were saving on bills (76%) and improving the liveability / comfort of the home (48%) countered by the two main barriers of upfront cost (51%) and finding appropriate tradespeople (32%). To inform their decision making 59% of customers use online research as their key channel for information, therefore ensuring our products and resources are readily available digitally will be key. Finding an expert installer and seeking advice from their energy supplier was a strong route to retrofit, therefore engaging with these parties will be key. Previous research shows that under 35s and first-time buyers are also more likely than other demographics to engage with advice on this.

When asked about the main motivators for engaging with retrofit, the strongest market segments identified were among first time buyers and those under 35 in newer properties for early engagement tools and advice. This research also shows that the under 35s, first time buyers, those buying/owning properties built post-1983 and with an EPC of C and above tend to be more open to retrofit technologies and financial support. As such, they make an excellent initial market with which to test any green finance product offer.
The participants who owned their property for over 10 years, are over 50 and or own properties built pre-1983 are less likely to find or know their EPC rating or have a time frame in mind for improving it.

The survey participants over 35 indicated they would be unlikely to use personal savings, preferring instead to use a personal loan or additional borrowing to finance retrofit work. Most respondents were within the income bracket £20,000 - £39,999 (33%) and the majority of respondents had a total household income of £30,000 - £59,999 (37%). 44% of respondents had a mortgage and 86% had a savings account. 7% of respondents were unemployed and 63% were in paid employment. 40% of respondents were under 35 and 35% were over 50. These findings indicate that the most receptive users are over 35 and have a mortgage.

2.3.5 Challenges

Throughout all research conducted, the impact of the cost of living and energy prices has been in evidence, with the main motivator for undertaking retrofit work being to save money on energy bills (76%). Increasing property value was also a big motivator amongst 45% of respondents. In addition, the high upfront cost was the main barrier listed by 51% of respondents, showing financial concern and worry about spendinglarge sums of money.

In terms of product design choice, it is intended that we will empower customers with the knowledge to make small sustainable changes that will ultimately impact their energy bills, won't involve large upfront cost, and have the potential to increase the value of their property. The Ivie Bud will provide customers with a range of opportunities in this respect (and pilot customers will be provided with the Bud free of charge). In addition to this the Bud will introduce customers to the full end-to-end journey which will offer them the option of larger

retrofit solutions via an in-home assessment, partner installer pathways and financing options (alongside government grant information). Therefore, the entire design has been focused around saving customers money in the long run.

Future price fluctuations will be accounted for, with any on-going customer offer we provide in collaboration with Chameleon beyond phase 2 funding. We will always take into account the wider market, consumer costs and energy bill costs when making pricing decisions in this respect. Earlier concepts in the ideation stage were higher risk against price and market fluctuations and the decision was made not to take these forwards.

Initially we had intended to target landlords in the proposal to cover the rental market, however we anticipate a higher level of disengagement from landlords than previously expected and a lower drive to make improvements to their rental property due to the slower rate of changes required to EPC via policy. Therefore, the product will not solely be targeted at landlords and will not include them in any initial launch, however they will be included in future green finance propositions and it is hoped to be possible to be able to extend the Ivie Bud offering to this cohort in the near future.

There is scope to expand in future from owner occupiers to private landlords. A small level of product design may be required to enable this but we do not anticipate this being a major barrier.

2.4 Relationship and partnership building

HTC-Up seeks to cover the complete journey for a homeowner improving their home. To offer installation and survey of a residence, the development of an installer list and corresponding portal was researched and considered. Through stakeholder and market research of this proposition supplier portal, it became clear that existing suppliers could offer this service and partner on the project. Doing so effectively reduces the technical development required and provides an established user experience for both the tradespeople and end customers. Development of the information and lead transfer between ivie (Chameleon) and the retrofit survey and installer portal (furbNow) supports the referrals business case for purchases and installation.

To assure and increase trust in the retrofit insights offered to consumers, partnership with a low-carbon technology modelling and simulation provider has also been initiated. The work is ongoing to integrate and adopt some of this modelling alongside less tailored recommendation services provided by third-parties. Simulation of the technologies improve impact calculations for different improvements and extend the range of modelled improvements to match Appendix E: List of eligible technologies. As a result of this work, simulations align with Building Research Establishment Domestic Energy Model (BREDEM) methodologies and use extended data on the property orientation, age, construction, and archetype derived from a mix of consumer survey/questioning and publicly available sources such as the Energy Performance Contract databases.

Further relationships have been established with providers of alternative technological solutions of fabric evaluations of a property to cover periods where the HTC cannot be applied (i.e. when heating is not active during summer months). These include various methods of consumer-led survey, remote property survey and direct surveyor visits. The improvement and development of the finance product and service has been informed through consultation with these organisations to ensure that the resulting platform is flexible enough to work with a mix of technical and operational solutions to assessment and validation. It is expected that the integration of these technologies will continue after the close of this Discovery Phase project.

These emerging partnerships support the business model and mitigate concerns from consumers and installers over trust in the product. Based on the consortium and subcontractor core business, good links with many players in the market were already present and it was possible to quickly engage installers, LCT manufacturers and portal providers to take part.

All partners and contributors to the project operate under Non-Disclosure Agreements and have strictly avoided transfer of any personal information as part of the research and activities undertaken. Work throughout the Discovery Phase has focussed on how the end-to-end journey from recommendation to post-installation can be achieved while maintaining a continuous experience for the consumer. To preserve the commercial interests of some of those parties, information on the products, integration and those selected have been redacted from the main body of this report.

Following stakeholder interviews concerning the development of a registered contractor and installer portal, it was clear that installers and surveyors were keen to see market growth and stability in the retrofit sector as it provides qualified opportunities. The service provider stakeholders were also keen to see simpler accreditation schemes and an increase in the availability of information and training both for the installer and homeowner over the technologies being installed. All stakeholders saw benefit in a fair comparison and quality assurance scheme to encourage and maintain best practice, especially those involved in funding the initial capital expenditure.

These findings encouraged project partners to find and engage with a new prospective partner to adopt an established supplier portal. The decision to work with an established solutions provider rather than to create a new solution from scratch was supported by the extensive projected development, assurance and recruitment times that would meet all core requirements.

It is expected that a shortage of LCT installers will become problematic as adoption of the technology increases. The consortium has been monitoring the legislation and certification space to account for changes in government policies, installer training requirements, certifications or building compliance.Installer training is reliant on dependable, long-term,

government led initiatives to encourage current practitioners and new apprentices to commit to a suitable learning programme.

The HTC-Up project user journey and products cover and mitigate most of the identified pain points. Those outside the scope of the project involve speculative scenario modelling of technologies based on the emergent or proposed market prices for energy is also a factor that the consortium has considered.Given recent changes in Net-Zero legislation, the consortium has committed to deliver a flexible solution which does not rely on any particular subsidy, deadline or legislative requirement. For some of the propositions originally considered, the dependency on the prevalence of particular technologies coupled with suitable market conditions put them out-of-scope for short term development.

2.5 Finance Product research

Preliminary research and activities were undertaken as described in Section 2.3.1 to select topics, criteria and target participants in the research. Financial product research was undertaken with marketing agency across 1000 survey respondents based on initial scoping and design of the green home finance products within the product teams at NatWest.

The final product selections for further development are considered commercially sensitive as they represent decisions for a wholly new product introduction to the market. Further details of this study and generalized findings that influenced the scope of the product can be found in Section 2.3. Based on this research, the partners elected to design and develop a flexible and complimentary pair of products to incentivise both the homeowner through the offer of finance for upgrades and the energy consumer through rewards over the improvement in energy efficiency and reduced consumption over time. This approach covers both the homeowner and the landlord/tenant customers to improve the energy performance.

As mentioned in Section 2.3.3, homeowners surveyed are not generally aware of the fabric performanceof their property. This promotes education and understanding of the current status of the property and its specific potential throughout a series of adopted steps as crucial to engaging customers more effectively.

Due to the pain points identified, survey respondents currently anticipate making only small retrofit changes that require on average £2,200 of investment either within the next year or soon. Most respondents did not prefer the idea of a long-term loan product due to the intrinsic level of commitment to the property. The products proposed and researched answer these concerns and constraints through different models to service the borrowed amount and associated interest.

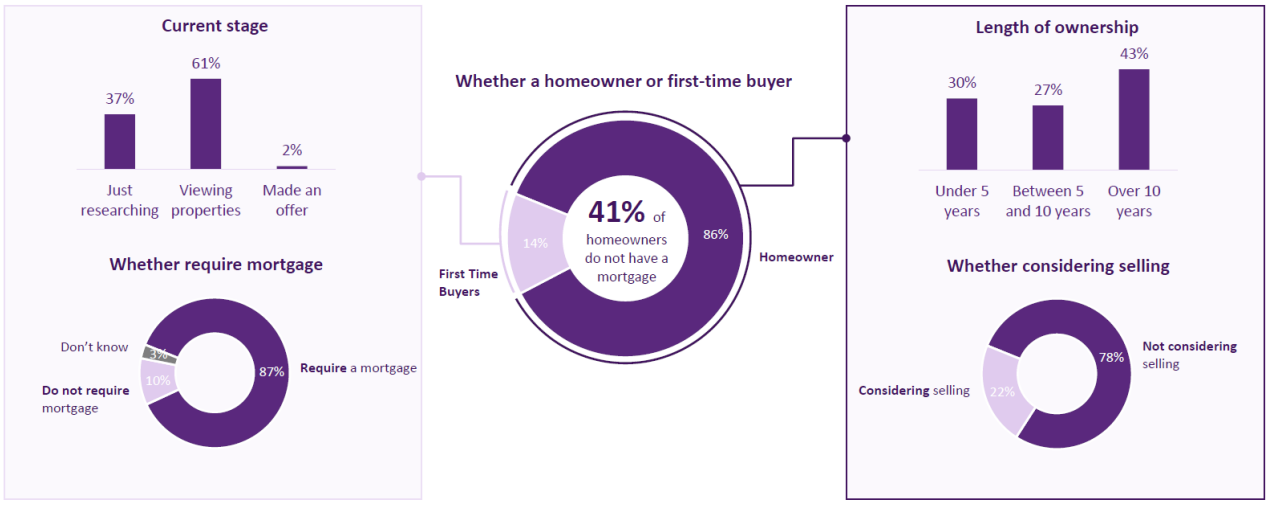


Figure 2.6: Profile of the homeowners studied
Report commissioned by NatWest Group and research undertaken by KAE: Marketing Intelligence Limited.

48% of respondents found a smart meter device and app would motivate them to take action, especially when coupled with upfront cash incentives. NatWest has taken the decision to offer a portion of mortgage customers (switchers and those interested in a new additional borrowing product) an ivie Bud device following the project that will link customers into a wider retrofit ecosystem. This engages customers with their energy consumption through the intuitive ivie app, and enables these customers to make small changes through the personalised recommendations, whilst introducing them to a retrofit journey provides them with tools to make larger changes as and when they become achievable. Through the HTC analysis of the property, tailored recommendations can be made.

Offering the Ivie Bud to customers who are rolling off the fixed-term on an existing mortgage and switching to a new mortgage product with NatWest captures a key trigger point for engagement. By further targeting customers with EPC D to G who will benefit most from the retrofit improvements from a cost and comfort perspective, the proposition will enable these customers to begin their retrofit journey at an appropriate time.

As illustrated in the selection process methodology (Section 2.3.1), several finance products were considered as part of the project. One of the goals of the project was to select and develop products that are achievable in the near-term and under current market conditions but offer opportunity to impact market trends and attitudes. The complementary products developed as part of the project reflect this goal, but research conducted covers a wider range of options that are subject to longer internal and external compliance, legislative constraints, technical complexity in delivery or dependency on appropriate market dynamics. While this rules out the concepts in the immediate term,several of these are still being taken through a longer-term feasibility process by the partners. Key to all of the product offerings is the education, analysis and engagement over the unique property under consideration.

Further to this, there are opportunities to embellish and grow the selected products by expanding the supply-chain, technology listings, market sectors or adjusting the amounts available as part of the offer should the volume of interest support it.

The selected product offering does not challenge or require regulatory consideration over and above other financial products. As the lender is not offering specific recommendations on either the mortgage or retrofit measures the customer should undertake, there is no current risk. For trials and piloting of the products, Chameleon will not be acting as an introducer or credit broker. Should our position on this shift as a result of the trials, the partners will follow standard, compliant processes to engage the relevant risk, regulatory and legal teams within NatWest to assure the Financial Conduct Authority (FCA) and ultimately, customer.

This position has been advised by the legal teams from partners within the project.

2.5 Advice/information research

Current advice on the next logical step for a property relies on one of two approaches, either a survey which is undertaken at the installer or customer cost; or an evaluation based on the most recent survey undertaken by another services professional. In each case, the result quality depends on the depth of survey undertaken and, in many cases, must be considered approximate due to the assumptions the surveyor has to make, considered outdated due to improvements made since a survey was undertaken or considered biased if the survey is conducted by an installer that profits through the installation of the home equipment.

Taking a real-life measurement of the heat-loss bypasses both constraints as it gives a performance figure that is both current and accurate. The next recommended energy efficiency improvement for a building can be determined using the Heat-Transfer Coefficient (HTC) measured from within a propertyusing the ivie Bud, an upgraded smart-meter display. Complementing this in-life performance with the location, construction, orientation and age of the residence, initial advice to the homeowner has a higher degree of accuracy as it accounts for many of the factors that complicate the retrofit journey. Counterfactuals considered include user surveys to determine their needs and usage. This is partially included through the app within the designed solution, however there are many answers which customers are unable to answer accurately or are concerned about providing the wrong information. Using the measurement approach removes the issue and/or helps to validate the answers provided.

On the basis of this technology, HTC-Up has tested the useability of a route-to-market whereby the real-life assessment technology and services are supplied free of charge to NatWest customers. Through the real-life measurement taken, it is possible to review the currently applied technologies and provide simulations of other available low-carbon technologies. The next step is then offered alongside a benefit analysis of the amount of carbon and cash the low-carbon technology will save the user throughout its lifetime.

Partner referral may then be made to a local installer or technology manufacturer through the online user journey. It recommends quality-approved, accredited specialists locally who can

provide the services the users require. In addition, trusted, third-party, independent sources and subsidies are also offered to provide the consumer, where applicable, with enough choice to make a decision. Enough information is provided such that the homeowner can assure themselves of a referral's suitability for their circumstances and the level of qualification of their selected supplier.

Consumer acceptance of energy and low-carbon home improvement advice is crucial in the global effort to combat climate change and reduce energy consumption (IEA 2021). While there has been a growing awareness of environmental issues and a desire to lower energy bills, several factors influence consumer acceptance of such advice. The consumer research found uncertainty on return on investment (ROI), unsure where to start, uncertainty on how well alternatives will work and unsure which measures are right for me are four of the top seven barriers to retrofit, all of which is resolved by accurate, independent advice specific to the customer's needs and property.

First and foremost, throughout all studies conducted on the project, cost vs benefit considerations play the most significant role in uptake. Many consumers are hesitant to invest in energy-efficient improvements due to the initial expense, even though these investments can yield long-term savings. Government incentives and subsidies can help alleviate this concern, making green home upgrades more affordable and appealing.

Secondly, awareness and education are essential. Consumers may not fully understand the benefits of energy-efficient improvements, or they may be overwhelmed by the array of options available. Effective communication and accessible information about the environmental and financial advantages of these changes can increase consumer acceptance.

Third, the quality and reliability of products and services are critical. Homeowners need assurance that energy-efficient products and renovations will deliver on their promises. Certifications and reputable service providers can build trust and drive consumer acceptance.

Lastly, societal norms and peer influence also impact consumer choices. As more individuals embrace low-carbon home improvements, social pressure and shared experiences can encourage wider adoption.

The customer experience proposed by HTC-Up offers a guided journey with bespoke advice and support for homeowners to take the next available step in improving the energy performance of their property. The usability study has shown that consumers value the simplicity, accuracy and validity of that advice, up to and including the performance of an improvement post-installation through HTC scoring (See 5.4 Annex D).

Consequently, it is important to provide people with the shortest journey possible whilst maintaining the reliability, relevance and security of the information provided.

It is also important that advice can be supported through or supplied by an impartial third-party rather than a benefiting organisation and that the advice includes the simplest and cheapest options to improve, not just those that offer the greatest benefits to the referrer. Research throughout the HTC-Up project has shown that where a referral is made to a third-party product or service provider, homeowners are sceptical of motivation and suspect bias based on any commission or referral fee.

Both NatWest and ivie provide consumers with advice on their areas of expertise. Each has established some level of trust and validity through that advice however consumers are wary of advice outside of a brand's historic practice. Referring to and incorporating links to independent, trusted third-parties such as the government or charitable organisations provides an advantage in that they are known for their integrity.

Advice provided by these third-parties is reliant on the same assumptions or information previously stated. Consequently, the information may be out-of-date or inaccurate due to dependencies on assumed information based on the type, age and construction of the property. The tailored advice from HTC-Up is backed by established energy saving advice from an in-depth, low-carbon technology model. By reviewing and accounting for the existing energy consumption of the property, it builds confidence in the customers that there is a genuine need and benefit to their circumstances. It also allows a much clearer ROI picture specific to the household, which is a key barrier which needs to be overcome to trigger the start of retrofit measures.

2.6 Verification methodology research

Using a regularly updating measurement of the energy performance of a property provided HTC-Up with a unique means to establish the level of change resulting from any alterations and upgrades made. By taking measurements before and after a new technology was adopted, the impact and effectiveness of both the technology and individual installation could be determined. Aggregated reports over the effectiveness of installation across particular property archetypes and geographical locations are then used to inform any future advice to those archetypes. These assessments will take place quarterly to ensure a number of additional properties can be assessed together for consistency. Effectiveness is measured in conjunction with the independent expert visits to benchmark against their findings. Independent expert surveyor visits offer a visual and qualitative assessment of any technology installation after the fact. Both the in-home measurements and surveyor visits are free to the customer under the HTC-Up scheme.

To ensure that the installer selected is of a known standard, HTC-Up employs known accreditation schemes from MCS and TrustMark to assure quality alongside the technical improvement evaluation.

The change in HTC afforded by a new technology installation is used to assure stakeholders

that the installation has been completed successfully and the fabric performance has been improved. The HTC methodology is capable of establishing the performance of improvements made. Results of the evaluation are shared with all parties in the process; Homeowner as the customer, NatWest as lender,ivie as energy insights partner and the original installer. By sharing and providing the results of the performance, these results may then be used to improve the trust in a particular trader.

Throughout HTC-Up, research and testing of the ivie Bud and HTC algorithm has been undertaken aspart of controlled environment testing and user research. The tests simulated conditions over Chartered Institution of Building Services Engineers (CIBSE) standard days on a property outfitted for extensive retrofit means that it is possible to undertake assessment and analysis of weather-related energy consumption in buildings. This allowed HTC-Up to test against parameters beyond those naturally occurring within the short project timelines.

Stakeholder reviews show that all parties are keen to ensure the quality of installation so that the risk of underperformance and failure is reduced. Integrating the means to technically validate an installation's effectiveness ensures that investors in the technology are appraised of the installation performance after the fact. This offers assurance that the upgrade is providing benefit, has been completed and is performant to the simulated projection. The corresponding evaluation and result should be shared with all interested stakeholders such as the financial backing organisation (NatWest), the consumer, the installer and the portal provider.

Aggregated data over the performance of installations can then be used to measure performance of technologies and organisations taking part in the recommendation, selection and installation process. Reports over this aggregated performance can then be used to serve industry through whitepaper andadditional publications.

Access to smart meter data and disaggregation of the in-home consumption significantly reduces risk of fraud by the occupant as the difference in energy performance and profile should become evident based on the ongoing results. Since this information is based on the smart metering equipment, it is generally beyond the reach of tampering by the consumer and has been through rigorous assurance andsecurity testing to prevent tampering or fraud. Information from this source can be used as a reliable baseline.

To minimise risk of deliberate bad behaviour impacting the fabric efficiency measurements, several techniques have been considered as feasible:

- Deriving a current measure of the occupancy of a building based on the in-life energy consumed or based on radio activity within the home prevents occupants from deliberately emulating a desired condition through invisible means (such as using an off-grid source to inflate an internal temperature measurement).
- Accreditation of the installer base and guarantee of the installation throughout its expected return-on-value life is crucial to the introduction of any green-finance support.
- Analysis of real-time electricity consumption to profile specific appliances will allow new

technologies introduced in the home to be identified, preventing spoofing a claimed improvement through the addition of a heating device rather than the actual installation of low-carbon measures being explicitly funded as part of the grant.

- An improved analysis of the warmup and cooldown responsiveness of a space will further help identify where an unrealistic response to the energy consumed is introduced and calls the fabric response measurements intoquestion.

2.7 Marketing related research

Key insights from the user research conducted over the ivie App experience can be found in Section 4.4 Annex D.

Usability and market research on the in-app experience showed that 68% of participants would trust a recommendation to supporting finance with a healthy amount of scepticism. On further enquiry, this tends to be a result of the expectation that the advice or referral biased due to any commercial arrangement. By providing clear terms and transparency over the referral, HTC-Up tackles such scepticism up-front. It is also crucial to include any subsidisation available to the participant as part of the finance packages.

Participants majorly need advice and information about government incentives and support, practical guidance on selecting suitable LCTs and guidance on finding reliable installers and service providers to overcome the barriers and further their uptake of low carbon technologies.

The marketing approach to customers has not changed significantly as a consequence of the Discovery Phase research. The research conducted has confirmed that there is overall market interest and need for a simple but effective finance offer across the homeowner and prospective homeowner segments. Promotion focused on groups who have opted-in to information in the retrofit and energy saving areas will help to target the solutions in the right way. The mix of partner access routes to consumers will ensure that groups are captured at different points along the user journey.

Furthermore, there is confirmed space and appetite for the resulting products to be introduced into the buy-to-let landlord sector alongside complementary products to engage and encourage tenants in energy saving behaviour and improvements.

2.8 Future Plans for green home finance

Market research during the Discovery Phase identified a shortlist of innovative financial products that would be appealing to and achievable for the homeowner market. The type of product most suitable to an end user is dependent on the upfront costs of electrification technologies such as heat pumps, solar, storage and EVs alongside maintenance of the current electricity-to-gas cost ratio.
These learnings will be progressed through both the NatWest product development teams and the Chameleon teams to provide solutions which overcome the key market barriers in ways

which have been found to be attractive to users.

The identification of barriers to retrofit upgrades, particularly understanding the nuances between some areas which were often aggregated in secondary research, means there is the potential to create more targeted solutions to resolving each issue.

For example, there is an important difference in the product design between those who are unsure where to start and those who are unsure which measures are right for them. For the former, providing a tool to help them to understand the general themes could be as simple as a tailored 'getting started' guide, while the latter would require the insights from a tool such as the HTC-Up solution and Energy Insights app, which will give specific estimates on their benefits. The HTC-Up solution addresses both well, but those unfamiliar with the real barriers may have deployed the former and assumed the need had been solved.

Further improvements to the end-to-end journey (to answer more of the in-situ requirements remotely) will continue to ensure there is no area of the process where the end user may choose to exit the journey through the perception that the solution does not overcome their specific issues.

In addition to work undertaken on this project, Chameleon will review the findings from the other Green Home Finance Accelerator and Net-Zero projects to determine whether there are learnings which emerge which can inform further product development. Outputs will be reviewed to identify collaboration opportunities for Chameleon to support other projects and overcome limitations to create a better solution to go to market. Contact will be made with project leads from appropriate projects and look for potential partnerships. This could either be through additional support for Phase 2 projects or to help create commercial propositions from work already undertaken if the companies are unsuccessful in the follow-on funding application.

Ultimately, finance and having the available resources to pilot the Discovery Phase concepts remains thebiggest barrier. The Phase 2 funding will play a key role in overcoming these barriers, but if unsuccessful,the partners will seek alternative routes to piloting the programme, which will significantly delay progress.

Consistency of government policy is also important to long-term success. For example, the recent changes to the regulations for landlords to reach EPC C or above within set timelines being removed significantly undermined the business case for this group. Landlords' primary motivation for making the changes was the regulation. Without the requirement in place, they are less likely to proceed, which meant the private householder market had to be prioritised.

Similarly, the EV market is impacted by the delay to the new petrol/diesel sales ban. The market discussion has shifted from many accepting their next car would need to be electric to

believing they would have at least two more petrol vehicles before they had to change.

Further work to highlight the savings over the lifetime ownership will be vital to reinvigorating the low-carbon technology market. It would include the sharing of the business case to users so they can better understand that investing in low carbon technologies can be cost-effective for them, as well as beneficial for the environment. Otherwise, partners will continue to respond when any requests for information are provided by government so the impact of decision making can be shared, and partners can try to influence the outcomes accordingly.

3 Conclusion

The Green Home Finance Accelerator experience has been invaluable, allowing the HTC-Up team to undertake detailed customer research and gain a clearer understanding of the barriers to uptake. This has allowed the design of solutions to better meet customer needs and provided a platform to undertake more robust analysis of the market than would otherwise have been possible.

Crucially, the funding has enabled Chameleon and NatWest to work together to develop a full end-to-end customer solution, which would have taken far longer to achieve without the funding being available to reduce the risk for both parties. Finding a partner for the supplier portal has reduced the development time and likely cost required to complete the customer journey.

It has been a positive process and partners would welcome the chance to be involved in future rounds. If a Phase 2 funding bid is successful, it will allow the HTC-Up solution to be accelerated to market, as the trial will provide essential real-world feedback which will shape the final commercial product.

4 Tables

4.1 Table of Figures

5 Annexes

5.1 Annex A: The nine major pain-points for adoption of low-carbon technologies

(Taken from HTC-Up homeowner pain point studies)

High Initial Costs: One of the primary pain points is the high upfront costs associated with many low carbon technologies. While they can lead to long-term savings on energy bills, the initial investment is a significant barrier for many homeowners.

Installation Challenges: Installing low carbon technologies often requires retrofitting existing properties, which can be technically challenging and costly. This is particularly true for technologies like heat pumps,which may require modifications to the heating system.

Compatibility Issues: Some low carbon technologies may not be compatible with older homes or specific heating systems, limiting their applicability. Retrofitting may require costly and time-consuming upgrades.

Complexity and Lack of Information: Many homeowners lack the necessary information and understanding of low carbon technologies. The complexity of these systems, as well as the various options available, can be overwhelming, making it difficult for consumers to make informed decisions.

Long Payback Periods: While low carbon technologies can lead to energy savings, the payback periodfor the initial investment can be quite long. This can discourage homeowners who may not see immediate financial benefits.

Limited Public Awareness: Many homeowners may not be fully aware of the environmental benefits and long-term savings associated with low carbon technologies. Education and outreach efforts are often lacking.

Regulatory Hurdles: Navigating building regulations, planning permissions, and local codes can be challenging for homeowners and installers, adding complexity and costs to projects.

Inconsistent Government Support: Government incentives and subsidies for low carbon technologies have been inconsistent over the years, creating uncertainty for homeowners and installers. Frequent policy changes can deter investments in these technologies.

Limited Availability of Skilled Installers: There is a shortage of skilled installers and technicians with expertise in low carbon technologies. This can lead to delays in installations and may result in subpar system performance.

These pain points were broken down into the following categories and stories:

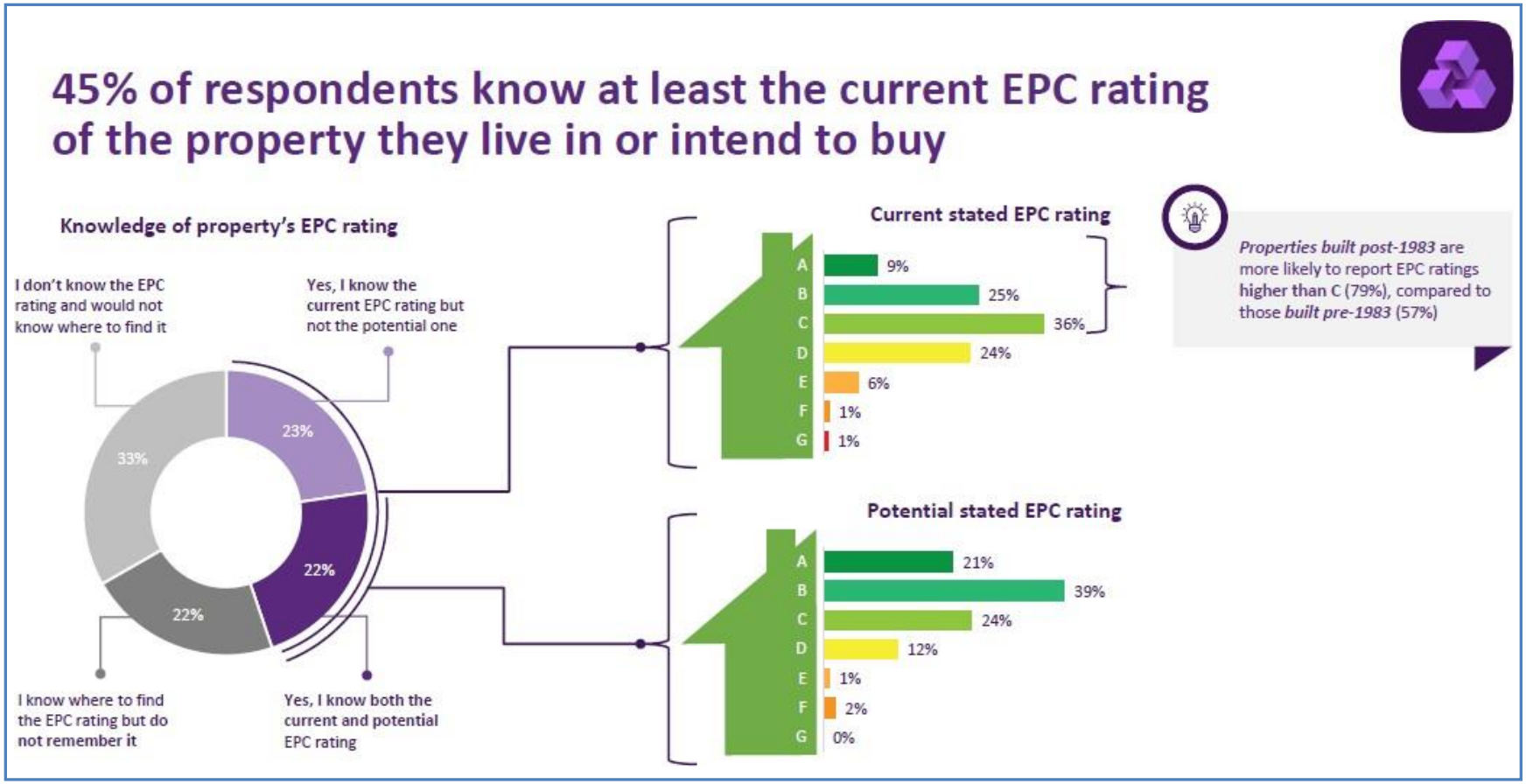
5.2 Annex B: Themes for analysis

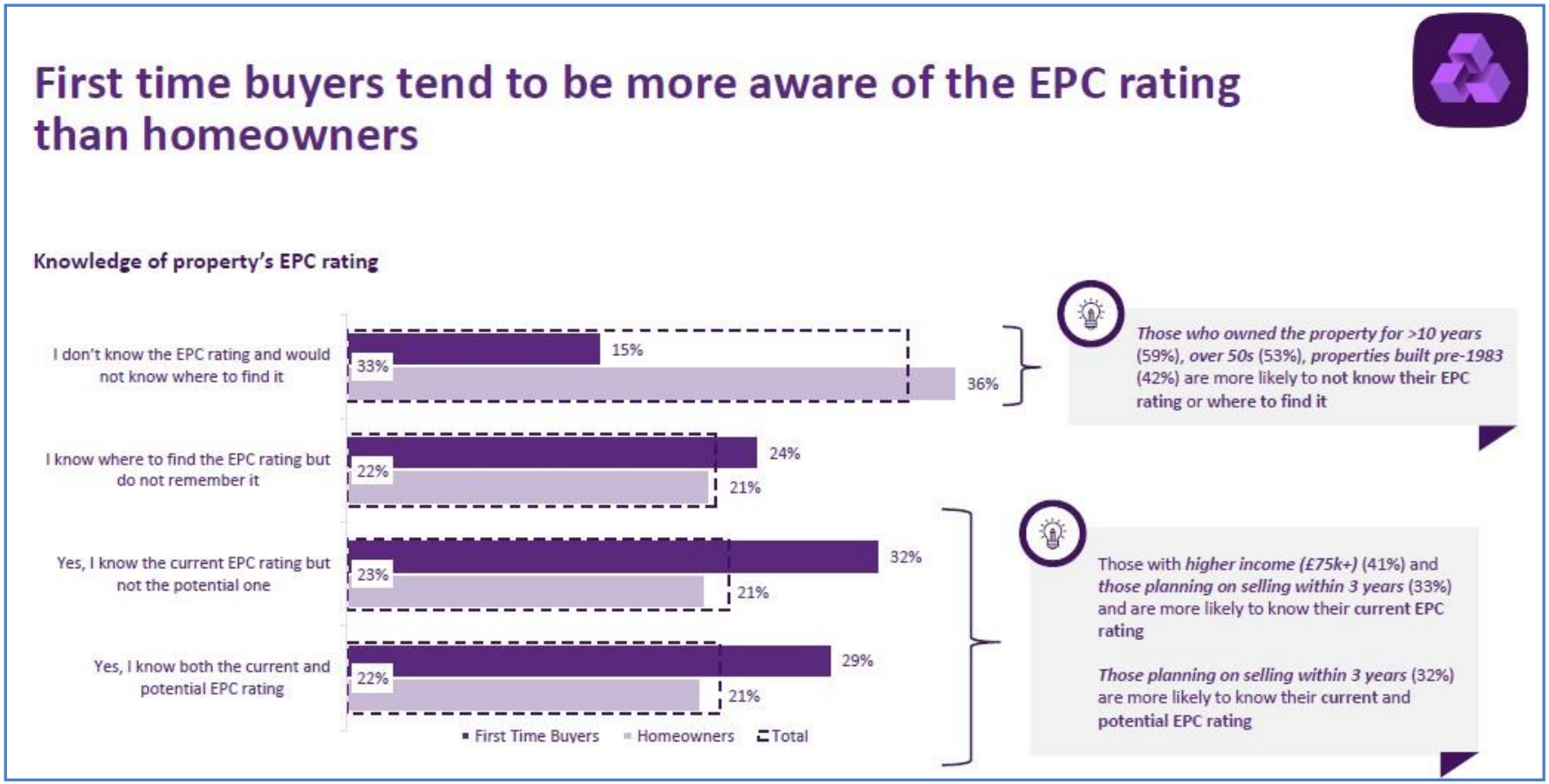
Themes under which prospective finance products were analysed include:

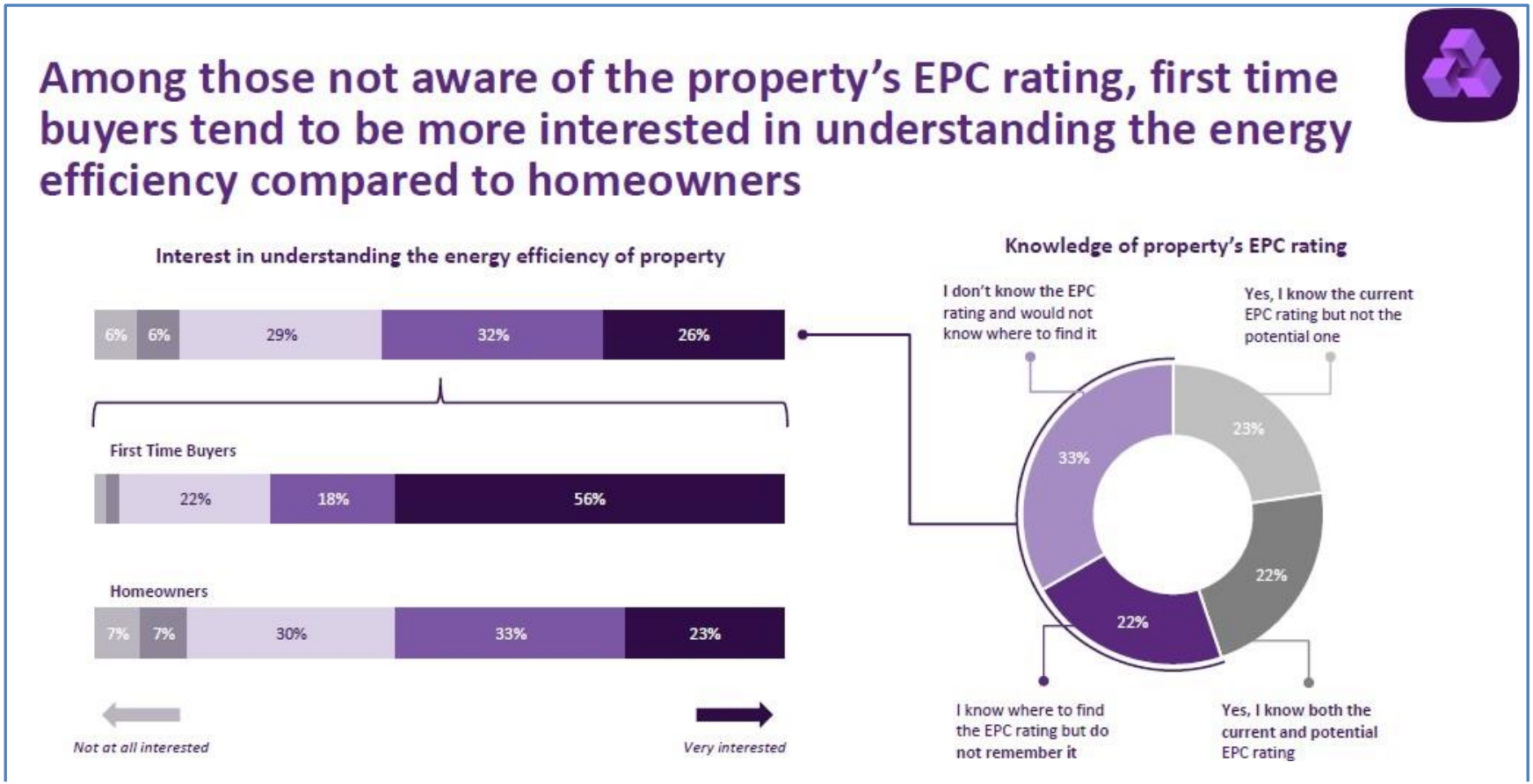
- **Simplicity**: How easy it is to understand the product as a customer.
- **Attractiveness**: How appealing the product is based on the ease of enrolment, perceived benefit and consequent desirability.
- **Benefits**: Categorised across customer, social, commercial, strategic and financial benefits are described and discussed.
- **Challenges**: A measure of how complex or difficult the solution is to deliver due to operational or technological factors.
- **Risks:** Exposure to liability, reputational damage or commercial insecurity through introduction of the product.
- **Technical ease:** Gauges the impact of technical and operational implementation of the product across partner organisations and teams.
- **Compliance**: Covers the expected and known legal and regulatory requirements that need to be considered.
- **Timescale** to launch based on internal processes and regulations.

5.3 Annex C: Finance product research excerpts - Understanding of EPC

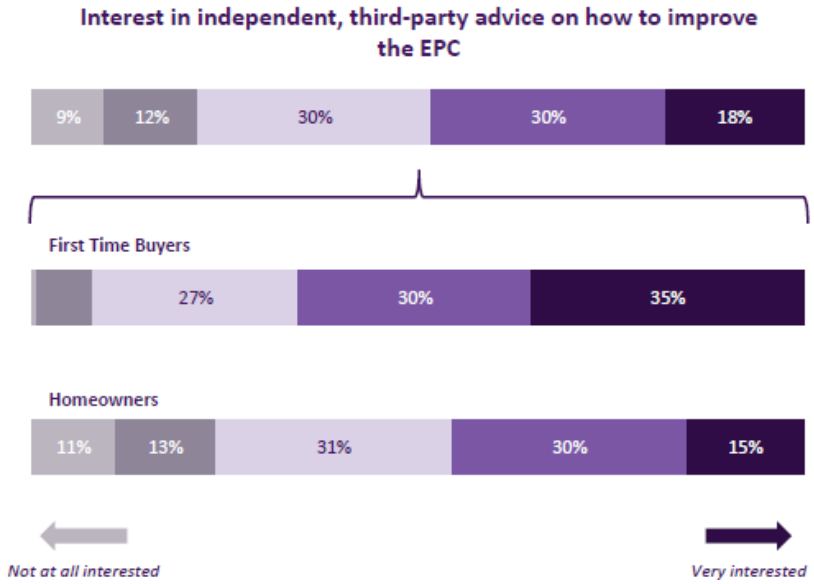
The following pages are taken from a study of 1009 online interviews conducted on behalf of NatWest by KAE.




First time buyers tend to be more aware of the EPC rating than homeowners
Knowledge of property's EPC rating
I don't know the EPC rating and would not know where to find it
15%
33%
36%
I know where to find the EPC rating but do not remember it
24%
22%
21%
Yes, I know the current EPC rating but not the potential one
32%
23%
21%
Yes, I know both the current and potential EPC rating
29%
22%
21%
First Time Buyers
Homeowners
Total
Those who owned the property for >10 years (59%), over 50s (53%), properties built pre-1983 (42%) are more likely to not know their EPC rating or where to find it
Those with higher income (£75k+) (41%) and those planning on selling within 3 years (33%) and are more likely to know their current EPC rating
Those planning on selling within 3 years (32%) are more likely to know their current and potential EPC rating


Among those not aware of the property's EPC rating, first time buyers tend to be more interested in understanding the energy efficiency compared to homeowners
Interest in understanding the energy efficiency of property
6%
6%
29%
32%
26%
First Time Buyers
22%
18%
56%
Homeowners
7%
7%
30%
33%
23%
Not at all interested
Very interested
Knowledge of property's EPC rating
I don't know the EPC rating and would not know where to find it
Yes, I know the current EPC rating but not the potential one
33%
23%
22%
22%
I know where to find the EPC rating but do not remember it
Yes, I know both the current and potential EPC rating

First time buyers are also more likely to be interested in independent, third-party advice on how to improve the EPC



The following groups are **more likely to be interested** in independent advice on improving EPC rating:

- ***First Time Buyers*** (65%)
- ***properties built post-1983*** (64%)
- ***under 35s*** (59%)
- ***selling within 3 years*** (56%)
- ***owned the property for <10 years (53%)***

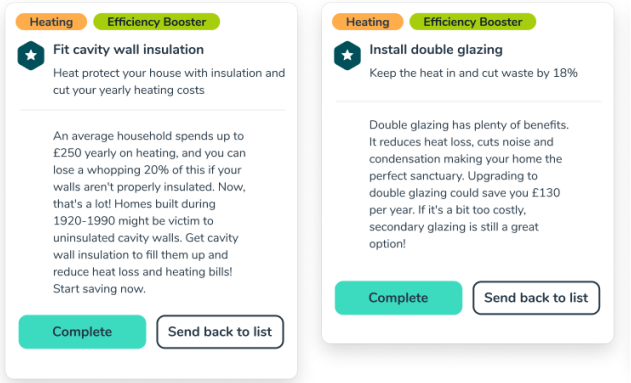
5.4 Annex D: Summary of insights from usability research study (ivie App customers)

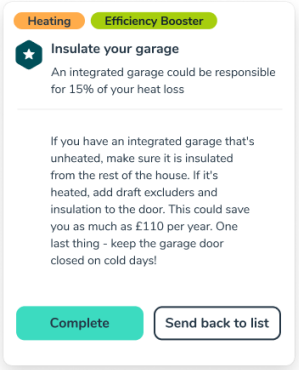
Statistics below are shared from the usability survey of 134 ivie App customers.

• **59%** of participants had **at least one** low-carbon technology
• **41%** of participants **did not own** any low-carbon technologies, out of which **18% are planning** to get at least one in the near future
• Major **barriers** to adopting low-carbon technologies identified were **high upfront costs, lack of financial incentives or government support and uncertainty about long-term benefits**
• Participants majorly **need advice** and information about **government incentives and support, practical guidance on selecting suitable LCTs and guidance on finding reliable installers and service providers** to overcome the barriers and further their uptake of low carbon technologies
• **76%** of participants **liked** the concept of the **HTC score** and thought it would be useful
• **53%** of participants believes that **HTC score and booster challenges** combined will **help** them enhance the heating efficiency of their home
• **57%** of participants said they are **likely to follow the booster challenges**
• **59%** of participants found the **articles** on the sustainable future page **useful**
• **16%** of participants said they would **highly trust** the **green finance offers** in the ivie app and another **52%** said they would trust the offers, but some scepticism.

Booster Challenge- feedback

The following examples of booster challenges were shown in the survey and participants were asked a few questions to gain feedback





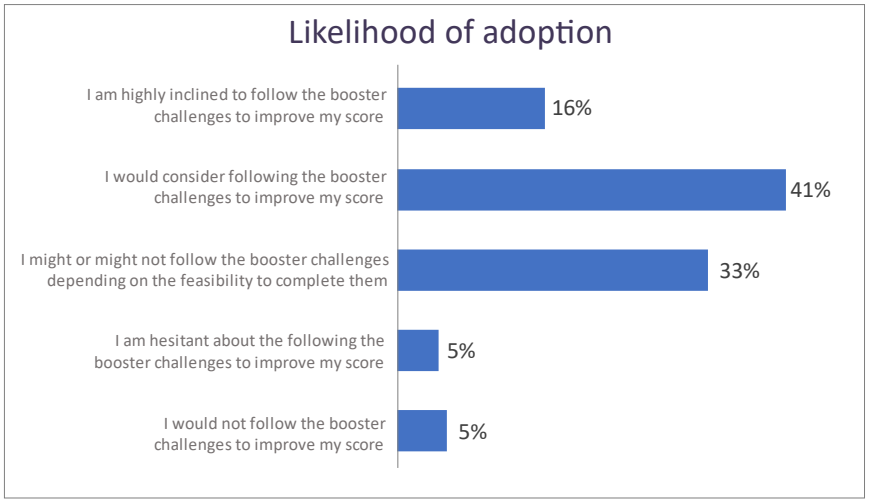
Understanding

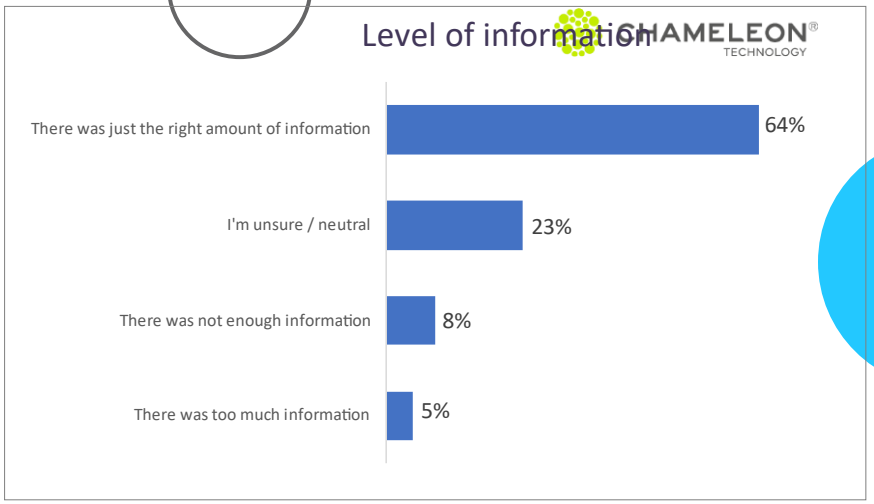
I did not understand at all *I fully understand*

Helpful

Do you believe that the Efficiency score and the associated booster challenges in the ivie app could help you enhance the heating efficiency of your home?

Strongly doubt *Strongly believe*





Other concerns about HTC and score booster challenges:

"Every home is different and would be difficult to get an accurate evaluation from an app and consumption alone but it is a good starting point and prompter"

"I question how accurate it would be, as you do not have access to data about the buildings thermal efficiency, its heat loss or indeed its humidity/damp issues"

"Due to the layout or construction of homes, some things may not be achievable, so you might need to "dismiss" certain suggestions and then offer a reason why, like "detached garage" means you don't need to insulate it"

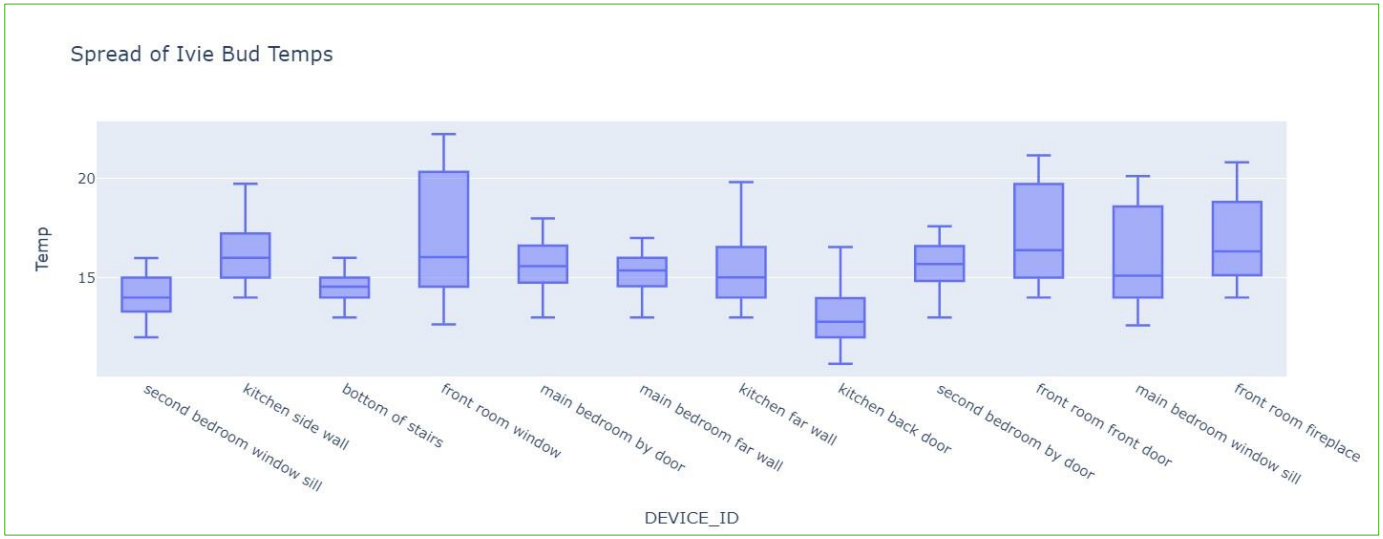
5.5 Appendix E: List of eligible technologies

This list is taken from the proposed list of technologies eligible for financial assistance.

Air Source Heat Pump Battery Storage Decentralized mechanical extract ventilation Demand Controlled Ventilation Doors - with draught exclusionDoors - external Draught Proofing External Wall Insulation (EWI) Flat Roof Insulation - Standard Floor Insulation - solid Floor Insulation - suspended Ground Source Heat Pump Heating & Hot Water ControlsHybrid Wall Insulation Internal Wall Insulation (IWI) Loft Insulation	Roof Insulation Room in Roof Insulation Solar PV Solar Thermal (Water Heating) Solid Wall Insulation Underfloor Heating Windows - double glazed Windows - triple glazed Windows - secondary glazing

5.6 Annex F: HTC Testing results (from controlled test)

ivie Bud Temperatures



- Average internal temperature recorded was 18.2 degrees Celsius
- Temperatures ranged from 10.7 degrees to 22.2 degrees Celsius
- Kitchen back door Bud had lowest average temperature, front room front door had highest average temperature
- Kitchen back door had highest HTC values with an average HTC value of 312 W/C, Bud placed at the bottom of the stairs had the lowest HTC value of 180 W/C

Security Classification: Privileged

HTC Validation

- Calculated HTC is within 10% of co-heating test result.
- Sensor should not be positioned by external window, doors or fireplace
- HTC levels out at 12 days into analysis. Two weeks of data should be viable.
- Further tests are being conducted following additional wall insulation. Expected to finish in Nov ’23. Results will not be available in-time for the project.
- Accuracy is enough to validate major improvements have been made to a property.