HEAT PUMP READY: OXFORDSHIRE

FINAL REPORT

CITY SCIENCE

delivering decarbonisation

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1 Executive Summary

Heat energy, which now accounts for over a third of the UK's carbon emissions, has been described as "the greatest decarbonisation challenge the UK faces to meet its net zero carbon commitment" (Regen, 2020). The Climate Change Committee describes that the "bulk of the challenge to decarbonise buildings remains, with the greatest challenge on decarbonising heating…barely yet addressed" (Climate Change Committee, 2020).

The Government has committed to ensuring that the transition to low carbon buildings is affordable and achievable for all and has committed to delivering a package of measures to scale up the deployment of heat pumps to 600,000 per annum by 2028 (Department for Business, Energy and Industrial Strategy, 2022). This is a sizeable challenge that requires new innovations to overcome widespread barriers to large-scale heat pump deployment.

This report presents the final key findings and evidence developed in the Heat Pump Ready: Oxfordshire Phase 1 project and will be used by the Department for Energy Security and Net Zero, and other stakeholders who may be interested in developing an approach to coordinated heat pump deployment. Phase 1 was a feasibility study that considered the viability of achieving high density heat pump deployment in Cherwell, Oxfordshire and developed a recommended methodology to achieve this goal. Phase 2 is planned to begin in early 2023 where the project teams will implement the recommended methodology, and ultimately provide the delivery of high-density heat pump deployment in the target areas.

The key findings derived from the research conducted in Phase 1 suggest the project's proposed approach to achieving high-density heat pump deployment is promising. The key findings included:

- Prosumer Model/System: A Prosumer Model (or system) is where consumers combine electricity generation (such as solar photovoltaic) with battery storage and a heat pump. The project's financial modelling demonstrated that against the context of rising energy prices, a Prosumer Model offers the opportunity to save ~£800/annum when compared to a heat pump retrofit without solar PV. Phase 1 engagement evidenced an enthusiasm for combining solar PV with a heat pump to improve financial attractiveness and increase self-sufficiency. The project team is confident that offering a Prosumer System will be more attractive to householders compared to offering heat pumps alone, therefore supporting heat pump uptake more generally and increasing the potential for high-density deployment.
- One Stop Shop: The term 'One Stop Shop' is used to describe a trusted service that removes barriers for complex projects, making them more easily achievable. In this case, a One Stop Shop offers trustworthy, expert advice to enable householders to understand how to install a Prosumer system in their home and guides them through the entire customer journey. The One Stop Shop enables the customer to obtain tailored advice and product/supplier recommendations. If the householder wants to go ahead, the One Stop Shop can provide access to trusted suppliers, help with project management, and assess the quality of work undertaken. The service includes providing advice on how to run the new system effectively once it is installed. Significant evidence from engagement throughout Phase 1 confirmed that a One Stop Shop approach is an attractive and necessary solution to support the widespread adoption of heat pumps.

- Financing: Under the Energy Price Guarantee, the Prosumer System has the potential to be 6% - 24% cheaper than retaining a gas boiler over a 30-year period (dependent on the building typology). A Prosumer Model is therefore significantly more attractive to a broad range of consumers and will maximise heat pump uptake. However, Phase 1 engagement provided overwhelming evidence that the upfront cost is a significant barrier to adoption. For this reason, we need to ensure that barriers to accessing finance are removed for everyone in the market. The team estimates that providing financing options within the One Stop Shop that reduce upfront costs in an affordable way will significantly increase uptake.
- Target Area Suitability: The building level modelling conducted in the project provided evidence that the target areas within NW Bicester are the most likely areas suitable for high-density heat pump deployment within Cherwell, Oxfordshire. This analysis was based on the imposed constraints and requirements of Phase 2 funding (such as having 85% or more target properties on-gas) and other site selection factors (such as building typology and EPC rating). In the target areas there is a high proportion of bungalows whose large surface areas are optimal for installing PV, and whose comparatively larger living spaces increase the likelihood of suitability for heat pumps and required home upgrades.
- Deep, Localised Engagement: Engagements and other research provided evidence that a localised approach that harnesses consumer power and social proof (where consumers value evidence that others have had success with heat pumps) is attractive and important to householders. A community approach that involves targeted localised engagement (such as community events and door to door engagement) is, therefore, an important consideration for achieving high-density deployment in a single area.

Although reaching the Phase 2 density requirements presents a significant challenge, Phase 1 research has evidenced that the project approach (which combines a One Stop Shop, a Prosumer Model, financing options and deep localised engagement) has a good chance of significantly boosting uptake in the target area. For this reason, the project team applied for Phase 2 funding with an innovative model and project plan:

- Prosumer Model: Core to the model is a Prosumer approach that bundles heat pumps, retrofit, and onsite generation. The Prosumer Model also insulates consumers from energy price volatility, provides greater opportunities for community self-sufficiency, and reduces grid impacts.
- Consumer-Centric Approach: We simplify the consumer journey by recommending a One Stop Shop that coordinates energy efficiency advice, feasibility, financing, installation, to aftercare.
- Deep Localised Engagement: Our deep local engagement builds on critical learnings from Project Local Energy Oxfordshire and the National Energy Foundation's local experience through Cosy Homes Oxfordshire and the 'Better Housing Better Health' service. We address consumer barriers through an embedded community-based, street-by-street engagement methodology that harnesses social proof and maximises consumer buying power.
- Digital Pathways: Our approach applies a digital-first model, building on customer engagement learnings from Phase 1. This ensures that all heat pump deployments are SMART, including standardised data to capture the benefits of advanced analytics and associated learnings.

- Innovative Financing: Innovative approaches that bring together existing financial products to reduce cost and enhance the customer experience have been investigated throughout Phase 1 to fund additional measures and realise the benefits of the Prosumer Model.

2 Introduction

This report presents the final key findings and evidence developed in the Heat Pump Ready Oxfordshire Phase 1 project and will be used by the Department for Business, Energy and Industrial Strategy (BEIS), and other stakeholders who may be interested in developing an approach to coordinated heat pump deployment.

The project is within Stream 1 of the Heat Pump Ready Programme funded by BEIS (BEIS, 2021). The objectives included understanding the viability of achieving the required density of heat pump deployment in Cherwell, Oxfordshire with the identification of suitable target locations. Phase 2 funding provides 40% of the heat pump cost, therefore requiring householders to fund the remaining 60% of heat pump installation costs. For this reason, the project considers a Prosumer Model (which combines heat pump installation with solar photovoltaic (PV) generation and battery storage) to make the offering more financially attractive to householders. In addition, evidence relevant to heat pump delivery was consolidated, and a supply chain support strategy and One Stop Shop blueprint were developed. Key components of the project and solution are detailed in Figure 1.

	Elements	What's Needed?
Consumer-Centric Approach	• Simplify consumer pathways by providing a One-Stop-Shop for energy efficiency, coordinated through existing local networks	• Key goal is to create a viable blue-print and initial collateral for the one-stop-shop.
Deep Localised Engagement	• Building on local best practice and learnings from Project LEO • Community-based, street by street engagement methodology	• Evidence to support uptake forecasts for Phase 2
Prosumer Model	• An approach that bundles heat pumps, retrofit and on-site generation • Opportunity for protection against price volatility and self-sufficiency	• Evidence that the prosumer model can be delivered in practice and meet 25% density requirements within a LV Network in Phase 2
Digital Pathways	• Digital-first model building on key customer engagement learnings from Trust Power	• Assurance that all heat pumps are SMART by default. • Capture the benefits of advanced analytics and associated learning via standardised data
Innovative Financing	• Researching financing options	• An evaluation of options for financing and recommendations for how these will be tested in Phase 2 (subject to application)

Figure 1 - Key Elements of the Project

The project was led by City Science, with key contributions by Oxfordshire County Council, the National Energy Foundation, Growth Guides, Trust Power, and Lendology. The total funding awarded for Phase 1 was £198,400 (exclusive of VAT).

3 Aims, Objectives & Expected Outcomes

The aims of our Phase 1 feasibility study were to:

- Investigate the viability of achieving high-density heat pump deployment in Cherwell, Oxfordshire.
- Develop a recommended methodology to achieve high-density heat pump deployment that is designed to be replicable anywhere in the UK.

The objectives of the feasibility study were to:

- Investigate, understand, and evidence the viability of high-density heat pump deployment in Cherwell, and identify favourable locations.
- Develop a One Stop Shop blueprint that includes a Prosumer Model offering.
- Test the suitability and attractiveness of Prosumer Model and One Stop Shop concepts.
- Develop a supply chain strategy.

The expected outcomes of the project were to:

- Reduce costs to consumers.
- Minimise barriers to uptake.
- Understand impacts/mitigations on the grid.

4 Summary of Work Packages

This section provides a description of how the delivery of the Phase 1 work was structured, outlining work packages, key activities, and deliverables.

The project work packages were delivered by a highly experienced, multi-disciplinary team including:

- Oxfordshire County Council: This is a local authority at the forefront of taking climate action and engages in a multitude of pioneering decarbonisation projects.
- National Energy Foundation: An independent domestic energy and sustainability charity who have been at the forefront of improving the use of energy in buildings. They focus on implementing projects to help residents feel warmer whilst helping them cut the cost of their bills.
- City Science: An ambitious technology company that support local authorities, national government and private organisations with decarbonisation strategies and activities using cutting-edge advances in data, analytics, and technology.
- Trust Power: This is a data and consumer modelling company with experience developing whole-house approaches and streamlining delivery of digital energy services. They also have extensive experience financing direct to customers and community schemes and have developed customer journeys including One Stop Shops.
- Lendology: This is a social enterprise and community lender specialising in energy efficiency. They have experience in financing solutions for consumers and community schemes.
- Growth Guides: A consumer marketing company specialising in new technologies and a critical player in the development of the one stop shop.

The project teams were organised as shown in Figure 2.

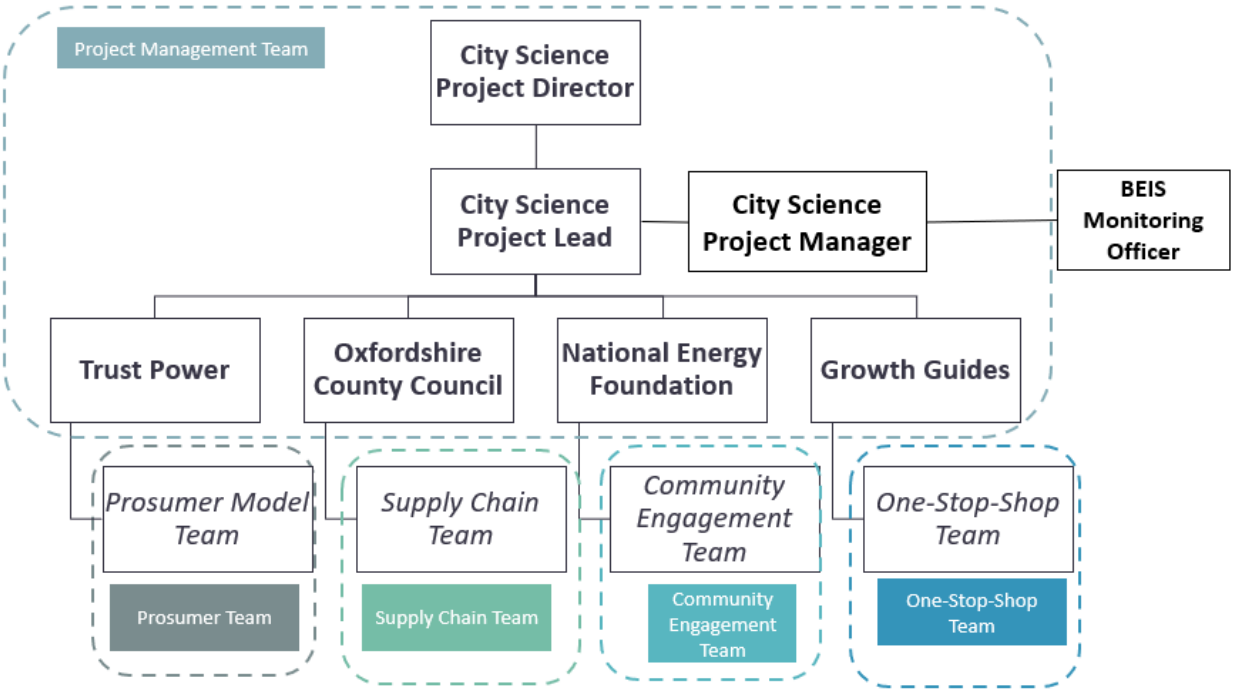

Figure 2 - Heat Pump Ready Oxfordshire Organogram

Project Governance & Management Team: This team was comprised of the core members of the Project Delivery Board and oversaw all work packages and the successful delivery of the project (work package 1). The project governance and management team also oversaw all reporting tasks (work package 7).

Prosumer Team: The prosumer team developed the prosumer model, including techno-economic modelling of technical bundles (work package 2) and financial modelling and development of the prosumer process (work package 3).

Community Team: The community team undertook user research and community co-design (work package 4).

Supply Chain Team: The supply chain team worked with the supply chain to identify learnings, develop the procurement model and work with strategic stakeholders to develop a supply chain support strategy (work package 5).

One Stop Shop Team: The One Stop Shop team took learnings from best practice and feedback from community engagement to develop the streamlined customer journey and One Stop Shop (work package 6).

4.1 Work Package 1: Project Management

Duration: 01/07/2022 – 30/11/2022

Lead: City Science

Purpose: The purpose of this work package was to complete the core project management processes that will allocate tasks, manage risks and dependencies, and provide ongoing project progress reporting to the Department for Energy Security and Net Zero. The Critical Success Factor was for all tasks, milestones, and deliverables to be delivered on-time and to budget.

Key Activities:

- Produced inception documentation.
- Delivered monthly external Monitoring Officer meetings.
- Provided internal coordination amongst consortium members and key stakeholders.
- Delivered a Project Closure meeting.

Deliverables:

- Inception meeting
- Interim project report

4.2 Work Package 2: Building Level Modelling

Duration: 01/07/2022 – 12/09/2022

Lead: City Science

Contributors: Oxfordshire County Council (OCC)

Purpose: To develop a Building Level Model that enables the quantification of heat pump installation viability by building typology and the identification of viable target areas in Cherwell, Oxfordshire.

The Critical Success factor was to provide a clear, systematic, standardised, costed technology approach that can be utilised for target area selection.

Key Activities:

- Reviewed spatial mapping from the Local Energy Oxfordshire project.
- Analysed and stratified the building stock within Cherwell.
- Selected key typologies.
- Developed technical modelling of heat pump technologies, retrofit actions, on-site generation, and other ancillary technologies for each of the build typologies.
- Modelled capital costs of different technology/installation options against the Department for Energy Security and Net Zero's benchmarks, evidencing cost-reductions to consumers.

Deliverables:

- Interim Technology Options Summary Report
- Technology Options Summary Report

4.3 Work Package 3: Prosumer Model

Duration: 01/01/2022 – 24/10/2022

Lead: Trust Power

Contributors: City Science, Lendology, Scottish and Southern Energy Network (SSEN) and OCC

Purpose: The purpose was to develop the prosumer model consumer offering. The Critical Success Factor was to provide evidence that a Prosumer Model can be delivered in practice and that it can meet the requirements for 25% density within a low voltage Network in Phase 2.

Key Activities:

- Developed the Prosumer Model.
- Understood where it is viable, what key contracts and practical measures need to be in place, and how financing should be arranged.
- Reviewed best practice to ensure this is captured in solution design.

Deliverables:

- Prosumer Model Research Summary Report
- Prosumer Model Evidence Summary Report

4.4 Work Package 4: Community Engagement

Duration: 01/07/2022 – 28/11/2022

Lead: National Energy Foundation

Contributors: City Science, OCC and Growth Guides

Purpose: To undertake community/user testing to support the development of the Prosumer Model and One Stop Shop offering and provide evidence of its potential to meet density requirements. The

Critical Success Factor was to provide evidence that our solution can galvanise sufficient community engagement and up-take to deliver the required levels of heat pump density in Phase 2.

Key Activities:

- Community Engagement to understand existing barriers to heat pumps.
- Co-design the key elements of the One Stop Shop.
- Tested the Prosumer Model.
- Evidenced that the street-by-street engagement approach will deliver the required density in Phase 2 and identify communities interested in heat pumps/Prosumer Model.

Deliverables:

- User Evidence Summary Report.
- Engagement Evidence Summary Report.

4.5 Work Package 5: Supply Chain Engagement

Duration: 01/07/2022 – 21/11/2022

Lead: City Science

Contributors: OCC and NEF

Purpose: To undertake supply chain testing to support the development of the Prosumer Model and One Stop Shop offering. The Critical Success Factor was to develop and evidence an inclusive, robust, and fair approach to the supply chain that will enable it to deliver through the One Stop Shop in Phase 2.

Key Activities: Includes undertaking engagement with the Supply Chain to:

- Identified lessons learnt from previous installations.
- Captured and validated in-practice cost experiences against the Department for Energy Security and Net Zero's benchmarks and identified opportunities for cost savings.
- Identified disruptive technologies with the potential to deliver cost savings.
- Developed and agreed the procurement model for the One Stop Shop.
- Identified minimum quality assurance processes that will be embedded in the delivery to protect the One Stop Shop.
- Developed a wider supply chain support strategy based on interactions and learnings.

Deliverables:

- Supply Chain Experiences Engagement.
- Costs and Barriers Summary Report.
- Preferred Procurement Strategy Agreed.
- Supply Chain Strategy Summary Report.

4.6 Work Package 6: One Stop Shop Design

Duration: 18/07/2022 – 30/11/2022

Lead: Growth Guides

Contributors: NEF, OCC and City Science

Purpose: To develop and refine the One Stop Shop offering. The Critical Success Factor was to create a viable blueprint and initial collateral for the One Stop Shop.

Key Activities:

- Reviewed existing portals and provided independent evidence/validation of the trust in local brands currently in operation.
- Identified the core elements that need to be operational (e.g., digital journey, stream-lined survey, customer service, contracts, financing etc.) and designed the delivery plan to enable these.

Deliverables:

- One Stop Shop Operations Summary Report.

4.7 Work Package 7: Reporting and Phase 2 Application

Duration: 01/07/2022 – 30/11/2022

Lead: City Science

Contributors: National Energy Foundation and OCC

Purpose: To provide final reporting and the dissemination of outputs. The Critical Success Factor was to ensure that all reporting deliverables were delivered on time and were of sufficiently high quality.

Key Activities:

- Project reporting.
- Dissemination.
- Phase 2 Application.

Deliverables:

- Phase 2 Application.
- Final Report.

5 Methodology for Feasibility Study

Table 1 describes how the tasks in the key work packages were carried out.

Work Package 2: Building Level Modelling	
Review of Spatial Mapping from Project Local Energy Oxfordshire (LEO)	An initial list of data requirements was created by the City Science team. A meeting was held with the Project LEO team to discuss the project's data requirements and the data Project LEO could provide access. Project LEO provided the relevant data and City Science conducted a review of the spatial mapping data and investigated gaps. See Technology Options Summary in the appendix for full details and findings.
Fill Spatial Mapping gaps	City Science filled the remaining spatial mapping gaps by accessing data from the District Network Operator. See Technology Options Summary in the appendix for full details.
Stratify Building Stock within Cherwell	City Science researched different methods for stratifying the building stock and included them in a slide deck.
Agree Focus Typologies	The slide deck was shared with the internal team, who evaluated the advantages and disadvantages of utilising different methodologies, and a methodology was chosen to align with the Department for Energy Security and Net Zero's previous work. See Technology Options Summary in the appendix for full details and findings.
BEIS Benchmark Analysis	The team conducted a desk-based review of publicly available resources, and collated identified cost types and their value. The team also utilised BEIS/government websites to identify resources that provide relevant air source and retrofit costs and extracted relevant costs. BEIS was contacted to obtain underlying cost data from the Cost-Optimal Domestic Electrification (CODE) report. The team also reviewed air source, retrofit cost data and reports online from research bodies and consultancies conducting heat pump research. They also looked for leads via the MCS website as this site has the most abundant data on air source heat pumps. See Cost & Barriers Summary in the appendix for full details and findings.
Technical Modelling of Technology Options	This task developed a Building Level Model. The following inclusions were built into the model: BEIS benchmark requirements, modelling data and prosumer technology options (air source heat pumps, solar PV, battery storage). See Technology Options Summary in the appendix for full details and findings.
Technology Cost Modelling First Draft	The ability to incorporate and quantify the cost and financial viability/attractiveness of heat pump installation and running costs at 10-, 20- and 30-year intervals were built into the model. See Technology Options Summary in the appendix for full details and findings.
Analysis of Viable Sites within Cherwell	The developed model and GIS layers were visualised in mapping software to reveal locations that meet the project's criteria. The four best performing areas were discussed with Oxfordshire County Council to gain local knowledge/nuances between each area. A target location and back up location were then selected and the DNO provided a detailed secondary substation analysis confirming that the selected location has sufficient capacity to be targeted for Phase 2. See Technology Options Summary in the appendix for full details and findings.
Work Package 3: Prosumer Model Development	
Prosumer Model Best Practice Review	Collated relevant literature and performed a Prosumer Model best practice review. See Prosumer Model Evidence Summary in the appendix for full details and findings.

Technical Standardisation	The team conducted research into available technologies relevant to the Prosumer Model and the degree of standardisation across technologies. A spreadsheet was developed providing key information such as key manufacturers, sizes of products, and compatibility considerations across heat pumps, heating system upgrades, retrofit/energy efficiency measures, and prosumer capacity (generation and energy storage). See Prosumer Model Evidence Summary in the appendix for full details and findings.
Technology Cost Validation Engagement	Suppliers in the Oxfordshire area were researched and mapped, and 63 suppliers were contacted. We developed an Excel-based form to send to willing installers to validate costs collated, as well as any omitted costs. The revised costs were fed back into the financial model. See Cost & Barriers Summary in the appendix for full details and findings.
Financial Model	Utilising the validated costs, the financial model (in the Building Level Model) was updated to identify the most cost-effective package of interventions (i.e. comparing heat pump only, heat pump with fabric retrofit, heat pump with fabric retrofit and solar, etc). The model considered both the capital and operational cost of interventions and compared these options against a baseline of continuing to operate and maintain a gas boiler. See Technology Options Summary in the appendix for full details and findings.
Financial Viability Analysis by Typology	Utilising the Financial Model as detailed above, the outputs were analysed to identify optimum typologies for heat pump deployment. This was then used to establish the financial viability of deploying heat pumps in target areas. See Technology Options Summary in the appendix for full details and findings.
Consultation with Financers	A pitch deck was created and shared with a variety of potential financiers during 1:1 engagements. During the meetings we discussed the project/consumer requirements, financing options, advantages and disadvantages of those options, interest rates and Phase 2 involvement.
Phase 2 Prosumer Model Plan	An internal workshop was held to discuss the Prosumer Model and One Stop Shop learnings to date (from WP3 and WP6). This included a breakdown of what is considered a Gold Standard and Minimum Standard offering. From this understanding, the team decided which elements of the Prosumer Model should be offered in the One Stop Shop. See One Stop Shop Operations Summary in the appendix for full details and findings.
Contracts	An internal workshop was held to discuss contracting requirements. The team considered the following: • Necessity of direct contracts between the installers and the consumer • Necessity of contracts between the installers and other subcontractors and the One Stop Shop/City Science • Relevant/innovative clause inclusions for the contracts • Implications for the customer journey See One Stop Shop Operations Summary in the appendix for full details and findings.
Work Package 4: Community Engagement	
Engagement Evidence Design, Planning and Activities	Developed a plan of activities to include: • Barriers Research Survey • Barriers Research Door to Door • Prosumer Model testing • One Stop Shop/Phase 2 Plan Testing

	See User Evidence Summary in the appendix for full details and findings.
Barriers Research Survey	This was a national survey to understand consumer heat pump awareness and barriers. The survey was live for 30 days. 1307 survey responses were received, with 183 from Oxfordshire. See User Evidence Summary Report in the appendix for full details and findings.
Prosumer Model Testing	The task sought to answer what is attractive from a consumer perspective. Key Prosumer Model questions were developed in a workshop with all project partners and were woven into the door-to-door research questions.
Door to Door Research	Door to door research was conducted in the target area in Cherwell. 83 surveys were completed. The questions covered the Prosumer Model, One Stop Shop and sought to provide evidence of how many volunteers for phase 2 are interested. See User Evidence Summary in the appendix for full details and findings.
One Stop Shop/Phase 2 Plan Testing and Validation	This task tested the complete package that was proposed for phase 2. An online workshop held with three members of NEF's SuperHomes Network. The SuperHomes Network is a network of organisations with an interest in domestic retrofit. The network members include around 12 local authority and housing association landlords. See User Evidence Summary in the appendix for full details and findings.
Work Package 5: Supply Chain Engagement	
Supply Chain Experiences Engagement	NEF reached out to suppliers in three key areas of interest to the project. 1:1 interviews were arranged with engaged suppliers. The suppliers interviewed included a prosumer system installer, a solar systems installer, a heat pump installer and a prosumer system and retrofit installer. Prior to the interview, the insight interview questions were written, and a review was conducted by project partners. See Costs & Barriers Summary in the appendix for full details and findings.
Cost Analysis / Reporting	A cost analysis was conducted based on learnings from the Supply Chain Experiences Engagement and the Technology Cost Validation Engagement (WP2). The team utilised responses to identify any inaccurate costs in the model and update to include the most accurate/reliable source. A summary of the validated costs (covering heat pumps, solar PV, battery storage and retrofit measures) was written. See Costs & Barriers Summary in the appendix for full details and findings.
Delivery / Procurement Strategy Options Appraisal	Utilising feedback received from engagement with the supply chain, procurement options were reviewed and considered to identify the optimum method for securing high quality, reliable goods and resources, whilst maintaining a seamless customer experience as part of the One Stop Shop. See Supply Chain Support Strategy in the appendix for full details and findings.
Supplier Quality Assurance Requirements	Based on the identified procurement strategy, the required quality assurance requirements were mapped out to ensure quality could be measured and controlled throughout the supply chain. See Supply Chain Support Strategy in the appendix for full details and findings.
Supply Chain Support Strategy Development	Utilising feedback received from engagement with the supply chain, key bottlenecks and supply chain risks were established, with mitigating support strategies identified. These included mitigations for both national and local barriers. See Supply Chain Support Strategy in the appendix for full details and findings.

Supply Chain Support Strategy Shared / Validated with Stakeholders	The supply chain support strategy was shared with selected key stakeholders. In the session, changes to the strategy were discussed and a consensus was gained.
Work Package 6: One Stop Shop Design	
Review of existing Digital Channels/Websites /Portals/Brands	The team identified and collated a range of existing digital channels, websites, portals, and brands that provide a One Stop Shop. The review analysed the functionality, strengths and weaknesses of the existing One Stop Shops and provided initial recommendations for our One Stop Shop. Different approaches to content and branding were recorded and trends were identified. See Developing a One Stop Shop Blueprint – Initial Recommendations in the appendix.
One Stop Shop Customer Journey	Trust Power developed two Customer Personas and a Customer Journey Map for the One Stop Shop based on the review of existing digital channels, websites, portals, and brands. The Customer Journey Map included five stages of the customer journey, customer thoughts/considerations at each stage and pain points. See One Stop Shop Operations Report in the appendix for results.
Systemise Process for Technology Inclusion in One Stop Shop	The team researched and developed a template for a Gold Standard and Minimum Standard offering. The templates included different levels of technology inclusion. The templates were discussed, and the team decided which technologies would be included within the One Stop Shop and how they would be presented/accessed. See One Stop Shop Operations Report in the appendix for results.
One Stop Shop Operations/ Delivery Internal Workshop	We held an internal workshop to develop an understanding of what operational and delivery components are required to support the development of the proposed One Stop Shop inclusions/functionality.
Operational Delivery Design	The operational delivery design was written based on the outcomes of the One Stop Shop Operations/Delivery Internal Workshop. See One Stop Shop Operations Report in the appendix for results.
Branding/ Content Focus Groups	A series of four 60-minute focus groups were held to investigate comprehension of and appeal of the Prosumer Model, the likely expectations of a One Stop Shop and reactions to a series of branding elements (name, logo, colours, etc). In addition, approaches to quantifying emissions savings were investigated. In total eight respondents took part, six of which were from Oxford and two from outside the region. All respondents were homeowners and represented potential One Stop Shop customers.
Agree Branding Strategy	The branding strategy was developed following the learnings from the Branding and Content Focus Groups. The branding was shared in an internal workshop where we agreed on the initial branding strategy. The strategy covered the name of the One Stop Shop, tone of voice, language, logo, colour palette, and other considerations.
Collateral Development	From the agreed branding strategy, Growth Guides developed collateral including home page content, a press release, flyer, and other collateral that can be used in Phase 2.
User Testing & Validation	An online workshop was held with three members of NEF's SuperHomes Network to test opinions on whether the One Stop Shop proposal is appropriate.

Table 1 - Feasibility Study Method

6 Work Package Findings

This section provides a summary of the deliverables and key findings from the individual work packages. Work packages 1 (Project Management) and 7 (Reporting and Phase 2 Application) have been deliberately excluded.

6.1 Work Package 2: Building Level Modelling

6.1.1 Building Level Model

Work package 2 consisted of developing a Building Level Model with the purpose of mapping the electricity substation areas and the building stock in Cherwell. This allowed us to estimate retrofit requirements of building typologies and provide a financial analysis of heat pump deployment for each substation catchment area. Ultimately, the work allowed us to identify the most viable substation catchment areas in Cherwell that are likely to achieve deployment density requirements. Further details can be found in the Technology Options Summary in the appendix.

Financial Modelling

The Building Level Model considers a variety of elements including modelling data and prosumer technology options (heat pumps, Solar PV, Battery Storage). A Financial Model is built into the Building Level Model to determine the most financially viable sites. 26 Archetypes were considered which were generated from nine core building typologies, split by EPC band and (in some cases) wall type. Those with EPC rating A or B and cavity walls are considered to require minor energy efficiency retrofit investment and therefore are more financially viable. Full details can be found in the Technology Options Summary in the appendix.

The model also considers the lifetime cost of a gas boiler compared to an air source heat pump and compared to an air source heat pump combined with solar PV, for the archetypes at 10-, 20- and 30-year interval scores (see Table 2).

		HP Only			HP + PV			
	Building Type	**Lifetime Cost % diff – 10 year**	**Lifetime Cost % diff – 20 year**	**Lifetime Cost % diff – 30 year**	**PV System Size (kWp)**	**Lifetime Cost % diff – 10 year**	**Lifetime Cost % diff – 20 year**	**Lifetime Cost % diff – 30 year**
Low tariff: Green Book Projection	bungalow	-66%	-71%	-53%	4.5	-88%	-60%	-27%
	mid_terrace_solid	-108%	-90%	-63%	4.5	-126%	-79%	-39%
	mid_terrace_cavity	-81%	-86%	-64%	5.0	-103%	-73%	-37%
	end_terrace_solid	-105%	-80%	-52%	5.0	-121%	-68%	-27%
	end_terrace_cavity	-86%	-89%	-66%	5.0	-103%	-74%	-38%
	semi_detached_solid	-93%	-69%	-44%	5.0	-108%	-56%	-19%
	semi_detached_cavity	-78%	-80%	-59%	5.0	-93%	-66%	-32%
	detached_solid	-145%	-113%	-75%	5.0	-163%	-102%	-51%
	detached_cavity	-134%	-133%	-96%	5.0	-151%	-120%	-69%
High tariff: Energy Price Guarantee 2022-2024	bungalow	-17%	-23%	-13%	3.0	-10%	-3%	13%
	mid_terrace_solid	-35%	-29%	-14%	3.0	-28%	-11%	9%
	mid_terrace_cavity	-26%	-31%	-20%	3.0	-18%	-12%	6%
	end_terrace_solid	-29%	-19%	-4%	3.5	-22%	-1%	20%
	end_terrace_cavity	-27%	-32%	-19%	3.5	-19%	-11%	7%
	semi_detached_solid	-22%	-13%	0%	3.5	-15%	5%	24%
	semi_detached_cavity	-22%	-26%	-16%	4.0	-14%	-5%	12%
	detached_solid	-49%	-36%	-16%	3.0	-43%	-20%	6%
	detached_cavity	-51%	-54%	-34%	3.5	-43%	-35%	-9%

Table 2 - Results of Financial Modelling with 10-, 20- and 30-year interval scores

In a low tariff scenario, after 10 years a heat pump without added prosumer elements (solar PV) will be between 66% and 145% more expensive than replacing with a gas boiler. When looking at a 30-year period, the energy cost savings gained reduce the overall cost, however replacing a gas boiler with a heat pump will still be between 44% and 99% more expensive, depending on the building archetype.

In a high tariff scenario (where electricity costs are more favourable compared to gas), the cost of replacing a gas boiler with a heat pump remains much higher. However, in this scenario, semi-detached houses with solid walls are expected to reach breakeven in year 30. This means that when considering the initial cost of installation, plus energy use, maintenance fees and replacement costs over the 30-year period, heat pumps will cost the same as a gas boiler for this archetype.

However, looking at the scenario where the gas boiler is replaced with a Prosumer System (heat pump and solar PV), under the high tariff projections, the householder breaks even more quickly, and the system becomes cheaper than the gas boiler. A Prosumer System installed in a semi-detached house with solid walls is projected to be 5% less expensive than a gas boiler in year 20. By year 30, the Prosumer system is less expensive for all archetypes (except for detached houses with cavity walls) and offers up to 24% cost savings vs gas boilers.

A key conclusion from the above analysis is that retrofitting an existing property with a heat pump is likely to cost more than replacing it with a gas boiler. The addition of a Prosumer System will improve the financials of the heat pump retrofit if the owner is willing to make a long-term investment. The Prosumer System is still likely to cost more than the gas boiler in the short term, but we could see a breakeven point long term if energy prices stay high (20 years plus). Furthermore, it is clear the impact of the cost of energy is substantial and will have a high influence on the financial attractiveness of heat pumps and the prosumer system moving forward.

Locations for High Density Deployment in Cherwell

The model was used to determine the potential to install heat pumps at 25% density at the primary substation level. The results of the primary substation analysis were that all primary areas require a significant amount of heat pumps to be deployed (>250) and have a low percentage of buildings with mains gas connections (<50%).

At primary substation level, all areas scored poorly (<25%) on our developed Heat Pump Ready Priority metric due to a low number of on-gas properties and the presence of protected properties. The metric prioritises properties that are domestic, on-gas, not protected/listed, and not social housing. From this analysis it was concluded that targeting a primary substation area is less favourable than targeting a secondary substation area.

The model was then used to determine the potential to install heat pumps at 25% density at the secondary substation level. We found that each supply area has between 0 and 1,000 addresses. Figure 3 shows the average 10-year interval scores within Cherwell. The green areas show where replacing a gas boiler with a heat pump would be least expensive over a 10-year period, compared to replacing it with a gas boiler. Higher numbers/darker green is therefore more favourable. Areas without colouring are those where no domestic EPCs were available, so scoring could not be determined. More densely populated areas in Banbury and Bicester typically had more favourable scoring areas.

Further analysis was undertaken on the mapped secondary substations to determine the four most appropriate locations. The following filtering conditions were used:

- Number of addresses less than 150 (to ensure the number of installs required to reach 25% density was achievable in Phase 2).
- Percentage of on-gas properties greater than 85% (to align with the Department for Energy Security and Net Zero's project restrictions).
- Percentage of social housing properties less than 20% (to align with the Department for Energy Security and Net Zero's project restrictions).
- Percentage of Heat Pump Ready Priority greater than 70% (to ensure the buildings chosen were highly suitable for the project).

The results from filtering left 161 areas, some of which in clusters. Targeting a cluster of areas would allow us to build in redundancy if the District Network Operator's (DNO) further analysis finds an area unsuitable, or if an area lacks engagement with the programme. The distribution of areas was sufficiently small enough that several could be targeted for engagement.

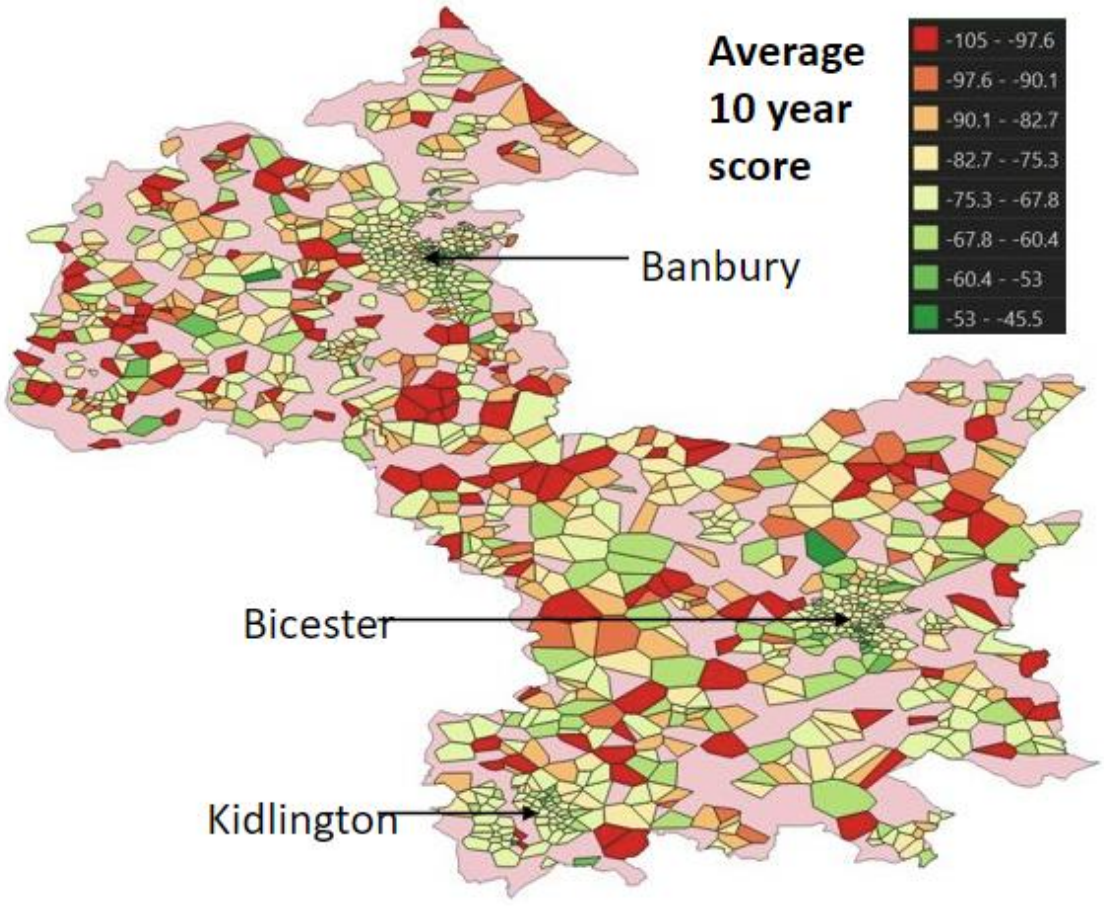

Figure 3 - Average 10-year interval score Cherwell

Four locations within Cherwell were shortlisted: Yarnton, Begbroke, Northwest (NW) Bicester and South Banbury. The Building Level Model does not take local knowledge or community culture into consideration. For this reason, a workshop was held to share the four locations with Oxfordshire County Council officers, who hold extensive local knowledge. The officers were able to provide valuable information pertaining to likely community engagement and the potential for more detailed

network data. From this discussion, the location options were narrowed down to two sites: Yarnton and NW Bicester.

Engagement with Local Authority officers highlighted that Yarnton had a greater sense of community and may be easier to target in communications, given that properties in the region are situated around a village hall. Furthermore, the electricity network in this area is being researched as part of Project: Local Energy Oxfordshire (LEO) providing an opportunity for the provision of enhanced, granular data. Furthermore, they highlighted that NW Bicester residents may be more open, or familiar with and accepting of low carbon technologies due to a new Ecotown being developed in the neighboring area. Ecotowns are a government-sponsored programme of new towns to be built in England, which are intended to achieve exemplary standards of sustainability.

Both the discussion with Local Authority officers and consideration of the following characteristics: Affluence; Building typology; Community culture; Occupant Age; Internet Use, led to NW Bicester being our chosen location (see Technology Options Summary Report in the Appendix).

SSEN (the DNO for the area) performed a detailed analysis on the target substations. Our targeted area falls under the Bicester primary substation and Bicester North bulk supply point with headroom capacity of 39 MVA and 95 MVA respectively. Headroom data on secondary substations is not readily available from SSEN, therefore, as part of our analysis in Phase 1, they undertook a capacity analysis of 12 substations within Northwest Bicester that were selected by our geospatial prioritisation methodology. The capacity analysis found that several substations could support 25% density heat pump deployment. We estimate that the headroom on two of our selected substations could support 34% density heat pump deployment. This is close to our expected 26% density; therefore, we have flagged this potential capacity risk to SSEN and we will work closely with them to ensure that these substations will have sufficient capacity to support our installation of heat pumps.

6.2 Work Package 3: Prosumer Model Development

In BEIS's Heat Pump Ready: Supporting Information Background on Innovation Needs report, a key recommendation was to trial different finance business models (such as Prosumer Models and One Stop Shops at scale to understand how effective they are and identify the models most suitable for different consumer profiles (BEIS, 2021). For this reason, our project sought to integrate the Prosumer Model within a One Stop Shop.

In the above research, the Prosumer Model is described as a model where consumers produce electricity (e.g. solar generation) and combine this with battery storage and a heat pump. Due to decreasing PV Feed-in-Tariffs and increasing retail prices of electricity, utilising generated PV electricity onsite at the household level has become more attractive than feeding it back into the grid. By combining PV with lithium-based battery storage with a heat pump, prosumers can maximise their PV self-consumption by storing electricity generated during the day for powering their heat pump during the night. The benefit of this model is that the consumer can radically reduce heat pump running costs by utilising electricity generated on site.

6.2.1 Phase 2 Prosumer Model

Commissioning and installing a Prosumer System is complex and often requires a householder to liaise between multiple suppliers to ensure the Prosumer System components (retrofit measures, home upgrades, the heat pump, solar PV and battery storage) are installed in the correct order. For

this reason, the Phase 2 project will develop a design for a One Stop Shop to support this process, therefore enabling an accelerated uptake of heat pumps.

It was necessary for the project team to scope out which Prosumer System components should be available for purchase in the project's One Stop Shop. Considering there are no existing One Stop Shops that specifically offer all components of the Prosumer System, the team was required to glean best practice principles from similar low carbon technology One Stop Shops (see the Developing a One Stop Shop Blueprint – Initial Recommendations in the appendix for details).

Following the review, the best practice principles were used to develop theoretical "Gold Standard" and "Minimum Standard" product offering scenarios that are specific to a Prosumer System One Stop Shop.

Gold Standard Product Offering Scenario: The gold standard product offering is the highest possible standard of product offering. In this scenario, the One Stop Shop includes the option of purchasing all Prosumer technologies in one place for utmost convenience. In addition, this offering includes a variety of models/sizes of each Prosumer component. This is so the vast majority of consumers find components that are viable for installation in their homes. The product offering includes:

- Air source heat pump.
- Solar PV.
- Battery storage.
- Retrofit measures.
- Home upgrades (such as radiators, hot water cylinder).
- Any other components that allow the system to interact (inverter, charge controller).

Minimum Standard Product Offering: The minimum standard product offering is the smallest viable product offering. To meet the concept of a One Stop Shop, at minimum the site should include heat pumps, solar PV, battery storage, home upgrades and required components. It was decided that the minimum viable offering could exclude the installation of retrofit measures. In this scenario, the customer is expected to seek external advice and services to retrofit their property prior to purchasing Prosumer elements from the One Stop Shop.

In terms of product options, the minimum offering scenario only includes one to two options per Prosumer element, which means that the specific products offered on the site may not be suitable for every home. The benefits of this option are that the One Stop Shop is easier to manage, however, the customer journey experience is negatively impacted which may cause a barrier to uptake when compared with the gold standard offering. Furthermore, in this scenario the One Stop Shop operator loses control over the implemented retrofit measures, which means that it cannot guarantee that the system will run optimally.

Chosen Product Offering: A workshop was held to compare the gold and minimum standard offerings and decide what the project's One Stop Shop product offering would include. To ensure payback is achieved within 20 – 30 years and to decarbonise the homes as far as possible, it is vital that customers retrofit their homes as needed prior to the rest of the system being installed. For this reason, it was decided that the gold standard product offering should be implemented in the project's One Stop Shop. Full details can be found in the One Stop Shop Blueprint summary report in the annex.

In addition, the team conducted research into available technologies relevant to the Prosumer Model and the extent of technical standardisation (see Prosumer Model Evidence Summary in the appendix).

The exact product offering is dependent on the offering provided by the suppliers contracted during the mobilisation stage of Phase 2. The learnings from the project will be embedded into the procurement specification developed during the mobilisation stage, to ensure that high quality, reputable products are offered as part of the system. Such relevant key learnings include making the process as easy as possible for users. This means that contractors need to work differently. For example, to make it simple for a user, consumers would need to be able to book their retrofit slot via the One Stop Shop in the same way they are used to reserving slots for their shopping. Therefore, these interfaces (between the One Stop Shop and the contractor processes) need to be set out in the procurement. Ultimately the project will aim for the Prosumer Model offering to include enough versions of each product to provide for most customers. This will enable faster and more successful uptake of the Prosumer System (and therefore heat pumps).

6.2.2 Financing Outcomes

Our modelling (15.1) evidenced that against the context of rising energy prices, a Prosumer Model offers the opportunity to save ~£800/annum when compared to a heat pump retrofit without solar PV. Under the Energy Price Guarantee, the Prosumer System has the potential to be 6% - 24% cheaper than retaining a gas boiler over a 30-year period (dependent on the building typology). A Prosumer Model is therefore significantly more attractive to a broad range of consumers and can maximise heat pump uptake.

The pricing for Prosumer Model components is decreasing, and while the upfront investment is still taking several years to generate a payback, increasing energy costs will likely drive consumer action. Even then, we need to ensure that barriers to accessing finance are removed for everyone in the market. There is a significant proportion of consumers who do not have access to fair rates of credit, which is currently a significant barrier to being able to afford to fund a Prosumer System, even with the use of some element of grant funding. With the increasing numbers of people falling into the fuel poverty bracket, it is anticipated that without intervention the Cost-of-Living crisis could worsen.

Maximising the number of consumers able to access credit to afford a Prosumer System will have the additional benefit of attracting investment to the sector, driving economies of scale and bringing it within the realms of affordability for most. There are multiple forms of credit available in the market. During Phase 1, we engaged 10 possible financiers (see Table 3) and have identified a considerable supply of funding ready to lend. Options for lending include point-of-sale finance, no interest loans, mortgage lending, unsecured borrowing, equity release, credit unions, PACE model, asset leasing and other products, such as those offered by Lendology. Detail on the advantages and disadvantages of each finance model can be found in the appendix.

Supplier Type	Number of Suppliers Engaged
Building Society	4
Bank	4
Fin Tech / Other	5

Table 3 - Financier Engagements

In terms of the customer journey, our preferred option is a point-of-sale loan with mortgage re-finance. This model allows the customer to secure funding immediately while having the confidence that they will switch to the lowest possible borrowing rate over the longer term. However, the financial attractiveness of this option (compared to say the Lendology model) has been materially affected during Phase 1 by external movements in interest rates. While at the beginning of the project indicative mortgage lending rates were ~3.65%, these rose to above 6% by the end of the project. As a result, additional borrowing became substantially more expensive, and less attractive for householders during the project.

Our project also investigated the current state-of-the-art with respect to green mortgages. Green mortgages offer reduced interest rates for owning or buying energy-efficient properties and therefore provide an incentive for increasing the energy efficiency of the home. Brown mortgages, in comparison, are mortgages that do not offer reduced interest rates for energy-efficient properties.

Our investigation sought to understand the difference (or spread) between the cost of green mortgages compared to brown mortgages. Table 4 shows the lifetime saving achieved between green and brown mortgages for different levels of mortgage value. The spread is currently 10 basis points or bps (which is a unit of 0.01%). For example, if a green mortgage offers an interest rate of 3.65% and a brown mortgage offers 3.75%, the spread is 10bps.

In the above scenario, a £400,000 mortgage with a current spread of 10bps provides ~£6,000 of saving if the customer qualifies for a green mortgage. The current spread between green and brown mortgage rates is therefore not large enough to cover the costs of energy efficiency measures (such as retrofitting the property and installing solar PV and heat pumps). Therefore, they do not offer a large enough incentive to encourage homeowners to invest in energy efficiency measures. The incentive increases as the spread increases. Using the £400,000 mortgage value example, if the spread was 100bps, the benefit increases to ~£62,000 over the life of the loan. Policies that support the widening of spreads between green and brown mortgage rates could provide a stronger incentive to invest in a wide range of retrofit measures.

Sensitivity Table										
Spread	10bps	20bps	30bps	40bps	50bps	60bps	70bps	80bps	90bps	100bps
Mortgage Value										
50,000	(803)	(1,601)	(2,395)	(3,184)	(3,968)	(4,747)	(5,522)	(6,292)	(7,057)	(7,817)
100,000	(1,606)	(3,202)	(4,789)	(6,367)	(7,936)	(9,494)	(11,044)	(12,584)	(14,114)	(15,635)
150,000	(2,409)	(4,803)	(7,184)	(9,551)	(11,903)	(14,242)	(16,566)	(18,876)	(21,171)	(23,452)
200,000	(3,212)	(6,404)	(9,579)	(12,734)	(15,871)	(18,989)	(22,088)	(25,168)	(28,228)	(31,270)
250,000	(4,014)	(8,006)	(11,973)	(15,918)	(19,839)	(23,736)	(27,610)	(31,460)	(35,285)	(39,087)
300,000	(4,817)	(9,607)	(14,368)	(19,101)	(23,807)	(28,483)	(33,132)	(37,751)	(42,342)	(46,905)
350,000	(5,620)	(11,208)	(16,763)	(22,285)	(27,774)	(33,231)	(38,654)	(44,043)	(49,399)	(54,722)
400,000	(6,423)	(12,809)	(19,158)	(25,469)	(31,742)	(37,978)	(44,176)	(50,335)	(56,457)	(62,539)
450,000	(7,226)	(14,410)	(21,552)	(28,652)	(35,710)	(42,725)	(49,698)	(56,627)	(63,514)	(70,357)
500,000	(8,029)	(16,011)	(23,947)	(31,836)	(39,678)	(47,472)	(55,220)	(62,919)	(70,571)	(78,174)
550,000	(8,832)	(17,612)	(26,342)	(35,019)	(43,645)	(52,220)	(60,741)	(69,211)	(77,628)	(85,992)
600,000	(9,635)	(19,213)	(28,736)	(38,203)	(47,613)	(56,967)	(66,263)	(75,503)	(84,685)	(93,809)
650,000	(10,437)	(20,814)	(31,131)	(41,387)	(51,581)	(61,714)	(71,785)	(81,795)	(91,742)	(101,627)
700,000	(11,240)	(22,416)	(33,526)	(44,570)	(55,549)	(66,461)	(77,307)	(88,087)	(98,799)	(109,444)
750,000	(12,043)	(24,017)	(35,920)	(47,754)	(59,517)	(71,209)	(82,829)	(94,379)	(105,856)	(117,261)
800,000	(12,846)	(25,618)	(38,315)	(50,937)	(63,484)	(75,956)	(88,351)	(100,670)	(112,913)	(125,079)

Table 4 - Mortgage Value and Spread of Mortgages

Our long-term preferred model is to use green mortgages combined with point-of-sale finance. However, given interest rate movement through the project, we believe the most attractive financial offer to consumers at the end of the project will be the Lendology model which provides loans at a flat rate of 4%. This model also allows customers to spread the upfront cost over a term that is affordable to them. Given the uncertainty in future interest rates we have retained flexibility for

Phase 2 to ensure we can provide the most cost-effective option to homeowners at the appropriate time. Full results can be found in the Prosumer Model Evidence Summary in the appendix.

6.3 Work Package 4: Community Engagement

6.3.1 Barriers Research Survey

Our first steps of this work package were to design, distribute, and analyse a national heat pump survey. Overall, 1,307 responses were gained with 183 respondents from Oxfordshire. The survey was distributed via National Energy Foundation and Oxfordshire County Council mailing lists. Analysis of the survey data provided a range of recommendations we can utilise for the project. A full write-up of the results can be found in the User Evidence Summary in the appendix.

Generally, the responses showed a positive attitude towards heat pumps with 86% aware of the government policy change to phase out of fossil fuel boilers. Only 3% of respondents had not heard of heat pumps before. However, it is noted that the sample was skewed toward the consumers who had an interest in low carbon technologies.

What was clear from the responses is the need for strong Government advice and peer-to-peer learning as key methods to instil public confidence in heat pump installation. This strengthens evidence of the need to develop a One Stop Shop that is backed by local government and peer reviews. The results also show certain demographics and house types are more willing to consider heat pumps, particularly those aged between 46-60 who live in detached and semi-detached homes. This means that the project partners can specifically target these groups in future stages of the project. Clear trends regarding the cost of heat pump installations emerged, with 75% of respondents saying they would generally pay a maximum price of £5,000 for heat pump installation. Therefore, the project should fund at least £5,000 to incentivise the public to consider the technology.

It has been assumed that respondents shown in Figure 4 who heat their home using biomass, LPG, oil and solid fuel are located off the gas network. Off gas respondents are more inclined to change to heat pumps (see Figure 4).

‘Only if it would save me money’ – 40% off gas versus 45% on gas.

‘Even if it might be more expensive’ – 34% off gas versus 31% on gas.

‘Regardless of environmental benefits’ – 26% off gas versus 24% on gas.

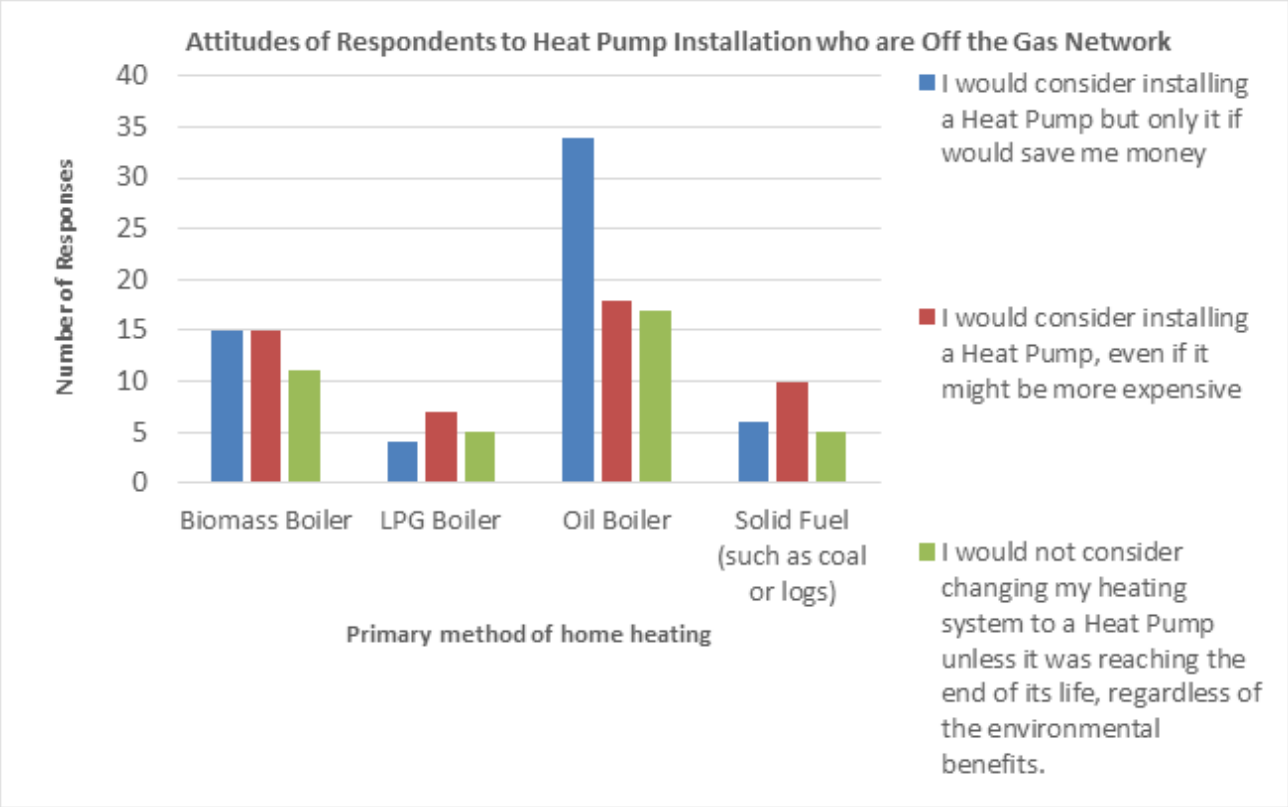

Figure 4 - Attitudes of Respondents to heat pump Installation who are off the Gas Network

Across all age groups, there appears to be a healthy willingness to consider alternative heating systems (Figure 5). The 18 to 30 age group appears to be more cautious, however, this is likely a result of this group having less disposable income. The 61 to 75 age group includes retired homeowners, e.g. empty nesters, who are likely to have more disposable income. It is encouraging that this age group and above do not appear to be overly averse to change.

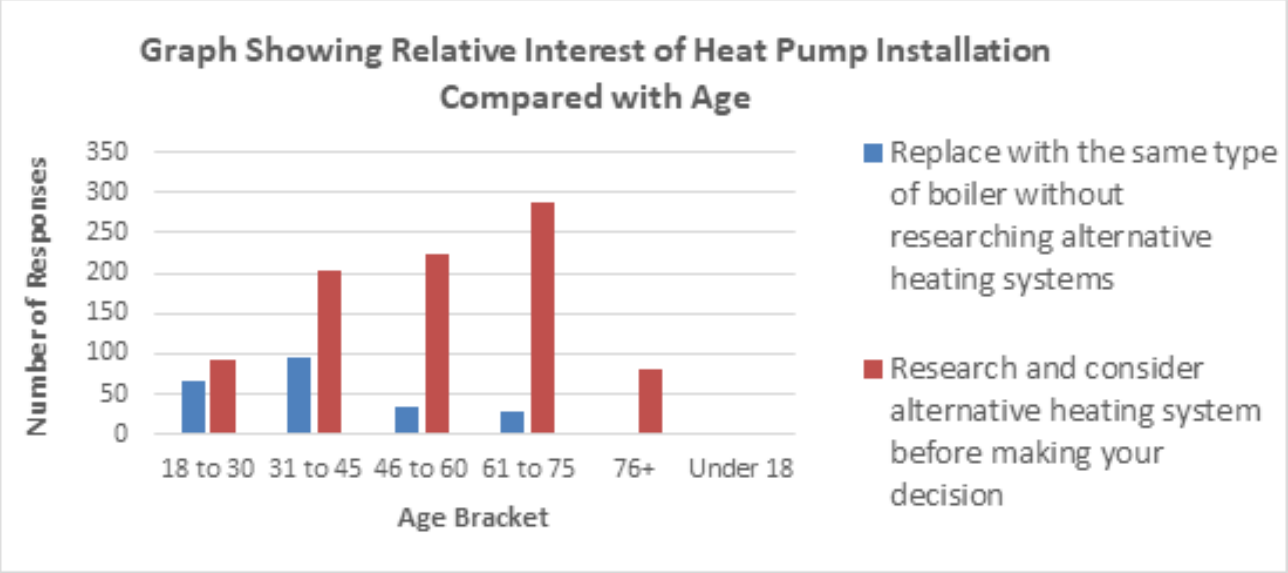

Figure 5 - Relative Interest in heat pump Installation Compared with Age

In conclusion, the initial insights from this survey analysis provided us with key recommendations to take forward into the next stage of the project. The headline recommendations include the targeting of specific age groups, house types and income levels for the mass deployment of heat pumps and

ensuring clear and reliable guidance is available to uphold confidence levels about the installation and maintenance of heat pumps.

6.3.2 Door-to-Door Research

The National Energy Foundation undertook door-to-door surveys in the target area of NW Bicester. A community of homes was identified for inclusion via the Building Level Modelling based on their suitability to meet the various Phase 1 and 2 Heat Pump Ready programme requirements. The objective of the door-to-door surveys was principally twofold, to ascertain the relative levels of interest in the proposed Phase 2 project and test the proposed Prosumer Model. 83 surveys were completed, at 15% of the community sample whereby ~530 doors were knocked over one week.

The findings were that 42 homeowners said they were interested in becoming a Prosumer with 17 of them serious about doing so in the next 12 months. 11 respondents expressed interest in participating in a Phase 2 trial, even at this early stage in the life of the project. 25 homeowners indicated interest who were considering a slightly longer window prior to installation, however, in some cases this would potentially still align with the Phase 2 project timescales. Surveys revealed that more homeowners are currently considering solar PV over heat pumps, as would be expected given PV's previous market penetration. There was clear evidence from those most interested that they wished to gain the benefits offered by installing a Prosumer System and bought into the technological and IT aspects.

The concept of a local Green Energy Advice Service via a One Stop Shop model was generally well received, with 52% believing that a One Stop Shop would be beneficial and 53% believing that having vetted installers is an attractive proposition. The strength of a community type project moving 'en masse' was felt to be slightly less important (supported by 47% of respondents), although some respondents were very keen on this, and it remains to be tested against a peer group.

It should be remembered that as the first proper project engagement exercise, momentum would be expected to build as more coherent information becomes available. Similarly, the emergence of common branding in a relatively compact community area would likely garner more interest over time.

On the negative side, the overwhelming barrier to the adoption of a Prosumer Model is cost. The value of the grant would need to be adequate to incentivise investment and early adoption of the Prosumer Model. Homeowners would be seeking value for money supported by their desire to see a minimum of three competitive quotations. This suggests that a minimum of three suppliers would be required under the One Stop Shop model. The ability to offer attractive and affordable finance packages as planned would help to overcome the cost barrier to some extent. It should be remembered that expressing a keen interest in participating in a project and making an actual investment can be very different.

From what was observed in the door-to-door engagement, the community generally cannot be described as an especially affluent one and the cost of living and energy supply crisis was on the minds of many participants. There is a high number of bungalows invariably occupied by the elderly who generally did not express a motivation to become a Prosumer.

Through a coordinated and sustained approach to community engagement supported by effective marketing activity in Phase 2, it is assumed that the service offer could progressively generate and build more interest, potentially leading to the adoption of the Prosumer Model in the community.

The door-to-door surveys have revealed that the whole service offer must be desirable, high quality, independently backed, trusted and affordable. The ability to carry out further testing before implementation in Phase 2 would be worthwhile and beneficial to both the project team and members of the community.

Full results can be found in the User Evidence Summary in the appendix.

6.3.3 One Stop Shop/Phase 2 Plan Testing and Validation

A key task in this work package was to test the marketing and branding materials (not currently available for public viewing) related to the One Stop Shop delivery model with a representative group of ten future customers. The online session was successful and valuable feedback was obtained, which will enable the collateral to be refined and further developed during the mobilisation phase of Phase 2. Key findings included:

- The word “independence” can be used to encourage trust in the service.
- The proxy group identified several useful tweaks to improve the informational graphics and Prosumer Model descriptions.
- Highlighting the recommendation for a fabric-first approach is important to consumers.
- The use of the word “green” may connote greenwashing to some consumers.
- It should be highlighted that the detailed home surveys are subsidised.
- Messaging related to embracing and investing in the future was seen as powerful.

Full results can be found in the User Evidence Summary in the appendix.

6.4 Work Package 5: Supply Chain Engagement

6.4.1 Supply Chain Experiences Engagement

The National Energy Foundation reached out to suppliers in three key areas of interest to the project: heat pump installation, solar PV, battery storage installation, and retrofit. The engagement aimed to identify supply side barriers and a deeper knowledge of customer demographics and motivations. The four suppliers interviewed included:

- Supplier 1: Prosumer System Installer
- Supplier 2: Solar Systems Installer
- Supplier 3: Heat Pump Installer
- Supplier 4: Prosumer System and Retrofit Installer

A full analysis and results of the engagement can be found in the Cost & Barriers Summary in the appendix. Key supply-side barriers which need to be factored into the procurement strategy include:

- Customer demand for heat pumps, building fabric upgrades, and PV are increasing. As this is a growing market, suppliers will be placed under increased pressure to match supply with demand.
- Due to this increased demand, the availability of suitably skilled/experienced installers is low. The impact of this is increased cost and longer lead times.
- Current mechanisms for funding (grant and/or debt finance) are complex and slow.
- Sourcing components (particularly batteries) is challenging, resulting in increased costs and longer lead times.

- The heat pump supply chain is relatively immature (compared to conventional boilers), resulting in slow/unpredictable lead times.
- Negative customer experience from poorly installed heat pumps can significantly damage reputation and lead to reduced uptake.
- A general lack of information about the suitability of heat pumps is causing reduced uptake.

Further recommendations from the research have been collated below.

Customer Demographics & House Types:

- Age 40+ and those with existing heat pump knowledge are key demographics to target.
- When targeting younger groups there should be an emphasis on connection to apps/performance monitoring.
- Those living in detached properties with 3 or more bedrooms are more likely to invest in heat pumps.
- Householders living in flats should not be targeted as they are hardest to treat for standalone solutions.
- No evidence suggested that targeting a particular age of building is necessary.

Customer Motivations & Retention:

- Marketing strategy and materials should focus on reducing costs bysaving on energy bills and becoming more self-sufficient and energy secure.
- The project team should expect traction when marketing the 40% Department for Energy Security and Net Zero funding.
- The Prosumer Model is likely to increase the uptake of heat pumps compared to offering heat pumps alone.
- The One Stop Shop must offer retrofit measures in addition to the Prosumer System components.
- Customer attrition rate at the detailed planning stage can be minimised by being upfront regarding costs early in the process.
- The energy crisis and potential recession are likely to increase the customer attrition rate.
- Aftercare is vital to ensure customers understand how to optimise the system and avoid bad word-of-mouth experiences for heat pumps.

Prevailing Marketing Conditions:

- Customer demand for heat pumps and solar PV is increasing.
- Availability and skill of installers present a risk to the project and installation lead times.
- There is a need for simplified access to funding.

Barriers to Widespread Adoption:

- Supply chain crisis and availability of the product technologies are likely to affect the project's deployment speeds.
- Requirement to involve multiple suppliers in Phase 2 to ensure demand can be met.

- Phase 2 will benefit from a targeted marketing approach that educates the householders on heat pump technologies and their benefits.

6.4.2 Supply Chain Support Strategy

The core theme of this project is to identify and alleviate as many barriers as possible, to ensure heat pump deployment can occur smoothly and efficiently. One of the most significant barriers identified is the juvenile state of the supply chain.

We investigated the key barriers identified during our supply chain engagement activities and sought to identify mitigations (via support mechanisms) to these barriers where possible. A full write up of the results can be found in the Supply Chain Support Strategy Summary in the appendix.

Demand Outstripping Supply

Customer demand for building fabric upgrades, and PV are increasing. As this is a growing market, demand is currently outstripping supply in certain areas. Due to this increased demand, the availability of suitably skilled/experienced installers is low. The impact is increased cost and longer lead times.

One way to ensure supply matches demand is by providing installers, and the wider supply chain, with certainty over the quantity and timing of demand. Due to the quantitative data held on target areas, and the known density requirements and stage gates for Phase 2, the quantity and timing of installs can be predicted with greater certainty than if installers were selling to single households in a broader area. By providing installers with this certainty, they can invest in scaling up their operations with reduced commercial risk.

Beyond Phase 2, this approach is repeatable by continuing to target hyper-local areas, and grouping/managing installations to ensure the supply chain has greater predictability over future demand.

Slow and Complex Funding Mechanisms

Current mechanisms for funding (grant and/or debt finance) are complex and slow. This is primarily due to current funding mechanisms not being designed with the sector in mind, and therefore often being unsuitable.

As part of Phase 1, we have engaged with a broad spectrum of funders to identify opportunities to modify existing lending mechanisms to provide tailor-made financing products for the sector. As part of Phase 2, we propose embedding these financial options into the One Stop Shop to effectively connect funders with households requiring finance. Doing so will significantly reduce the (perceived) complexity of taking out additional borrowing and reduce the application time.

Difficulty in Sourcing Components

Sourcing components (particularly batteries) is challenging, resulting in increased costs and longer lead times. By providing predictability over the quantity and timing of demand, lead times can be built into the installation plan and accommodated. By grouping installations into ‘batches’, our approach can engage directly with technology/component suppliers as it increases buying power.

Through discussions with heat pump manufacturers, we have identified an opportunity to purchase heat pumps directly from a single manufacturer (Daikin). In doing so, this has two key benefits (1) The cost to the consumer is reduced through eliminating installer margins and achieving greater

quantity discounts, (2) reduces the burden on installers having to source components, enabling them to focus on installation. We propose similar relationships are developed during the mobilisation of Phase 2 with other key technologies/components, including solar panels, batteries, and insulation.

Low Quality Installation Damaging Technology Reputation: Negative customer experience from poorly installed heat pumps can significantly damage reputation and lead to reduced uptake.

Effective quality assurance procedures will be built into both the procurement stages and post installation checks of our Phase 2 approach. This will ensure installers are suitably qualified and experienced. Only accepting installers that have industry recognised qualifications will signal the need to invest in appropriate training and development in the sector. In doing so, we aim to encourage all installers to raise quality levels to access lucrative, high value contracts.

Through discussions with the local and district authority, we have identified opportunities to signpost companies to suitable training providers in the area, to allow them to meet the qualification requirements. By encouraging the enhancement of quality, we aim to increase credibility within the sector, which will ultimately lead to faster uptake, and potentially increased pay for skilled staff.

Despite these activities, residual risk will remain through 'bad experience' stories from other areas of the UK (and abroad) that are currently outside of the scope of influence for Phase 2. However, if the approach is deployed nationally beyond Phase 2, then the scope of influence will filter throughout the UK and have a greater impact on overall quality within the sector.

Lack of Skill in Identifying Suitable Properties

Many heat pump installers are diversifying into the sector from parallel sectors (gas/heating engineers, air conditioning engineers). Whilst they are often suitably qualified to install equipment, they are not always suitably qualified/experienced in identifying which properties are/aren't suitable.

Our proposed approach incorporates a two-phase survey. The first should be an online suitability tool which should combine publicly available data, with consumer-provided information, to determine the potential suitability of the property in a fast and cost-effective way. For those properties that are determined to be potentially suitable, an in-person survey will be offered to accurately determine the suitability, as well as confirm the specific package of retrofit measures that best suit the property and its occupants. By incorporating these surveys into the customer acquisition stages of the approach, installers are not required to assess/advise on suitability and can focus on installation. This will increase their capacity for installations, as well as reduce their risk of misidentifying suitable properties.

Lack of 'Full Scope' Installers

There are a limited number of 'full scope' installers who can provide heat pumps, fabric retrofit, PV, and battery installations. This increases the disruption to householders through needing to coordinate multiple suppliers. As the market develops from a transitional market (i.e. the slow transition from gas, to electric heating systems), to a more developed, stable market, we expect there to be an increase in the number of companies that can offer a 'full scope' offering. However, as this is currently rare, our One Stop Shop approach effectively creates this 'full scope' offering through actively managing the supply chain on behalf of the consumer. Through the delivery of this service, we aim to stimulate uptake through reducing disruption, which will ultimately result in the sector maturing more quickly.

Reliance on Government Policy

The deployment of heat pumps at scale is being driven by government policy through the phasing out of fossil fuelled boilers and the recommendation of heat pumps as a decarbonising solution. As the market is heavily reliant on these policies (rather than organic consumer demand), there is a heightened risk that a change of policy and/or government could significantly reduce the market. This risk contributes to the reluctance of some companies heavily investing in the sector.

To avoid overreliance on government policy, it is important to educate consumers on the benefits of heat pumps so that the decision to purchase is based on desire, rather than necessity. Central to our One Stop Shop approach is the delivery of reliable, trusted information on the operational, environmental, and economic advantages of heat pumps and the associated retrofit measures. Our aim is to use this information sharing to stimulate customer desire to install a heat pump, regardless of government policy. Achieving this will support the supply chain to obtain greater certainty over the long-term growth of the sector, resulting in lower risk investment.

As detailed above, we have identified several practical supply chain support mitigations for the key supply chain barriers identified during our engagement with companies operating in the sector. These mitigations have been discussed during interviews with companies operating both in the local area and nationally, who took the view that they could have a positive impact on the sector.

6.5 Work Package 6: One Stop Shop Design

In this work package, we mapped out the operational delivery design elements of the One Stop Shop and the associated requirements that must be delivered at the beginning of Phase 2. This work also detailed the confirmed project offering and the operational delivery requirements associated with delivering the project. The team produced a One Stop Shop Operations Summary report which can be found in the appendix. A One Stop Shop Blueprint was also developed. This blueprint will be made publicly available once the One Stop Shop has been launched. Below lists the key design features and operational requirements.

6.5.1 Key Design Features

One Stop Shop Website: A website to support the end-to-end customer process.

1. Development of a website (utilising suitable available white label back-end elements where possible).
2. Development of branding (utilising branding work in Phase 1).

Customer Service: To provide expertise and support at key stages of the customer journey.

1. Develop a partnership with a company that can provide customer service advisors that have heat pump, solar and battery storage expertise and experience in coordinating installations. The company should have customer service processes ingrained.
2. Source upfront financial cover for the account manager for the duration of the trial. (In BAU this will be covered by a % commission.)

Technology & Inclusions: The Prosumer Model products offered in the One Stop Shop.

1. Aim to develop a partnership with a larger supplier that can provide multiple components of the system.

2. Curate a supplier mix that can collectively offer all the included technologies.
3. The specific product models offered are dependent on confirming the suppliers. The product model offering will be curated from the suppliers' existing offerings.
4. Account managers with knowledge of all the technologies and with the ability to liaise between multiple suppliers.
5. Decide whether to allow customers to purchase solar only.

6.5.2 Customer Journey Steps and Associated Requirements

Part of Work Package 6 was to understand the stages a customer goes through when entering the programme. Figure 6 shows the five stages of the customer journey, from first awareness of the project through to purchase and aftercare:

Figure 6 - Five Stages of the Customer Journey

Awareness & Consideration: The customer becomes aware of the project, finds the landing page, and reads through the high-level explanation of what the service is.

The One Stop Shop needs to support initial awareness of the concept and allow the customer to actively learn more about the Prosumer Model and start to evaluate the potential benefits and costs. The requirements include:

1. Development of informational pages, drawing from the collateral produced in phase 1.
2. Development of case studies (preferably in Oxfordshire).
3. Consideration of how we inspire/motivate the customer to move forward.
4. Call to action to enter their email and use the feasibility tool.
5. Integration of email capture and process to contact the customer.

Suitability & Feasibility: The customer uses the online tool to check if the service is suitable for them.

The One Stop Shop needs to enable the customer to understand whether their home and finances might be suitable and whether the offering is desirable to them. The technical requirements include:

1. Build a similar tool to the Cosy Homes Free Plan Builder tool.
2. Develop a webpage for tool integration.
3. Integrate the ability/process to capture contact details at this stage.
4. Develop collateral for the page.
5. Consider how to manage user expectations of cost savings.

Detailed Planning: After completing the suitability tool, the customer books a home survey where more detailed planning is given, as well as costs and timelines.

To plan the Prosumer Model, the functionality of the One Stop Shop must include:

1. A page with a booking system that integrates with the supplier's booking system or if this is unfeasible, develop a process for making bookings via the site.
2. Develop a customer portal.

3. Develop the page collateral.
4. Ensure cost savings are presented in a way that does not oversell the benefits.
5. Develop a feedback mechanism.
6. Explore the potential to offer a whole house retrofit plan.

Commissioning & Installation: After the site visit, the customer is provided with product options. The customer decides on the installation and financing options and is contacted by a dedicated account manager to book the installations.

Commissioning requires:

1. Development of a page or portal which enables the account manager to upload recommendations and for the customer to select their choice. Page should include the option to print the recommendations.
2. Develop the page collateral.
3. Investigate how the proposition can be simplified and not overwhelming to the customer.

Installation requires:

1. Develop a process for supplier contact/flow of information to the customer.
2. Develop a mechanism for feedback.

Quality Assurance & Aftercare: Post-installation, the customer is provided with supporting materials to use their new system effectively. They are provided with reassurance that the system has been installed correctly and ongoing support for the running and maintenance of the system.

Quality Assurance technical requirements:

1. Investigate how to build in an audit process for the contractors.
2. Develop a partnership with a surveying company that can provide the site analysis (in detailed planning) in addition to the quality audit.
3. Develop a process for issues (e.g. issues are reported to the Account Manager, faults in equipment go back up through the supply chain).
4. Develop a mechanism for feedback.

Aftercare technical requirements:

1. Develop a transfer pack.
2. Include one call in the package agreed with the customer service company.
3. Develop a self-diagnostic tool if possible. Develop a text-based FAQ as a backup option.
4. In the procurement of installers, require them to offer ongoing support post project (e.g. 7 year warranty).
5. Develop a process for end of project support.
6. If a customer portal is used, develop functionality to include aftercare information in the portal.

6.5.3 One Stop Shop Branding

Following the Branding focus groups, key learnings were processed along with lessons from Growth Guides' initial report on existing One Stop Shops for domestic retrofitting (see Developing a One Stop Shop Blueprint – Initial Recommendations Summary in the appendix). Core strategic considerations have been outlined, along with a brand blueprint that covers the brand's strategic objectives and provides examples of creative development.

All the evidence, including our own focus groups, suggests the nature of a Prosumer Model-style retrofit project is sufficiently new, complex, expensive and disruptive that independent trusted advice is seen as essential by most people open to considering it.

It will need to provide input through all aspects of the customer journey, but its immediate priority is to get customers onto the journey by explaining the approach and showing prospective consumers how it might help them.

Providing information online is as absolutely crucial and a scalable digital-first solution is vital for achieving heat pump deployment at scale. Telephone and face-to-face options were generally not seen as important, however the online service does need to have real people behind it and provide genuine responses to enquiries, in addition to the ability to serve customers who do not have access to smartphones. Customers can be driven to the site via a variety of locally targeted communications, such as door-to-door visits and community events. Ultimately, a flexible 'pick-and-mix' approach to services is recommended where consumers can choose which aspects they need help with.

A One Stop Shop Blueprint has been created which includes brand positioning, purpose, vision, mission, values, personality and tone of voice. Initial collateral for the website has also been created. This will be publicly available following the launch of the One Stop Shop.

7 Innovative Methodology

7.1 Innovative Model

The consensus of Phase 1 findings is that more-effective coordination between relevant stakeholders is critical to overcoming barriers to heat pump deployments (see sections 6.4, 6.5, and User Evidence Summary, Cost and Barriers Summary, and Supply Chain Support Strategy Summary in the appendix). To achieve this, our project pioneers the following innovative recommendations:

7.1.1 Prosumer Model

Core to our recommended model is a Prosumer approach that bundles heat pumps, retrofit, and onsite generation. Phase 1 research has shown that against various scenarios (see section 6.1 and Technology Options Summary in the appendix), a Prosumer Model offers the best opportunity to reduce energy costs for consumers and insulate them from the energy price volatility. Modelling suggests that considering current and projected gas and electricity prices, alongside the high initial cost of heat pump installation, switching to a HP system is currently significantly more expensive than retaining a gas boiler over 30-year period scenarios (see section 6.1 and Technology Options Summary in the appendix).

In comparison, against the context of rising energy prices, a Prosumer Model offers the opportunity to save ~£800/annum when compared to a heat pump retrofit without solar PV. Under the Energy Price Guarantee, the Prosumer System has the potential to be 6% - 24% cheaper than retaining a gas boiler over a 30-year period dependent on the building typology (see section 6.1). A Prosumer Model

is therefore significantly more attractive to a broad range of consumers and can maximise heat pump uptake.

The Prosumer Model also provides greater opportunities for grid innovation if ambitious levels of on-site generation can be achieved alongside heat pumps, opening up opportunities to explore shared community assets (e.g. storage) and flexibility services to reduce impacts on the grid.

7.1.2 One Stop Shop

The current consumer journey for heat pump installation is complex for consumers to navigate (see sections 6.4, 6.5, and User Evidence Summary, and Cost and Barriers Summary in the appendix). A One Stop Shop that enhances and simplifies the customer journey by providing everything in one place is recommended (see section 6.5 and One Stop Shop Operations Summary in the appendix). Throughout Phase 1 the One Stop Shop concept and branding were tested, providing substantive evidence that a One Stop Shop is both viable and desirable (see section 6.3, 6.4 and the User Evidence Summary in the appendix). The One Stop Shop should provide the customer with a single point of contact that integrates financing, project management, design, and support services. This should be led through a consumer-focused design that meets the needs of key local stakeholders. Digital and face-to-face recruitment methods that are backed by trusted partners (such as local authorities) should be utilised to maximise impact and heat pump uptake (see sections 6.3, 6.5 and One Stop Shop Blueprint Development – Initial recommendations in the appendix).

7.1.3 Digital Pathways

It is recommended that the approach applies a digital One Stop Shop, building on customer engagement learnings from Phase 1 (see section 6.3 and User Evidence Summary in the appendix). This means that the customer journey of the One Stop Shop should be seamlessly processed digitally to minimise barriers. This approach will enable the consumers to be shown the expected benefits of the Prosumer Model early on in the process and enable them to compare this to their existing tariff.

Furthermore, we know that suppliers provide smart heat pumps, however, there is currently no open, interoperable standard. For this reason, the approach should ensure that heat pump deployments are SMART by default and can be coordinated using standardised data within a closed ecosystem. This will enable an understanding of the wider benefits of improved flexibility and performance.

7.1.4 Consumer/Community Engagement & Recruitment

The approach to engaging consumers is user-centric with deep, localised engagement. This recommendation is informed by key learnings from Project LEO (see section 6.1), NEF's local experience through Cosy Homes Oxfordshire, the 'Better Housing Better Health' service, and the project's Phase 1 research (see User Evidence Summary in the annex). Based on these learnings, consumer barriers should be addressed and consumer buying power should be maximised to encourage recruitment. This should be conducted through a community-based, street-by-street engagement methodology, undertaking in-depth engagement with households in selected clusters. This approach was successful in Phase 1 where the project engaged with around 1,600 individuals (see section 6.3 and User Evidence Summary for further details).

Furthermore, during Phase 1 research, social proof was found to be essential (see User Evidence Summary) for increasing heat pump uptake. This is where householders are reassured when someone in their community installs a heat pump and are then more likely to install one themselves. Integrated community engagements can simultaneously provide a key mechanism for building social

proof and will assist in raising awareness and knowledge of heat pumps. This can be enforced by targeted local marketing and a community-based engagement officer who provides a key link and coordination between consumers and the Prosumer Model.

7.1.5 Consumer Retention Throughout the Customer Journey

The One Stop Shop provides a streamlined customer journey that focuses on customer retention at each stage (see section 6.5 and One Stop Shop Operations Summary in the appendix).

Customer Relationship Management: From the Awareness & Interest stage, automated data capture and targeting marketing should be used throughout the customer journey to maximise uptake. Existing methods and tools utilised by successful companies (such as Compare the Market) should be replicated to encourage customers to return to the One Stop Shop and progress through the customer journey.

Fully Digital Pathways & Consumer Centric Approach: The One Stop Shop site should provide a fully digital customer experience and streamlined customer journey (see the Developing a One Stop Shop Blueprint – Initial Recommendations in the appendix). By providing rich yet accessible information at the awareness stage, customers will be armed with the knowledge required to progress and expedite their decision to install heat pumps. A digital initial feasibility tool provides a quick and easy way for the consumer to understand whether a Prosumer System is right for them, including indicative costs and benefits. Booking a Detailed Home Survey will be simple with an integrated booking system. From there, the customer's online portal is tailored with a choice of product options. The availability of an Account Manager enables consumers to decide the level of support they receive along the way.

Aftercare within the One Stop Shop: An issue with current heat pump installations is that consumers do not understand how to use the heat pump control panel (see User Evidence Summary). Customer information can be streamlined by working closely with reputable organisations (such as Daikin, TrustMark) and consumers, making it much more engaging, and easy to understand. The aftercare provision will instil trust in the service and encourage consumers to commit to the Prosumer System.

Customer Journey Insights: Mechanisms that provide the Engagement and Marketing Coordinator with feedback on the digital customer journey should be embedded throughout the site (such as pop-up site rating requests or monitoring mouse movements). This will allow for a deep understanding of customer progress and drop-off points (see Prosumer Model Evidence Summary).

Prosumer Model Standardisation: The One Stop Shop takes an active role in the standardisation of both technology specification, techno-economic appraisal and presentation of information to the customer, while providing the customer choice from a modular set of options/components. Technology Providers that can provide a small, standardised selection of each Prosumer technology (such as heat pumps, solar PV, battery storage, retrofit products, etc.) should be procured (see Prosumer Model Evidence Summary). By managing a small selection of technologies, each one can be audited to ensure they are of the highest possible quality. This will provide the consumers with a streamlined, high-quality product offering they can trust.

SMART by Default: Installations should be SMART by default, therefore future-proofing the installations. This will put consumers in the best position to easily manage and customise system settings, monitor their energy usage and system efficiency. This will be an attractive offering for customers and encourage them to progress through the customer journey (see User Evidence Summary).

7.1.6 Finance

To enable the uptake of a Prosumer System, the model should include financing for solar, linked to heat pump installation (see Prosumer Model Evidence summary in the annex), delivered through the One Stop Shop service. Innovative approaches that bring together existing financial products to reduce cost and enhance the customer experience have been investigated throughout Phase 1 to fund additional measures and release the benefits of the Prosumer Model (see section 6.2 and Prosumer Model Evidence Summary). The preferred approach combines point-of-sale lending with a mortgage re-finance to make it as easy as possible for consumers, whilst minimising financing costs. However, through Phase 1, mortgage rates have risen sharply calling into question whether this model will be the most attractive in the future. It is recommended to retain flexibility so that the most attractive offer to customers compared to prevailing interest rates can be delivered.

7.1.7 Cost Reduction

The methodology addresses heat pump cost reduction in the following core ways:

Prosumer Model: The Prosumer Model will not only reduce the upfront costs of the heat pumps, but the introduction of on-site generation has the potential to provide ongoing cost savings compared with otherwise rising energy prices (see section 6.2). Standardised, preferred technology and place-based, regional purchasing also enable bulk discounts compared to alternative installation methods.

Consumer Buying Power: By coordinating high density installations, potential access to cost discounts are enabled.

Integrated Supplier Approach: By integrating technology suppliers into the project with our procurement approach, volume/bulk discounts will be encouraged which will be passed onto the consumer.

Digital Pathways: The digital-first approach ensures the best use of innovative and smart technologies both to streamline workflows and support in-use performance optimisation post-installation. Evidence shows that reducing the performance gap can greatly affect the COP of the heat pump increasing the benefit/cost of the technology (BEIS, 2021).

One Stop Shop: Finally, the approach also reduces cost by consolidating operations into a single “One Stop Shop” entity. Over the long-term this reduces cost by providing shared management, back-office and customer acquisition.

Overall, this combination of actions has the potential to reduce heating costs for consumers by reducing upfront costs of hardware and installation, and enabling onsite generation (see Technology Options Summary). We estimate that factoring in price cap changes, an average household with our Prosumer Model could save £800 per year on their energy bills against heat pump retrofits without solar PV (see section 6.2).

7.1.8 DNO Application Process

There is currently no process for DNOs to accept bulk applications. A key innovation is to work closely with the DNO to streamline the application and connection process to enable fast-tracked, bulk applications to enable the high-density deployment of pumps.

7.1.9 Bespoke Installer Training

The One Stop Shop has a clear goal to scale up heat pump installations. This creates a real incentive to work closely with communities, in particular, to support the development of skills, encourage

learners into the heat pump sector, and ensure skills providers are supported with technical expertise and that training aligns to industry need (see section 6.4 and Costs and Barriers Summary in the appendix).

The skills agenda, (in particular, in relation to Green Jobs), has been highlighted as a key area of focus in Oxfordshire. Working closely with suppliers can enable innovative support of apprenticeships and traineeships, allowing wider upskilling and capacity increases.

Examples of how organisations can create a legacy in skills, supporting strong integrated communities are as follows:

Training Materials: Creation of a standardised, high-quality approach to the installation of heat pumps. This can be documented in a series of training materials that can be shared with local educators and the supplier network, and others to promote training in heat pumps. Learners or those looking to re-train should be signposted to clear skills pathways within the local area.

Collaboration: Collaborative working with key local stakeholders and local education providers should be utilised to ensure there are clear skills pathways for local residents wishing to enter the Clean Energy sector. This could include supporting education providers to tailor and align their courses to industry needs and promote these throughout the life of the project.

Presentations: Provide presentations on heat pumps and the opportunities within the Clean Energy sector to colleges and schools. Materials can be shared widely, including providing these as a resource through a digital platform, so that the message can be repeated by others, including community members. Presentations should be recorded so that they can be shared online supporting learners to find out more about opportunities within the sector.

Careers Fairs: Attendance of careers fair to promote the opportunities within the Clean Energy sector.

Supply Chain Confidence: Delivering confidence in long-term demand is a key issue for the supply chain to support investment in skills and strong, integrated communities. Projects should provide evidence of, and stimulate demand for heat pumps, providing greater confidence in the supply chain to invest widely in the necessary skills.

8 Recommended Methodology for Coordinating High-Density Heat Pump Deployment

8.1 Coordinated Methodology: One Stop Shop Key Stakeholders and Roles

Our One Stop Shop proposes the following key stakeholders and roles, as shown in Figure 7. These stakeholders and roles were developed from the learnings from the project's One Stop Shop Operations Summary (see appendix and section 6.5).

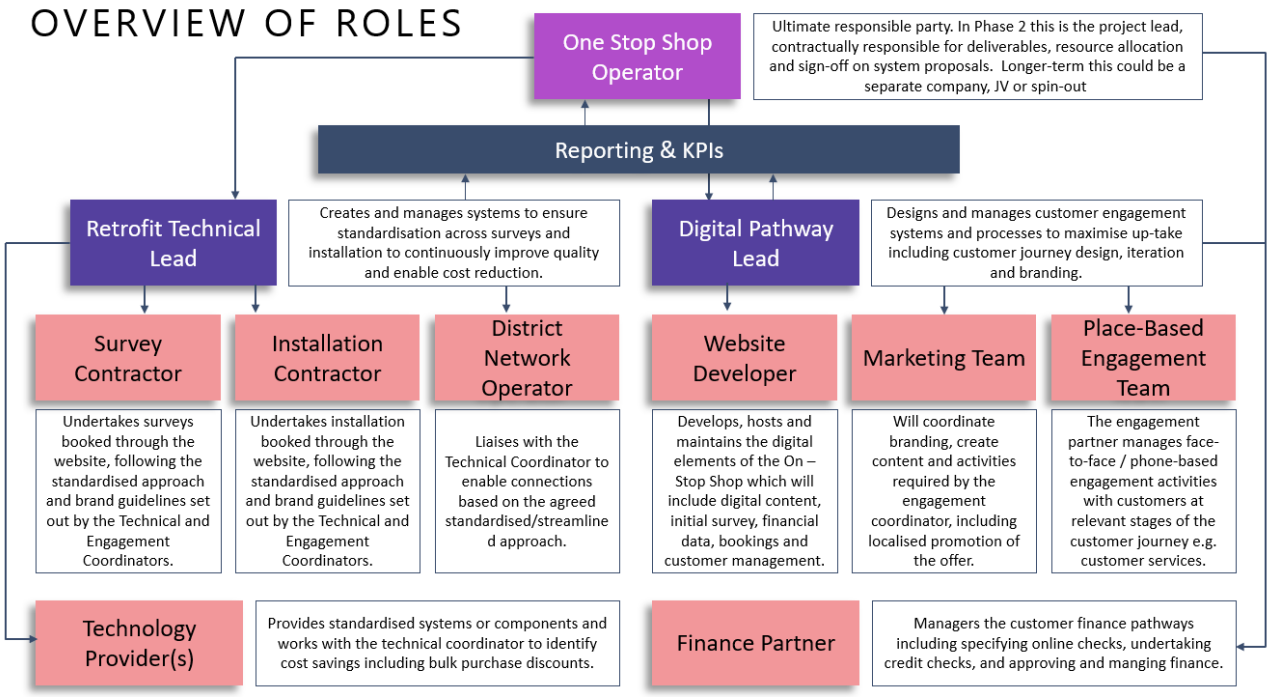

Figure 7 - Overview of Roles

8.1.1 Role 1: One Stop Shop Operator

The One Stop Shop Operator is the company/entity that manages the end-to-end service, including all systems and processes. It is recommended that the One Stop Shop is a commercial entity and that trust is secured through local government partnership and collaboration with a quality assurance focused organisation (such as TrustMark).

Key roles for the One Stop Shop Operator:

- **Ownership/Leadership:** Own the overall targets and ultimate responsibility for the trial.
- **Resource Allocation:** Prioritise resources to maximise the likelihood of high-density heat pump installations.
- **Process Management:** Own/manage the overall technical Prosumer and Digital processes to maximise heat pump installations.
- **Contractual/Commercial Management:** Secure partners and procure sub-contractors to perform the necessary roles within the One Stop Shop.
- **Cost-Reduction and Continuous Improvement Initiatives:** Coordinate cost-reduction activities and continuous improvement including procurement, finance models, technical specifications, programme learnings, and subcontractor training.

- **Customer Care:** Own and enhance the overall customer experience including engagement, quality assurance, and customer satisfaction.
- **Coordination:** Ensure the necessary coordination between stakeholders.
- **Key decisions:** Including deciding on the overall process flow; the deployment of resources to capture customers; and supply chain and procurement choices.

8.1.2 Role 2: Marketing and Engagement Coordinator

The Marketing and Engagement Coordinator manages the marketing, engagement, recruitment and customer care activities of the One Stop Shop including:

- **Engagement Strategy & Allocation:** Allocation of resources to specific locations and customer channels to maximise engagement and support uptake of heat pumps at high-density in Cherwell.
- **Digital Customer Journey:** Development, management, iterative improvement and maintenance of the digital customer journey.
- **Engagement Marketing:** Development of marketing content, place-based activities and in-person events to maximise interest and sign-ups in relation to target areas.
- **Place-Based Engagement:** This includes management of the place-based activities such as local events and door-to-door campaigns necessary to drive engagement sufficient to deliver high-density heat pump deployments.
- **Customer Services:** The Place-Based Engagement Coordinator will also manage the customer journey including the provision of the customer service offer and customer service centre.
- **Key Decisions:** Key decisions include finalising the overall seamless customer journey design, including the integrated management of the Customer Relationship Management system across partners/installers; finalising core messaging and ensuring a balance between online/in-person marketing activities.

8.1.3 Role 3: Retrofit Technical Lead

The Technical Coordinator manages the technical elements of the shop including the selection of standard technology, development of digital assessment tools to include heat pumps within the Prosumer Model and supports the procurement and evaluation of delivery contractors. The role includes:

- **Standardised Advice to Consumers:** The Retrofit Technical Lead will ensure the project surpasses MCS and traditional home energy efficiency surveys (such as EPCs) by gathering data and developing a standardised assessment approach. Standardised advice can then be provided to consumers that is easy to understand and technically rigorous.
- **Technology Options:** This role will work with the Prosumer System component manufacturers to define the technology/product mix and produce a blueprint for Prosumer System installations. This will include all components, such as heat pumps, solar PV and battery storage. The use of a defined technology selection will allow for bulk discounts and streamlined customer decision making and care.

- **Contractor Specification:** The Retrofit Technical Lead will specify the minimum requirements for contractors and support the technical evaluation of procurement responses.
- **Standardised Specifications:** Using a standardised process of data input (digital data capture), output and processing allow for both streamlined delivery of high-quality advice to consumers, but also a scientific approach to be applied to specification to drive up standards. This will meet and exceed the requirements of MCS and traditional survey techniques.
- **Supply Chain Training:** The Retrofit Technical Lead will develop and coordinate a Standardised Deployment Model training package to ensure consistency of skills across the supply chain.
- **Aftercare:** Research has shown that the aftercare is an important factor for ensuring the consumer can enjoy the benefits of heat pumps (and recommend them to others). We will provide easy-to-read standardised handover packs that cover the technologies included in their installation.
- **Quality Assurance:** The Retrofit Technical Lead will instruct quality assurance activities to ensure the installation is to a high standard. This will include specifying the quality assurance standards, in-home tests, and quality thresholds for the programme. Data analysis will inform process improvements and continuous technical learnings.
- **Key Decisions:** Key decisions include finalising the product mix/technologies offered; developing the surveys; ensuring cost savings and developing training content.

8.1.4 Role 4 - Survey Contractor

The Survey Contractor manages the detailed home survey and quality assurance aspects of the customer journey. They are responsible for ensuring a seamless customer journey by integrating with the One Stop Shop booking system and branding.

- **Detailed Feasibility:** At the Detailed Feasibility stage of the customer journey, the Survey Contractor will undertake detailed Home Survey to identify the dwelling's suitability for heat pump and Prosumer System installation.
- **Standardised Approach:** The Survey Contractor will follow the agreed standardised approach and One Stop Shop brand guidelines set out by the Retrofit Technical Lead and Marketing and Engagement Coordinator.
- **Quality Assurance:** The Survey Contractor will also provide Quality Assurance surveys to ensure that the work has been undertaken to a sufficient standard.
- **Who is Responsible:** The Retrofit Technical Lead will be responsible for procuring a suitable Survey Contractor during the mobilisation stage of Phase 2.
- **Key Decisions:** The Survey Contractor will follow the digital survey process using tailored, professional judgement.

8.1.5 Role 5: Installation Contractors

- **Installation:** Once booked through the website, the contractors will provide high-quality installations of heat pumps, the Prosumer System, necessary home upgrades and retrofit measures.

- **Standardised Approach:** Installation contractors will follow the agreed standardised approach and One Stop Shop brand guidelines set out by the Retrofit Technical Lead and Marketing and Engagement Coordinator.
- **Quality Assurance:** The Installation Contractors provide Quality Assurance checklists to ensure that the work has been undertaken to a sufficient standard. They will also provide further home visits if the installed systems are not working properly.
- **Training Commitment:** As part of the commitment to upskilling the local market, the Installation Contractors will agree to facilitate training activities, and this will be embedded into their contract.
- **Ongoing Support:** The Installation Coordinators will provide warranties for consumers that extend past the life of the Phase 2. This is to ensure that the trial customers have access to ongoing aftercare.
- **Key Decisions:** Installation decisions that are within the process and quality thresholds set out by Green Home Energy Advice.

8.1.6 Role 6: Financial Product Provider

Access to finance will be embedded in the One Stop Shop and delivered by an existing financial provider. The target model is to combine point-of-sale lending with a refinance into the customer's mortgage to minimise borrowing costs. However, given the external mortgage rate volatility, observed through Phase 1, we are retaining multiple options for financing in Phase 2 to ensure we can minimise the cost to consumers. Responsibilities of the Financial Product Providers are to:

- **Integrate Processes with the One Stop Shop:** For example, supporting point-of-sale finance and appropriate communications to the customer.
- **Finance Provision:** Where possible, the Financial Product Provider will reduce the upfront costs to the consumer by providing a tailored financial offer to part-fund the cost of the Prosumer System.
- **Adherence to/Management of FCA Regulations:** As part of the contract with the project, the Financial Product Provider will be approved by the Financial Conduct Authority to undertake regulated credit activities such as lending.
- **Key Decisions:** The Finance Partner will be responsible for lending decisions to customers.

8.1.7 Role 7: Technology Providers

Technology Providers will provide the technology and components of the Prosumer System.

- **Key Decisions:** The Technology Providers will make decisions with respect to the design of their technologies.

8.1.8 Role 8 - Distribution Network Operator (DNO)

The DNO will allow the project to submit bulk Prosumer System connection applications for timely approval. The DNO may be required to develop new processes to enable this. They will also assist in the provision of data relevant to the project and provide network advice to inform prioritisation.

- **Key Decisions:** The DNO will make decisions concerning network connections.

8.2 Coordinated Methodology: Key Processes

The key stages and processes for the One Stop Shop delivery are described below. They were developed from the learnings from the project's One Stop Shop work package (see section 6.5 and the One Stop Shop Operations Summary in the appendix).

8.2.1 Stage 1: Awareness and Interest

The first stage is to identify target areas connected to separate secondary substations, using a prioritisation approach (as discussed in section 4.2). Awareness is then raised in these target locations. This involves a range of engagement and marketing activities including traditional marketing (e.g. formal letter from the council providing information), digital marketing, place-specific events and door-to-door recruitment processes to maximise awareness within the target area.

Consumers who are interested to progress will be directed to the Awareness and Interest section of the One Stop Shop. This should be focused on educating the reader about the benefits of the Prosumer System and motivate them to continue to the next stage.

This stage also involves the acquisition of basic customer information in the Customer Relationship Management (CRM) system. The use of a shared CRM system is a core mechanism to manage customers through the journey enabling continued, automated and cost-effective follow-up. It also allows consumers who are interested, but time-poor to be logged and engaged at a more appropriate time.

8.2.2 Stage 2: Suitability and Feasibility

Following the Awareness and Interest Stage, the core goal is to progress the customer to the initial offer. This requires them to undertake a basic online survey which is combined with other (e.g. EPC) data to provide a tailored recommendation for the property with indicative capital and operational cost implications alongside projected benefits. The customer will also be able to understand the impacts of the solution with and without financing.

The progression from Stage 2 to Stage 3 will require the customer to book a date for the physical survey and add their credit card details. This is an important step to ensure the customer is sufficiently invested regarding their desire to progress, and to protect the service against missed appointments/sunk costs. This evidence will also form a core part of the Primary Stage Gate. At this point, the customer should have access to an account manager available by email and phone, through a customer portal.

8.2.3 Stage 3: Detailed Planning

The Survey Contractor will undertake the Detailed Home Survey on the date agreed upon with the customer, following the standardised approach set out by the Retrofit Technical Lead. The details of the survey will then be processed, and a standardised report and quote provided to the customer. At this stage, the customer can apply for finance, if this is required as part of the offer. The final offer is then approved and presented to the customer.

The progression from Stage 3 to Stage 4 requires the customer to choose their product and service mix, culminating in the signing of a contract, which will include a cancellation fee. Again, this is necessary to ensure the customer is serious and also protects the service against missed appointments/sunk costs. For the purpose of a trial, the contracts should be between the customer

and the installers/finance providers, rather than the One Stop Shop Operator. This is to protect the consumer and ensure that aftercare will be provided post project.

8.2.4 Stage 4: Commissioning & Installation

The One Stop Shop Account Manager will coordinate the installation bookings for a seamless customer experience. This is a vital component of the One Stop Shop considering that the installation of heat pump, solar, battery, retrofit and home upgrade works is highly interdependent and complex. The coordinated methodology will handle the applications to the DNO to secure connections. The installation will then take place and standardised confirmations (e.g. photos of hardware in situ) should be uploaded to the CRM as part of the installer's Quality Assurance checklist. The uploaded details are used to create a standardised Installation and Handover Report for the customer. Throughout the installation and handover stage, the customer should have access to a helpdesk to assist with any queries or booking amendments.

8.2.5 Stage 5: Quality Assurance & Aftercare

The Installation and Handover Reports are uploaded to the customer's online account and presented to them in person. Quality Assurance checks should be undertaken by a trusted provider (such as TrustMark). Following confirmation that the installation is in order, the handover stage will be complete and the customer progresses to the aftercare stage.

The aftercare stage should be as automated as possible to minimise costs. This should include access to online information, through a personalised/tailored account. This will also enable the customer to access warranty details for both the manufacturer and installer. The CRM system can also be used to send annual reminders, for example, to undertake maintenance and servicing, providing details on approved providers. This information should also be provided as part of the handover report to mitigate any negative impacts of the website being potentially closed post-project.

8.3 Coordinated Methodology: Innovatively Managing Interactions Between Partners

Underpinning the coordinated methodology is a series of systems that enable data sharing and the management of interactions between partners. Systems also allow for a scientific approach to the service, ensuring the One Stop Shop Operator is provided with all the necessary information at each stage to correctly allocate resources to achieve high-density heat pump deployment and provide a seamless customer experience.

The following key systems enable the management of interactions between partners and were developed from the learnings from the project's One Stop Shop Operations Summary (see appendix and section 6.5).

Customer Management System: A shared, off-the-shelf CRM system should be used to connect the key stakeholders within the system. Using a holistic approach, the system should be embedded in the digital customer journey and ensure that all stakeholders have access to relevant information about the user's journey. These include the One Stop Shop Operator, Installation Contractors, Survey Contractor, Marketing & Engagement Coordinator, Retrofit Technical Lead and Financial Product Provider. It should also enable automated messaging, allowing enhanced and regular contact with the customer.

Modular Product Offering: Phase 1 benchmarking research has shown that a "Gold Standard" version of the One Stop Shop would offer support for the end-to-end customer journey, and follow a "pick-and-mix" approach where the consumer can choose which elements they would like to install (see the Developing a One Stop Shop Blueprint – Initial Recommendations in the appendix for full details). This is a vital recommendation as it allows a tailored approach that is adapted to consumer needs. For example, if a customer already has solar PV, they will still be able to move forward with heat pump and battery storage installation. This empowers the consumer to customise their system but also ensures the One Stop Shop is a valuable source for a wide range of information.

Performance Tracking: The process should enable enhanced performance tracking to coordinate the quality across all stages. This includes ensuring that different teams undertake surveys and installations consistently and that customers get a high standard of quality throughout.

8.4 Coordinated Methodology: External Stakeholders

External stakeholders have different levels of influence and interest in the project. We can split these into the following groups:

High Influence/Low Interest: These are stakeholders such as National Government, Ofgem and the Bank of England. Their influence on the Cost-of-Living Crisis is strong and any future actions (such as changes to the energy price cap or guarantee or influence over borrowing rates) could have a significant effect on the financial viability of the Prosumer System over the life of the project and beyond. To mitigate this, we will keep up to date with industry news and policy to anticipate potential impacts.

Moderate Influence/Moderate Interest: There is a range of local community groups associated with our target locations such as Elmsbrook Community Organisation group, Bicester Green Gym and Bicester Green. These groups will have an important role in supporting the project by providing local momentum. Those looking to follow the recommended methodology should identify similar environmentally-driven local community groups and provide early engagement.

Low Influence/High Interest: Stakeholders in Oxfordshire with high interest but limited influence geographically include organisations such as climate-focused Community Action Groups outside of our target areas. To harness their interest, project information sessions should be held to enable external stakeholders to understand the project and to disseminate information about heat pumps and the Prosumer System. This will provide secondary impacts by motivating such groups to spread awareness of the benefits of the Prosumer System. Interested individuals outside of the target area should be supported by utilising the One Stop Shop website to provide information enabling the One Stop Shop to have a wider impact across Oxfordshire in the first instance. The same methodology is applicable to any area of the UK.

9 Approach for Mobilisation & Deployment following the Recommended Methodology

9.1 Strategy

The strategy for high-density heat pump deployment is built on the following key steps, the first two steps were completed in Phase 1:

- Use a data-led, geospatial process to identify long-list of areas most likely to enable high-density deployment of heat pumps.
- Undertake a quantitative prioritisation process with stakeholders (in particular the DNO and local stakeholders) to include additional local information such as grid capacity and the presence of active stakeholder networks.
- Undertake hyper-local marketing activities within the identified areas (see below).

9.1.1 Innovation

The first innovative element of the strategy is the data-led approach that used evidence to identify the locations expected to most likely facilitate high-density heat pump deployment. Our geospatial analysis method uses the following data (see Technology Options Summary in the annex):

- Building stock data including OS Address-base locations of all properties (domestic and non-domestic), identified by Unique Property Reference Numbers (UPRN), EPC data, Off-Gas postcodes, Listed buildings, etc.
- Geospatial data including archaeological sites and conservation areas.
- Grid data including SSEN Substation Electricity Supply Areas and HV Substation point coordinates.
- Financial prioritisation data including heat pump costs, heating system upgrade costs, energy efficiency measures costs, and energy savings tailored to the locally-identified property types. This means we target the clusters of properties for whom a heat pump is most likely to be financially viable/attractive.
- Demographic data including income/deprivation.

This data is used to identify a short list of target areas. These can then be supplemented by local knowledge, in particular, from local stakeholder managers and the DNO.

9.1.2 Hyper-Local Marketing

The next step in the strategy is the use of hyper-local marketing. In Phase 1 we undertook further market research in the identified areas to generate a strong understanding of the local area and populations. The future strategy for generating interest and stimulating demand is as follows:

- Early marketing enabling registration of interest. This should use multiple channels including the council's social networks, location-targeted marketing (such as local flyers, and stalls in town centres) alongside traditional marketing methods.
- A full launch should be targeted at each specific area. This should include additional marketing, and local events (including for example the use of Daikin's Mobile Showroom and county shows). Specifically, an official letter should be circulated to all residents in these areas informing them of the event schedule and when they can expect a consultant to visit their property.

- One of the key engagement methods will be door-to-door within the locations identified. The door-to-door engagement will allow for residents to discuss heat pumps, retrofit and cost saving measures with a consultant and find out more about the programme and how they can get involved.

Once customers are captured, it is recommended to utilise a range of automated digital communication techniques to prompt them to progress to the next stage of the customer journey. For example, if a customer starts filling in details of the online survey, but stops, the system should email them to remind them of the benefits and prompt them to continue through to the completion of the stage.

9.2 Number and Density of Heat Pumps in the Target Location

The Phase 1 modelling has identified six secondary substations that are suitable for high-density heat pump deployment within Northwest Bicester, connected to a total of 529 properties. To achieve 25% density under each substation, at least 136 heat pumps should be installed.

9.2.1 Heat Pump Numbers

TOTAL:

- Target number of heat pumps: 136
- Total number of properties within sites: 529
- % A: Social housing properties within the target area: <1%*
- % B: Non-domestic within target area: 4%
- % A+B: 3%
- % Off-Gas within target area: 2%
- *Estimated from available EPC data which covers approximately 50% of domestic properties in the area.
- Technology Deployment Type target: 100% Hydronic air source heat pumps. These will be the Daikin Monoblock range 4 kW-16 kW.

The target area is in Cherwell District, in Oxfordshire. Cherwell is a district of rolling hills around the basin of the River Cherwell covering ~589 square kilometres (227 sq mi) of semi-urban/rural land. The district has a population of 150,503 and a population density of 660/sq mi, with around 75% of these inhabitants living in the towns of Banbury and Bicester. There are 64,782 domestic properties in Cherwell, of which 41,633 (64.2%) are connected to the gas network.

9.2.2 Building Stock

The housing stock in Cherwell is suitable for heat pump deployment. Considering that Cherwell is representative of other Urban with Significant Rural locations.

27.6% of properties in Cherwell are detached whilst 32.1% are semi-detached, meaning that 59.7% of the housing stock is likely to have ample space for a range of heat pump technologies. 21.1% of properties are terraced which may require specific technology choices such as shared networks. 10.2% of properties are flats, with 9.1% designated as “other”.

Currently, the energy efficiency of the building stock varies throughout the district but is reflective of the remainder of the county. For instance, only 0.3% of properties have an EPC rating of A or above,

and 12.3% have an EPC rating of B or above. The majority of properties (67.3%) have an EPC rating of C or D with the remaining properties being rated at E and below. Our Phase 2 focuses on settlements within Northwest Bicester where 62% of properties are owner-occupied.

9.3 Number of Consumers Engaged in the Recruitment Journey

Our detailed analysis of the customer journey has identified 24 customer decision steps in the process from awareness through to heat pump installation. Our analysis clearly demonstrates there are numerous points along the customer journey where customers may choose to drop out. Therefore, to maximise the likelihood of high-density deployments our system/process design addresses 2 core issues:

Ensuring as many households as possible enter the core sales/capture funnel: This is achieved through a multi-channel awareness method which includes door-to-door consultation. While highly manual, door-to-door consultation is the only way to truly guarantee that each household has been visited. Our Phase 1 has evidenced that an official Local Authority letter, sent in advance to households, will maximise the chance that they will be available during the door-to-door phase and that they will engage positively (see User Evidence Summary). The household capture process therefore includes a direct mailing, an initial door-to-door engagement and a secondary door-to-door engagement (to try to capture any remaining households that were not captured in the initial stage), in addition to other local events and activities coordinated by the engagement partner throughout the project timeline.

Supporting households/customers to continue the customer journey and complete each stage: Here the use of digital tools and automated digital communications is critical to provide tailored and targeted messaging to help customers progress through the customer journey. Our analysis has identified targeted messaging and support that can be provided at each customer decision step to maximise the likelihood of continuation to the next step.

Our approach to maximising the likelihood of high-density deployment is to employ our innovative coordinated methodology at each stage of the customer journey as follows. To deliver the target of 136 heat pumps overall, the system needs to ensure the following capture and drop-out rates at each stage.

9.3.1 Pre-Analysis

Conduct a geospatial analysis within the target locations. This should utilise automated and analytical techniques to review remote data for all properties in the entire area to prioritise sites to maximise the likelihood of high-density deployments. This is a fully remote technique that uses EPC and other data, meaning that sites can be prioritised without requiring customer interaction. This process has first analysed over 80,000 addresses in Cherwell and is similar to a remote/bulk survey method.

9.3.2 Stage 1: Awareness & Consideration

At the awareness stage, 100% of households need to be aware of the project within the target locations. This means our hyper-local marketing approach needs to create awareness with 529 households within the target areas. This can be achieved through a three-stage approach including an official letter, an initial door-to-door campaign and a follow-up door-to-door campaign supported by local events and activities. By individually targeting each individual household the number of households measured can be reached.

At the consideration stage online and in-person tools can be used to maintain interest. This could include early sign-up/indication of interest, the ability for consultants to capture customer details through the door-to-door campaign and for the use of the website with a clear call-to-action to register to find out more. Naturally, a high proportion of households will not take interest in heat pumps, we will seek to mitigate the loss of consideration by capturing customer details through the door-to-door campaign and through digital engagement via the website. We expect a 40% drop off at this stage, leaving 60% remaining (317 households). This drop off rate is based on 64% of surveyed customers stating that they either expect to install a heat pump or could be persuaded to install a heat pump when they next replaced their heating system. This statistic has been conservatively rounded down to 60% - representing those customers that are likely to remain interested at the considerations stage.

9.3.3 Stage 2: Suitability & Feasibility Assessment and Offer

Stage 3 represents the first customer-validated remote survey stage. This should be as streamlined as possible, drawing information from EPC and other sources such that it asks the customer to validate the information (not enter it from scratch). This process will be reduced to between 7-10 questions to provide the appropriate balance between speed of completion and accuracy/additional information. Our streamlined initial assessment will be a low barrier to entry to gain an initial expectation of household suitability and cost of the retrofit. Our research has shown that cost is the single biggest barrier to heat pump uptake, therefore, this stage will experience the greatest drop-off rate. We are allowing for a 50% drop-off at this stage, leaving 30% of households remaining (159).

9.3.4 Stage 3: Detailed Assessment and Offer

The detailed assessment involves the in-home survey and finalised quote from the installer. Customers will already have an indicative cost of retrofit therefore we expect consumers at this stage will be serious about heat pump uptake and so just a 10% drop-off has been estimated here.

9.3.5 Stage 4: Installation & Commissioning

Given feedback from installers a 5% drop-off rate is expected, resulting in 136 households successfully installing a heat pump (26% density). Given that the customer has not rejected the high cost of heat pump installation at the point of initial assessment, we expect that the remaining cohort is very motivated to install a heat pump. The detailed assessment may uncover some properties which require significant disruption to install a heat pump, therefore we are allowing for a 10% drop-off at this stage, leaving 26% of households remaining (136).

9.4 Survey Process

The survey process involves an initial wide-area remote analysis, followed by a two-stage standardised household/property survey. A two-stage survey has largely been shown to be necessary, with each survey serving different roles in the overall customer journey (see One Stop Shop Operations Summary).

The first feasibility survey gathers basic information about the property in a streamlined way to enable an automated analysis to be undertaken, providing the customer with a solution tailored to their property/circumstances and an indicative offer.

The second, detailed home survey builds on the data captured in the first and is semi-automated/physical. This ensures that the contractor undertaking the surveys fills out all elements, that all aspects of the survey are consistently addressed, that the data and inputs are standardised and enables standardised/automated reports to be generated.

9.4.1 Innovation in Surveying

Our innovation is to introduce a locational prioritisation stage that is fully remote. This uses remote data to assess the expected financial viability of heat pumps based on the housing types observed within the region. This allows for a full region to be analysed in advance and the focused activity to target high-density deployments to be focused on smaller areas that have effectively been pre-screened.

The subsequent surveys then use digital tools to standardise both the inputs and outputs. One of the key challenges with surveys is the consistency of both inputs and outputs. While processes, such as EPCs, provide some consistency, even these are often not comprehensively completed and do not provide all data/evidence in a format suitable for remote analysis. Our approach uses a standardised form that enables both the capture of quantitative data, but also the storage of evidence that sits behind that data. This leads to enhanced consistency, allows for auditing of the surveys to be undertaken remotely and enables remote analysis to be performed in a standardised way. A standardisation of inputs can be achieved by ensuring the data requested in the feasibility survey is readily accessible to the consumer and that the detailed home surveys are conducted utilising a standardised methodology. Collectively this provides the customer with a consistent level of quality, analysis and understanding, and provides the system operator with a scientific/systematic approach.

9.5 Deployment Challenges to be Overcome by the Coordinated Methodology

There are extensive challenges that need to be overcome by the coordinated methodology, in particular, to maximise the likelihood of high-density uptake.

9.5.1 Customer Awareness/Innovation

The first challenge is customer awareness of heat pumps and making sure customers have the appropriate information. It is also important to note the context of this information. Phase 1 demonstrated that many customers are already aware of heat pumps but there is also misinformation, stories of negative experiences (e.g. regarding heat pumps) or an expectation that other fuels/options might also be available to decarbonise heating (e.g. hydrogen), (see User Evidence Summary in the appendix).

Clear, consistent, trusted messaging is a core element of our coordinated methodology.

9.5.2 Streamlined Process/Customer Experience

A second challenge is streamlining the customer experience so that they can access everything they need from a single source. This requires both the design and implementation of a customer experience (brand, and consistent experience across digital and in-person channels) that is consistent across multiple stakeholders. Streamlining will require procurement of supply chain partners such that it is clear through the engagement that they will work within standardised processes.

This is addressed through the One Stop Shop that streamlines the customer journey and process standardisation.

9.5.3 Financial Viability/Uncertainty

One of the key challenges in the deployment of high-density heat pumps is the financial viability of heat pumps compared to gas, and the certainty of that viability into the future (see section 6.1 and the Technology Options Summary in the appendix). Providing an honest and trustworthy account of the financial decisions, in light of future uncertainties, is a key consideration in terms of the customer experience. It is essential that customers are protected from misleading selling of both heat pumps and financial products.

Our methodology addresses the financial challenges by bundling the heat pump with other services into a Prosumer Model. Phase 1 has demonstrated that this offers the most cost-effective deployment method for the consumer (see section 6.1 and Technology Options Summary). Through Phase 1 we have also engaged numerous financial providers and are continuously monitoring lending rates across all products to ensure we can offer the most cost-effective solution to consumers.

9.6 Quality Assurance Method Statement

Phase 1 evidenced that high quality engagement, customer protection, quality assurance and monitoring should be embedded throughout the approach (see One Stop Shop Blueprint Development – Initial Recommendations Summary and One Stop Shop Operations Summary in the appendix).

9.6.1 Stage 1: Awareness and Interest

Engagement and customer protection start at the awareness stage. In all marketing and sales activities, it is critical that appropriate advice is provided for consumers based on their needs. Consumer protection requires that claims are not misleading, and that advertising is clear and honest regarding areas of uncertainty. It should also be as easy as possible for consumers to sign up. Customers should be transparently informed about how their data will be used, understand that their data will be treated in line with GDPR and that their rights will be protected. In particular, customers must be provided with the right to opt-out and unsubscribe from all systems with all their data being deleted in response to such a request.

9.6.2 Stage 2: Suitability and Feasibility

The Suitability and Feasibility stage aims to provide the customer with a true and fair quote based on the information provided remotely. This is the first stage in the process where quality assurance should be carried out to ensure the analysis is as accurate as possible based on the information provided, and that the customer report is of the highest quality. Quality assurance should be undertaken at the “system level” (i.e. ensuring the analysis underpinning the initial assessment is free from error) and at the “output level” (i.e. ensuring that the outputs provided to the customer are robust, clear, transparent and fit-for-purpose). At the system level, quality assurance procedures include extensive testing and test coverage of the automated system, use of highly qualified staff, use of automated quality control systems (such as continuous integration) and applying multiple sense checks of the system outputs. At the output level, quality control will include user testing of output designs, testing of initial outputs before they are passed to customers, and continued auditing of outputs to ensure consistent levels of quality. A trusted organisation (such as TrustMark) can be used to validate technical assumptions and ensure they are consistent throughout.

As in previous stages, open and transparent presentation of information, including uncertainties is important. References, sources and additional detail behind calculation assumptions, should be made clear to enable customers to make informed decisions.

For customers that choose to proceed to the next stage, payment information or a deposit should be taken to ensure that customers are sufficiently committed to the survey time selected. In order to protect consumers, customer payment information should not be taken directly, rather a trusted/protected third party systems (e.g. Stripe/PayPal) should be used to process payment data.

9.6.3 Stage 3: Detailed Analysis/Survey

At the detailed analysis stage, all customers should have an in-person interaction with a surveyor arranged by the platform. It is important for the ease of the customer experience that they are able to book a time for the survey that suits them and be confident that the survey will take place at the agreed time, without inconvenience. The surveys will be booked via the platform and the survey contractor will be subject to an SLA that will monitor and ensure that surveys take place at the agreed time.

Survey contractors should be provided training in the core brand messages and the process when on-site with customers. This training will cover professionalism and customer care to ensure a consistent level of advice throughout this important interaction with customers.

Our standardised system for the survey (see section 9.4.1) will enable a consistent approach to quality in the survey output. By using digital tools at this stage, we can ensure we gather evidence associated with the survey that can be reviewed and tested independently (e.g. copies of heating bills, images of heat sources etc.). This will allow for an additional layer of quality assurance checks that verify the information captured within the survey. The standardised system will then allow the application of best-practice approaches to the processing of survey data, to ensure high-quality, consistent outputs.

9.6.4 Stage 4: Commissioning & Installation

Our recommended system uses a standardised installation and commissioning process that aligns to and exceed the requirements of MCS. These should be developed in partnership with a trusted organisation, providing additional confidence. This process will exceed MCS by involving a higher level of prescription and more detailed installation documents and checks. All contractors should be MCS certified and supported by additional training and in the standardised approach, to ensure consistency and quality across the supply chain.

Equipment: The project should use a tried and tested primary technology (such as the Daikin Monoblock range as detailed in the Prosumer Model Evidence summary in the annex). This ensures consistency, shared learnings across the supply chain and has the benefit of allowing close working with suppliers to assure installation quality.

The standardised approach will allow for images to be loaded to the CRM during the installation stage which will enable additional remote checks on installation quality to be undertaken.

9.6.5 Stage 5: Quality Assurance and Aftercare

Quality Checks: Quality for this project is essential as it is our goal to promote best practice and ensure that every customer provided with a heat pump is satisfied. This is important for promoting a successful project, protecting the project partners and the Department for Energy Security and Net Zero while also ensuring positive messaging around heat pumps. It is recommended that the installation is quality checked for every property. This is important to ensure that absolute confidence

is provided to the consumers through independent assessment and that any issues are remediated within the project.

Warranty Checks: Warranties will be provided to the customer for both the equipment (manufacturer warranty) and installation. The Technology Providers should be responsible for manufacturer warranties and the Installation Contractor will be responsible for installation warranties. The commissioning stage should include sign-off by the Installer to verify the installation and warranty. Quality Assurance undertaken by a trusted organisation will ensure that any issues are remediated. Images of the installation will also be reviewed remotely to confirm consistency and the final approval signed off. This will ensure that any issues under installation warranty are remediated within the project and that the manufacturer warranties are fully valid.

This standardised method allows for the provision of detailed, automated handover documentation that can be tailored toward the specific property, installation or customer thermal comfort preferences. This will include a clear, easy-to-understand document, tailored toward homeowners that describes the operation of the equipment. A consultant should call the customer following handover to answer any further questions and ensure that no issues are being encountered. The customer will then have access to aftercare including digital resources and a dedicated customer service desk for the duration of the project.

9.7 DNO Engagement

Throughout Phase 1 we were in close contact with SSEN in running the geospatial analysis to pick the optimal location for high density heat deployment in Bicester. We worked with SSEN to obtain substation location, catchment area data and network constraints that fed into our geospatial prioritisation process (see section 6.1). It is recommended that organisations follow the same methodology and bring the local DNO on board from project inception.

The DNO should oversee the network connections process and increase monitoring on our target substations. Furthermore, currently each household is required to submit an application to the DNO prior to installing a heat pump. For large scale deployment in a concentrated area this is both an administrative burden for the homeowner and the DNO who must process the applications. For future implementation we recommend integrating the local DNO into the project team to assist in the development of a streamlined application process for multiple households at once. The expectation is that the design of this process will be replicable across other DNOs and become the standard approach for large scale, national deployment of heat pumps.

10 Costs to Consumers

10.1 Innovative Costs Reduction Methods

Affordability is a key barrier to heat pump uptake. Our approach has identified a number of opportunities to achieve cost reductions within the innovative, coordinated high-density deployment described above. These cost reductions for the consumer can be achieved during the mobilisation and customer acquisition phases of the project. Examples of these cost savings have been provided below:

Data-Led Site Selection: By utilising open geospatial, EPC and grid capacity data, the target area has been validated to ensure it incorporates the key characteristics suitable for heat pump deployment (see section 6.1 and Technology Options Summary in the appendix). This desktop-based approach is

far more efficient and cost-effective than other labour-intensive consumer surveying and therefore reduces the cost of customer acquisition.

Hyper-local Marketing: Phase 1 research identified a variety of motivations for installing a heat pump, with the prevalence of these motivations varying significantly between different geographic areas (see User Evidence Summary). A catalogue of marketing resources and techniques should be produced for all customer segments and then applied to the specific demographic and motivations of the target area. For example, marketing approaches/messaging would be different for an affluent area, compared to a deprived area. In doing so, uptake is likely to be higher, reducing the average cost of customer acquisition.

Customer Journey/Decision Mapping: During Phase 1, we undertook extensive research into the customer journey and decision stages for the purchase of a heat pump (see section 6.5 and One Stop Shop Operations Summary). This research should be used to inform the One Stop Shop design to reduce the drop off rate and therefore the average cost of customer acquisition.

Remote Feasibility Survey: Surveys can be a wasted cost when they identify a property is not suitable for a heat pump. To reduce costs, a remote, customer completed survey should be incorporated into the user journey to filter out any unsuitable properties at an early stage. This survey should be easy to access and part of a web-based platform (see One Stop Shop Options Summary).

Streamlined, In Person Detailed Home Survey: A streamlined, in-person, detailed home survey should be developed which can auto-populate with openly available data, as well as information entered into the remote survey (see One Stop Shop Operations Summary). This will speed up survey times and reduce their cost. Over time, we have also identified a cost saving from bringing survey costs in-house within the One Stop Shop.

Survey & Installation Grouping: Through focusing on a hyper-local area, the delivery of surveys and heat pump/retrofit installations can be grouped together to avoid travel time. This will lead to reductions in the installation cost to the consumer (see Costs and Barriers Summary).

Single Suppliers: Where possible, single suppliers should be utilised for the provision of equipment, materials and installation for the entire project (see One Stop Shop Operations Summary). Doing so provides much greater buying power than purchasing for a single property. A direct relationship also has the benefit of removing the distributor between the manufacturer and retail, creating additional cost savings.

Whole House Approach: By using a Prosumer Model, customers are incorporating the heat pump installation with solar PV, and potentially other fabric retrofit upgrades. By grouping these into one upgrade, installation efficiencies will be achieved – leading to a reduction in costs (see Technology Options Summary).

Streamlined DNO Engagement Process: The streamlined DNO engagement process (as described in section 9.7) will reduce the administrative time in completing and approving applications, which will reduce overall costs.

10.2 Prosumer Model Costs

Through the use of a Prosumer Model, the annual cost to the consumer is significantly reduced compared to the installation of a heat pump in isolation (see section 6.1 and the Technology Options Summary). For the archetypes which are suitable for solar PV, the following annual cost savings can be achieved (as derived from the Technology Options Summary results):

- Bungalow – 20% saving
- Mid-terrace with cavity walls – 18% saving
- Mid-terrace with solid walls – 16% saving
- Compact semi-detached – 20% saving
- End-terrace with cavity walls – 18% saving
- Semi-detached with solid walls – 17% saving
- Detached with cavity walls – 14% saving
- Detached with solid walls – 13% saving

The above savings are achieved through the generation and utilisation of electricity on site, which displaces the cost of purchasing energy from the grid. Additional savings are also achieved through the sale of surplus energy back to the grid – particularly in summer months when the most electricity is generated, but the least amount of heating is required.

10.2.1 Sources of Funding

The recommended methodology does not include any other public funding. To fund the upfront capital costs not covered by the £5,000 Department for Energy Security and Net Zero funding, customers will be offered financing options to spread the upfront capital cost.

It is widely known that one of the key barriers to uptake is the high upfront capital cost of heat pumps, and any associated property retrofit. Therefore, our deployment model assumes that the majority of customers will require financing to spread the cost over a number of years (see section 6.2 and the Prosumer Model Evidence Summary in the appendix). A range of financing options should be offered that allows the customer to spread the upfront cost over a term that is affordable to them. For some lending schemes, customers on average spread the repayments over a 10-year period, but this could be extended to 15 years to match the expected life of the heat pump. Where the property is sold or re-mortgaged, the borrowing can be repaid early with no early settlement penalties.

11 Long Term Sustainability

11.1 Longevity of the Business Model

A key consideration of Phase 1 was to ensure the developed business model can be maintained beyond the life of the project.

Technical Sustainability: Our technical approach is based on interoperability and standards. To ensure interoperability, it must be researched and confirmed that the various Prosumer components are compatible when developing the product mix. By including products that are widely compatible will allow for other manufacturers to "plug in" to the smart eco-system. This ensures sustainability of the overall process, independent of suppliers, making the solution more sustainable over the long-term.

Financial Sustainability: Phase 1 research evidenced that the Prosumer Model is the most financially sustainable of all heat pump deployment models, providing a clear market-led incentive to accelerate the uptake of heat pumps (see section 6.1 and the Technology Cost Model Summary). As an approach, it also offers flexibility for the platform to support different standard mixes of interventions to a property based on homeowner preferences. This increases the commercial viability of the platform over the long-term and builds in the possibility for diversification should any specific element of the offer become unviable for a period in the future.

Business Model/Commercial Offering: The business model is to establish the One Stop Shop as a new commercial offering (new company/spin-out) based on a regional growth approach. From the perspective of customers, they will see a new brand for green home improvements, with a specialist offer to transform their heating and energy supply, providing an end-to-end service, including lending (see Developing a One Stop Shop Blueprint – Initial Recommendations). Once the approach has been demonstrated and evidenced, we believe there will be a strong incentive to position the company for significant growth in the heat pump market.

To enable growth, access to delivery capacity will be critical. A key role for management will therefore be to strike deals/contracts with contractors, demonstrate the benefits of heat pumps and the pipeline of work being delivered through the One Stop Shop and support them with training to become approved within the supply chain (see section 6.4 and Supply Chain Support Strategy in the appendix). This will grow the capacity of the One Stop Shop, aligned to the regions of operation to support the growth aspirations.

Public Funding: For the consumer, our solution provides the option for up to 100% funding for heat pumps and associated measures from private sources, with no long-term requirement for public funding.

Promotion: Partnerships with suppliers, lenders or local authorities will provide additional routes to growth (see Developing a One Stop Shop Blueprint - Initial Recommendations in the annex), and so it is expected it will be worthwhile undertaking active promotion of the project, operational engines/backend systems and One Stop Shop service to these potential partner groups. Promotion to potential partners could include blog posts, social media, attendance at conferences, presentations, webinars and direct marketing activities.

Wider visibility will be especially important in locations where the One Stop Shop has launched and so, we recommend the hyper-local marketing approach detailed in section 9.1.2.

11.2 Replicability of the Methodology to Other Locations

The business model can also be maintained through growth in other locations. As such, our goal is to develop a market-led model that is commercially replicable. We believe the Prosumer Model provides an attractive value proposition to consumers based around:

- Lower cost of energy (see section 6.1).
- Security against energy price volatility (see section 6.1).
- Carbon savings compared to gas alternatives (see section 6.1).
- Finance removing/reducing up-front costs (see section 6.2).

Through our digital platform, we believe promotion to other locations will follow naturally from success in Cherwell. This will be supported by wider sharing of project learnings and benefits via project partners including Oxfordshire County Council. Our methodology and design are highly replicable with the potential to deliver significant carbon impacts across the UK and have been designed with replicability in mind throughout.

One Stop Shop: Based on its replicability, the One Stop Shop will be able to support similar, high density heat pump deployment activity in other regions. While the initial focus will be on Oxfordshire, the One Stop Shop will be capable of national coverage. Furthermore, the standardised documents created within the platform can be produced for any location in the UK.

Digital Platform: The digital-first approach will be designed from the outset to be capable of a national roll-out, including use of national data sources for analysis (see section 8.1.3 and Technology Options Summary).

Single, Universal Brand: The One Stop Shop should have single, universal brand that will be tested with representative users to ensure that there is high confidence that the brand will be popular UK-wide upon roll-out.

Quality Assurance/Partnership: The replicable quality assurance standards embedded in the method promotes trust and consistency and can drive confidence in heat pump installations across the UK.

Partnership with Single Technology Provider: Utilising a single technology provider that has UK coverage will provide access to suppliers and installers nationally, thereby supporting wider replicability and rollout.

GIS Prioritisation Process: Our data-led site prioritisation process has been designed to prompt and enable discussion with UK DNOs and provide intelligence for regional authorities in heat/retrofit planning. Using national datasets, it is replicable to any location in the country.

Bulk Application Process: The tools and approach enable a strong partnership with DNOs, supporting the analysis, groundwork and changes necessary to enable and prioritise locations for high-density deployments.

Hyper-Local Marketing Approach: The marketing approach is replicable and repeatable within other locations to support future high-density deployments.

Contractual Materials: Contracts and legal documents will be designed to be replicated or extended to other regions and will be drafted in accordance with UK laws, supporting replicability.

11.3 Number of Heat Pumps deployed by 2028

11.3.1 Within the Target Region

All local authorities within Oxfordshire have declared a climate emergency and many districts, including Cherwell, aim to deliver Net Zero well ahead of 2050. City Science has recently modelled a Net Zero Route Map and Action Plan for Oxfordshire County Council. The trajectories within this plan require that the domestic sector is decarbonised, largely through retrofit, heat pump measures and the addition of solar, consistent with the Prosumer Model.

There are currently 311,000 households in Oxfordshire. Under a Net Zero pathway to 2050, we expect that 80% of existing properties will need to be retrofitted with a heat pump. This equates to a total of 248,000 of the 2022 properties requiring a heat pump. As a result, heat pump retrofits will need to be scaled rapidly to meet the decarbonisation objectives. On an annual basis (assuming a 2025 start date), heat pump retrofits would need to scale to 9,920/year. This is a significant expansion in activity from today's levels.

The key barriers to delivering this level within Oxfordshire are supply chain capacity and funding for the consumer. Our One Stop Shop addresses both constraints and is therefore expected to play an essential role in enabling scale-up to this level of activity. Assuming a 20% market share, this would equate to 1,984 heat pump deployments per annum. This is in line with the Year 1, post-project target for the platform of 2,000 heat pumps.

11.3.2 Expansion to Other Regions

The model for the One Stop Shop has the potential to grow aggressively through acquisition and organic growth (via promotion to City Science's existing clients across the south of England and the midlands). Target acquisitions, for example, would include existing suppliers specialising in gas boiler or air conditioning installations who could be retrained in the installation of the Prosumer Model. Based on a combination of organic growth, localised contractual relationships and acquisitions, we target for the One Stop Shop to grow, initially across the South of England and then moving north up the UK.

11.3.3 Total Impact by 2028

Based on these growth ambitions, we target the following annual installations originated through the One Stop Shop:

- 2025 heat pumps installed: 2,000.
- 2026 heat pumps installed: 10,000.
- 2027 heat pumps installed: 30,000.
- 2028 heat pumps installed: 60,000.

The cumulative target for heat pumps installations to 2028 will therefore be 102,000. As a result, if all targets are met, the total heat pump deployments expected to be delivered through the One Stop Shop by 2028 is 102,136 made up of:

- 136: Number of heat pumps deployed during Heat Pump Ready.
- 102,000: Number of heat pumps deployed between 2025-2028 across the target region.

11.3.4 Impact of Carbon Targets

Our methodology which removes barriers to heat pump deployment and reduces consumer costs could have a significant impact on delivery and, as a consequence, carbon targets. Every home that adopts a heat pump (using renewable electricity) for heating, will save on average 1.84 t CO_2 (gas) or 2.45 t CO_2 (oil)/annum (see Technology Options Summary in the annex).

11.3.5 Carbon Emission Reduction Achieved

In Phase 2 we seek to deploy at least 136 heat pumps in on-gas properties within Cherwell. Delivery of these installations will save 268.6 t CO_2/annum. As set out above, by 2028 we aim for our solution to have incentivised, encouraged and funded the deployment of 102,146 heat pumps. At this level, the carbon savings would equate to 187.9 kt CO_2.

Beyond 2028, we aim for our solution to continue to grow, supporting addressing the UK's 23.2 million domestic properties where heat pumps are expected to be the main decarbonisation technology. By 2028 we aim to be positioned to have secured deals and be providing direct coverage of regions totalling 15m households. From 2028 we aim to be delivering 75,000-100,000 heat pump deployments per annum with an ultimate goal to support the conversion of 20% of those 15 million properties to heat pumps. If this ambition can be achieved, the carbon saving would be 5.52 Mt CO_2 per annum. This level of delivery would also represent 12.5%-16% of the government's ambition to deliver 600,000 heat pumps by 2028.

11.3.6 Net Price/Tonne (To Consumer)

Our project also seeks to bring together a range of technologies and techniques to reduce the cost to consumers (see section 10.1). We aim for our holistic approach to technology selection, financing and performance improvement to reduce the lifetime costs of a heat pump.

The differential between gas and electricity costs has changed such that a heat pump with a Seasonal Coefficient of Performance (SCOP) of 2.8 will have fuel costs equivalent to a gas boiler system. Our installs will use the latest heat pump technologies and will be fitted to high standards, as developed through our technical specifications. We calculate (see 15.1) that our proposed heat pump retrofit package for a typical bungalow archetype with a SCOP of 3.0 will deliver fuel cost savings of £260/annum against a gas boiler system. Furthermore, our modelling has demonstrated the improved economics of installing solar PV alongside heat pump retrofits. Given the current energy price guarantee, inclusion of solar PV can save £1,000/annum for a typical bungalow against a gas boiler system.

Considering the total lifetime cost of a heat pump retrofit (capital, operational, replacement, maintenance), for a typical bungalow without solar PV the cost per tonne of CO_2 saved after 10 years could be as little as £133/tonne, whereas with PV this could be £72/tonne.

12 Recommendations

Phase 1 culminated in the following key recommendations that are relevant to stakeholders in other locations who would like to deploy heat pumps at high density (or encourage widespread uptake).

12.1 Prosumer Model

Phase 1 research has shown that against various scenarios, a Prosumer Model offers the best opportunity to reduce energy costs for consumers and insulate them from energy price volatility. It is therefore recommended that stakeholders in other locations offer all Prosumer Model technologies to increase uptake.

12.2 One Stop Shop

Evidence from Phase 1 suggests that the consumer experience of heat pump deployment needs to be simplified. A One Stop Shop that enhances and simplifies the customer journey by providing everything in one place is therefore a key recommendation for any stakeholder looking to increase uptake/density of heat pump deployment. The One Stop Shop should:

- Minimise barriers through a seamless, digital customer journey that takes customers through the end-to-end process.
- Ensure that heat pump deployments are SMART by default and can be coordinated using standardised data. This will enable an understanding of the wider benefits of improved flexibility and performance.
- Include affordable financing for the full Prosumer Model to minimise cost barriers.

12.3 Reduce Costs

In addition to offering affordable finance and weaving generation into the system offering, to further tackle cost barriers, stakeholders should consider increasing consumer buying power/available discounts by coordinating high-density deployments on a street-by-street basis. They should also look to develop an integrated supplier approach whereby further technology discounts may be unlocked via the procurement process.

12.4 GIS Analysis

Conducting a GIS analysis was key to enable the identification of areas that provided the highest confidence (see Technology Options Summary). It is recommended that stakeholders always conduct a GIS analysis when developing a strategy for high-density heat pump deployment.

12.5 Community Engagement

Phase 1 evidence suggests that it would be very difficult to reach high-density deployment without a robust, hyper-localised community engagement approach (see User Evidence Summary). Due to drop-off rates, it is necessary to capture 100% of consumers in the target area in the sales funnel from the outset. Although door-to-door engagement is time consuming and can be considered “old fashioned”, it is recommended for achieving high density.

12.6 Work Closely with DNOs

There is currently no process for DNOs to accept bulk applications. Therefore, pioneering stakeholders who are the first to attempt high-density deployment in their Electricity Supply Area are likely to run into significant delays in the connection approval process. A key recommendation is to

work closely with the local DNO to streamline the application and connection process to enable fast-tracked, bulk applications to support the high-density deployment of pumps.

12.7 Supplier Support

During project supplier interviews, it became clear that installers currently have a lack of capacity and struggle to hire staff with the right skillset. This is especially true for solar installers due to a recent boom in solar PV demand following the energy crisis. Although the project team interviewed Oxfordshire-local suppliers, this is known to be a UK-wide issue. For this reason, stakeholders should consider how they can support suppliers in developing the required knowledge and human capital to increase capacity and meet the demand generated by high-density deployment strategies. Examples include providing training materials and access to training, collaborating with Local Authority and skills development organisations, and promoting Low Carbon Technology careers at careers fairs.

13 Conclusion

In conclusion, the research conducted in Phase 1 provides sufficient evidence that the proposed approach to achieving high-density heat pump deployment is most likely to be successful within NW Bicester in Cherwell, Oxfordshire. The key points in determining these factors included:

- Evidence for One Stop Shop Appetite: Significant evidence throughout Phase 1 confirmed that a One Stop Shop approach that simplifies and enhances the customer journey is an attractive and necessary solution to enabling widespread adoption. Evidence for this was gained in the Barriers Research Survey, Door to Door Research, Branding Research, Focus Groups, and One Stop Shop Testing and provided the project group with confidence that a One Stop Shop approach will gain traction in the market and support general uptake. This is likely to be the case irrespective of whether high-density deployment is desired or not, however, we believe this model is likely to be supportive of deployments at high density.
- Evidence for Prosumer Model Appetite: Similarly, the user engagement quoted above evidenced an enthusiasm for combining solar PV with a heat pump to improve financial attractiveness and increase self-sufficiency. The overwhelming interest in solar PV provides the project with a unique opportunity to include solar PV within the product offering as a "hook" to attract householders who may not yet have considered heat pumps. Utilising this method, we are confident that offering a Prosumer System will be attractive to householders, support heat pump uptake more generally, and support high-density deployment.
- Evidence of Financing Impact: Phase 1 engagements provided overwhelming evidence that the upfront cost is a significant barrier to adoption. The team therefore estimates that providing financing options within the One Stop Shop that reduces upfront costs in an affordable way will significantly increase uptake.
- Evidence of Target Area Suitability: The Building Level Modelling in work package 2 provided evidence that NW Bicester is the most likely area within Cherwell to be successful for high-density deployment (based on our site selection factors). However, overall, high-density deployments are likely to be far more challenging to deliver than the delivery of absolute numbers.
- Evidence of Capability for Deep, Localised Engagement: Engagement provided evidence that a localised approach that harnesses consumer power and social proof is attractive to householders. The project team achieved significant response rates during Phase 1 engagement. We believe that in order to achieve the density targets, initial marketing/engagement needs to reach 100% of those living in target areas. While we expect this level of engagement to be challenging, we believe our overall engagement approach was as successful as could be expected. This, therefore, supports our view that our method is likely to maximise density in the target locations (although the possibility of 25% density is yet to be proven).

Although reaching the Phase 2 density requirements presents a significant challenge, Phase 1 research has evidenced that the project approach which combines a One Stop Shop, a Prosumer Model, financing options and deep localised engagement has a good chance of significantly boosting uptake in the target area. For this reason, the project team applied for Phase 2 funding. In the event of the project not meeting density requirements, negative impacts have been mitigated by ensuring

significant value is delivered by the project in Stage 2a. As an example, the stage will develop a robust One Stop Shop website that can be utilised for a variety of Low Carbon Technologies and easily be replicated across the UK.

14 References

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15 Appendix

15.1 Technology Options Summary Report (Authored by City Science)

IN-BUILT FINANCIAL MODEL

A financial model has been built into the Building-Level model.

26 Archetypes generated from 9 core building typologies, split by EPC band and (in some cases) wall type. Those with EPC rating A or B and cavity walls are considered to require minor energy efficiency retrofit investment and therefore are more financially viable.

The model also considers the lifetime cost of gas boiler versus an Air Source Heat Pump for 26 archetypes at 10, 20 and 30 year intervals.

MODEL INCLUSIONS

Cost of heat pump install

Cost of enlarging radiators

Cost of energy efficiency measures (for EPC C – G)

Lifetime Cost

LIFETIME COST INCLUSIONS

Capital cost of boiler/heat pump (with replacement at 15 years)

Servicing

Fuel costs

Energy efficiency measures

Heating system upgrades (such as larger boilers)

26 BUILDING ARCHETYPES

Archetypes 1 – 9: Properties requiring minor retrofit:

Small Flat, Ground Floor Flat, Mid Floor Flat, Top Floor Flat, Bungalow, Mid Terrace, End Terrace, Semi-detached House, Detached House

Archetypes 10 – 18: Properties requiring significant retrofit:

Small Flat, Ground Floor Flat, Mid Floor Flat, Top Floor Flat, Bungalow, Mid Terrace, End Terrace, Semi-detached House, Detached House

Archetypes 19 – 22: Properties with solid walls:

Mid Terrace, End Terrace, Semi-detached House, Detached House

Archetypes 23 – 26: Properties with cavity walls:

Mid Terrace, End Terrace, Semi-detached House, Detached House

IN-BUILT FINANCIAL MODEL

The table below details the key assumptions and technologies that were included in the in-built financial model.
Key costs sources included:

- BEIS, Cost-Optimal Domestic Electrification (CODE)
- BEIS, Delta-EE, The Cost of Installing Heating Measures in Domestic Properties

Technologies	Costs	Assumptions
ASHP (air-to-water) capital and installation cost	Fixed component: £1870 Variable component: £690/kW	Total cost is summation of fixed and variable components Replacement at 15 years, annual service cost included (£182) Cost includes installation labour
Gas boiler	£2568	Replacement at 15 years, annual service cost included (£109). Cost includes installation labour
Heating system upgrades (enlarged radiators)	£270/radiator	Where radiators are already present. Cost per radiator, includes labour costs
Electricity and Gas tariffs	Varies from 2022 to 2051: Elec: 19-22p/kWh Gas: 4-5p/kWh	Government Green Book Projections
Solid wall insulation (external) – applied to solid wall archetypes only	Fixed component: £4,490 Variable component: £40/m^2 Annual energy saving: 14% - 24% (varies per archetype)	External wall insulation the summation of the fixed and variable component. Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs.
Top-up loft insulation	Fixed component: £175 Variable component: £6/m^2 Annual energy saving: 2% - 6% (varies per archetype)	Top-up insulation the summation of the fixed and variable component. Variable component is per unit roof area. Costs include labour costs.
Draught proofing	£400 (fixed) Annual energy saving: 2.5%	Includes labour costs.
HPR Grant funding	40% core HPR costs (or max £5000)	

FINANCIAL MODEL TARIFF ASSUMPTIONS

Two energy tariff scenarios have been modelled:

- **Low**: Government Green Book Projections 2021 – prices are pre-energy crises levels, prices are variable until 2040 after which they are flat.
- **High**: New Energy Price Guarantee, fixed from 1 October 2022 to 1 October 2024. Prices are flat for 30 years.
- Using the low tariffs, an ASHP will cost more to run in terms of fuel costs than a gas boiler.
- However, under the new energy price guarantee, the ASHP will cost slightly less to run than the gas boiler.

	Energy Price Guarantee 1 October 2022 - 1 October 2024
Electricity per kWh	£ 0.34
Gas per kWh	£ 0.10
SCOP Required for Price Parity	2.8

	Green Book Energy Prices (p/kWh)		
Year	Electricity	Gas	SCOP Required for Price Parity
2022	21.5	4.51	4.0
2023	21.4	4.55	4.0
2024	21.1	4.59	3.9
2025	21.3	4.63	3.9
2026	21.5	4.66	3.9
2027	21.1	4.69	3.8
2028	21.0	4.73	3.8
2029	20.9	4.75	3.7
2030	21.3	4.77	3.8
2031	21.2	4.79	3.8
2032	20.7	4.82	3.7
2033	20.2	4.83	3.6
2034	19.9	4.86	3.5
2035	19.6	4.89	3.4
2036	19.5	4.92	3.4
2037	19.4	4.92	3.4
2038	19.3	4.91	3.3
2039	19.6	4.91	3.4
2040	19.3	4.90	3.3
2041	19.3	4.90	3.3
2042	19.3	4.90	3.3
2043	19.3	4.90	3.3
2044	19.3	4.90	3.3
2045	19.3	4.90	3.3
2046	19.3	4.90	3.3
2047	19.3	4.90	3.3
2048	19.3	4.90	3.3
2049	19.3	4.90	3.3
2050	19.3	4.90	3.3
2051	19.3	4.90	3.3

HEAT PUMP VS PROSUMER SCENARIOS

- Addition of PV improves financials at 20 year point under low tariff.
- But under high tariff there is a financial benefit from 10 years onwards.
- If property owner is willing to make a long-term investment in PV, it makes financial sense to do so.

		HP Only			HP + PV			
	Building Type	**Lifetime Cost % diff – 10 year**	**Lifetime Cost % diff – 20 year**	**Lifetime Cost % diff – 30 year**	**PV System Size (kWp)**	**Lifetime Cost % diff – 10 year**	**Lifetime Cost % diff – 20 year**	**Lifetime Cost % diff – 30 year**
Low tariff: Green Book Projection	bungalow	-66%	-71%	-53%	4.5	-88%	-60%	-27%
	mid_terrace_solid	-108%	-90%	-63%	4.5	-126%	-79%	-39%
	mid_terrace_cavity	-81%	-86%	-64%	5.0	-103%	-73%	-37%
	end_terrace_solid	-105%	-80%	-52%	5.0	-121%	-68%	-27%
	end_terrace_cavity	-86%	-89%	-66%	5.0	-103%	-74%	-38%
	semi_detached_solid	-93%	-69%	-44%	5.0	-108%	-56%	-19%
	semi_detached_cavity	-78%	-80%	-59%	5.0	-93%	-66%	-32%
	detached_solid	-145%	-113%	-75%	5.0	-163%	-102%	-51%
	detached_cavity	-134%	-133%	-96%	5.0	-151%	-120%	-69%
High tariff: Energy Price Guarantee 2022-2024	bungalow	-17%	-23%	-13%	3.0	-10%	-3%	13%
	mid_terrace_solid	-35%	-29%	-14%	3.0	-28%	-11%	9%
	mid_terrace_cavity	-26%	-31%	-20%	3.0	-18%	-12%	6%
	end_terrace_solid	-29%	-19%	-4%	3.5	-22%	-1%	20%
	end_terrace_cavity	-27%	-32%	-19%	3.5	-19%	-11%	7%
	semi_detached_solid	-22%	-13%	0%	3.5	-15%	5%	24%
	semi_detached_cavity	-22%	-26%	-16%	4.0	-14%	-5%	12%
	detached_solid	-49%	-36%	-16%	3.0	-43%	-20%	6%
	detached_cavity	-51%	-54%	-34%	3.5	-43%	-35%	-9%

HEAT PUMP VS PROSUMER SCENARIOS

The table below illustrates the potential electricity cost savings when operating a heat pump alongside on-site solar PV. The cost savings occur as a result of on-site generated electricity displacing the need to purchase expensive electricity from the grid. Additional savings could also be achieved through selling surplus electricity (i.e. during summer months where heating requirements are low, but solar generation his high), however, for the purpose of these calculation, it has been assumed that this electricity has been used to satisfy other household demand (e.g. lighting, appliances, electric vehicle charging).

	Without Solar PV		With Solar PV				
Typology	**Total estimated annual energy requirement for heat pump after fabric retrofit (kWh)**	**Estimated annual electricity cost (based on 34p per kWh) (£)**	**Total estimated annual energy requirement for heat pump after fabric retrofit (kWh)**	**Less: Estimated annual electricity generated and utilised on site (kWh)**	**Estimated annual electricity requirement to be sourced from the National Grid (kWh)**	**Estimated annual electricity cost (based on 34p per kWh) (£)**	**Annual electricity cost saving (£)**
Bungalow	4,644	£1,579	4,644	2,309	2,335	£794	£785
Mid-terrace with cavity walls	5,291	£1,799	5,291	2,393	2,898	£985	£814
Mid-terrace with solid walls	4,962	£1,687	4,962	2,375	2,587	£880	£807
Compact semi-detached	5,119	£1,740	5,119	2,761	2,358	£802	£938
End-terrace with cavity walls	6,071	£2,064	6,071	2,811	3,260	£1,108	£956
Semi-detached with solid walls	5,409	£1,839	5,409	2,817	2,592	£881	£958
Detached with cavity walls	6,092	£2,071	6,092	2,762	3,330	£1,132	£939
Detached with solid walls	4,844	£1,647	4,844	2,457	2,387	£812	£835

CARBON SAVINGS

- % differences are the difference in fuel emissions from gas boiler vs ASHP (gas vs electricity).
- ASHP will save a huge amount of GHG emissions over its lifetime compared to gas boiler.
- Addition of PV saves even more as we are displacing electricity from the grid.

	HP Only			HP + PV			
Building Type	**Lifetime CO2e Emissions % diff – 10 year**	**Lifetime CO2e Emissions % diff – 20 year**	**Lifetime CO2e Emissions % diff – 30 year**	**PV System Size (kWp)**	**Lifetime CO2e Emissions % diff – 10 year**	**Lifetime CO2e Emissions % diff – 20 year**	**Lifetime CO2e Emissions % diff – 30 year**
small_flat	87%	92%	94%	-	-	-	-
ground_floor_flat	87%	92%	94%	-	-	-	-
mid_floor_flat	-	-	-	-	-	-	-
top_floor_flat	87%	92%	94%	-	-	-	-
bungalow	87%	92%	94%	3.0	95%	97%	98%
mid_terrace_solid	88%	93%	95%	3.0	95%	97%	98%
mid_terrace_cavity	86%	91%	94%	3.0	94%	96%	97%
end_terrace_solid	89%	93%	95%	3.5	96%	98%	98%
end_terrace_cavity	86%	91%	94%	3.5	94%	96%	97%
semi_detached_solid	89%	93%	95%	3.5	96%	97%	98%
semi_detached_cavity	86%	91%	94%	4.0	94%	96%	97%
detached_solid	90%	94%	95%	3.0	96%	97%	98%
detached_cavity	86%	92%	94%	3.5	94%	96%	97%

Uses Government Green Book projection of electricity grid carbon intensity.

FINANCIAL MODELLING CONCLUSIONS

- Retrofitting an existing property with an ASHP is probably going to cost more than sticking with a gas boiler.
- The addition of solar PV will improve the financials of the heat pump retrofit if the owner is willing to make a long term investment.
- The prosumer HP model is still likely to cost more than the gas boiler in the short term, but we could see a breakeven point long term if energy prices stay high (20 years plus).
- Impact of different energy tariff scenarios is substantial.

BUILDING LEVEL MODELLING DATA

The following datasets have been included in the model:

Dataset	Purpose/Function
Building Stock Data	
Addressbase data - locations of all properties (domestic and non-domestic), identified by Unique Property Reference Number (UPRN)	To map all properties in Cherwell and determine which properties are domestic
EPC data (domestic)	To understand the current housing stock and estimate retrofit requirements
Geospatial Data	
Listed buildings, archaeological sites, conservation areas etc	Allows the exclusion of these areas, which are unlikely to be suitable for retrofit.
Off-gas postcodes	To ensure a maximum of 15% of off-gas homes are progressed in the stream 1 trial
WPD and SSE Primary Substation Electricity Supply Areas (ESAs)	To map the properties served by each primary substation
WPD and SSE Secondary Substation Electricity Supply Areas (ESAs)	To map the properties served by each secondary substation
Financial Prioritisation Data	
Heat pump costs	To estimate financial viability.
Heating system upgrade costs	
Energy efficiency measures costs, and energy savings	

SITE PRIORITISATION SCORING

The Building Level Model outputs results for each Electricity Supply Area (ESA) to derive:

- **The number of addresses**
- **The number of domestic addresses**
- **% On-Gas**
- **% Social Housing**
- **% Heat Pump Ready (HPR) Priority:** Those that are domestic, on-gas, not protected/listed, not social housing.
- **Average 10, 20 and 30 year score:** This is a financial score describing the comparison of installing a Heat Pump versus retaining a boiler. In the example below, the total costs of installing Heat Pumps in the area now will be 66% more expensive for householders than retaining a boiler after 10 years of use. After 30 years of use, it is estimated to be 50% more expensive to install a Heat Pump overall.

Area name	Number of addresses	Number of domestic addresses	% on-gas	% social housing	% HPR priority	Domestic EPC coverage (%)	Average 10 year score	Average 20 year score	Average 30 year score
GREEN ST-MARCH	196	193	93%	21%	82%	61%	-66	-70	-50

Note: Financial scoring is only possible where an EPC is available.

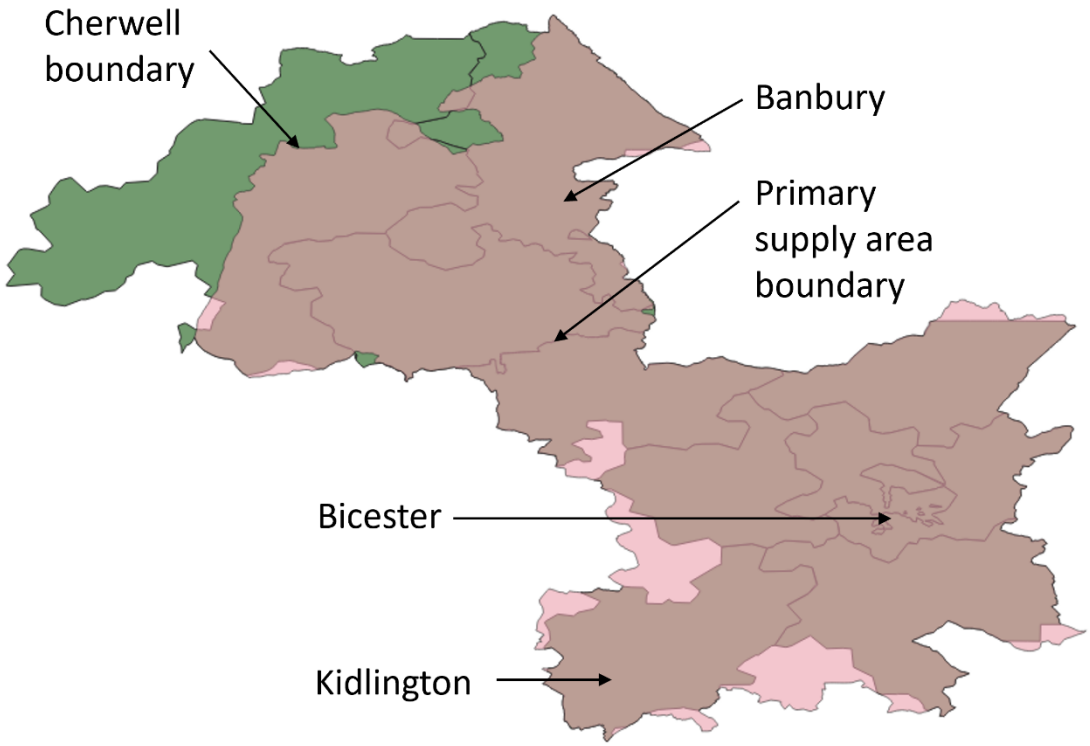
MAPPING PRIMARY SUBSTATION CATCHMENT AREAS

Primary Substation catchment areas were mapped to ensure we achieve 25% density on either at least one low-voltage network, secondary substation or primary substation.

WPD and SSE have openly available data on the electricity supply areas served by primary substations, complete with headroom available.

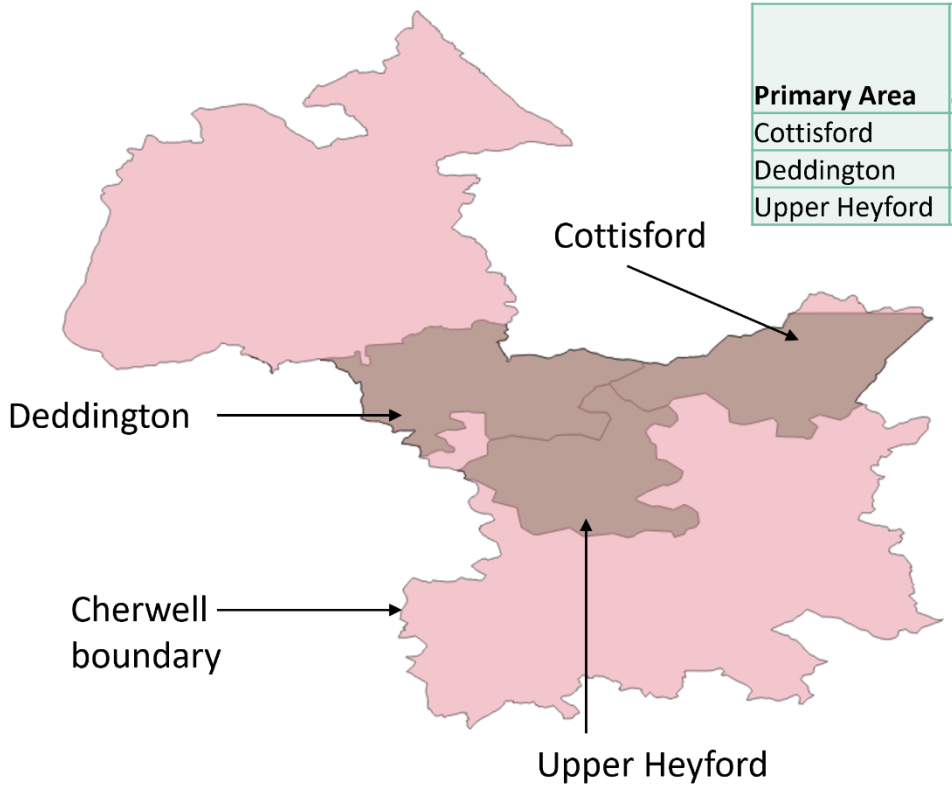
Primary ESAs have thousands of customers, most have >2000 customers, requiring >500 heat pumps to be deployed.

Outcome: There are 10 primary substation areas that have significant overlap with Cherwell's boundary.



PRIMARY SUBSTATION ANALYSIS

Potential to Install Heat Pumps at 25% density at a Primary Substation:

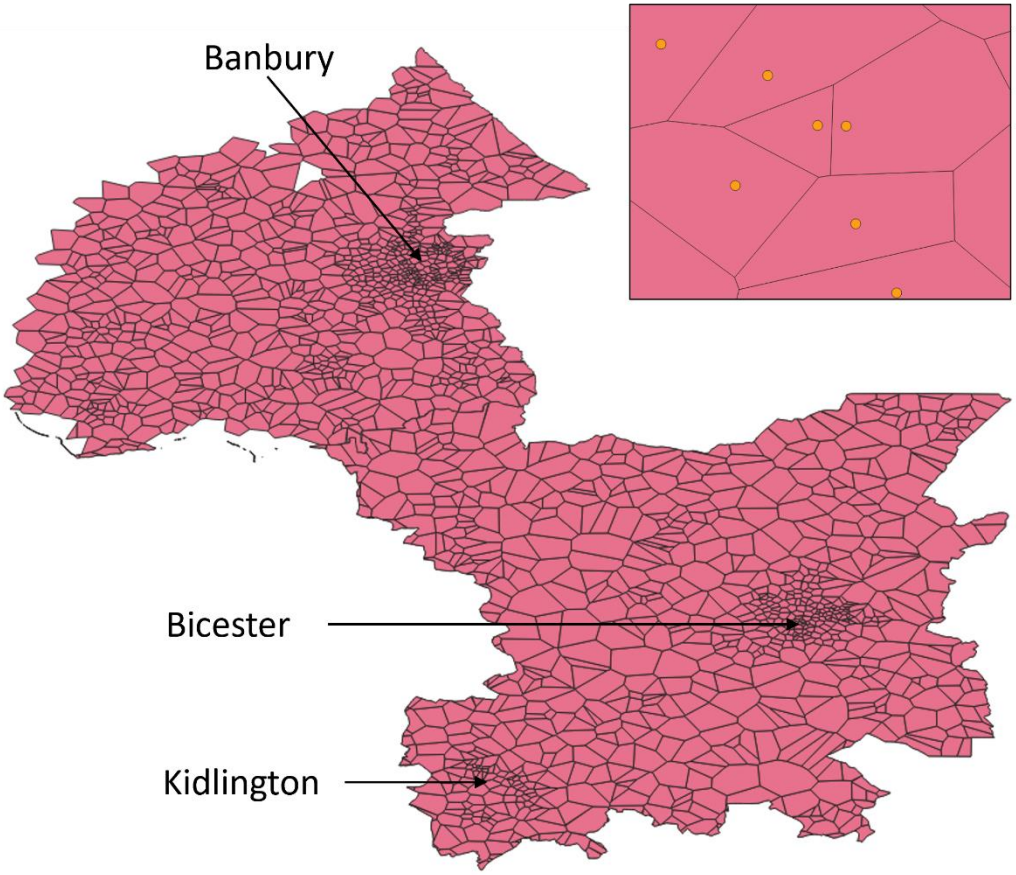


Primary Area	Number of addresses	Winter Headroom 2023 (MVA)	% on-gas	% social housing	% hpr-priority
Cottisford	1037	0.31	18%	4%	4%
Deddington	2242	-0.81	20%	9%	16%
Upper Heyford	3144	2.17	48%	4%	23%

All primary areas require a significant amount of heat pumps to be deployed (>250).

Decision: Targeting a primary area is less favourable than targeting a secondary area.

MAPPING SECONDARY SUBSTATION CATCHMENT AREAS



Secondary substation catchment areas were estimated and mapped.

WPD only has openly available data on the coordinates of distribution substations and their supply areas.

This same data was sourced from SSE after discussions with them (it is not publicly available).

Supply areas appear to be estimations only (using Voronoi polygon technique) and data is not available on the available headroom for each substation.

Outcome: Within Cherwell there are circa 1,800 of secondary substation supply areas.

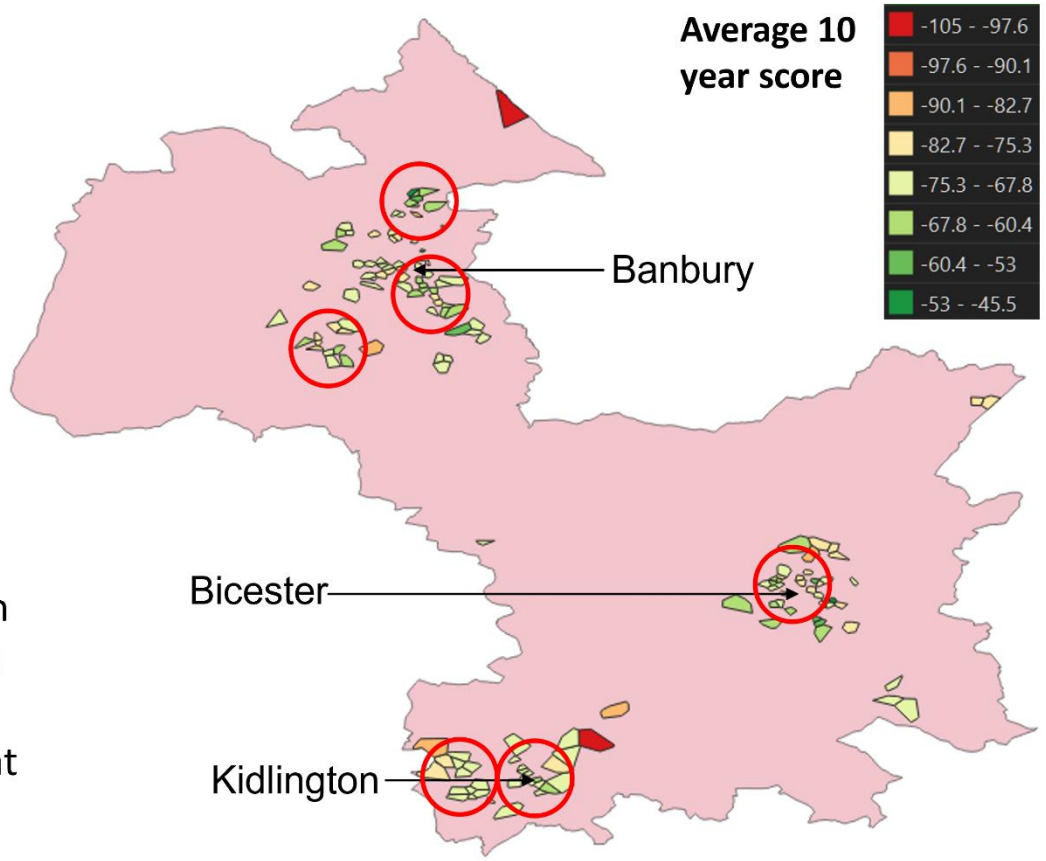
SECONDARY SUBSTATION ANALYSIS

Filtering conditions:

- Number of addresses < 150
- % on-gas > 85%
- % social housing < 20%
- % HPR-priority > 70%

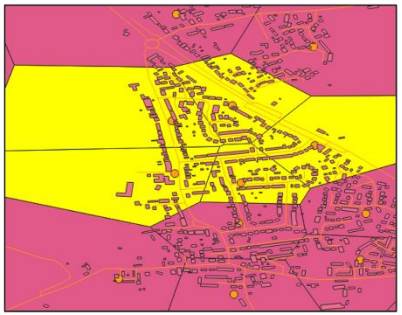
Results:

- 161 areas remain
- Some clusters of areas are present
- Targeting a cluster of areas would build in redundancy if the DNOs further analysis on finds an area unsuitable, or if an area lacks engagement with the programme.
- Distribution areas are sufficiently small that several could be targeted for engagement.

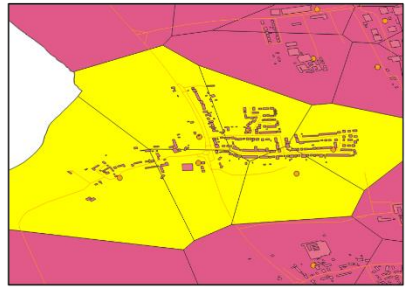


SHORTLISTED SITE COMPARISON

Area name	Yarnton	Begbroke	NW Bicester	South Banbury
Number of areas selected	5	6	6	7
Average number of addresses per area	105	63	87	118
% domestic addresses	96%	92%	96%	97%
Domestic EPC Coverage	52%	54%	53%	56%
% on-gas	97%	98%	98%	98%
% social housing	1%	0%	0%	3%
% hpr-priority	93%	87%	94%	94%
Average 10 year score	-71	-73	-66	-68
Archetype mix				
small_flat_significant_retrofit	8%	7%	1%	2%
bungalow_significant_retrofit	28%	36%	50%	47%
semi_detached_cavity_significant_retrofit	27%	23%	11%	25%
detached_cavity_significant_retrofit	16%	14%	32%	16%



Yarnton



Begbroke

NW Bicester

South Banbury

SECONDARY SUBSTATION ANALYSIS
SHORTLISTED SITE COMPARISON

The Building-level model does not take local knowledge or community culture into consideration. For this reason, a workshop was held to share the four locations with Oxfordshire County Council officers who hold extensive local knowledge. The officers were able to provide valuable information pertaining to likely community engagement and the potential for more detailed network data. From this discussion, the location options were narrowed down to two sites: Yarnton and NW Bicester.

The LA officers were able to highlight that Yarnton had a great sense community and may be easier to target in communications, given that properties in the region are situated around a village hall. Furthermore, the electricity network is being researched as part of Project: Local Energy Oxfordshire (LEO).

Furthermore, they highlighted that NW Bicester locals may be more open or familiar with and accepting of low carbon technologies due to a new Ecotown being developed in the neighboring area.

To decide on the final location the following characteristics were taken into consideration: Affluence; Building typology; Community culture; Age; Technology Use.

Yarnton

NW Bicester

SECONDARY SUBSTATION ANALYSIS
SHORTLISTED SITE COMPARISON

To decide on the final location the following characteristics were taken into consideration. The table below shows how NW Bicester performed more favourably against many factors.

Area name		Yarnton	NW Bicester	Notes
Average number of addresses per area		105	87	Lower number of addresses preferred due to the feasibility of reaching 25% density.
Domestic EPC Coverage		52%	53%	Higher percentage = higher accuracy of EPC data.
% on-gas		97%	98%	Higher percentage preferred due to project constraints.
% social housing		1%	0%	Lower percentage preferred due to project constraints.
% hpr-priority		93%	94%	Higher percentage = more suitable for the project.
Archetype Mix				
Small flats		8%	1%	Less flats preferred as the are often unsuitable for heat pump installation
Bungalows		28%	50%	Bungalows preferred (due to solar potential).
Detached with Cavity Walls		16%	32%	Detached preferred (due to assumption of higher income).
Age of Occupants (Population Estimates for LSOAs in England and Wales by Single Year of Age and Sex, ONS)				
0	25	27%	23%	Lower percentage is preferred – This age group assumed to have low percentage of home ownership and low levels of financial savings.
26	45	25%	17%	
36	45	15%	8%	
46	65	28%	33%	Higher percentage preferred – This age group assumed to have greater financial savings.
66	75	11%	14%	Lower percentage preferred – Beyond 70 people may not see out the 15 year lifespan of the heat pump, reducing its attractiveness.

It was also found that specific postcodes in NW Bicester had a slightly higher performance than Yarnton when considering affluence and internet use.

A high proportion of e-Veterans and Digital Seniors is favourable when considering their ability to accept and utilise the One Stop Shop.

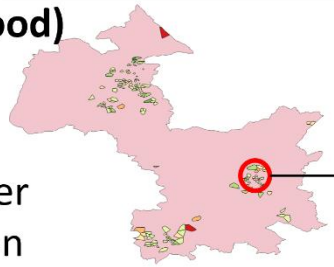
The e-Veterans Group represents affluent families, with populations of mainly middle-aged and highly qualified professionals. They are more likely to be frequent and experienced users of the internet and engage using multiple devices and in a variety of ways. They are fairly mature users and as such they have higher levels of engagement for information seeking, online services and shopping.

Members of the Digital Seniors Group are ageing and predominantly retired and relatively affluent. They make average use of the internet, typically using a personal computer at home. They are adept enough to use the internet for information seeking, financial services and online shopping.

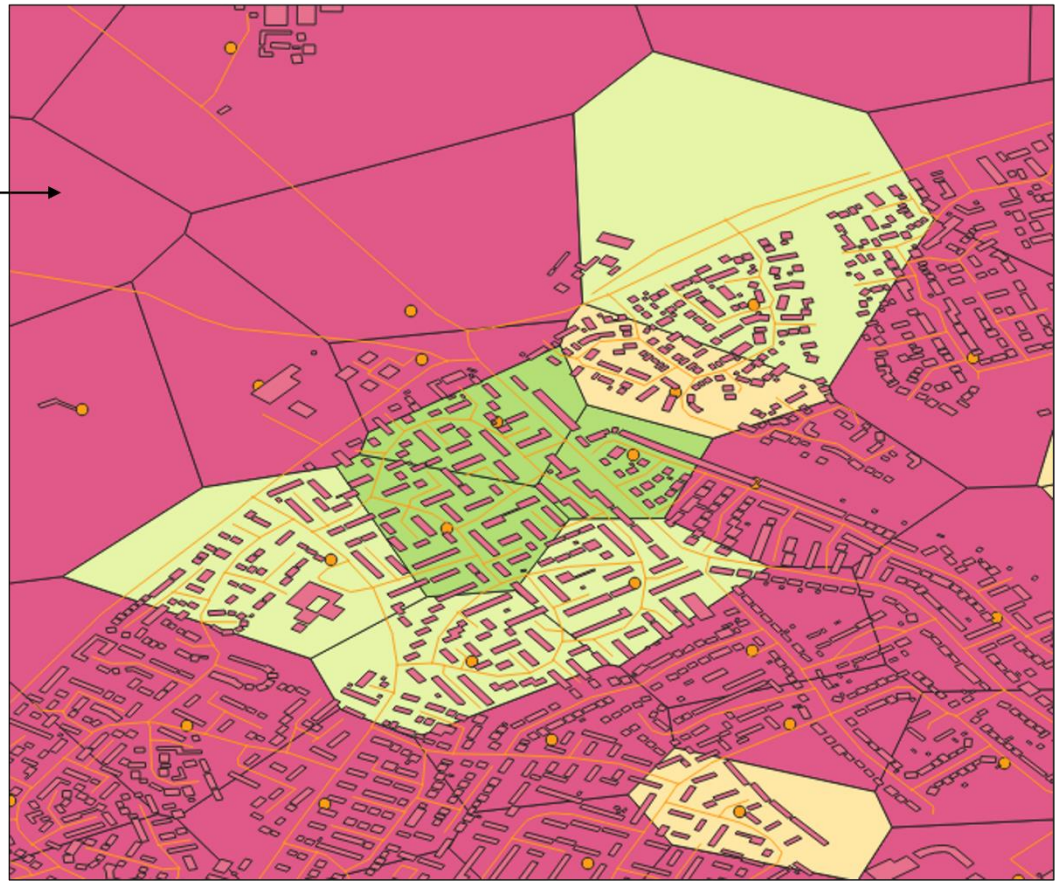
By comparison, Yarnton residents are predominantly classed as e-Rational Utilitarians who engage in constrained internet use.

CHOSEN LOCATION

North West Bicester (Greenwood)

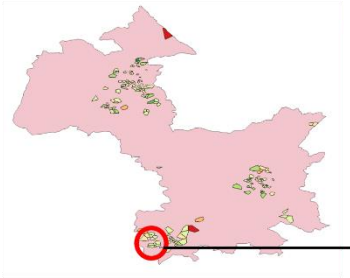


- Suburban section of Bicester
- Filtered areas have between 52 – 140 addresses.
- High proportion of bungalows (promising for solar).
- Affluent area
- New ECO village due to be built in NW Bicester (Elsmbrook Community). This could lead to increased resident engagement in low carbon technologies within the area.

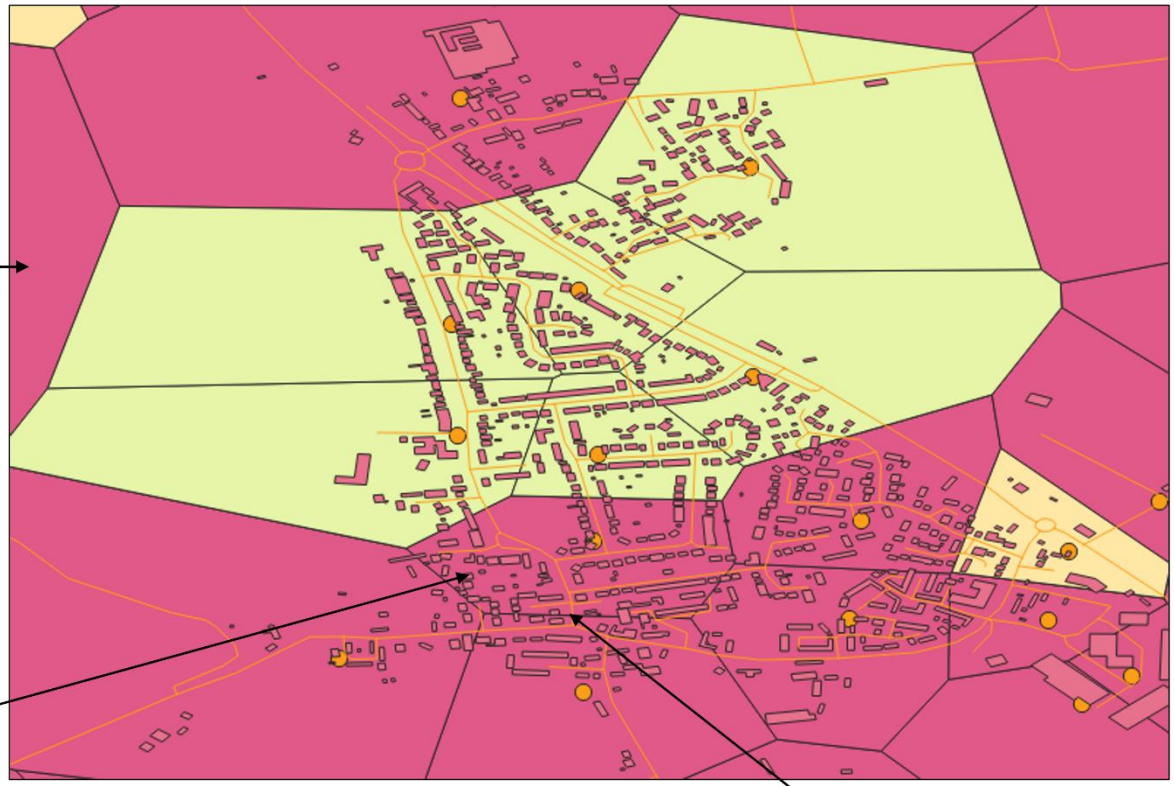


BACK UP LOCATION
YARNTON

Yarnton was selected as our back up location for the following reasons:



- Village community
- Unfiltered areas have between 70 – 140 addresses (which is feasible for phase 2 deployment)
- Fairly affluent
- Links to project LEO, more detailed substation catchment analysis coming in September.



15.2 Developing a One Stop Shop - Initial Recommendations Summary (Authored by Growth Guides)

15.2.1 Executive summary

Accelerating the take-up of heat pumps is a priority to help the UK reach its Net Zero 2050 target. The Oxfordshire Heat Pump Ready project is one of several looking to develop innovative solutions and methodologies for the optimised deployment of domestic heat pumps at high density.

In particular, the project will look to develop a 'prosumer model' to make heat pump adoption more attractive to a significant number of households. It will integrate air source heat pumps with improved insulation and solar panels to deliver a heating system that should (for suitable properties) be greener, warmer and potentially cheaper to run.

This report analyses the functionality, communications and branding of existing one-stop shops and related projects. It provides initial recommendations on the model, branding and communications approach for a one-stop shop to support and promote this prosumer model, with the intention of developing a blueprint for a scalable solution by the end of the project.

Through a review of existing channels in Oxfordshire, one-stop shops that have been developed to encourage retrofitting, and experience in the solar market, a number of relevant key learnings and recommendations have been identified. These include:

- The importance of a one-stop shop approach due to the considerable complexities and risks involved.
- The presence of likely early adopters who are either driven by environmental concerns or are at least keen to demonstrate they are taking action.
- The value of working with existing networks to reach households likely to be receptive to the approach.
- The need to focus communications on key benefits with clear calls to action.
- The scale of the challenge in the absence of clear financial arguments.
- The need to tailor communications to the stages of the consumer journey, starting with a quick, easy-to-understand but compelling overview to drive interest.
- The importance of developing appropriate language to describe the prosumer model.
- The reason a new brand for the one-stop shop will likely achieve better results but with the suggestion of flexibility to feed interested and viable householders into existing channels where these are appropriate for later stages of their journey.
- The ideal brand positioning that will reflect an exciting new approach to greener, warmer and (ideally) cheaper homes
- The need for straightforward language and a clear, trustworthy tone to appeal to a wide enough number of households to make a 25% density uptake possible.

15.2.2 Background and objectives

Overview

In order to accelerate the take-up of heat pumps to a density of 25% of households, a three-pronged 'prosumer model' is to be tested that integrates improved insulation, self-generation of electricity through solar (PV) panels and an air-source heat pump.

The intention is to make heat pumps more viable and attractive to a wider audience by improving their effectiveness as a heat source (via enhanced insulation) and potentially reducing their running costs (through self-generation of electricity and, possibly, innovative financing).

The combined 'prosumer' package will therefore aim to deliver the 'holy grail' of improved warmth, reduced emissions and lower cost.

However, while the principle of the prosumer model is fairly simple, the reality of understanding, planning, costing, financing, installing and operating a package like this is extremely complex and needs to be tailored to individual properties and householders.

A one-stop shop approach is therefore planned to introduce the model to householders and guide them through the process as a trusted, impartial expert resource. Through this project, a blueprint for such a one-stop shop and its initial resources will be developed.

In this summary report, we share key findings from a preliminary assessment of the branding and content requirements of this one-stop shop, including drawing learnings from a review of existing Oxfordshire County Council channels and a review of other heat pump-related/retrofit projects, related sectors and reports.

The 'prosumer model'

The prosumer model being developed and tested aims to increase the uptake of heat pumps by making them more attractive to households by simultaneously reducing their running costs and improving their effectiveness.

It involves improving the home's insulation to reduce its energy needs and offsetting the electricity costs by producing electricity through solar panels.

Planned and operated as an integrated system, this approach should make heat pumps more viable to a wider range of households and help mitigate current concerns about their suitability.

In addition, all three of the measures - insulation, solar generation and heat pumps - all reduce emissions and therefore help with the UK's commitment to Net Zero by 2050.

The 'one-stop shop' approach

In this context, the term 'one-stop shop' is used to describe a trusted service to householders that makes complex energy-efficient retrofit projects easier and more effective.

A one-stop shop offers expert, impartial advice to enable a householder to understand the efficiency options that might be available to them, what impact they would have on running costs and emissions, and how much they would cost. If the householder wants to go ahead, they can provide access to trusted suppliers, help with project management and assess the quality of work undertaken. They can even advise the household on running the new system effectively once it is installed.

The intention behind a one-stop shop is to build awareness, establish trust and create a smooth customer journey through the multiple stages required in the project such as the installation of the prosumer model into a home.

There is no universal agreement on the customer journey, but we would assume it will be based roughly on the following steps for the householder (expanded in more detail in section *The customer journey*):

1. Interest
2. Consideration
3. Suitability and feasibility
4. Detailed planning
5. Commissioning
6. Installing
7. Quality approval
8. Post-installation

Why do we need a one-stop shop for the prosumer model?:

Deciding to retrofit a heat pump is an extremely complex decision and the factors involved are likely to be too difficult for most if not all potential customers to accurately assess.

It is necessary to consider the costs (upfront and ongoing running costs), the reliability of contractors, the disruption of installation, the effectiveness as a source of hot water and heat, and the environmental impact, amongst other factors.

These are all dependent on the specific characteristics of the individual premises in which the heat pump will be installed and it is therefore extremely difficult to predict based on simple comparisons with other properties.

In addition, there is considerable jeopardy for the customer in getting the decision wrong. The financial sums, the fear of being mis-sold, the disruption of installation and the prospect of having an inadequately heated home are all real and significant.

Finally, there is currently little 'social proof' (and even a negative backlash in the media and social media) regarding the value of heat pumps, which means those committing to them may need significant reassurance before going ahead.

For these reasons, a one-stop shop approach is often cited as key in recommendations for promoting the uptake of heat pumps.

For example, in the SEAI (Sustainable Energy Authority of Ireland) report[1] 'Encouraging heat pump installations in Ireland' (November 2020), they make a policy recommendation to:

"Encourage the development of one-stop-shops. One-stop shops are designed to provide a single point of contact that can help simplify the customer journey of installing a heat pump for homeowners. One-stop shops should focus on helping homeowners identify quality installers, access low-cost finance, review the design of the proposed heat pump system, provide training on how to operate the heat pump efficiently, and help homeowners choose the best electricity tariff for their situation."

In the prosumer model being proposed for this project, the benefits to householders are improved (warmer, potentially cheaper, greener) but the project is made even more complex because the

requirements for enhanced insulation and choosing/installing a solar generation system need to be integrated into the modelling and plan.

This suggests the value of a one-stop shop is even more significant for the prosumer model approach than in a number of other cases where it has been recommended or used.

15.2.3 3. Summary review of existing channels, one-stop shops and reports

Before outlining initial branding and content recommendations for the prosumer model one-stop shop, we would share the following learnings from a review of existing Oxfordshire County Council channels, prototype one-stop shops in the heat pump installation and retrofitting space, research reports and related sectors.

Existing Oxfordshire County Council Channels

Cosy Homes Oxfordshire: Cosy Homes[2], which was developed by National Energy Foundation[3] and Low Carbon Hub[4], is a local planning service based in Oxfordshire that gives homeowners impartial advice and guidance on retrofitting their homes.

Cosy Homes was developed as part of BEIS's Supply Chain Demonstrator Project[5]. It was the second most successful of the six localised retrofit projects that were rolled out (according to the evaluation report at the time of writing), with six retrofitted projects started and two completed at the time of the evaluation in March 2021.

Cosy Homes describes itself on its website as *'a one-stop home retrofit service, making it simple to make energy efficiency improvements to homes in Oxfordshire'.*

The website has very direct language, aiming to convert website users immediately and encouraging them to find out more about their Plan Builder. It keeps things relatively simple - instead of discussing the actual measures they may implement as part of the retrofit project, it focuses more on the end benefits of retrofitting your home.

It addresses individual audiences with relevant messaging, explaining how a retrofit will benefit them - whether they are a homeowner-occupier, a landlord or a tenant.

Cosy Homes' process is described as follows:

- Stage 1: Home assessment
- Stage 2: Whole House Plan
- Stage 3: Design and contracting
- Stage 4: On-site
- Stage 5: Evaluation & handover

It is a comprehensive, seamless service where, on registration, a householder is assigned a Retrofit Coordinator who, if they proceed, then oversees the project on their behalf.

Cleverly, the first stage - the initial home assessment - utilises an online tool - the Cosy Homes Free Plan Builder. This, in conjunction with known information about the property (e.g. EPC data) and priorities selected by the householder, automatically generates an initial plan, indicating likely energy cost savings, emissions savings and the overall cost of the project. This gives householders the ability to get an initial indication of suggested measures to implement and an indicative cost without having to engage directly with anyone (especially someone who might be likely to 'sell them' something), which probably reduces friction and encourages usage.

This stage is free, but if the householder wants to go further and obtain a bespoke Whole House Plan, then costs (from about £250) are involved. If the householder goes ahead with the installation, Cosy Homes charge a 5% fee for project management.

Overall, the Cosy Homes model, positioning, branding, outreach and marketing activity appear to have been successful.

The model itself offers a comprehensive and seamless end-to-end service with an appointed Retrofit Coordinator guiding the householder from initial registration through detailed planning, overseeing the installation, assessing the quality, and supporting the householder with their new home post-installation.

Actively engaging with relevant community groups to access the right people with messaging that worked for them translated into positive results.

We have evaluated Cosy Homes in more detail in the *'Retrofit brand review report summary'* section below, alongside that of another one-stop shop, People Powered Retrofit from Manchester, which was also evaluated very positively but had a different 'pick-and-mix' approach.

Better Housing Better Health: Better Housing Better Health[6] is a charity supporting residents to keep warm, stay safe & live well in their homes. It is based on a consumer-facing website with both online and telephone options for seeking further assistance with keeping warm and well at home from trained advisors.

It describes itself as *"a longstanding service working to reduce the number of people in fuel poverty and improve domestic warmth & wellbeing".*

It goes on to say: *"In a preventative approach to health and wellbeing, our service provides residents with a single point of contact to get impartial expert advice to help improve the energy efficiency of their home, save money and improve comfort".*

Clearly, there are relevant elements of a one-stop shop here, especially in terms of the single point of contact and impartial expert advice, but it is not, we would suggest, a one-stop shop in terms of delivering a major retrofit project, although it does offer *'measures to improve energy efficiency'* (see below).

It is therefore being considered more as a channel that the project's one-stop shop might feed in to.

It is coordinated by National Energy Foundation but involves many other organisations across Buckinghamshire, Oxfordshire, Watford, Three Rivers, Luton, Central Bedfordshire and Dacorum with a cross-referral mechanism in place to maximise the benefit to residents of each organisation's field of expertise.

Better Housing Better Health also invites referrals from care workers and people concerned for the well-being of other residents.

The service offers help in a number of ways including:

- Access to free impartial advice: "We understand that every home is different and your own individual circumstances will determine how you use energy in your home. Our team are here to work with you to understand your usage and provide outcomes to help you save money and live more comfortably."

- Routes to manage energy bills: "One of the quickest and easiest ways to save money is to switch your energy tariff or energy supplier to make sure you're getting the best deal. The average household can save £300 per year by switching gas and electricity supplier and the BHBH team work with you to look at your energy consumption and help find the best deal to suit your household."
- Support in applying for grants and funding: "As well as national funding available to help with paying energy bills and installing energy efficient measures, there is also local funding available to help residents. We can work with households to help apply for any eligible grants and funding to help with a resident's home energy."
- Measures to improve energy efficiency: "Through our home visit service BHBH+ (Oxfordshire only) and a long-standing partnership with LEAP, an expert energy advisor can assess a property's energy efficiency and provide free measures such as low energy LED lightbulbs, shower savers and radiator panels. All these small measures add up and can help save money on energy bills."
- Ongoing support with additional services: "We're here to help and know that home energy might not be the only cause for concern. If someone in the home is struggling with their mental health, struggling to pay for food or have further needs – we're part of a network that is here to support residents and will signpost to further services from other charities and local services."

In particular, and of most relevance, in Oxfordshire it offers a home visit service and expert energy advisors who can assess a property's energy efficiency and provide free measures such as low-energy LED lightbulbs, shower savers and radiator panels.

Beyond this, there is a reference to heat pumps in a section on the Boiler Upgrade Scheme, but they are not given a high priority on the site.

In conclusion, we would suggest the Better Housing Better Health concept is a useful channel for communicating to fuel-poor households once a clear proposition for them has been established. Using it purely as a test of concept might not, at this stage, be appropriate because it is dealing with people in immediate need of assistance to stay warm and well.

Climate Action Oxfordshire: Climate Action Oxfordshire[7] is not a one-stop shop but a recently launched website developed in association with Oxfordshire County Council and a number of district councils with the aim of helping encourage more environmentally conscious choices. It has been included in case it is suitable for the project's one-stop shop to plug into.

Climate Action Oxfordshire's proposition from its website is:

- "How much can you do?
- We should all be making better climate choices, but don't worry - it's not just the big stuff that matters.
- Here are lots of ideas for practical things that you can do, with the time and effort you can spare. Some are free. Many will even save you money.
- Together, small changes add up to big action."

The website gives examples of more environmentally conscious actions people can take and ranks these actions for the user based on filters covering their preferred degree of: effort; impact; cost and savings.

The output is a list of the most suitable actions they could take, which might include: adopting a plant-based diet; choosing ethical banking, pensions & investments; joining a community group and so on.

For each action, there is a page on the website with more details and suggested next steps.

This is a useful and well-designed site, but it is very much focused on those seeking inspiration to make better choices rather than hard information for a serious retrofit project. Currently, adding solar panels is an option, but there is nothing about insulation, heat pumps or heating systems in general. Adding them to the options would be a useful addition, but not of major significance to this project.

Key recommendation: Cosy Homes Oxfordshire has a network of connections and contacts that could be useful for the prosumer model once people understand the idea and their suitability has been confirmed. However, it is a much broader concept and therefore not ideal for investigating the likely take-up. Better Housing Better Health could become a useful outlet to promote the prosumer model to fuel-poor customers, but it is not an appropriate lead vehicle for promoting it. Climate Action Oxfordshire could be useful for raising awareness of the prosumer model and feeding interested households into the one-stop shop, but does not offer the required functionality in its own right.

Retrofit brand review report summary

We identified six key brands (see below), all of which had been developed and evaluated as part of BEIS's Supply Chain Demonstrator Project to test different approaches for increasing the rates of energy efficiency improvements amongst able-to-pay owner-occupiers. These six projects were given funding from BEIS on the basis of being the best-in-class of the submitted project applications.

While not necessarily directly comparable to the Oxon HPR Prosumer One Stop Shop, there are some useful learnings that can be applied to this project, which we found on the brands' respective websites (where still live), in BEIS's evaluation report and the respective learnings reports (where publicly available).

Some of the projects used a One-Stop Shop approach to retrofitting, while others ended their involvement with customers at the stage of contractors providing quotes.

We have focused on the two most successful projects in this review - Cosy Homes (which is particularly relevant being based in Oxfordshire) and People Powered Retrofit8 (based in Manchester), which was the best-performing project at the time of the report (with the highest number of retrofit projects completed) and delivered many learnings through its data-driven approach.

The six brands evaluated as part of BEIS's supply chain demonstrator project:

- Cosy Homes Oxfordshire (including 'Pilot phase learnings and impact report'[9])
- People Powered Retrofit, Manchester (including 'Project Report'[10])
- Future Proof, Bristol[11]
- Warmer Sussex, Sussex[12]
- Ecofurb, London[13]
- Homeworks, Cornwall[14]

Core offering/model review

The two models that received the highest numbers of customer sign-ups and completed retrofit projects were one-stop shops (Cosy Homes, Oxfordshire and People Powered Retrofit, Manchester). Both offered a service that encompassed the whole retrofit process, from the planning stage through to quality approval, although their delivery models were different:

- Cosy Homes promotes an 'end-to-end' approach where they oversee the entire process (for a fee) on behalf of the householder.
- People Powered Retrofit offers more of what they describe as 'a range of pick-and-mix services to help you along your retrofit journey'.

In terms of the levels of success achieved:

- Cosy Homes had 6 retrofitted projects started and 2 completed at the time of the evaluation in March 2021. A further 29 customers were at the stage of being ready to progress, with signed Client Service Agreements. 569 people registered with the scheme.
- People Powered Retrofit had 9 retrofitted projects completed and 2 in progress at the time of the evaluation in March 2021, along with hey had 200 enquiries.

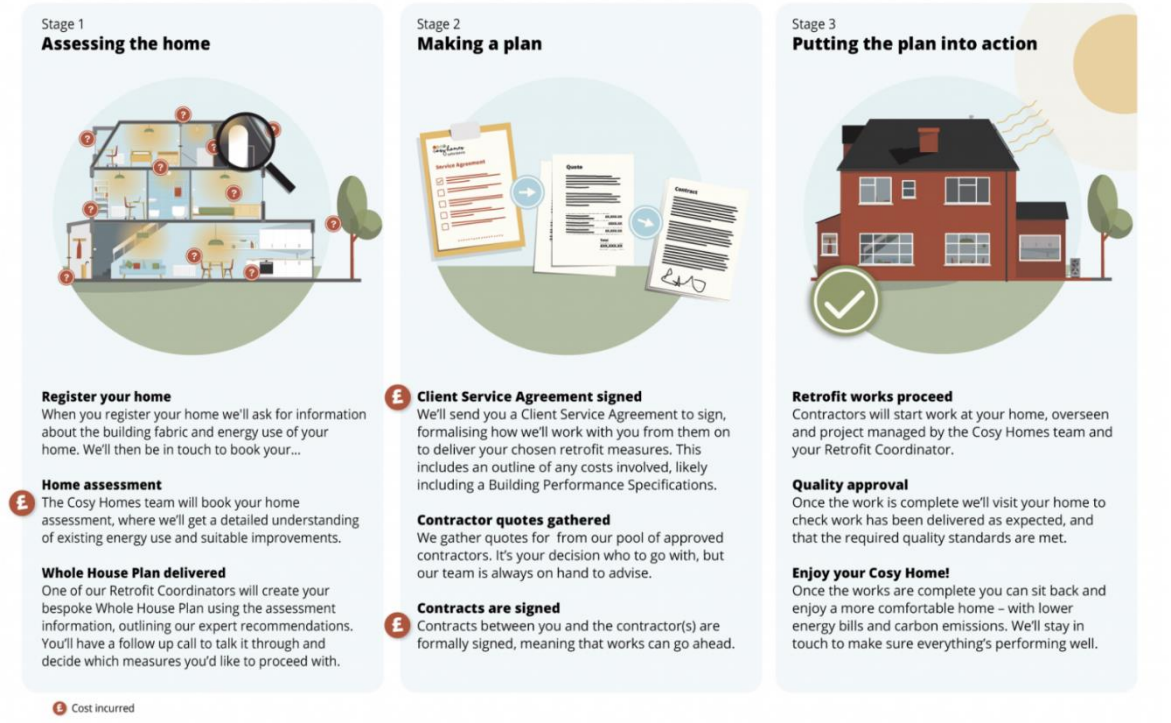
According to Cosy Homes in the BEIS evaluation report:

"As we have tested the model with real-life customers, we've found that our clients were happy to engage with the whole house approach and to use the Whole House Plan as the starting point of what combination of measures work best for their home."

Key learning: A one-stop shop approach appears to be an effective route based on the findings in this report, which shows householders are seeking a service operated by an impartial party they can trust to help them assess their home and deliver energy efficiency improvements as an integrated package.

Because of the differences in delivery models, we have reviewed each of these two one-stop shops in detail below:

The Cosy Homes model: On their website, they summarise their process into three stages with this graphic:



Stage 1 – Assessing the home

While the process describes starts with 'Register your home', the focus of the website is to get visitors to start on Stage 1 by completing their 'free Plan Builder', which is explained like this:

"Simply put in your postcode and you'll see everything we know about the current energy efficiency and performance of your home, based on existing data. Then, choose your budget and priorities and the Plan Builder will create a draft retrofit plan for your home – which you can edit to suit your needs."

There is also a short video explaining what the Plan Builder delivers and how to use it.

The Plan Builder automatically generates for the user a set of recommendations that are costed and impact assessed based on what is currently known about the property (e.g. from EPC certificates), the priorities chosen by the householder (e.g. cost saving, reducing impact), and the approximate budget they set. These can be adjusted subsequently by the user. The Plan Builder then gives an estimate of the impact on the property's energy bill and carbon emissions. It also estimates the overall installation cost.

Once the householder is happy with the draft plan the Plan Builder generates, they can choose to submit it to start the Cosy Homes process, described as follows:

"Submit your draft plan to start the Cosy Homes process

If you'd like to move forward with the suggested measures, you can submit your plan to the Cosy Homes Oxfordshire team.

We'll then be in touch to discuss next steps, and book in your home assessment and Whole House Plan – or to suggest a different retrofit route if we don't think the Cosy Homes Oxfordshire whole house retrofit service is quite right for you."

At this stage, the householder will have a 'Retrofit Assessor or Coordinator' assigned to them, their role being described as:

"Once you register your home you will be assigned an expert Retrofit Coordinator based on your needs, who will act as your single point of contact throughout – though there will likely be other Coordinators involved behind the scenes depending on the expertise needed for your specific home."

The next step is delivery of the Whole House Plan, described as follows:

"Your Retrofit Coordinator will then use this information to develop a bespoke Whole House Plan for your home, detailing all the measures you could take to make your home as energy efficient as possible as a whole, with recommendations on the most cost-effective and impactful measures to take forward, and in which order."

Unlike the initial free online Plan Builder, the Whole House Plan carries a cost to the householder, starting at £250 (including VAT) for a 1 or 2 bedroom property.

Following this, the householder receives a follow-up call to discuss the Whole House Plan and decide if they wish to proceed.

Stage 2 – Making a plan

If the householder wished to move forward with Cosy Homes, a Client Services Agreement (CSA) is signed. This is described as follows:

"The CSA outlines any additional costs before work can begin on your retrofit project. This will likely include a Building Performance Requirement (BPR) and any additional technical reports or architectural drawings needed for contractors to be able to provide detailed quotes for the project. Because every home is different, the cost will vary depending on the home and the measures needed, but a typical project will have costs of £500-1500 at this stage."

Once the CSA is signed, Cosy Homes sources contractor quotes from their panel of approved suppliers and once the householder has decided who to appoint, contracts are signed with the contractors.

Stage 3 – Putting the plan into action

Next, work commences, and Cosy Homes oversee the project and provide quality assurance of all work done for an overall project fee of 5% of the value of the retrofit works.

Once the work is done, Cosy Homes promise to stay in touch to "make sure everything's performing well".

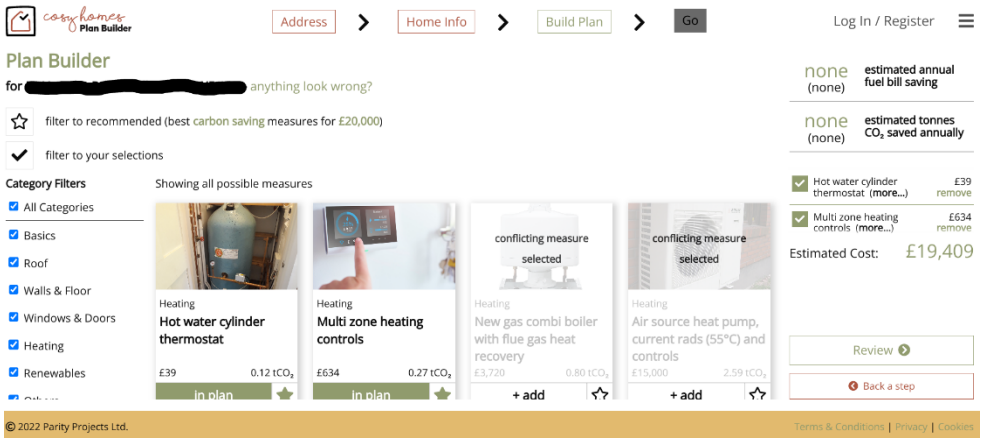
Parity Projects and RetrofitWorks – third party providers

Cosy Homes outsources delivery of a number of key components in its one-stop shop to third party organisations, Parity Projects and RetrofitWorks, even though that is not obvious to users (a 'white-label' approach).

Parity Projects[15]: Cosy Homes outsources their free plan builder to Parity Projects Ltd. The plan builder has been white labelled and is offered on a Cosy Homes subdomain with Cosy Homes branding, copy and CTAs throughout. This is a paid option from Parity Projects Ltd., with no available pricing on their website.

The Plan Builder is an app that allows householders to enter the postcode and receive a summary of their property information (this is all editable in case the information is not up to date). They then enter their priorities (e.g. reduce CO_2 or reduce energy bills) and budget, before a suggested initial whole-house-plan is generated automatically.

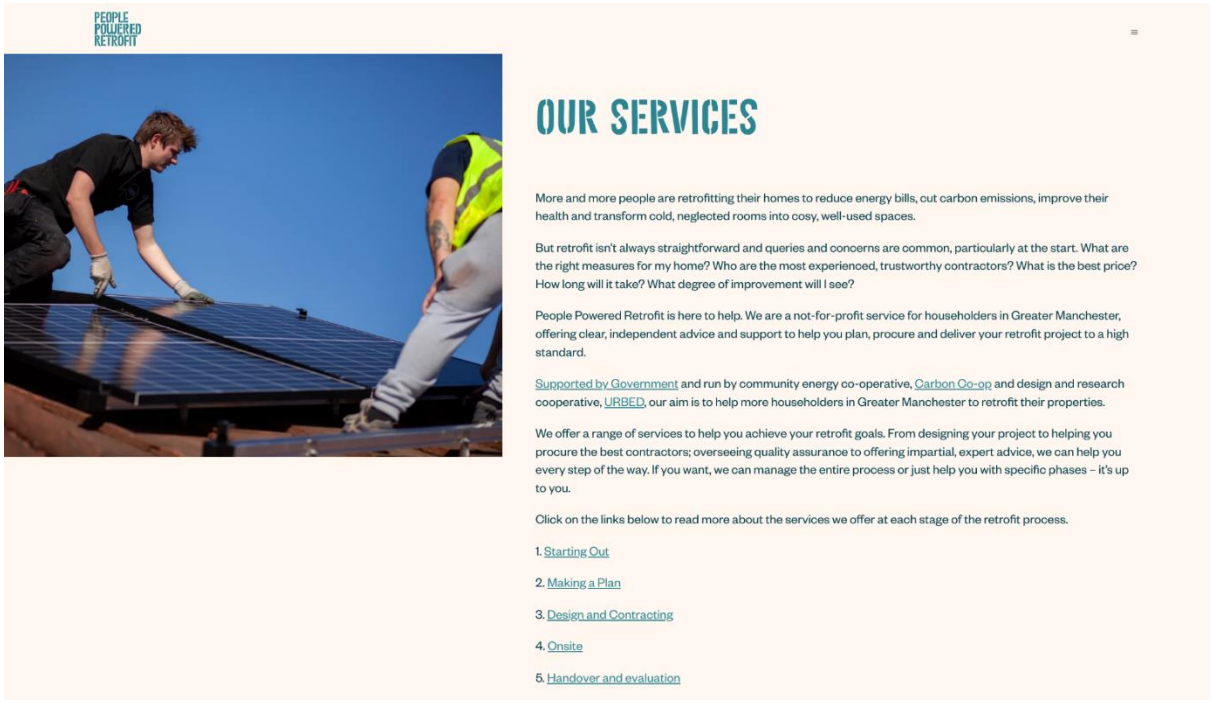
It indicates the suggested measures they should take to achieve their selected priorities and the associated costs of each. This is editable so users can add or remove measures where desired.



RetrofitWorks[16]: Cosy Homes works with RetrofitWorks and appears to outsource a significant part of the delivery of advice and contractor networks/training to RetrofitWorks. Overall, RetrofitWorks helps clients in a number of different ways, ranging from developing and helping deliver one-stop shops for retrofit through to providing training and certification to contractors in the retrofit space.

The People Powered Retrofit model: People Powered Retrofit states on its website:

"We offer a range of services to help you achieve your retrofit goals. From designing your project to helping you procure the best contractors; overseeing quality assurance to offering impartial, expert advice, we can help you every step of the way. If you want, we can manage the entire process or just help you with specific phases – it's up to you."



Stage 1 – starting out

"In the Starting Out stage, we can help you pinpoint exactly how retrofit might improve your home. This includes supporting you to develop a Retrofit Project Brief which sets out the key elements of your works, your goals and motivations."

Within this stage of People Powered Retrofit's process, there is a range of options customers can choose to get advice on, depending on their level of knowledge.

They have a team of advisors to give customers support around whatever they need help with – on the website, they say they will:

- Signpost you to relevant information, such as websites, factsheets, sources of advice and case studies
- Develop your expectations around what can be achieved
- Help you to articulate your aims and priorities
- Outline options in terms of service level (single phase or multi-phase etc) and delivery pathway (traditional, design & build, DIY)
- Assist your decision-making around products, contractors and all other procurement considerations
- Ensure you take an appropriate direction through your retrofit project in terms of scale, costs and other priorities

- Support you to baseline your energy use

The goal is to give customers "a strong, clear retrofit project brief that will be used throughout your retrofit journey".

Stage 2 – making a plan

Part 1 – assessment: Emphasis is put on People Powered Retrofit's advisory nature here – in fact, they say that:

"If you know what you want or suitable energy efficiency measures are straightforward, we may decline to progress you further in the People Powered Retrofit service. We might think you can meet your priorities yourself with some signposting to information."

However, for customers that *"want to do something more complicated, or want to explore [their] options",* People Powered Retrofit provides a Home Retrofit planner, an in-depth survey that "*considers householders' motivations for retrofit, their priorities and preferences as well as factors like comfort, health and indoor air quality".*

According to People Powered Retrofit, *"Home Retrofit Planner will help householders to create a whole-house retrofit plan even if they decide to do the work in stages rather than all at once."*

There is a link to a sample report[17] on the page, which details the different elements of the final report and all that will be covered, and helps bring to life the output of this stage.

People Powered Retrofit also explain on this page what the Home Retrofit Planner doesn't cover, to make it clear what their role is and what customers can expect from this stage of the process (along with what they shouldn't be expecting). This section reinforces PPR's impartiality and makes clear that it's not a prescriptive report, instead providing recommendations and potential scenarios to help them make decisions.

Once customers have completed the assessment (part 1), they move on to part 2, which involves commissioning a Retrofit Surveyor to finalise the plan and develop a scope of works (costing from £550 inc VAT/.

Part 2 - scope of works: This part is about making decisions on what retrofit measures will be put in place, and working on the recommendations laid out in part 1 to start solidifying the plan. PPR states on its website:

"Now it's time to choose and 'lock in' your measures.

A Retrofit Surveyor can:

- Call to discuss and confirm your energy efficiency measures.
- Draw up a Scope of Works: listing the improvements you want to commission.
- Identify who needs to be involved and how to manage risks linked to your project.
- Specify any initial investigations required and design requirements
- Identify a suitable pathway to progress any design work either within or outside the People Powered Retrofit service.

And we'll need you, as the householder, to:

- Make the final decision on which works you want to include in your Retrofit Project."

Stage 3 - design and contracting: People Powered Retrofit offers a range of services and they help customers commission design work for their project with Architects and Retrofit Designers within their team - or by putting customers in touch with Retrofit Designers from their network.

Their Retrofit Surveyors can help with procurement, supporting customers to find suitable contractors from their network or beyond.

"The People Powered Retrofit service can:

- Appoint a qualified Retrofit Surveyor to support the Design and Contracting stage of your project.
- Help you to take forward necessary design work for retrofit measures
- Help you to procure suitable contractors to install your retrofit measures"

Part 1 of the Design and Contracting stage is design development, where design work is commissioned and specifications are created, to enable accurate quotes from contractors.

Part 2 of the Design and Contracting stage is procurement and contracting, where Retrofit Surveyors help with the procurement process.

The Retrofit Surveyors can:

- Finalise a Schedule of Works and preliminaries. Create a document outlining how the work will be delivered and setting out acceptable working practices, for example, agreeing working hours and access arrangements.
- Advise on pre-existing relationships with builders: so you find the best contractor for your home.
- Provide quality assurance checklists: and information on standards to include in your contract.
- Signpost you to contractor networks: and provide contact details for potential contractors.
- Offer market intelligence: on expected prices, competencies and supply chain networks.
- Review the tender package: for clarity and usefulness and provide feedback.
- Provide guidance on contracts: including a range of suitable standard templates.
- Offer a quote template: that you can send to potential contractors.
- Give you a tender review checklist: or weighting template to help you select the right contractor.
- Review tender returns: providing feedback on quality and cost.
- Advise on contractor training needs: and create a professional development plan if needed.

On this page, People Powered Retrofit explains their code of conduct, which their retrofit contractors have to sign up to, to put customers at ease. They also explain what they can't do at that stage, along with their requirements from the customer. This provides total clarity of expectations in both directions, giving customers confidence and a clear idea of what is coming - and what they should and shouldn't expect.

Stage 4 – onsite: This is where People Powered Retrofit helps monitor and assess the quality of work being carried out. They can:

- "Create a quality assurance checklist: tailored to your Retrofit Project. This will outline exactly what needs to be examined and recorded.
- Provide training/ 'Toolbox Talks': for contractors on specific issues, for instance airtightness or insulation installation.
- Carry out site visits: at agreed points and provide written notes and photos to you promptly.
- Facilitate discussions: such as round table meetings or email conversations, ensuring effective communication between you, your contractor and designers to address issues.
- Provide guidance on handover and commissioning: for example, what documents (such as warranties, guarantees or manuals) to expect from the contractor.
- We'll also supplement this information with our own user friendly materials to explain key concepts.
- Outline appropriate post-completion monitoring: this will happen at Stage 5 and will include gathering some basic information about your experience and energy consumption as standard, but may also include more detailed evaluation and assessment work if required."

Stage 5 – evaluation: This stage is about providing customers with monitoring, handover and aftercare for their project. They can:

- "Develop a retrofit evaluation report: assessing the performance of your home once all measures have been delivered
- Create a retrofit handover pack: Including a checklist bespoke to your project that details the documents and information you should ask for once works are complete. This pack also includes a number of user guides helping you to understand how to use and look after your retrofit kit.

Depending on your project and household requirements we can commission and carry out further investigation, including:

- Occupancy surveys
- Environmental monitoring services i.e. on internal temperatures, humidity etc.
- Building performance study
- Air pressure tests, to benchmark air tightness within a property."

Comparing the Cosy Homes and People Powered Retrofit models: Whilst the two delivery models have a number of things in common, there are also important differences that highlight decisions our project's one-stop shop will need to address. We summarise the relevant points as follows:

Similarities include:

- Both offer a single point of contact for the householder
- Both offer a full end-to-end service (although PPR also offer pick-and-mix - below)
- Both offer a paid-for service beyond the initial stage

- Both have a network of approved suppliers

Significant differences include:

- CH focuses on an 'end-to-end' service while PPR focused on 'pick-and-mix' (although PPR can deliver end-to-end if required)
- CH offers a free online assessment prior to engagement whereas PPR requires contact and discussion with one of their Retrofit Assessors (although this stage is also free of charge)
- CH outsources delivery of elements of their model to third-party suppliers (although via a 'while label' approach where it is not obvious to the householder). These third-party suppliers are Parity Projects and Retrofit Works)

Key learning: these two most successful one-stop models seem to have in common the provision of a single point of contact for customers to liaise with and at least the option to take customers through the entire process from initial interest to post-installation.

Evaluation of 'end-to-end vs. 'pick-and-mix' models: In their assessment of a number of retrofit one-stop shop models (BEIS Supply Chain Demonstrator Project Evaluation Report - October 2021), BEIS describes two core delivery models for retrofit one-stop shops:

- "A more fixed, intensive and coherent support package; with the additionality to retrofit action clear if the journey is followed through."
- "A more ad hoc approach; customers can dip in and out, selecting from a suite of separate services/support."

The report suggests the two one-stop shops that delivered the most successful outcomes followed different approaches, with one (Cosy Homes, Oxfordshire) adopting the first approach and the other (People Powered Retrofit, Manchester) adopting the second.

The report goes on to say that the second of these approaches is *"arguably more resilient (in that it is flexible to changing circumstances), though the additionality of the schemes is sometimes less clear."*

That said, and regardless of approach, the gold standard seems to be the presence of the one-stop shop as a trusted party that can inform, advise, connect (with trusted suppliers) and reassure the customer through all stages of the journey, whether the customer decides to utilise them at every stage or not.

Key learning: A 'pick-and-mix' approach with the option of a full end-to-end service where appropriate (like People Powered Retrofit's model) would likely be more flexible and sustainable. It would give the option of outsourcing parts of the service (e.g. Parity Project's plan builder and Retrofit Works' supplier network) where this is more financially viable, which could also make it much quicker for the project to deliver a one-stop shop solution at scale if required.

It's also worth noting that a 'pick-and-mix' approach would give more flexibility for the one-stop shop to operate more as a 'shop window for the prosumer model in situations where customers could be directed into an existing retrofit one-stop shop where these exist and it is seen as more sensible to utilise existing channels than recreate something that largely already exists.

Audiences review: People Powered Retrofit took a data-driven approach to identifying audience archetypes and found two key audiences that appeared to offer the most potential.

The first, perhaps most obviously, is older, wealthier, environmentally aware homeowners (we would suggest these are the very 'early adopters').

The second group is driven by an interest in what PPR call 'green bling' - individuals who are perhaps driven more by social status than social conscience - and want to be seen as adopting on-trend green initiatives. No demographic details are provided for this group - instead, it is more of an audience motivation.

According to People Powered Retrofit in the BEIS evaluation report:

"The archetypes deemed to be potentially most receptive to the PPR offer were older, wealthy, environmentally-aware homeowners. Whilst many of the project's customers fit within this profile, the project has identified a new type of customer, driven by an interest in what they loosely describe as 'green bling'; in other words, some of the cutting edge technological aspects, and status, of certain retrofit measures."

Cosy Homes' findings reinforce the above:

"Customers have tended to match the early adopter characteristics seen on the other projects. Of the customers interviewed as part of the evaluation, most had installed one or more retrofit measures previously."

Key learning: Able-to-pay homeowners with an environmental conscience that have already either implemented or considered home-improvement solutions will be the lowest hanging fruit in terms of target customers. However, there is room to expand to a secondary (probably younger) group more interested in overt displays of 'green bling' element/s in our offering and communications.

Outreach review: Cosy Homes focused on using existing local networks to engage with potential customers - for example, they worked with Low Carbon Hub to connect with local community groups. These community partnerships were highlighted as key to the success Cosy Homes had signing up interested householders in the BEIS evaluation report:

"Project partner the Low Carbon Hub already had strong ties with local community groups, including their 30+ Community Shareholders. This network of motivated communities was the main channel for building up demand from homeowners and gaining feedback, with a number of groups becoming Cosy Homes Oxfordshire community advocates."

"...Customer interviewees had heard about the Cosy Homes project from a range of sources, including word of mouth from friends, family or neighbourhood/community group, and information on social media."

People Powered Retrofit also worked with existing groups and networks to engage with potential customers, with a good degree of success. According to the BEIS summary report:

"Building on assets that already exist at a neighbourhood scale, including local knowledge and relationships, quality workforce skills and supply chain networks, and local authority and community capital."

Key learning: Working with existing networks within relevant areas of concern will be key to driving interest. Active, motivated, vocal and accessible groups in the environmental space will likely be the easiest to find and work with to generate results. These networks likely already have connections with motivated householders who have the right mindset to engage with the One-Stop Shop.

Communications review: The most successful projects were very simple and direct in their communications and avoided the temptation of giving all the information at once. They focused on explaining the benefits of retrofitting, leading on environmental (Cosy Homes initially led with warmth/cosiness, but quickly adapted their approach and messaging to focus more on climate after realising that it was the most powerful lever within key audiences), and followed that up with additional benefits like warmth and cost savings.

Some of the projects split their messaging with tailored pages for homeowners, landlords and tenants, which appears to work well and allows each audience to receive the most appropriate, relevant communications.

Cosy Homes provided collateral for tenants to share with their landlords to persuade them of the project, which appeared important to help potential customers get buy-in from the ultimate decision-makers and property owners.

The most successful projects focused on one clear call to action (CTA) - for example, to get customers to sign up for a free plan builder. These CTAs were visible on all pages, making it obvious and easy for customers to take the first step. They weren't trying to sell the whole retrofit project - just the next (first) step for customers to take.

Key learning: Communications should include key benefits relevant to the audience (most likely leading with environmental) rather than giving prospects an information overload. Breaking everything down into simple, easy-to-understand terms with clear, direct calls to action (which should be focused on getting them to take the first step - e.g. register interest) will be key. One caveat is the energy price crisis that householders are now facing and the impact this might have on priorities.

Branding review: It could be argued that none of the projects got the branding quite right - Cosy Homes had an inconsistent message with their name/logo putting emphasis on comfort and warmth, yet an ultimate focus on environmental benefits (this is due to them changing their approach once the project had begun).

People Powered Retrofit had a clearer name and brand in this sense, but it still falls short of accurately and immediately communicating what they offer to audiences who aren't already familiar with the retrofit landscape. This means while likely to be effective with the early adopters, it may not have been suitable for a more mainstream audience.

The visuals of both the projects are decent - clean, bright, colourful and modern. They need to convey trustworthiness, which both these projects did. In comparison, Warmer Sussex went for much more dated visuals that had a public sector feel, which was a bit old-fashioned and wouldn't necessarily garner immediate trust in the brand.

Key learning: the name, logo, visuals and strapline all need to be coherent, with a focus on the agreed key messaging, which will in part be defined by the outreach activity (e.g. - if we focus on environmental community groups for outreach, which makes sense considering this is a primary factor in customer motivation, we should go with environmental focused branding). It should appeal to the eco-conscious early adopters while also being attractive to 'green blingers' and eventually, a more mainstream audience.

Comparisons with the marketing of residential solar panel installation: The PV market is considerably more mature and developed in the UK than that for heat pumps. Solar Energy UK reports that "there are close to a million solar PV systems on houses around the country"[18], representing an uptake of over 3% across all UK households (whether suitable or not).

The key drivers[19] to the uptake of solar panels from 2010 onwards appear to be financial and risk mitigation - especially the Feed-in Tariffs (FIT) scheme[20] - which paid out a guaranteed amount for every kWh of solar energy generated and every kWh of solar energy sent back to the grid.

New applications to the FIT scheme closed on 1 April 2019, and in January 2020 it was replaced by the smart export guarantee (SEG) scheme[21].

The impact of the FIT in 2010 was to enhance the commercial argument for solar panels and reduce the risk by locking in the rates. Solar uptake in homes increased significantly from this period.

In addition, the option to install solar panels and benefit financially was also made possible for many more homes through the Rent-a-Roof scheme[22]. This lets people who can't otherwise afford solar panels get access to them through installers who will offer to install solar panels on roofs for free and let them use the electricity in their homes.

Installers earn their return by selling any excess electricity generated back to the grid, although it is reported that the popularity of the Rent-a-Roof scheme has fallen as the value of the SEG rates that guarantee a price for this surplus energy has dropped.

It is worth noting that private companies drove the uptake of the Rent-a-Roof scheme by offering householders a way of both cutting their energy bills and helping reduce emissions with no upfront investment or financial risk. They were in turn incentivised by the returns they could make through the SIG.

Key learning: The challenge for the one-stop shop, its branding and its communications is significant. Unlike the market for residential solar panels, where uptake rose significantly when the financial case for installing them became compelling (whether directly or through the 'Rent-a-Roof' scheme), the financial case for heat pump installation is not yet clear in most cases, which will likely make it a much less attractive proposition.

15.2.5 4. Prosumer One-Stop Shop - deliverables, branding and communication strategy

The project specification focuses on the branding requirements for the one-stop shop.

Whilst decisions and the right approach are needed with that, there is arguably a more complex communication challenge here because we are going to be promoting an entirely new approach to household energy based on the prosumer model.

The customer journey

We envisage the one-stop shop providing trusted advice, expertise and support for householders interested in the prosumer model to make their homes warmer, greener and less costly to run.

In reality, this will need to encompass several stages of a likely customer journey, which - as suggested previously - might look like the following:

Interest - initial awareness of the concept and wondering if it might be something they should find out more about.

Consideration - actively learning more about the proposed model (in our case the prosumer model) and starting to evaluate the potential benefits and costs.

Suitability and feasibility - an assessment (either via online screening and/or an expert advisor) of their suitability for the project in terms of the property, the costs and the impact it is likely to have.

Detailed planning - if they decide to move forward on the basis of the initial assessment, a detailed plan is required to understand what will be required to make the project work, how much it will cost, the likely disruption and so on.

Commissioning - if the plan is approved, the project needs to be initiated and appropriately skilled (and ideally independently screened) suppliers commissioned.

Installing - this is the actual process of installing the components of the new system into the property and making it work as planned.

Quality Approval (QA) - providing reassurance that the work has been undertaken to an appropriate level (something that most householders will not be qualified to do).

Post-installation - getting the system up and running is one thing, ensuring they are able to run it effectively and efficiently is another. Ideally, a one-stop shop continues to provide advice and guidance to help the householder get the most out of their new system.

Matching deliverables to the customer journey

The messaging and resources will need to be tailored to each stage of the journey, where knowledge and attention are likely to be considerably lower at the start than at the end. This means it is ineffective, for example, to attempt one definitive explanation that starts at the beginning and goes logically to the end. Instead, the approach needs to be like a series of Russian dolls, starting with the smallest and progressing to the largest, with a clear call to action for customers to progress at every point.

At the start of the journey, the overall concept has to be communicated as succinctly as possible, ideally in a sentence or two (or on a simple leaflet, web page etc), so the audience can decide if it deserves more of their attention. They are unlikely to be receptive to a long explanation without this. However, as they pass through the stages, they will want and need increasingly detailed explanations.

Matching the communication to the appropriate stage of the journey will therefore be crucial.

In particular, we would recommend specific deliverables at each stage as follows:

Interest - this is outreach introducing the prosumer model and the one-stop shop to prospective customers. It could involve flyers delivered door-to-door, social media posts that can be shared by appropriate groups, targeted social media advertising, PR and other routes. The objective would be to get householders (especially those likely to be suitable) to visit the one-stop shop website.

Consideration - the core delivery vehicle against this stage would likely be a website that explains the prosumer model and the benefits that it delivers. This would ideally include an explainer video, background information, and happy customer stories. The objective would be to get householders to take action to see if they/their home would be suitable for the prosumer model.

Suitability and feasibility - ideally the delivery of this will be an online tool where, with minimum effort (or initial interaction), customers can quickly get an idea of what is possible for their specific property. The free Plan Builder approach used by Cosy Homes (delivered by Parity Projects Ltd) seems an excellent model for this. The objective would be to give householders a realistic idea of what the prosumer model could do for them and how much it would cost, without having to talk to anyone or fear being sold to. The quicker and easier this stage is the better.

Detailed planning - once a householder has completed the feasibility assessment and wants to progress, a detailed bespoke plan/model will be required. Due to the complexity of the prosumer model, this will require considerable skill but can (and probably should) be a paid-for service (as with both Cosy Homes and People Powered Retrofit). It should detail the new system proposed, the cost, the disruption of installation likely, the running costs and the emissions (and how these will change from the current situation). The objective is a thorough and realistic assessment of the project to enable the householder to decide whether to progress.

Commissioning - If the householder wants to proceed, the one-stop shop should be able to offer a range of suitable contractors to undertake the work. These will be known and screened by the one-stop shop. In addition, the one-stop shop should be able to help assess quotations and advice on contracts. The objective is to ensure the customer gets the system they want, to the spec required, for the agreed budget and with as little disruption as possible.

Installing - whilst this stage is largely in the hands of the contractors, the one-stop shop should offer support if required, especially in terms of coordinating the different contractors involved. An option to consider is a complete project management service on behalf of the householder, like currently offered by Cosy Homes for a fee (5% of costs). The objective is to ensure the planned-for and commissioned system is installed without any significant issues, cost or time overruns.

Quality approval - if the installation stage has proceeded well, this should be largely a formality, but in reality, being able to help the customer know whether the installations are of the required standard will be important as it will likely be well outside of their own skill level. The objective is to sign off all the contracting with the customer reassured they have the functioning system they commissioned.

Post-installation - feedback from existing one-stop shop evaluation suggests householders often still need or value support with the effective operation of their new systems. Both Cosy Homes and People Powered Retrofit offer this as part of their service (in the latter's case they refer to it as 'handover'). The objective is to provide reassurance and ensure the householder is able to realise the improvements intended by operating their new system appropriately.

Key recommendation: we need to offer support and guidance throughout the entire customer journey. Communication formats and style needs to match the appropriate stage of the customer journey. At the start of the journey, this means being able to explain the overall concept simply and succinctly. At later stages, more detail will be required. Giving too much detail too soon is likely to be counter-productive. For the purposes of this pilot, the resources will need to focus on the journey up to the stage of confirming a likelihood to go ahead if the proposition was real and available (e.g. Stage 3 of the journey outlined above).

Language for the prosumer model - a new category

When launching a new approach, category, genre or idea, especially a complex one, it needs a label/descriptor that people can use as a shorthand to identify it and think/talk about it.

This is not (normally) a formal brand or brand name, but a concept or description that is new and unique, but one that is descriptive, and people are happy to use colloquially.

So, for example, we don't talk about "a vertical search engine that shoppers use to filter and compare products based on price, features, reviews and other criteria", we talk about a "price comparison site". There are different brands and different types of price comparison sites in different markets, but we know immediately what is meant by the term.

Currently, the language we have is 'prosumer model', which on its own is at best meaningless and at worst misleading (in many categories, 'prosumer' is used to describe a range or offer that is positioned at a premium to normal consumer options, using aspects of a professional range, but at a more affordable price than a genuine pro range).

We could hope consumers come up with their own language but it is much safer to try and create our own, so they grasp this as a new idea and use it to position it against the things they already know and understand.

Key recommendation: Finding language to describe the prosumer model in a more meaningful way will be crucial. This is because promoting a new idea is difficult due to the additional challenge of needing new language or terminology to help define the new category, but it can also be highly rewarding because being first is newsworthy and interesting in its own right, which will make organic promotion, e.g. PR, easier and more memorable.

The value of a new brand

The prosumer model should be seen as a meaningful new approach that makes the previous approaches seem 'old hat' or missing something.

Generally, where this kind of shift occurs in consumer thinking, it is normally the right time to develop a new brand that focuses clearly on the new approach. It also helps raise people's awareness that something new is on offer.

We therefore recommend that the one-stop shop should ideally have its own brand to identify clearly with this specific new approach. With very limited time and resources, making clear that something is new and different is likely to create interest and curiosity - it's an inherent bias for people to pay attention to something that is novel.

However, this might be inappropriate where proven, related one-stop retrofit channels exist, as might be the case in Oxfordshire with Cosy Homes. In a situation like this, it might be pointless to try

and recreate much of the functionality for the stages of the customer journey (especially '4 - detailed planning' onwards) where these already exist and deliver the required functionality.

Our recommendation is to develop a flexible model that can adjust to different situations. We therefore propose creating a new one-stop shop brand based around the prosumer model, but with the option to 'hand over' those who progress through the journey (beyond stage 3) to an existing, closely aligned retrofit centre where a suitable one exists. In these cases, the prosumer model one-stop shop wouldn't technically be a one-stop shop, but would be a front end, or 'shop window, with the delivery of stage 4 onwards (as appropriate) being delivered by an existing one-stop shop.

Our recommendation, should this approach be used, is to consider that the services supplied from stage 4 onwards could remain under the umbrella of the prosumer model one-stop shop brand but where delivery is outsourced to the existing one-stop shop on a white-label basis (i.e. no formal transfer of customer relationship - that remains with the new one-stop shop - but delivery is completed by the existing one-stop shop).

Where no existing retrofit one-stop shop exists, the prosumer one-stop shop will deliver over the entire journey.

Key recommendation: A new brand for the prosumer model one-stop shop should be developed but it should retain the flexibility for this to either operate as a stand-alone entity across the whole customer journey or as a 'shop window' for the model, which then feeds householders into existing channels once they are qualified with confirmed interest and suitability. In the case of Oxfordshire, we would suggest considering an approach where stages 4 onwards in our customer journey are outsourced to Cosy Homes because they have a successful infrastructure and network in place already.

Brand positioning recommendations

In terms of the new brand's positioning, we believe it should reflect a sense that this is an exciting new approach to home energy - a new era - that results in potentially lower running costs, warmer homes and significantly reduced environmental impact.

There are several viable routes for creative development depending on the core features or benefits conveyed. And while benefits are crucial, with a new idea it is often at least as important to communicate the new approach and then position yourself clearly as the place you go for it (for example, the first major brand to exploit mobile phones was 'The Carphone Warehouse' - a new entity that made it clear it was the place to go if you wanted one of these exciting new devices). We therefore recommend exploring branding approaches that convey a sense of a new approach as well as core benefits.

However, a significant complication is that consumers don't yet have an awareness of the 'prosumer model' or language to talk about it. In other words, to use the above example again, they don't know what a 'car phone' is, so they are not looking for one. This means we will also need to consider approaches that focus on both the core benefits and the unique approach while simultaneously developing this language required.

Our review suggests retrofit one-stop shops have often focussed on warmth as the key benefit, but evaluation suggests this might not be ideal. It is very generic and fails to provide any meaningful insight into what's on offer. It seems more likely that impact can be made by promoting clear environmental impact in the context of (ideally) cost saving and warmth for the householder. This

will also make it easier to promote the idea and initiative as it is seen as being 'for the greater good'. However, there is the caveat of rising energy prices, which might affect the way messaging is received.

Key recommendation: The brand positioning should reflect an exciting new approach to home energy that results in significantly reduced environmental impact alongside potentially lower running costs and warmer homes.

Communication style and language

As explained above, the customer journey from first becoming aware of the 'prosumer model' and one-stop shop to actually having an installed system that is operational is long and complicated. The communication at each stage will need to bring additional explanation as the customer becomes ready for it, without overwhelming them at the start.

In order to obtain 25% uptake (or at least 25% indication of the significant likelihood of uptake), the campaign will need to target a high proportion of households where the prosumer model will be viable.

For this to be possible, the language used will need to be clear, simple and straightforward. The prosumer model will need to be explained - at first very simply so householders quickly 'get it' - and then in more detail.

Because this is a new model and the investment levels involved are significant, there is also considerable risk for a householder. Therefore, the advice/information needs to convey authority and trustworthiness.

Key recommendation: Communications (and calls to action) need to be simple and straightforward to explain the prosumer model in a meaningful and compelling way. The language should be easy to understand for a broad audience (beyond the likely early adopters). It will be important to be transparent about the potential downsides and make it clear who this model might not be most appropriate for. This will avoid alienating householders who might be mis-sold and filter the most suitable prospects for more attention.

15.2.6 Summary list of learnings and recommendations

Key learnings from the reviews

A one-stop shop approach appears to be an effective route. Householders appear to be seeking a service operated by an impartial party they can trust to help them assess their home and deliver energy efficiency improvements as an integrated package.

- The two most successful one-stop shop models seem to have in common the provision of a single point of contact for customers to liaise with and at least the option to take customers through the entire process from initial interest to post-installation.
- A 'pick-and-mix' approach with the option of a full end-to-end service where appropriate (like People Powered Retrofit's model) would likely be more flexible and sustainable. It would give the option of outsourcing parts of the service (e.g. Parity Project's plan builder and RetroftrofititWorks' supplier network) where this is more financially viable, which could also make it much quicker for the project to deliver a one-stop shop solution at scale if required.
- Able-to-pay homeowners with an environmental conscience that have either implemented or considered home-improvement solutions will be the lowest hanging fruit in terms of target customers. However, there is room to expand to a secondary (probably younger) group more interested in overt displays of 'green bling' element/s in our offering and communications.
- Working with existing networks within relevant areas of concern will be key to driving interest. Active, motivated, vocal and accessible groups in the environmental space will likely be the easiest to find and work with to generate results. These networks likely already have connections with motivated householders with the right mindset to engage with the OSS.
- Communications should include key benefits relevant to the audience (most likely leading with environmental) rather than giving prospects an information overload. Breaking everything down into simple, easy-to-understand terms with clear, direct calls to action (which should be focused on getting them to take the first step – e.g. register interest) will be key. One caveat is the energy price crisis that householders are now facing and the impact this might have on priorities.
- The name, logo, visuals and strapline all need to be coherent, with a focus on the agreed key messaging, which will in part be defined by the outreach activity (e.g. - if we focus on environmental community groups for outreach, which makes sense considering this is a primary factor in customer motivation, we should go with environmental focused branding). It should appeal to the eco-conscious early adopters while also being attractive to 'green blingers' and eventually, a more mainstream audience.
- The challenge for the one-stop shop, its branding and communication is significant. Unlike the market for residential solar panels, where uptake rose significantly when the financial case for installing them became compelling (whether directly or through the 'rent your roof' scheme), the financial case for heat pump installation is not yet clear in most cases, which will likely make it a much less attractive proposition.

Key recommendations for prosumer one-stop shop

- Cosy Homes Oxfordshire has a network of connections and contacts that could be useful for the prosumer model once people understand the idea and their suitability has been confirmed. However, it is a much broader concept and therefore not ideal for investigating the likely take-up. BHBH could become a useful outlet to promote the prosumer model to fuel-poor customers, but it is not an appropriate lead vehicle for promoting it. Climate Action Oxfordshire could be useful for raising awareness of the prosumer model and feeding interested households into the one-stop shop, but does not offer the required functionality in its own right.
- We need to offer support and guidance throughout the entire customer journey. Communication formats and style needs to match the appropriate stage of the customer journey. At the start of the journey, this means being able to explain the overall concept simply and succinctly. At later stages, more detail will be required. Giving too much detail too soon is likely to be counter-productive. For the purposes of this pilot, the resources will need to focus on the journey up to the stage of confirming a likelihood to go ahead if the proposition was real and available (e.g. Stage 3 of the journey outlined above).
- Finding language to describe the prosumer model in a more meaningful way will be crucial. This is because promoting a new idea is difficult due to the additional challenge of needing new language or terminology to help define the new category, but it can also be highly rewarding because being first is newsworthy and interesting in its own right, which will make organic promotion, e.g. PR, easier and more memorable.
- A new brand for the prosumer model one-stop shop should be developed but it should retain the flexibility for this to either operate as a stand-alone entity across the whole customer journey or as a 'shop window' for the model, which then feeds householders into existing channels once they are qualified with confirmed interest and suitability. In the case of Oxfordshire, we would suggest considering an approach where stages 4 onwards in our customer journey are outsourced to Cosy Homes because they have a successful infrastructure and network in place already.
- The brand positioning should reflect an exciting new approach to home energy that results in significantly reduced environmental impact alongside potentially lower running costs and warmer homes.
- Communications (and calls to action) need to be simple and straightforward to explain the prosumer model in a meaningful and compelling way. The language should be easy to understand for a broad audience (beyond the likely early adopters) It will be important to be transparent on the potential downsides and make it clear who this model might not be most appropriate for. This will avoid alienating householders who might be mis-sold and filter the most suitable prospects for more attention.

15.2.7 7. References

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15.3 Prosumer Model Evidence Summary (Authored by City Science and Lendology)

15.3.1 Project Background

The Heat Pump Ready Programme supports the development of innovative solutions across the heat pump (HP) sector. HPs are a key solution for decarbonising homes and will be critical for meeting the UK's commitment to achieve net zero by 2050.

Heat Pump Ready Oxfordshire is part of Stream 1 of the programme and is currently in Phase 1, the feasibility stage. In this stream, projects devise solutions for high-density HP deployment, support the development and trial of solutions and develop methodologies for the optimised deployment of domestic HPs at high-density.

The project seeks to understand the viability for HP deployment in Cherwell, Oxfordshire and identify suitable locations. In addition, it will consolidate evidence relevant to HP delivery, develop a supply chain strategy and create a blueprint for a One-Stop-Shop. The project also considers the viability of achieving the required density of HP deployment in Phase 2, which requires householders to fund 60% of the dwelling's HP installation. For this reason, the project considers a Prosumer Model (which combines HP installation with solar photovoltaic (PV) generation and battery storage) to make the offering more financially attractive to householders. Within this paper, we consider how the Prosumer Model can be optimised to ensure maximum impact on uptake and carbon reduction.

15.3.2 Decarbonising Domestic Heat

Heat Pump Potential: In 2019, the UK became the first major economy to adopt a legally binding obligation to reach net-zero greenhouse gas (GHG) emissions by 2050 (HM Government, 2020). Buildings accounted for 30% of the national GHG emission mix in 2019, with 56% of these emissions resulting from heating homes (HM Government, 2021), therefore decarbonisation of residential heating is central to meeting national climate targets. One option is a significant increase in the electrification of heating, with HP technology identified as being the most efficient energy option at a residential scale (Love et al., 2017), therefore individual HPs are likely to be a key technology in the decarbonisation of the national heating sector (Vorushylo et al., 2018). The popularity of domestic HPs is echoed in national policy, with the UK government aiming for 600,000 HP installations per year by 2028 (HM Government, 2020).

HP technology works by absorbing low temperature thermal energy from the environment and using electrically driven compressors to 'pump' it to a higher temperature using the refrigeration cycle (Vorushylo et al, 2018). The thermal energy source can vary between air, surface water or the ground but, whilst each has its advantages and disadvantages, Air Source Heat Pumps (ASHP) have been shown to be the cheapest and most suitable solutions for typical housing retrofits (Kelly and Cockroft, 2011; Bianco, Scarpa and Tagaliafico, 2017).

Prosumer Models: Electrifying heat through ASHPs can mitigate more carbon emissions when compared with conventional options, such as gas or oil (Vorushylo et al., 2018), however, these reductions are further maximised when a renewable energy electrification source is applied. As a result, PV, which traditionally has been used to decarbonise the energy supply, can also be key to decarbonising the heating sector (Rinalidi et al., 2021). PV modularity and cost reductions have resulted in PV technology becoming increasingly popular worldwide (Pena-Bello et al., 2021), empowering consumers to transition to "Prosumers", defined as market participants who both produce and consume energy (Parag and Sovacool, 2016; Zinsmeister et al., 2021). By extension, a

Prosumer Model is a system comprising of components that facilitates a consumer with generating and expending their own energy.

Despite the potential decarbonisation benefits, this strategy implies a stronger interaction between two traditionally decoupled sectors (Rinalidi et al., 2021), and a major barrier to implementation amongst consumers is cost (Oluleye et al., 2018). Therefore, this review will focus on Prosumer Model cost optimisation for a ASHP and PV system, with the aim to maximise uptake amongst the population of Oxfordshire.

15.3.3 Prosumer Model Cost Optimisation

Prosumer Configuration

Capital-investment components such as PVs, battery storage systems, HPs and thermal storage units playing a major role in profitability for the consumer, with optimisation of component sizes proving to be a more economical approach when compared to applying advanced or basic operating strategies. A study into the optimisation and operation of integrated homes with PV energy storage and power-to-heat coupling (Angendt et al., 2019) found:

- The non-optimised investigated integrated home has annual costs of around £3,500 per annum, depending on the operation of the system. The optimised integrated home has annual costs of around £2,200 per annum, if basic operation strategies are used and £2,275 per annum if advanced operation strategies are applied.
- A comparable household with fossil heating and a conventional electricity supply from the rid have annual costs of £2,600 per annum, meaning that the application of optimised power-to-heat coupled system can lead to savings of up to 16%.

Our proposed system, as shown in Figure 2, has the potential to cover 90 – 95% of electricity demand and 85 – 95% of heat demand in households with moderate seasonal solar variation as experience in Europe (Keiner et al., 2019), and will work as follows.

Solar radiation is absorbed through amorphous silicon solar PV modules and fed into the converter, converting DC into AC which can be utilised for the house's electrical load or feed back into the grid. However, in order to reduce the overall cost of the system, an internal battery management system will automatically divert any excess energy to the battery, rather than allowing it to generate back into the grid. The battery system will then distribute the stored energy when it detects a demand in the house greater than the PV system can provide, or when there is no PV generation. It is advised that a lithium-ion based battery is utilised with a battery/PV capacity ratio of 2 kWh cap/kWp (Keiner et al., 2019) and paired with a battery converter between 1.5 to 2 kW (Weinger et al., 2016).

The converter supplies AC to the ASHP, maximising self-consumption of the PV system and minimising the electricity drawn from the grid, again contributing to lower annual total cost of energy (ATCE). Integrating thermal storage in the form of a stratified hot water tank with a suggested capacity of 800 l, however subject to change based on the size of the HP needed, prevents frequent shutdowns and start-ups of the ASHP units (Wu et al., 2020). Additionally, this integrated heating system can be used as a demand management strategic tool, through using the water tank's thermal storage capacity to switch the ASHP units off using peak periods to alleviate electric load and take advantage of off-peak electricity tariffs, reducing the overall operating costs (Wu et al., 2020). The minimum size of the buffer storage is flexible, because this will be relevant to the size of the HP necessary to support the electrical load of the household (Angenendt et al., 2019).

This system, shown in Figure 2, has the potential to cover 90 – 95% of electricity demand and 85 – 95% of heat demand in households with moderate seasonal solar variation as experience in Europe (Keiner et al., 2019).

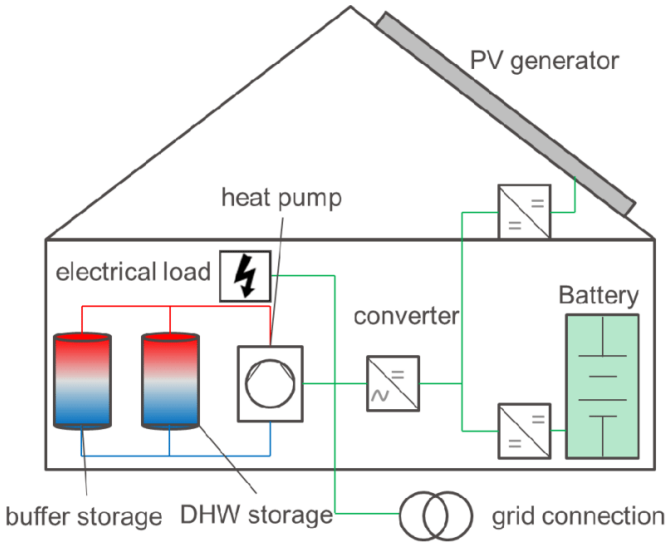


Figure 2: A simple diagram outlining the proposed prosumer model (Angenendt et al., 2019)

Solar Photovoltaic

PV is a technology used to convert solar energy into electricity (Li, Boyle and Reynolds, 2011) and can be widely categorised into two types: grid-connected (GCPV) or off-grid-connected PV systems (OGPV) (Karthikeyan et al., 2017). The primary difference between them, as their name suggests, is whether the system is connected to the main power supply (Karthikeyan et al., 2017). Once a novel technology, ongoing development and mass production has resulted in the continuous reduction in the initial cost of GCPV systems (Wang, Das, Putrus and Kotter, 2020). Therefore, they have become among the most attractive distributed generators amongst domestic consumers due to their easy application (Bakhshi and Sadeh, 2018), and reduced capital and maintenance costs (Li, Boyle and Reynolds, 2011).

In GCPV systems, the grid can act as the storage bank for solar PV systems, where unused, excess electricity can be deposited with consumers further compensated through feed-in tariff (FIT) schemes (Li, Boyle and Reynolds, 2011). Despite removing the requirement for battery bank storage technology, GCPV systems still require a variety of components in order for the system to be operational, with a range of options available to consumers in order to maximise efficiency. Table 1 summarises this information, and describes the role of the three main components in a GCPV system as defined by (Li, Boyle and Reynolds, 2011), with Figure 2 providing a simple illustration.

Component	Definition and Role	Maximising Efficiency
Solar Cell	Acts as the foundation of any PV system and is a semiconductor	Series versus Parallel Solar Cell Arrangement

	device, typically made of silicon, used to convert the solar radiation into useable electricity	• If solar cells are connected in series the voltage increases but the current remains the same, however if they are connected in parallel the opposite occurs, current increases but voltage remains the same (Demiororen and Yilmaz, 2010) Despite not having an operational difference, wiring in series is considered preferable with regards to cost as it eliminates the need for larger and thicker cables to cope with the higher amperage, however, since all panels in a series circuit are dependent on each other, the whole system can become faulty if one panel breaks
Solar PV Module	Assembled from solar cells to obtain a desired power, producing direct current (DC) electricity. Additionally, when a GCPV system is employed for domestic use, the PV modules are commonly mounted on the rooftop, which can reduce the size of the mounting structure and land requirements	Material Type • One of the most important parts in determining the output of a PV system is the PV modules used (Kharseh and Wallbaum, 2020) • Three main types of Solar Panels exist, Monocrystalline, Polycrystalline and Thin Films, which all come with their various advantages and disadvantages • Thin-film based PV modules emerge as an advantageous option, with a study by Kharseh and Wallbaum, (2020) that analysed over 30 brands across the three types of PV module for a south-facing residential building in Lancashire UK identifying that the initial implementation cost of the system was potentially £13,000 lower than monocrystalline panels • Study simulations went on to indicated that monocrystalline module types show the best energy performance, however thin-film module type shows the best economic performance at the current conditions in the UK (Kharseh and Wallbaum, 2020) • In Oxford, most electricity is produced under low to medium lit intensities, defined as overcast light which is bluer than clear sky conditions (Jardine and Lane, 2003). Amorphous silicon is one of the only technologies capable of efficient absorption of blue light, so these technologies

		outperform the crystalline silicon arrays (Jardine and Lane, 2003) • Amorphous silicon cells are the most widely developed thin-film solar cell (Shi, Guo an Bedford, 2015) making this an ideal material to use for a GCPV system in Oxfordshire with regards to efficiency and cost
Solar Inverter	Converts the DC electricity to alternating current (AC) electricity in order for it to be used for AC electrical appliance or for exporting to the grid (on average needs to be replaced every 8th year (Kharseh and Wallbaum, 2020))	Type of Inverter • Inverters covert DC to AC and are vital for a GCPV system because this is what allows the solar generated electricity to be used for the household's electrical load • Three main types of inverters exist, string (centralised inverter), power optimizer (string inverter + power optimizer) and Microinverters • String inverters are the most affordable option when compared to microinverters and have seen rapid market adoption across the UK in recent years (Greenmatch, 2022) • The installation and replacement cost of string inverters originates from the design. The inverter takes its energy input from a chain of solar panel and is governed by the performance of the weakest panel, therefore efficiency can be lower but only one inverter is needed typically costing between £500 to £1,500 to install/replace (Greenmatch, 2022)

Table 1: Summarising the key components of a rooftop PV system as defined by Li, Boyle and Reynolds (2011) and techniques for maximising their efficiency

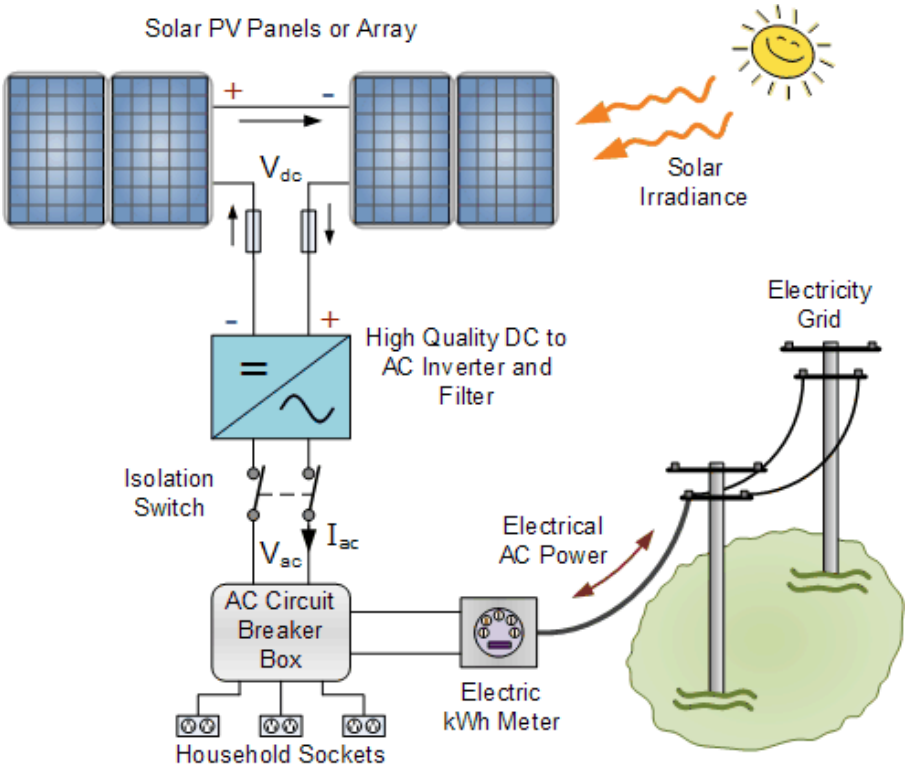


Figure 3: Simplified GCPV system (Alternative Energy Tutorials, n.d.)

Storage Opportunities

The primary concern with pairing ASHP and GCPV technology is that both systems are subject to intermittency and variability throughout the day due to their weather driven energy sources. With regards to ASHPs, their heating capacity decreases with the ambient temperature, usually whilst the typical household heating demand increases (Arteconi, Hewitt and Polonara, 2013). Similarly, with GCPV, that are driven by solar radiation, their capacity to produce electricity greatly diminishes late afternoon/evening, again when typical electricity demand increases. This further reduces in colder seasons, with both technologies less efficient in winter months when the demand for heating in the UK is at its highest (Angenendt et al., 2019).

Therefore integrating a form of storage into the prosumer system has been cited as advantageous to control the balance between supply and demand, preventing continuous on/off cycling of the HP that would result in a shorter working life of the unit and higher overall cost (Arteconi, Hewitt and Polonara, 2013), combat gradually declining FIT rates and to increase electricity self-consumption which can decrease the ATCE (Pena-Bello et al., 2021). Additionally, battery storage can also work to support sector coupling through the synergy of low-carbon technologies across the heating and power sectors (Rinaldi et al., 2021).

Battery Storage:

Due to decreasing PV FIT and increasing retail prices of electricity, utilising the generated PV electricity on-site at the household level has become more attractive than feeding it back into the grid, with the development of battery storage, more precisely Lithium-based batteries, enabling prosumers to reduce their ATCE through maximising their PV self-consumption and generation (Keiner et al., 2019). See Figure 4.

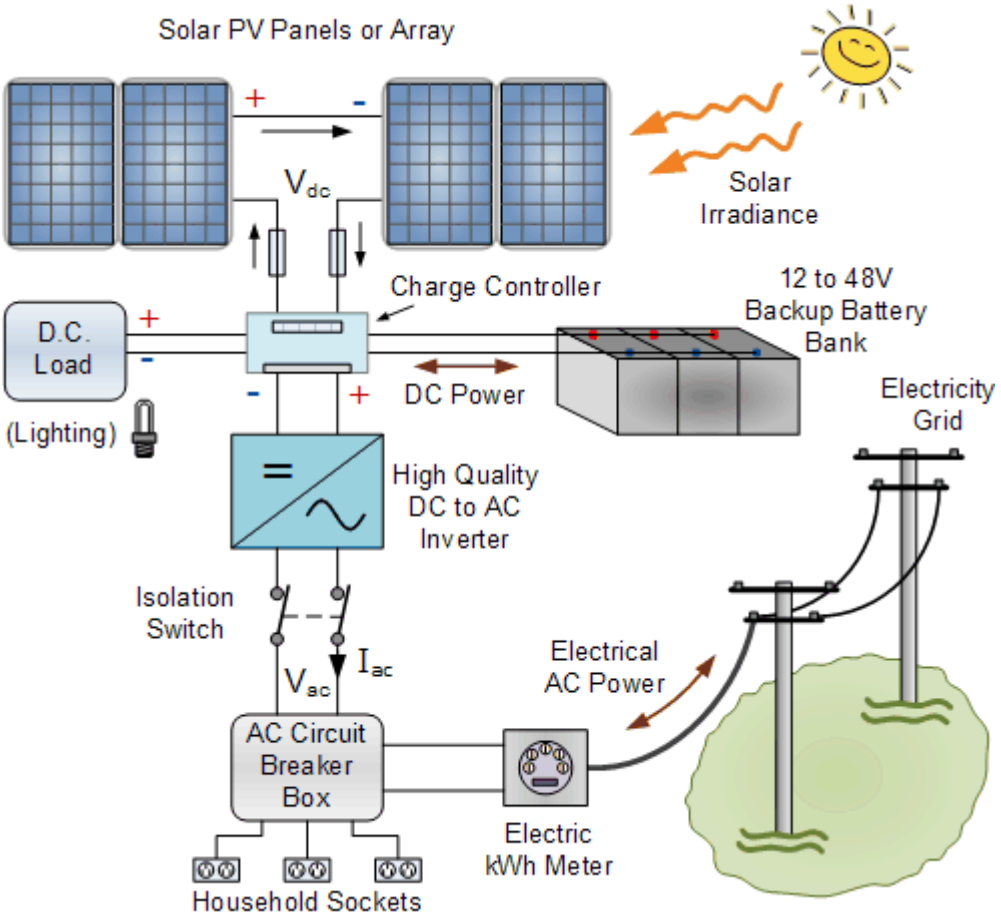


Figure 4: Simplified GCPV system with battery storage (Alternative Energy Tutorials, n.d.)

Weniger, Tjaden and Quaschning (2014) show that self-consumption rates and the degree of self-sufficiency strongly depend on the PV system and battery size considered, with their results highlighting that in the long-term a conjunction of PV systems with batteries is not only profitable for consumers but the most economical solution as FIT continue to play a minor role in the future. Keiner et al (2019) investigated this threshold for the economical maximum battery capacity per installed PV capacity for over 145 different regions around the world across four separate storage scenarios, finding that the development of the least ATCE systems had a cost efficiency limit of battery/PV capacity ratio of 2 kWh cap/kWp, with most of the systems below this limit.

Battery energy storage systems do require an additional component: a battery converter, with its size affecting the battery charge and discharge behaviour and, by extension, the annual amount of stored PV energy (Weinger et al., 2016). Weinger et al (2016) investigated the impact of the battery converter rating on the energy throughout PV-attached storage systems, concluding that battery converters rated at 4 to 5 kW are optimal with regards to maximum discharged energy. However, the rated battery converter power can be sized significantly smaller in residential buildings, between 1.5 to 2 kW without losing more than 5% of the optimum discharged energy, and are usually less cost-intensive (Weinger et al., 2016).

Thermal Energy Storage:

Thermal Energy Storage (TES) units can be defined as a device that can store thermal energy by cooling, heating, melting, solidifying or vaporising a material, with the basic principle that energy is supplied to the TES (charging), where it is stored, then drawn from the TES (discharging) and used at

later time (Arteconi, Hewitt and Polonara, 2013). TES technologies have been identified as particularly suitable for coupling with ASHPs, with their integration reducing the operational cost of the HP system (Oluleye et al., 2018) and the levelised cost of meeting the electricity demand by 13-26% (Pena-Bello et al., 2021). This is primarily through improving the HPs performance by decoupling energy generation from energy distribution, thereby allowing for the HP to be smaller in size (Arteconi, Hewitt and Polonara, 2013). Schwarz et al (2018) goes on to show that PV integration with TES units in combination with power-to-heat applications (such as HPs) are extremely beneficial regarding PV self-consumption rate. Additionally, Keiner et al (2019) highlighted that they are relatively inexpensive, reliable and do not require specific maintenance, contributing to their overall attractiveness. Energy storage technologies also has co-benefits for the grid, helping to manage increases in peak electricity demand which arise from heat electrification (Vorushylo et al., 2018). Strbac et al (2010) concluded that a projected increase of 92% in peak demand due to heat electrification could be reduced by two thirds if TES and electric vehicle optimised technology control could be applied.

Simple sensible heat storage solutions are appropriate in scenarios where the thermal load for the home is produced electrically for space heating and domestic hot water, such as with ASHP (Arteconi, Hewitt and Polonara, 2013). Water at lower temperatures is one of the best storage mediums available, with low-cost operating ranges of 5-15^{o}C, resulting in thermally stratified hot water tanks being widely studied for use in building applications. Additionally, the vast majority of homes in the UK are heated with hydraulic radiators and therefore highly compatible with water based thermal storage, contributing to the ease and simplicity of installation (Vorushylo et al., 2018).

It is considered beneficial to determine the optimal size of the TES and HP in order to maximise efficiency between the technologies. Keiner et al (2019) found that regions with moderate solar conditions, such as central Europe, a TES of 800 l coupled with a HP of 7 kW was a good choice. This was further confirmed in a study by Arteconi, Hewitt and Polonara (2013) who considered the heating load needed for a semi-detached in Northern Ireland. They found that a volume of 800 l was sufficient for a house that was supplied with heating systems with a low thermal inertia (such as radiators), that were switched on for 10 hours a day, however a HP of 4 kW was sufficient.

Domestic Side Management

Applying a domestic side management (DSM) strategy reduces the electricity bill by avoiding the costs incurred during the peak hours.

Pospíšil, Špiláček and Kudela (2018) proposed a novel operation strategy, that the AHSP only operated during the period with the highest temperature in the day, while the thermal energy storage unit would compensate at other periods. Under this operation strategy, the ASHPs always operated at the highest ambient temperature and switched off at lower ambient temperatures where they are less efficient. Although they found that this did not directly improve the coefficient of performance of the AHSP units, it did have a significant effect on conservation (Zhang et al., 2019). According to their results, the seasonal coefficient of performance of the ASHP increased by up to 23% (Dongellini et al., 2015). This suggests that aftercare should be included in the One Stop Shop customer journey to ensure the householder is utilising their system correctly.

15.3.4 Technological Standardisation

The team conducted research into available technologies relevant to the prosumer model and the extent of how standardised the technologies are. The table below provides information across heat pump types, heating system upgrades, retrofit/energy efficiency measures, prosumer (generation and energy storage).

Category	Technology/Measure	Key Manufacturers/Suppliers (Domestic Solutions)	Key Sizes Available (Domestic Applications)	Compatibility Considerations
Heating plant	Air source heat pump (air-to-water)	Daikin, Mitsubishi, LG, Samsung	Sizes generally range 4 kW – 16 kW in very variable increments. **Daikin Monoblock (air to water):** 4 kW – 16 kW (can come with integrated heating and hot water unit) **Mitsubishi:** 4.5 kW,5 kW, 6 kW, 8.5 kW,11.2 kW,14 kW **LG THERMA V:** 9 kW, 12 kW, 14 kW, 16 kW **LG Monobloc:** 5 kW, 7 kW, 9 kW, 12 kW, 14 kW, 16 kW **Samsung:** 4 kW – 16 kW (in steps of 1 – 2 kW)	N/A
Heating plant	GSHP	Kensa, Daikin, Viessmann, Nibe, Vaillant, Worcester Bosch	Sizes generally range 3 kW – 17kW in very variable increments. **Daikin:** max capacity: 7.98 kW, 9.55 kW,13 kW, 11.9 kW **Kensa:** 3 kW, 6 kW, 7 kW, 9 kW, 13 kW, 15 kW, 17 kW **Viessman:** 5.6 kW, 7.5 kW, 9.7 kW, 10.3 kW	N/A
Heating system upgrades	Replacement radiators: High performance aluminium radiators	Wide range	Large variety of size and styles.	N/A

	Some households may need to replace their current radiators with larger ones so that they gain more heat output. Aluminium's superior heat conductivity allows for much faster heating up of the radiator with lower water volumes. They are marketed as being best installed with, however, tend to be significantly more expensive than conventional radiators and only make-up a very small part of the market (BEIS, 2021).			
Heating system upgrades	Replacement radiators: Conventional radiators Some households may need to replace their current radiators with larger ones so that they gain more heat output.	Extensive	Extensive	N/A
Heating system upgrades	Fan convectors: Alternative to radiators, good addition with because the work best at lower temperatures.	Mitsubishi electric, Myson, Daikin, Smiths	No standard sizing	N/A

Heating system upgrades	Thermostatic radiator valves: Can be installed on existing radiators. Allows for automatic regulation of radiator output as the room temperature changes. In 2016, estimated that 1/3 to 1/2 of households use these already (BEIS). Studies have suggested that using TRVs rather than wheelhead valves can reduce energy use by 15%, however it is estimated that savings of around 3% are more realistic (BEIS P65)	Drayton, Oslo designer, Ecospa, Kartell, WarmeHaus	N/A	Often installed, but not actually used to moderate radiator temperature.
Heating system upgrades	Heat transfer modifiers: Can help improve the efficiency of GSHPs and in the central heating system if using ASHPs. They change the thermal properties of water to improve the efficiency of the heating systems. Claims to improve	Endotherm- Only heating additive recognised by Energy Saving Trust.	N/A	Compatible with most heating systems

	efficiency by up to 15% (BEIS, 2021).			
Heating system upgrades	Magnetic radiator/central heating filters: Prevents build-up of iron oxide sludge, to help improve radiator efficiency. Magna energy claims company claims that energy bills can be reduced by up to 6% per annum, on average. There are also 30% fewer breakdowns.	MagnaClean, Fernox, Boilermag, Worcester Greenstar, Altecnic	N/A	Should be installed after a cleanse of the sludge from the radiator system, which is often performed as part of the installation.
Heating system upgrades	Radiator fans: Fans can be fitted to blow air across radiators, rather than just relying on natural convection. Can see an increase in radiator output of 14.3% to 19.4% (BEIS, 2021).	Radfan, 4YourHome, Speedcomfort	Radfan: 50cm Speedcomfort: Comes in sets that can be extended, from 50 cm to whatever length is needed. 4YourHome: 48 cm	Very affordable. Potentially noisy and may need regular cleaning.
Heating system upgrades	Radiator reflectors	Radflek (Energy Saving Trust recommended)	N/A	Modern radiators are often designed to limit radiative heat loss to the wall, so reflectors may not have a dramatic effect.
Heating system upgrades	Hot water cylinders	Heatrae Sadia, Telford, Gledhill, Viessmann, Vaillant	120, 150, 180, 200, 210, 250, 300 litre capacities. On average increase by one size when you	Unvented/Vented depending on how many bathrooms and whether

			add a bathroom or bedroom: https://www.hotwater.org.uk/hot-water-cylinder-calculator/	there is a loft space available for a water tank.
Heating system upgrades	Buffer tanks	Not clear who "key" manufacturers are, but came across the following most regularly: Advance Appliances (collaboration with Kensa), Cordivari and Joule. Appears that they are often manufactured/supplied alongside.	100 – 500 litre capacities. (Average 3 bed house ~150 l buffer tank). Need to hold approximately 15 litres per 1kW of heat pump capacity.	Sometimes necessary to install buffer tanks alongside to prevent short cycling and loss of efficiency. If house has space for a large one (e.g. in a basement), they can also be used for daily energy storage which can be used to save money if using variable rate electricity tariffs.
Heating system upgrades	Underfloor heating installation Very well paired with heat pumps.	Warm Up, ProWarm, Heat Mat, Flexel, ThermoSphere	Increase from 1 m^2 in increments of 0.5m^2	When retrofitting underfloor heating, changes to floor height will need to be considered. Wet underfloor heating is the most efficient, but requires more structural changes and installation is more expensive. Electric underfloor heating is cheaper and easier to install, but can end up being inefficient and costly.

Prosumer – Generation	Solar PV	LG, Panasonic, Canadian Solar, Sharp, SolarWorld, Yingli Solar	Each individual panel usually has an area of 1.3-1.7m², with 1.6m² the most common size.	Roof size: If roof is facing north and shaded might not be compatible
Prosumer – Energy Storage	Battery Storage (li-ion)	Tesla Powerwall, Powervault, LG Chem, BYD, Enphase and Sonnen. These seem to be some of the top rated, but there are also numerous other manufacturers: https://www.solarguide.co.uk/solar-batteries#/. Each are popular for different reasons e.g. cost effectiveness, capacity ect.	Capacity of 1-30kWh in variable steps: **Tesla Powerwall:** 2.0: 13.5kWh **Powervault G200:** 2kWh, 4kWh, 6kWh **Powervault 3 (Lithium-polymer (Li-MNC)):** 4.1kWh, 8.2kWh, 12.3kWh, 16.4kWh, 20.5kWh **Powervault 3 second life:** 3.9kWh, 5.9kWh, 7.9kWh (Recycled batteries at much lower cost) **LG Chem:** 2.9 kWh, 5.9 kWh,8.8 kWh,12.4 kWh, 6.6 kWh, 9.3 kWh **BYD B-Box:** 2.45 kWh steps - to 78.4 kWh (combine multiple 2.45 kWh units) **Enphase:** 1.2kWh (Idea is to buy multiple units, to tailor specifically to your energy needs) **Sonnen:** 4 kWh – 16 kWh (in 2 kWh steps)	N/A
Energy Efficiency	Loft/Roof insulation (mineral wool, organic foam, or rigid insulation boards.)	Ecotherm Insulation (Insulation boards), Excel Warmcel (Cellulose Fibre Insulation made from recycled newspaper), Knauf Insulation (Blowing wool, glass/rock mineral wool), Rockwool Ltd. (Stone wool), Superglass Ltd (Glass-wool insulation)	Overall required minimum of 270mm. Rolls/slabs of insulation come in varying thicknesses: 100mm, 120mm, 150mm and 170mm ect. to allow consumers to build up to this thickness. Loose fill comes by the kg.	Harder and more expensive to install for flat roofs, but likely to have a very significant impact on energy losses because they tend to lose more heat. Ventilation may need to be improved.
Energy Efficiency	Floor insulation	Ecotherm Insulation (Insulation boards), Excel Warmcel (Cellulose Fibre	Rolls/slabs of insulation come in wide variety of thicknesses: 100 mm, 120 mm, 150 mm	Wooden floors: easily insulated by lifting the floorboards and laying

		Insulation made from recycled newspaper), Knauf Insulation (Blowing wool, glass/rock mineral wool), Rockwool Ltd. (Stone wool), Superglass Ltd (Glass-wool insulation)	and 170 mm ect. Loose fill comes by the kg.	mineral wool insulation supported by netting between the joists. Concrete floors: can be insulated when it needs to be replaced, or can have rigid insulation laid on top. Ventilation may need to be improved.
Energy Efficiency	Draught proofing	Schlegel Seals, Astrodraft Seals, Raven Seals, Stormguard Seals	Variable depending on application	Chimneys are a particular source of draughts and can be draught proofed using a chimney cap or draught excluder. Old extractor fans can be bricked in and sealed to reduce draughts. House should be well ventilated.
Energy Efficiency	Cavity wall insulation	Knauf, Rockwool, Thermabead, Knauf Insulation, Superglass, Celotex	Thicknesses from 40 – 150 mm, in variable steps ~10 – 20 mm	Only possible where cavity walls are present Also may not be able to fit standard cavity wall insulation if: - house is particularly exposed to driving rain - cavities are too narrow - cavities are uneven

				-cavities are blocked with rubble - defective wall ties - home is prone to flooding Ventilation may need to be improved.
Energy Efficiency	Solid wall insulation - internal insulation	Xtratherm, Ecotherm, Marmox	**Ecotherm:** 25, 40, 50 ,70 mm (+ 12.5 mm plasterboard) **Xtratherm:** 50 – 90 mm in increments of 10 mm (+ 12.5 mm plasterboard) **Marmox multiboards**: 10 – 60 mm in 10 mm increments (including one that is 12.5 mm)	Ventilation may need to be improved.
Energy Efficiency	Solid wall insulation - external insulation	Knauf insulation, Dryvit, PermaRock, Structherm, Weber, Saint-Gobain	Thickness between 50 – 150 mm, generally in 10 mm increments	Ventilation may need to be improved.
Energy Efficiency	Glazing (double)	Safestyle, Everest, Anglian, CR Smith, First Home Improvements	Standard UPVC window: Heights: 450 mm, 600 mm, 1,050 mm, 1,200 mm, 1,350 mm and 1,500 mm. Widths: 488 mm, 630 mm, 915 mm, 1,200 mm and 1,770 mm. However, there are also made to measure options.	Ventilation may need to be improved.
Energy Efficiency	Glazing (triple)	Everest, Anglian	Standard UPVC window: Heights: 450 mm, 600 mm, 1,050 mm, 1,200 mm, 1,350 mm and 1,500 mm. Widths: 488 mm, 630 mm, 915 mm, 1,200 mm and 1,770 mm. However, there are also made to measure options.	Probably not worth the expense if house already has double glazing.

Energy Efficiency	Doors (improved thermal performance)	Endurance, Rockdoor, GRP Composite Doors, Hallmark Panels, Everest, Solidor	Width: 799 mm – 1,000 mm Height: 1,978 mm – 2,150 mm	
Energy Efficiency	Low energy lighting:	Wide range of UK manufacturers all offering low energy options. Top rated for energy efficiency: Sylvania, Phillips, GE lighting,	Standard lightbulb sizing	Can directly replace incandescent light bulbs with energy saving alternatives.
Energy Efficiency	Multi zone heating controls: Can be installed via smart radiator valves or smart thermostats	Loxone, Wiser, Honeywell, Nest (google), Tado	N/A	

15.3.5 Phase 2 Prosumer Model Plan

Commissioning and installing a Prosumer system is complex and often requires a householder to liaise between multiple suppliers to ensure the retrofit, home upgrades, the HP, solar PV and battery storage are installed in the correct order. For this reason, the Heat Pump Ready Oxfordshire project develops a design for a One Stop Shop to support this process, therefore enabling an accelerated uptake of HPs.

Within Phase 1, we have decided what the Phase 1 Prosumer model offering should be by considering the impacts of 'Gold Standard' and 'Minimum Standard' offerings.

Gold Standard: A gold standard Prosumer model offering includes a sufficient number of each product to provide for the vast majority of customers. All Prosumer technologies are included:

- Solar PV
- ASHPs
- Battery storage
- Retrofit measures
- Home upgrades (such as radiators, HW Cylinder)
- Any other components that allow the system to interact (inverter, charge controller)

Minimum Standard: The One Stop Shop provides one or two options of each technology Prosumer technology but excludes retrofit measures. For this reason, this option cannot guarantee that the system will run efficiently.

The desired Prosumer offering for the project aligns with the Gold Standard Prosumer offering detailed above. To ensure payback is achieved within 20 – 30 years and to decarbonise the homes as far as possible, is vital that the customers retrofit their homes as needed prior to the rest of the system being installed. The exact product offering (such as the model choices described in section 3 of this report) is dependent on the offering provided by the suppliers contracted during the mobilisation stage of Phase 2. The learnings from section 3 will be embedded into the procurement specification developed during the mobilisation stage, to ensure that high quality, reputable products are offered as part of the system. Ultimately the project will aim for the Prosumer model offering to include enough versions of each product to provide for most customers. This will enable faster and more successful uptake of the prosumer system (and therefore HPs).

15.3.6 Prosumer Model Finance Evidence

Introduction

The pricing for Prosumer model components is decreasing, and while currently the upfront investment is still taking a number of years to generate a payback, it is likely that increasing energy costs are going to be a driving force for consumers to take action. Even then, we need to ensure that barriers to accessing finance are removed for everyone in the market.

Maximising the number of people able to access credit to afford a Prosumer system will have the additional benefit of attracting investment to the sector, driving economies of scale and bringing it within the realms of affordability for most.

There are multiple forms of credit available in the market, and it is likely that the true 'able to pays' would be able to access this credit, if not their savings, should the energy savings and payback periods on initial investment be attractive enough. It is unlikely that the return generated from lending

directly to this market would be sufficient to lend to the 'fuel poor'. Conversely, the market attempts to generate a return for lending to 'riskier' consumers by charging them more, often driving this group away from being able to accessing credit.

There is a significant proportion of consumers who do not have access to fair rates of credit, which is currently a huge barrier to being able to afford to fund a Prosumer system, even with the use of some element of grant funding. With the increasing numbers of people falling into the fuel poverty bracket, it is anticipated that without intervention there will be a serious Cost-Of-Living crisis.

General Consumer Analysis

The ideal consumer for standard credit[1] has a stable income, good financial management skills and a stable address history.

This model is exclusionary on two fronts:

- The poorer are denied access to credit
- If they are granted access, the poorer pay more.

This is described as the poverty premium.[2] This poverty premium impacts many services, with the fuel poor often charged more disproportionately on energy, via the standing charge forming a larger proportion of their fuel payments, and top up meters costing more than consumers paying by Direct Debit.

Other consumers fall into the same bracket whereby they do not fit the mould; by employment status, with increasing numbers of self-employed consumers finding it difficult to access credit; or by age, so retirement being a factor despite income levels being stable.

Later in this section, analysis of live Lendology clients who have been provided a loan to demonstrate clearly how other factors, such as age of occupants, whether they have a mortgage or dependents can cause significant shifts in disposable income, is provided.

Any models for finance typically aiming for the 'able to pays' to pay for the provision of the service tend to be problematic:

- Charging 'able to pays' more drives them away from borrowing from the scheme as they are able to source better rates elsewhere due the nature of financial product pricing in the main markets.
- Attempting to set differentiators to categorise 'able to pay' versus 'fuel poor' consumers can result in complex algorithms that are unable to flex to what poverty can look like in practice, across the many different segments of the population; household size, geographic location, and employment status etc.[3]

[1] By standard credit, we mean main stream or high street lending

[2] See here for more information https://fairbydesign.com/povertypremium/

[3] For example, Fair Finance reported a user accessing a loan to help pay off pay day loans despite earning £65,000: https://www.ft.com/content/45deb236-985b-44e7-a3c1-a39d88ce79b2?fbclid=IwAR2Cja3UE0MaLQkM_9Juyg_fdfbZES4j2Q_mxYfJopq3AmtTLd-YCP04iQk&fs=e&s=cl

With 51.2% of adults without emergency savings[4], the number of consumers who may struggle to afford repayments via standard credit is likely to be higher than expected. The number of homeowners who are fuel poor is on the rise, with 11.4% of households in fuel poverty last year before the recent and upcoming increases in energy costs.[5] There is also a growing concern that buy now pay later products are hidden from the credit scoring system, meaning people are potentially accessing credit they cannot afford.

60% of the general population do not understand how a credit score is calculated, and only 41% know their credit score, falling to 35% in the most deprived groups.[6]

The other enemy of progress in provision of energy saving measures such as heat pumps, solar and battery is lack of action, with current customers surveyed by Lendology taking an average of 5.5 years to borrow for what might be deemed emergency works; leaking roofs, broken windows and boilers. A potential borrower is going to sit and wait until they really do have to take action.

General Disadvantage to Uptake

To our knowledge, there is no lending mechanism that can provide the borrower with assurances on payback, returns or guarantees on the work. While this is true of all items financed by credit, some form of assurance would further reduce the barriers on the consumer end.

However, it is anticipated that this assurance would need to be provided by the fitter of the pump as lenders are not likely to guarantee returns or the work as this adds to the risk basis. If they were to guarantee the work, this cost would be passed to the consumer.

If a leasing model was adopted, it would be expected to see some form of warranty provided with the energy saving measures. This would increase the cost to the consumer, but it is anticipated that this model would have an inbuilt saving from economies of scale as it would involve a large player supplying and fitting the prosumer system rather than several, smaller contractors.

Financial Options Summary

Financial Option	General Rate	Timescale	Summary
Mortgage Lending	3.09% plus fees - APRC, 4.1%	4 - 8 weeks if re-mortgaging. Quicker if borrowing via an advance.	Obtaining a (minimum) advance of £10,000 is relatively straightforward if the consumer is in the 'able to pay' market, already has an established mortgage and over 15% available equity overall.
Unsecured Borrowing	3.1% - 32.5% (rates are higher outside of 'high street'	Decisions can be made and funding paid very quickly,	If the consumer is in the able to pay market the rates will be attractive

[4] Taken from the UK Financial Vulnerability Index, created using unique data from Lowell and publicly available measures. Lowell is one of the largest credit management services companies in Europe: https://apps.urban.org/features/uk-financial-vulnerability-index/

[5] Sub-regional fuel poverty data: https://www.gov.uk/government/statistics/sub-regional-fuel-poverty-data-2022

[6] https://drive.google.com/file/d/1-z3kfW9GTBzpG_8lMZ9KCd8OtvDQ1RTC/view

	lending – in excess of 49%)	often same day, if more information required longer.[7]	without intervention. Rates are higher for longer term lending with larger amounts due to the anticipated further rise in interest rates.
Interest Free Borrowing	0%	As it will be subject to additional checks, if not managed this could increase the timescale from 1 week to however long the checks are anticipated to take and additional staffing capacity capability. Will require two quotes.[8]	Most attractive option for the consumer but requires extensive public sector funding, and the additional checks can cause delays that ultimately push the consumer elsewhere.
Equity Release	4.43% - 7.39%	Around 8 weeks, similar to a re-mortgage as same security	Only available to homeowners over 55 and usually requires a minimum amount of borrowing which will likely be in excess of the sums required.
Credit Unions	Unavailable for the volumes of lending	1-7 days[9]	Attractive rates are possible, but the funding mechanisms are unlike to be scalable without support as deposits are generally localised and insufficient.
PACE Model	6-10%	Data unavailable. Anticipated to take in excess of 4-8 weeks mortgage timescale	Becoming an increasingly popular option in the US. However to implement in the UK will require extensive legal changes to UK law and council tax mechanisms. Some mortgage companies in the US will not lend if a PACE loan is in place.[10]

[7] https://www.oceanfinance.co.uk/loans/personal-loans/how-long-does-personal-loan-take/#:~:text=As%20the%20bank%20will%20have,or%20the%20following%20business%20day.
[8] https://www.scope.org.uk/advice-and-support/disabled-facilities-grant-home-adaptations/
[9] https://creditunion.co.uk/what-to-expect-when-you-apply-for-a-loan/
[10] https://www.investopedia.com/terms/p/property-assessed-clean-energy-pace-loan.asp

Asset Leasing	Looking at the car leasing market, a rate is generally unavailable as it is complex to calculate, often requires a deposit and comes bundled with servicing and fair usage.	A car lease – 1-7 days for finance approval dependent on consumer queries[11]	There have only been trials conducted to date and consumer costs are unavailable. Consumers may appreciate the ability to effectively rent a prosumer system for a monthly sum, especially if it is bundled with a servicing plan.
Lendology Model	4% (influenced by amount of public sector subsidisation in terms of capital funding and funding towards running costs)	The timescale varies depending on the preparedness of the client with financial documentation and council policy and checks. Can be assessed within 1 day if everything is in place.	Flexible lending in partnership with councils. The public sector backing allows successful lending at lower rates to enable the fuel poor to afford energy saving measures typically out of their reach from the standard forms of credit.

Forms of Credit

No Interest Loans (NILS): With full public or grant funding, it is possible to administer an interest free loan scheme. Bar a grant scheme and offering full payment for the works, it is the most attractive offering for the consumer, but offers no returns or funding towards the overheads of provision of credit.

The cost for a £20,000 loan over 10 years for a client is £202.49 a month at a rate of 4% interest. Providing the same loan interest free would still require a repayment of £166.67 a month. It is deemed that the additional £35.82 a month is unlikely to be material when considering affordability in context of the overall payment amount.

Advantages	Disadvantages
Most attractive to the consumer, and easier to create attractive marketing messages	Difficult to establish criteria, with many households falling through the assessment gaps
Regulatory environment is well established.	Needs substantial investment from the public sector and other charitable sources to fund the running costs, with no attraction for other investment forms

[11] https://www.nationwidevehiclecontracts.co.uk/blog/how-long-does-a-leasing-application-take

	Fails to recognise the largest proportion of repayments is generally the capital, so repayments are often not too dissimilar to repayments where a low rate of interest has been added to help support or fund running costs
	An influx of interest may make the scheme costly to administer and cause backlogs in processing

Mortgage Lending: The best mortgage rate available at the time this report was generated from First Direct was 3.09% fixed for 5 years, converting to 4.54% at today's variable rates. The APRC was 4.1% with a maximum loan to value (LTV) of 60%.[12]

Mortgage rates are on the rise, with the sustained low interest rates available coming to an end as the base rate goes up.

Year	Average UK Mortgage Rate[13]
2011/12	3.86%
2012/13	3.62%
2013/14	3.51%
2014/15	3.04%
2015/16	2.76%
2016/17	2.50%
2017/18	2.09%
2018/19	2.03%
2019/20	2.11%
2020/21	1.84%
2021/22	1.91%
2022/23	2.96%

[12] https://moneyfacts.co.uk/news/mortgages/best-uk-residential-mortgage-rates-this-week/
[13] https://www.statista.com/statistics/814493/mortgage-interest-rate-united-kingdom/

Mortgages are protected by a first charge on the property which more or less guarantees full recovery of funds, unless repossession happens in the earlier years when the loan to value ratios are higher. Repossessed properties can lose about a third of their value due to the nature of sale.[14]

Total interest charged on mortgages can be more expensive than unsecured borrowing because the repayments are spread over a longer term than, say a personal loan over five years, but have the advantage of meaning smaller monthly repayments within a single payment.[15]

Obtaining a mortgage advance to increase a mortgage with an existing mortgage in place with that same lender is not overly complex[16]but generally has a minimum amount of £10,000 and will usually involve a similar financial assessment for obtaining a mortgage in the first place.[17] Fees are dependent on the mortgage provider but are relatively low.

Halifax had the following stipulations:

- No advance within 6 months of completion of the original mortgage[18]
- Maximum 85% LTV; where above 80% LTV, a revaluation would be due (including fees of approx. £100.)

HSBC have similar stipulations.[19] The funds are available relatively quickly.

Remortgaging is more complex if there is an intention to move lenders – it can take weeks to complete the checks, conduct the legal transfer of the charge against the property and remit the funds, with Halifax and Barclays both quoting around four to eight weeks. There are also additional product fees.[20] Switching rates and obtaining an advance from an existing mortgage lender will be quicker but can involve paying a higher rate than switching providers.

Advantages	Disadvantages
Often the cheapest form of credit overall as the value of lending is generally high	Variable term at some point may increase the cost of credit.
Less risky for the lender as first charge on the property guarantees first place for creditor repayment in the event of default and repossession	Remortgaging or obtaining an advance from the existing mortgage company generally incurs additional fees. If the mortgage is fixed, the borrower is likely to wait until their fixed term comes to an end as there are further fees.
Regulatory environment is well established.	If a property is unmortgaged, the consumer is not likely to leverage a mortgage to fund a Prosumer system as the value is too low.
Funding mechanisms are already in place via bank deposits	Returns on investment flow to shareholders rather than communities.

[14] https://www.moneysavingexpert.com/mortgages/house-auctions/
[15] https://www.moneysupermarket.com/mortgages/additional-borrowing/
[16] https://www.halifax.co.uk/mortgages/existing-customers/additional-borrowing.html
[17] https://www.forbes.com/uk/advisor/mortgages/additional-borrowing/
[18] https://www.halifax-intermediaries.co.uk/products/mortgages/further_advances/default.aspx
[19] https://intermediaries.hsbc.co.uk/frequently-asked-questions.html#additional-borrowing
[20] https://www.barclays.co.uk/mortgages/remortgage/remortgage-process/

	Harder for people who are self-employed or on benefits to access.
	Impacted by money markets and need to generate financial returns, so rates may rise overnight impacting availability of credit.

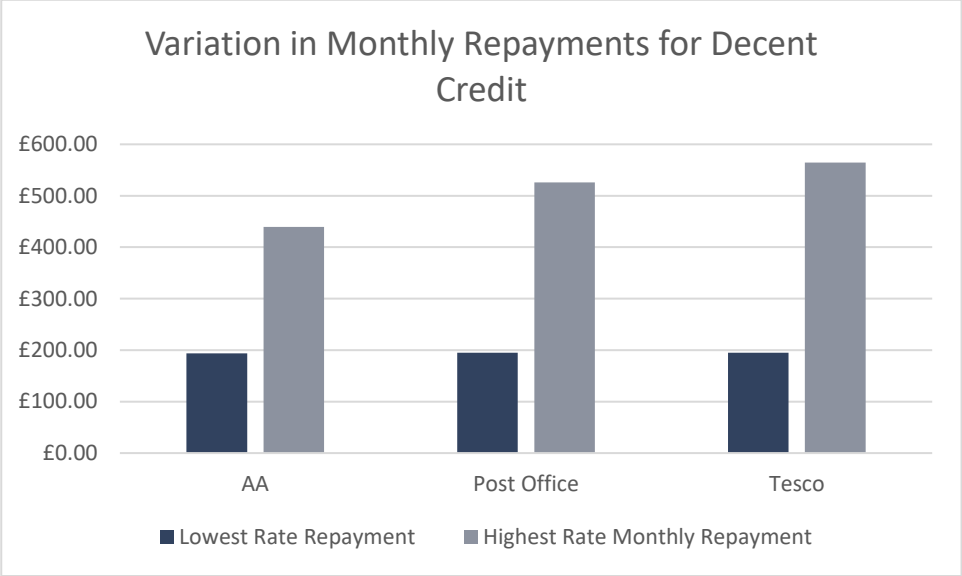
Unsecured Borrowing: These were generally the cheapest rates during August 2022.[21]

Lender	Rate for £20,001 - £25,000 over 1 - 7 years available to 51% of successful applicants	Highest rate of Credit
AA	3.1% APR	23.9%[22]
Post Office	3.2% APR	29.9%[23]
Tesco	3.2% APR	32.5%[24]

Assuming there are no fees and the APR is based on interest rate alone, the repayment for a £20,000 loan over 10 years could differ significantly as follows:

Lender	Lowest Rate Repayment	Highest Rate Monthly Repayment	Monthly Difference
AA	£194.05	£439.57	£245.52
Post Office	£194.97	£525.76	£330.79
Tesco	£194.97	£564.52	£369.55

[21] https://www.moneysavingexpert.com/loans/cheap-personal-loans/#20k
[22] https://www.theaa.com/loans
[23] https://www.postoffice.co.uk/personal-loans
[24] https://www.tescobank.com/loans/



It is important to note that these forms of credit are generally only available to people who have an excellent or good credit rating. At the time of writing, ClearScore were advertising loans for people with bad credit with a representative rate of 49.7%. Assuming the APR correlates with interest rate, the monthly repayment for a loan of £20,000 over 10 years at 49.7% would be £834.74.

It is evident that this would not be an attractive offer for persuading a homeowner to fund a prosumer system.

Advantages	Disadvantages
Can be a cheap and attractive form of credit for the able to pays	Riskier for the lender in the event of default, so subject to variable APRs and fees on application, with greatest variation for the fuel poor
Regulatory environment is well established.	Returns on investment flow to shareholders rather than communities
Funding mechanisms are already in place for provision of credit	Harder for people who are self-employed or on benefits to access
Fast turnaround of credit	Impacted by money markets and need to generate financial returns, so rates may rise overnight impacting availability of credit
Borrower can potentially fund other items at the same time rather than being restricted to the Prosumer system	

Equity Release: An equity release product usually requires taking out a minimum amount loan of between 20% - 60% of the equity in the property, with the interest compounding until the loan is repaid. Usually, the intention is for the loan to be repaid in the future via the sale of the property.

The Equity Release Council noted in its Autumn 2022 Market Report that the average interest rate for Equity Release is **4.26%**. The highest rate is 7.39%.

Rates are tailored to the age and loan to value of the property and are typically backed by a charge on the property.

At age 55, if you wanted to release 25.00% of your property value, the best interest rate would be 5.01% (AER).

At age 75, if you wanted to release 25.00% of your property value, the best interest rate would be 4.43% (AER).[25]

Advantages	Disadvantages
Regulatory environment is well established.	Usually have minimum amounts borrowed in order to make it worthwhile
Funding mechanisms are already in place	Can result in no equity after a few years, meaning homeowner is unable to move home
Borrower can access funds for other items at the same time	Returns on investment flow to shareholders rather than communities
Can assist the asset rich, cash poor	Impacted by money markets and need to generate financial returns, so rates may rise overnight impacting availability of credit
Asset backed for investor reassurance	Need sufficient equity to access
	Need to be 55 or over
	Investors have to wait for returns, however the long-term investment attracts higher returns

Credit Unions: Credit unions offer unsecured loans, typically to the financially excluded or vulnerable, utilising deposits to lend funds and generate a return for the savers, who are normally based in the community.

Great Western Credit Union rates were 4.9% for a £7,500 loan over 60 months.[26] This rate was however only available to borrowers who had been either a homeowner for three years or have an excellent credit score. They also had to be employed for at least three years, mirroring the mainstream credit model. Their personal loan rate for the same value had a rate of 10.9% APR with a top rate of 42.6% APR.[27]

They do not have the facility to offer the amounts of funding required, with their maximum amount being £15,000.

[25] https://www.moneyrelease.co.uk/Equity-Release/Interest-Rates/
[26] https://greatwesterncu.org/loans/advantage-loan
[27] https://greatwesterncu.org/loans/personal-loan

Advantages	Disadvantages
Regulatory environment is well established	Borrowing rates are typically higher than other forms of credit
Returns on investment flow to communities	Funding mechanisms are tight, with cash flow dependant on credit union deposits
Rates are fair for the 'fuel poor'	Impacted by need to generate financial returns for deposits to be attractive, so rates may rise overnight impacting availability of credit
	Lacking infrastructure to scale up[28]
	Credit unions are specialists in small short term loans that tend to be unsecured

PACE Model**:** Unlike other forms of property assessments and long-term repayment mechanisms such as mortgages, PACE assessments are attached to the property, and not the owner.

The PACE assessment is structured around the tax lien being connected to the property, and the position of the lien (a debt attached directly to your house) being equal to other tax and assessment liens and senior to non-tax debt on the property such as mortgages, which creates high security for investors as in the event of bankruptcy the R-PACE is paid first.

PACE eligibility criteria includes a review of property ownership (must have a clear title to the property), property location (must be located in the financing district), homeowner income, existing debt obligations, property tax payments (have not been late in last 3 years), mortgage payments (have not been late in last year), applicants have not had any bankruptcies in the last seven years, and credit score. Unlike traditional mortgages, PACE financing does not require upfront down payment and lack a regular monthly payment routine. Instead, loads are paid through property assessments as an addition to the owner's regular property taxes, which is spread between 5-25 years.

Advantages	Disadvantages
Asset backed so can provide reassurance to investors regarding their investments	Regulatory environment is lacking
If the borrower moves house and successfully leaves the loan attached to the property, the returns on investment stay with the person making the repayments	Investor infrastructure is not in place in the UK
Provides additional options for the consumer, and may be most attractive to a	Linking the loan to the property rather than the individual may be problematic given the

[28] https://www.ft.com/content/45deb236-985b-44e7-a3c1-a39d88ce79b2?fbclid=IwAR2Cja3UE0MaLQkM_9Juyg_fdfbZES4j2Q_mxYfJopq3AmtTLd-YCP04iQk&fs=e&s=cl

homeowner who has no intention of moving home	solar panel scandals that impacted the news as recently as 2018[29]. Repayment of the loan is possible at sale of the property but is likely to incur additional legal fees and add complexity to the loan sign up compared to understood models where the loan is expected to be repaid on sale of the property
Appears to attract investment over a long lifespan of up to 20 years	Repayment infrastructure is not in place in the UK which has a different tax mechanism
	Taxes have a negative connotation, with even student loans described as a loan even though repayments are made like a tax from salary
	Passing credit to a new owner of the home is likely to mean additional fees for refinancing the loan and moving payments and agreements across. It may be a barrier to sale, particularly if the new borrower is a first time buyer and already mortgaging at a high loan to value ratio – the lender under the PACE model is likely to become involved in house sales and assessing for the same loan multiple times over its lifespan which could prove difficult to model and result in fees being charged to the buyer of the home to take the loan on. The Financial Conduct Authority requirements to Treat Customers Fairly is already a barrier with some borrowers unable to remortgage at lower rates due to affordability checks. It is anticipated that these checks (while generally necessary to ensure affordability) may result in loan transfers being turned down when properties are sold, with most loans repaid in full upon sale in practice anyway.
	Impacted by money markets and need to generate financial returns, so rates may rise overnight

Asset Leasing: With many components of the Prosumer system being tangible assets that can be removed from a property, it is possible that leasing may be an option for financing, once the fabric

[29] https://www.theguardian.com/money/2018/nov/25/homeowners-trapped-solar-panels

first measures (which are not leasable) have been completed. The fabric first measures are likely to need funding in the form of a loan or a grant.

There is the opportunity for commercial organisations such as energy providers to offer leasing marketed as 'heat as a service' (HaaS), with a trial already undertaken by Baxi Heating UK in conjunction with Bristol Energy to that effect.[30]

Advantages	Disadvantages
Regulatory environment is well established	Fabric first measures need to be in place before the Prosumer system will operate effectively. These measures are unleasable and sometimes costly to implement
Commercial organisations are likely to be able to find the funds to lend as there is a tangible return on investment	Homeowner may not be able to buy the Prosumer system so remains locked into the lease in order to continue to heat their home
Homeowners are likely to see the payments as a switch from paying their energy bills to a gas or electric supplier to a new heating provider which may be more palatable than a borrowing message	Current lack of competition means there is currently no mechanism for switching providers
	Returns will repeatedly flow to shareholders rather than communities

Lendology Model: Working with council partners, Lendology provides access to low cost, responsible finance at a fixed rate of 4% for all, regardless of status. Their mission is to make their lending decisions with people, for people and put impact before profit. Lendology has carved a niche into an underserved market of consumers who cannot access mainstream credit at affordable rates.

Lendology recognised that the current credit market penalises people based on an algorithm, and credit is also more expensive for the consumers who have less disposable income to begin with. Lendology relies on individuals being assessed on an individual basis rather than use of any algorithms.

The way Lendology makes finance accessible is to blend the rate across the whole book, so everyone pays the same. This is completely opposite to typical finance, and therefore an innovative way to ensure support of those in need with a sensible rate, and those who can afford it help ensure the capital is turned around for others to borrow into the future.

[30] https://es.catapult.org.uk/news/baxi-and-bristol-energy-heat-services/

General Customer Profile

46% in receipt of benefits

14% 18-39

40% 40-59

46% 60+

29% either did not know their credit rating, or described their credit rating as fair, poor or very poor

£20,180 Average median household income

This model is not as resource intensive as it may appear. By utilising telephone assessments, one case manager can approve 25 applications a day. The use of Open Banking to facilitate the smoother processing of applications by instant access to bank statements is expected to speed up processes further.

By providing a fixed interest rate of 4% for all borrowers, credit is simple and straightforward to understand. The rate is fair and affordable because Lendology tailors the loan term and product to the disposable income available for repayments. If the client requires a smaller repayment, this does increase the total interest paid in order to reflect the longer payback period, however this is considerably fairer than the market rates which charge a higher rate and naturally cause a longer repayment term in order for the client to afford it anyway – if at all.

If there is no disposable income but the client is of a suitable age and has equity in the property, there are loan products to allow repayment on an interest only basis only, or no repayments at all. This operates similarly to equity release, only with no minimum amount and typically at a lower rate than available on the high street so there is still equity left in the property when it is sold.

Assessing people as individuals and providing flexibility with loan products has a myriad of benefits. Despite borrowing funds, in 2021/22, 39% of Lendology customers reported a positive effect on their financial wellbeing. Arrears rates are remarkably low, with less than 1.8% of loans in arrears at any given time, and very low rates of bad debt 71% of borrowers reported a positive effect on their health and wellbeing.

With various scandals reported in the media for banks, and generally poor PR, the majority of borrowers choose Lendology because of their council partnerships and not for profit status. Lendology has the facility to charge alternative rates should the rates available in the market cause a need for the interest rate to be higher (to avoid a capital drain to 'able to pays' who discover the rate is less than on the main market) or lower.

A Capital and Interest loan would always be the first avenue pursued by Lendology, as in the best interests of the client, this would be least expensive. This is in line with the company's not for profit status but also the regulatory guidance provided by the Financial Conduct Authority regarding the need to act in the client's best interest.

The table below shows some example repayments for a loan amount of £20,000.

Term (Months)	Repayment	Total Interest Paid
60	£368.33	£2,099.83
120	£202.49	£4,298.83
180	£147.94	£6,628.77

A repayment holiday period can be added to the beginning of the loan. Lendology calls this a Deferred Loan, whereby if there is evidence that the client has a future increase in disposable income, such as another loan coming to an end in a few months that will free up money for repayments, the works can be completed now, and repayments start in the future when they will be affordable.

Should the disposable income be insufficient to service any repayments, there are other loan products available, subject to the age of the client and the remaining equity in the property.

On a £20,000 loan, an Interest Only loan would mean the homeowner would have a monthly repayment of £66.67 a month.

Another similar option available is the Interest Roll Up Loan that has no repayments, and interest compounds on an annual basis. While this means that capital can take years to be repaid, it does attract a higher return over time as demonstrated on this example of a £20,000 loan:

	Client Interest	Capital Return in that Year
Year 1	£800.00	4.00%
Year 2	£832.00	4.16%
Year 3	£865.28	4.33%
Year 4	£899.89	4.50%
Year 5	£935.89	4.68%

At the end of year 5, the total amount repayable would be £24,333.06 – £4,333.06 of which would be interest. These rates are typically less than equity release (or lifetime mortgage) products which also require a minimum borrowing amount to maximise financial returns (e.g. 20% of the property value[31])

Advantages	Disadvantages
Most loans asset backed so can provide reassurance to investors regarding their investments. Tailored loans have led to the majority of funds being recovered in full	Investors will likely be seeking higher rates of return which will drive up rates for the consumer unless the public sector, recognising the value of intervention, steps in and provides a mixture of financing
Opportunity for council partners to help fund some of the riskier debt	Loans with no repayments can take several years to recover the capital and interest which may put off investors, especially as the funds will not be available until they are paid by the borrower in full. They do however attract higher returns and may be part of the council partner funding mix
Regulatory environment is in place	Repayment mix can make actual returns difficult to model

[31] https://www.sunlife.co.uk/equity-release/equity-release-calculator/how-much-equity-can-i-release/

Simple pricing for the client, and demonstrably easy for the client to understand compared to other forms of credit. Ability to be completely transparent with only fee £20 for the registration of a title restriction for security	Fuel poor still pay a larger amount of interest overall as their loan terms tend to run longer, however at much lower rates than available elsewhere
Opportunity for higher returns on non-repayment lending as interest is on a compounding basis – however this means a longer-term investment	Loan needs to be repaid on sale of property, however the return may still be found in the form of an increase in property value
Returns flow back to the community as the organisation is a community interest company, delivering impact to the community	Before economies of scale are fully realised, a small investment towards running costs may be needed as the infrastructure for UK wide utilisation is not in place compared to a bank etc
More likely to attract social investment which will be at lower rates than commercial investment	Interest rate is currently set to cover operational costs rather than generate investment returns. The possible need to generate a return would impact the rate available
Affordable and accessible for most homeowners.	Council backed lending has allowed Lendology to keep the rate fixed at 4% since 2011
Some 'able to pays' access credit at slightly higher rates compared to market lending in order to support a good cause	

15.3.7 References

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15.4 User Evidence Summary Report (Authored by National Energy Foundation)

15.4.1 Heat Pump Barrier Survey Findings

The first section of this report is intended to provide initial insights of feedback on the national survey data and should be read in conjunction with the actual survey results and graphics summarised in Microsoft Forms. It should be noted that the initial insights have been provided substantially by taking the survey results at face value.

More in depth analysis is provided from page 5 to offer more specific knowledge of the type desired to be captured by project partners.

Qualification Over Feedback

It should be borne in mind that a significant proportion of the survey participants were derived from stakeholders of NEF and organisations / community groups it collaborates with. As such, a greater proportion of the respondents are likely be 'climate aware', familiar with heat pumps and more pro their deployment meaning there is a likely to be a level of the feedback collected being skewed.

Had the possibilities for outreach been less selective i.e. a more neutral / typical cross section of public representation, then the results may well have looked different, nonetheless, this cannot be said to be exclusively the case.

In addition, when the survey initially went live it was possible for a period of several days for respondents who already had a heat pump installed in their home to answer the full set of survey questions. Upon discovery this was restricted by a tweak to the survey form.

Acronyms

DHW – Domestic Hot Water

BUS – Boiler Upgrade Scheme

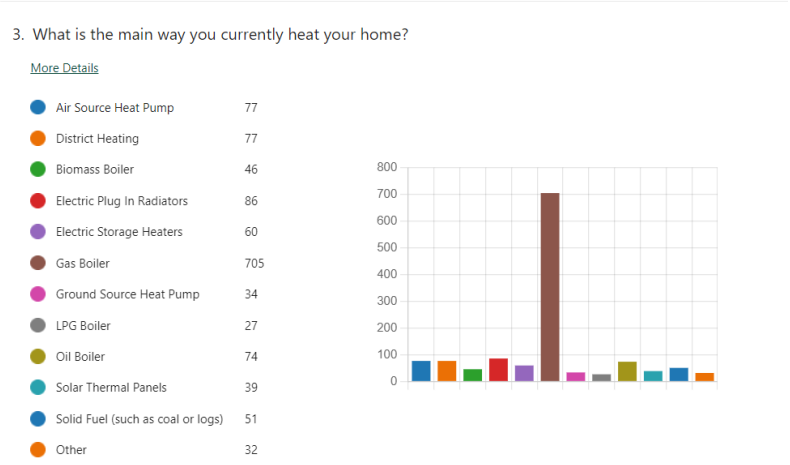
ASHP – Air Source Heat Pump

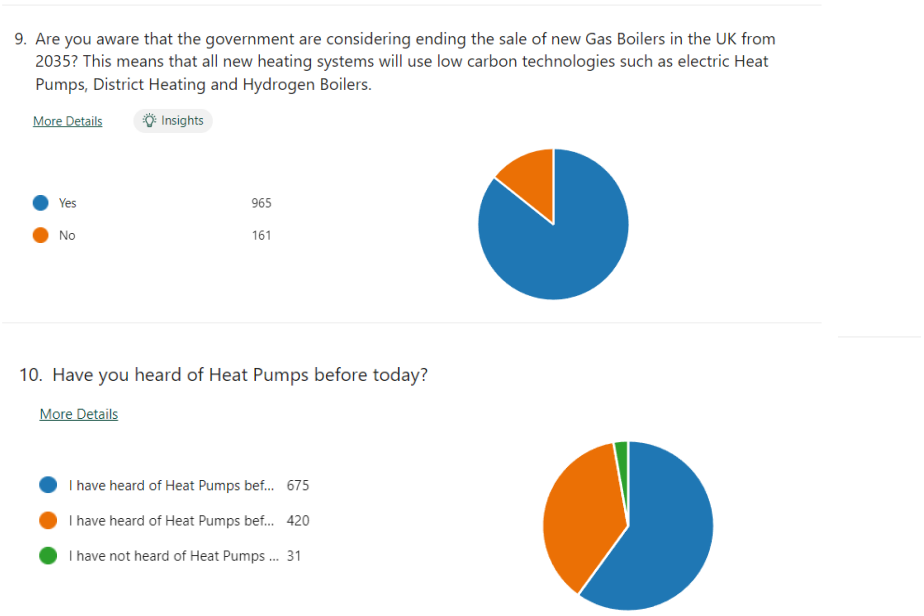
GSHP – Ground Source Heat Pump

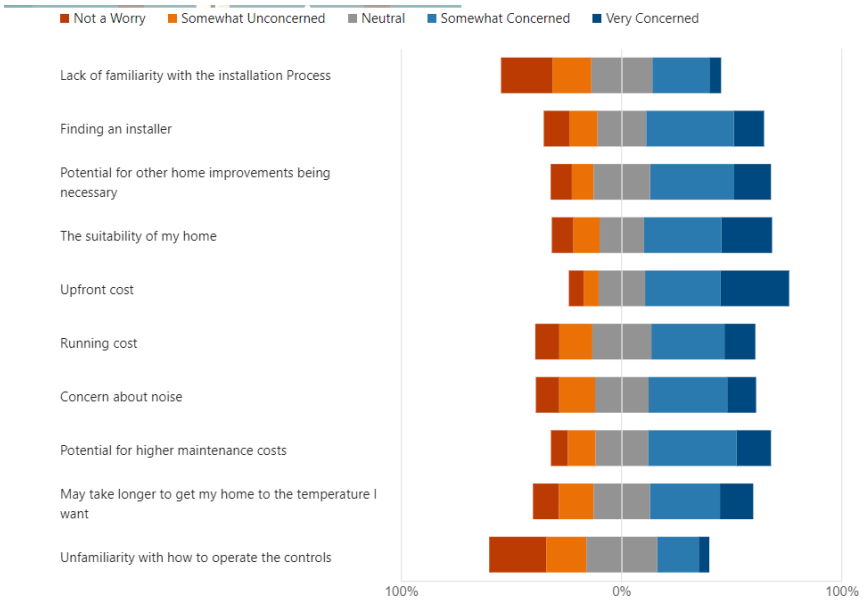
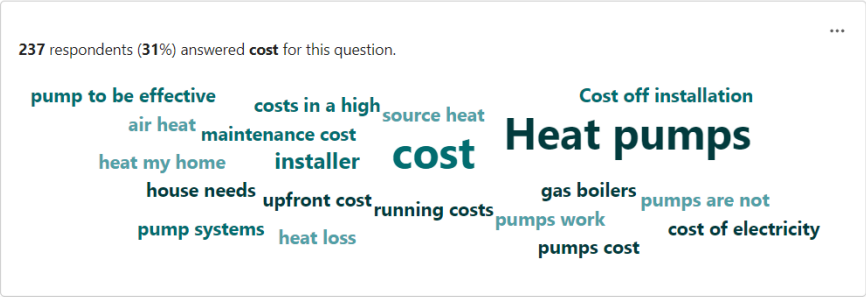
Initial Insights

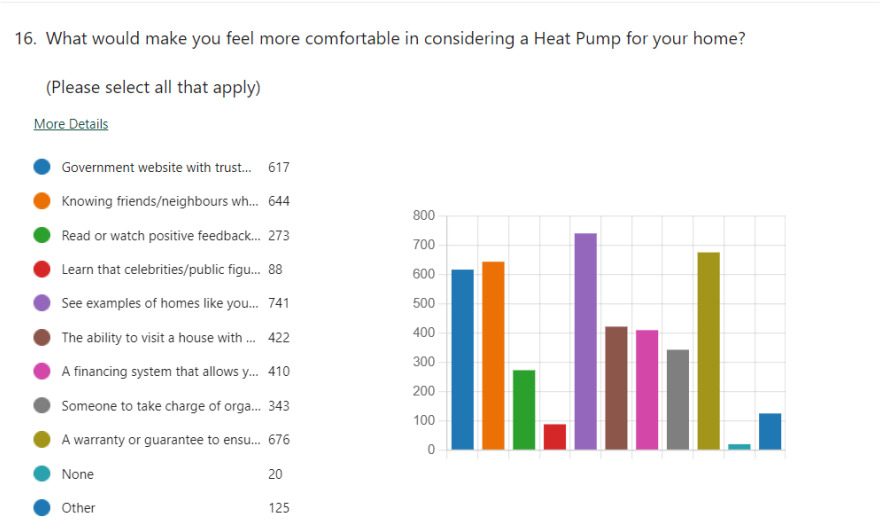
Total respondents = 1,307 of which 1,126 answered all questions.

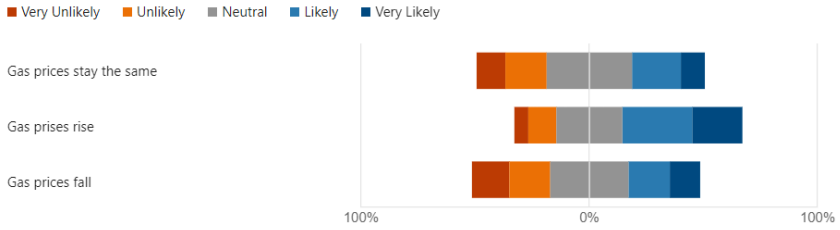
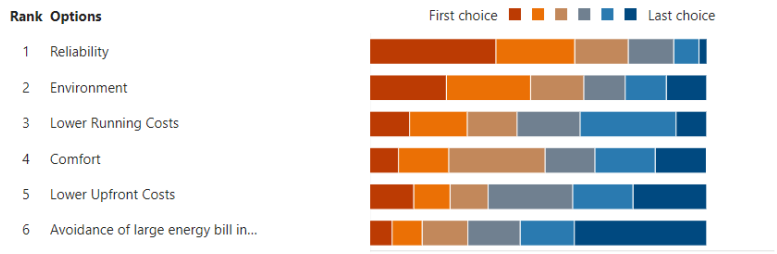
Survey question ref	Initial insights and observations
Q3 – What is the main way you currently heat your home?	Based on the results of the existing primary heating type / fuel, it is estimated that 152 respondents live in homes located off the gas network e.g. heated by oil, LPG etc. Homeowners located off the gas network are known by NEF to have traditionally been amongst the earlier adopters of heat pump technology given the financial benefits of reduced running costs from fossil fuel displacement i.e. such homes will invariably be a good classification to target for widescale deployment. What this means for the project is that targeting those who are already off gas could result in higher interest levels for the installation of heat pumps due to the benefit of reduced running costs.

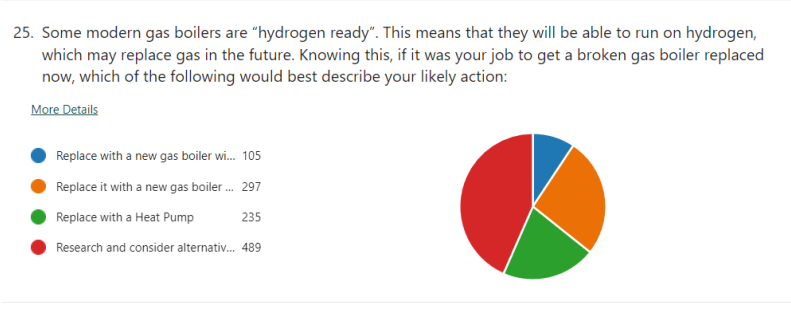
	39 households reported that their main heating is from solar panels which is highly unlikely for space heating. 
Q5 – what type of house do you live in? Q6 – how many bedrooms? Q7 – how many people live in your home?	59% of respondents live in detached or semi-detached houses with 76% of respondents having 3 or more bedrooms. However, there appears to be a reasonable level of under occupation with two persons being the most common occupancy level which would mean space heating and DHW demand will likely be lower than a fully occupied dwelling. Heat pumps are likely to be considered as a more viable investment for larger properties and this insight may lead the project team to focus more of the door-to-door surveys on larger homes (accepting that selection is being decided by another partner). By focusing on targeting the older demographics who live in detached or semi-detached homes could result in more promising insights for the project.
Q8 - If you had a Gas Boiler, it broke down beyond repair and it was your job to get it replaced, which of the following would best describe your likely action	Whilst 898 respondents said they would research alternative forms of heating prior to replacement, it should be recognised that it is most common for boilers to break down in the depths of winter which may necessitate an emergency 'like for like' replacement in order to maintain sufficient health and comfort. This means that perhaps looking to deploy heat pumps in the spring or summer months to encourage respondents to consider changing their heating system, so that they are less worried about heating their home in colder months.
Q9 - Are you aware that the government are considering ending the sale of new Gas Boilers in the UK from 2035?	86% are aware of the government policy change considering the phasing out of fossil fuel boilers which seems surprisingly high despite recent media coverage, and might be taken as evidence of the nature of our stakeholders who are generally more climate aware. Only 3% hadn't previously heard of heat pumps before. What this means for the project is that overcoming the first step of engaging the public in heat pumps may be easier than originally expected.

Q10 - Have you heard of Heat Pumps before today?	
Q11 - do you believe that Heat Pumps are better or worse for the environment than Gas Boilers?	30% think the environmental impact of heat pumps depends on the electricity source. While this is understandable, excluding any on-site electrical generation, the average carbon factor for grid electricity is currently 0.136gCO2/kWh regardless of whether their energy supplier is able to prove by audit that their supply is 100% produced by renewables. The project can use this evidence to dissuade the public to think the source of electricity can make heat pumps less environmentally friendly, therefore potentially increasing the likelihood of people willing to install them.
Q12 - If your heating system was not approaching the end of its life, would you consider installing a heat pump system anyway because of the environmental benefits?	20% wouldn't replace their heating system until it is life expired, regardless of the environmental benefits. What this means for the project is that there is still a majority of respondents who would not install a heat pump, therefore other benefits or incentives could be used to change their opinion, such as subsidies and grants.
Q13 - If it was your responsibility to replace your heating system, to what degree would the	The upfront costs is by far the greatest barrier with people being hesitant to install a heat pump (65%). In addition, 56% of respondents have concerns over maintenance costs (Manufacturer / installer recommended servicing costs / health check inspections of heat pumps are known by NEF to not represent any saving against gas servicing and will in fact likely cost more). The word 'cost' was the dominant phrase for concerns over the installation of heat pumps from the open text box responses with 31% of respondents mentioning 'cost' in their answer.

below considerations prevent you from considering installing a Heat Pump? Q14 - If you answered that you would be either somewhat concerned or very concerned about any of the considerations above, please let us know what made you say that in each case.	53% of respondents have concerns over the potential for other home improvements being necessary which would have cost and disruption implications e.g. fabric upgrades, replacement of radiators / cylinders, electricals etc. 58% of respondents have concerns over the suitability of their home to be heated by heat pumps. 52% of respondents have concerns over finding an installer (and one who is trusted and competent could be implied here).   What this means for the project is that the amount of money the public can use to reduce the cost of installing a heat pump is vitally important and it needs to be considered alongside the existing subsidies available, such as the BUS. The concern of finding a competent installer also means engaging with the right suppliers is imperative and using their capabilities to build an effective one stop shop service.
Q16 - What would make you feel more comfortable in considering a Heat Pump for your home?	In terms of information and advice to help instil public confidence with making the transition over to heat pumps, it was evident that Government have a strong role to play according to respondents with this being highest ranked. There was also strong evidence of the benefits of peer-to-peer learning and seeing examples of installations in use. This supports NEF's learning from the SuperHomes initiative.

	Provision of a warranty / guarantee to ensure heat pump are reliable was a popular choice among respondents. This is interesting as providing heat pumps are designed, installed, commissioned and maintained appropriately they are known to be reliable.  The findings here link to the points made in the above box about what this means for the project.
Q17 - how much do you think a Heat Pump including installation costs? Q18 - what would you consider an ACCEPTABLE price to pay for Heat Pump including installation?	At least 41% of respondents think that installation costs are below what the reality of the heat pump market is currently. With interpolation of answers, NEF believes this figure to be >50%. *It is not known as to if any respondents answered this question thinking that the cost brackets given were an 'extra over' cost e.g. above standard boiler replacement.* 75% of respondents wouldn't be prepared to spend over £5K to have a heat pump installed. It is interesting here that the Government's BUS (providing £5k ASHP & £6k GSHP) would probably make this work. This suggests that for a project of mass scale deployment, something in terms of capital grant funding levels of BUS level or higher would be needed. What this means for the project is that the funding offered has to be of a certain amount to make it appealing for respondents to engage with.
Q20 - How likely would you be to consider a Heat Pump in the following circumstances	An additional 20% of respondents would be more motivated to install heat pumps if gas prices continued to increase.

	20. How likely would you be to consider a Heat Pump in the following circumstances: More Details 
Q21- If you were to choose a new heating system, how would you prioritise the items?	A positive insight is that heat pumps are generally known to be very reliable if correctly installed etc, so despite it being 37% of respondents' main concern, this could in time be overcome (One stop shop; better education; Government leadership). There is no evidence to suggest that if respondents were aged 61 and above that they were more concerned by the reliability of heat pump installation. This may have been expected on health grounds and the need for the more vulnerable to keep warm (it is not known if respondents in this age group have any form of secondary heating which could be used as a backup e.g. wood burner). There is an absence of strong evidence suggesting that lower upfront running costs are the major concern between different demographics. 11% stated lower upfront running costs as being their primary barrier for installing a heat pump. Neither is there an obvious trend that lower running costs is demographic sensitive. 21. If you were to choose a new heating system, how would you prioritise the below? Please reorder the below items with the most important at the top. (Drag the items to reorder or use the up and down arrow buttons) More Details  These findings are useful for the next stage of the project because proof of heat pump reliability can be demonstrated through the engagement of suppliers.
Q22 - How many households do	57% of respondents know one or more person with a heat pump who they could potentially learn from (although this is unlikely to reveal complete satisfaction) with Q23 showing 60% of those with heat pumps would recommend heat pumps to others.

you know that have a Heat Pump? Q23 - do they recommend Heat Pumps to others?	What this means for the project is that peer to peer learning can be utilised as a key method to encourage heat pump installation in the public.
Q25- if it was your job to get a broken gas boiler replaced now, which of the following would best describe your likely action?	It is encouraging that 21% of respondents expect to install a heat pump when they next replace their heating with a further 43% who could be persuaded through the process of considering their options. The development of a one stop shop and prosumer model is key, especially if we want to keep the 43% who could be persuaded to install a heat pump by considering other options. 
Q27 - Which age category do you fall into?	Out of a total of 401 respondents saying they would consider installing a Heat Pump, even if it might be more expensive, 154 are aged over 60 and 151 are aged 18-45 with the balance between. It would appear that the desire to install a heat pump on environmental grounds is more of a personal held value i.e. there is no clear trend by age group.
Q31- Do you receive any benefits?	40% of respondents are in receipt of some kind of benefit, implying / suggesting that the survey has reached those who are less able to pay and who could be potentially classed as fuel poor.
Q33 - What is your tenure?	83% of respondents are owner occupiers either with or without a mortgage. It is likely that a proportion of these occupiers could be said to be 'asset rich but fuel poor'. What this means for the project is targeting this type of respondent could yield more positive results for heat pump installation.
Q40 - Do you live in Oxfordshire?	Only 317 respondents answered question 40 (do you live in Oxon) with 183 confirming they live in that county. Only 34 respondents answered question 42 (despite 317 saying they live in Oxfordshire). Out of the 34 answers, only 26 said that they would like to know more about the opportunities available, which is interesting as it was intimated that 40% of the costs of heat pumps could be covered.

Conclusion

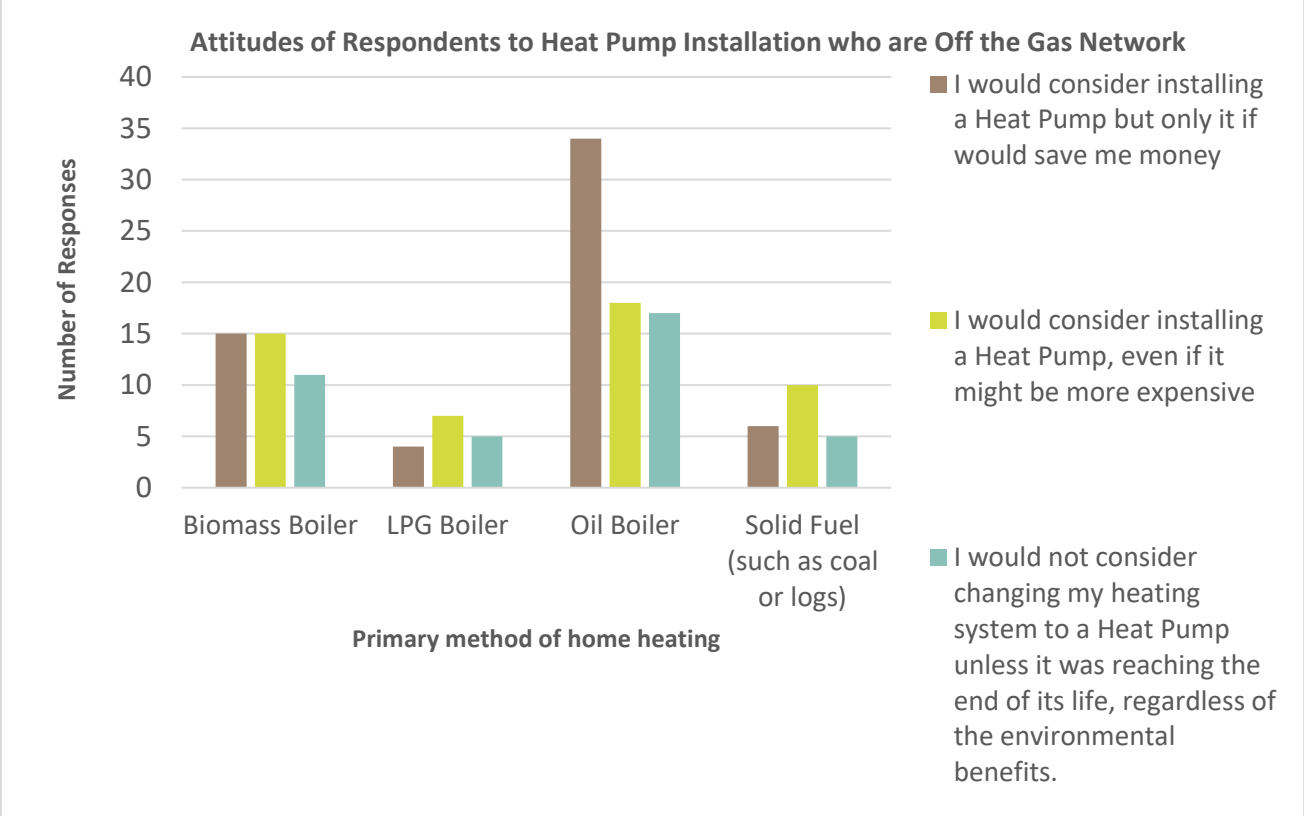
Overall, these initial insights provide us with a range of recommendations we can use for the project. Generally, the responses show a positive attitude towards heat pumps because 86% are aware of the government policy change considering the phasing out of fossil fuel boilers and only 3% of respondents had not heard of heat pump before. What is clear from the responses is that the need for strong Government advice and peer to peer learning are key methods to instil public confidence in heat pump installation, which strengthens the development of a one stop shop this project is planning to implement. The results also show certain demographics and house types are more willing to consider heat pumps, particularly those aged between 46-60 who live in detached and semi-detached homes. This means that the project partners can specifically target these groups in future stages of the project. Clear trends regarding the costing of heat pump installations emerged, with 75% of respondents saying they would generally pay a maximum price of £5,000 for heat pump installation. Therefore, the project needs to fund at least £5,000 to incentivise the public to consider the technology.

In conclusion, the initial insights from this survey analysis has provided NEF with key recommendations to take forward into the next stage of the project. The headline recommendations include the targeting of specific age groups, house types and income levels for the mass deployment of heat pumps and also making sure clear and reliable guidance is available to uphold confidence levels about the installation and maintenance of heat pumps.

Specific Knowledge Capture Data Analysis

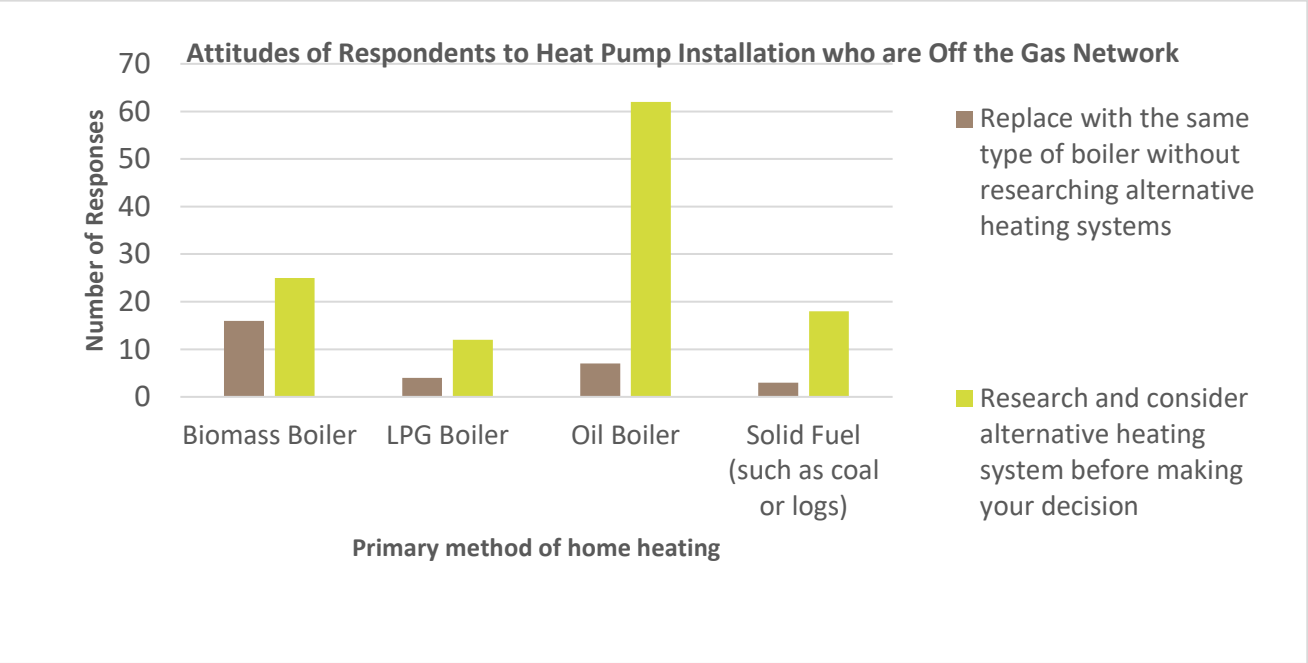
This section provides more detailed analysis on the cross examination of specific survey questions.

The existing primary heating fuel to see if those off gas / on oil / LPG etc are more interested in making the change.



It has been assumed that respondents who heat their home by the above primary fuel types are indeed located off the gas network. We have excluded electric heating in this scenario. There is little apparent difference between attitudes of heat pump installation for respondents who are located either on or off the gas network, it appears that those off gas respondents are more inclined to change to heat pumps.

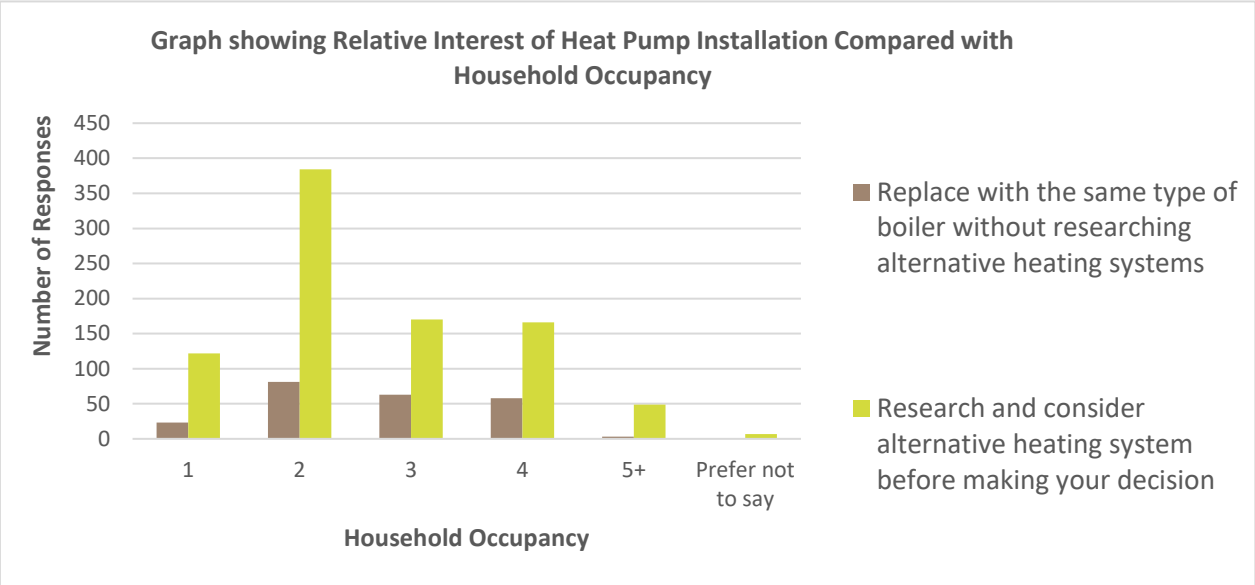
- 'Only if would save me money' – 40% off gas versus 45% on gas.
- 'Even if it might be more expensive' – 34% off gas versus 31% on gas.
- 'Regardless of environmental benefits' – 26% off gas versus 24% on gas.



20% of respondents off the gas network do not feel they need to undertake research into an alternative heating system, as opposed to 12% who are on the gas network. This might suggest that respondents located the gas network are more aware of the need to transition to cleaner fuels and have a desire to reduce running costs.

Overall, based on the two graphs above, there does not appear to be any significant differences in attitudes with respondents living on or off the gas network.

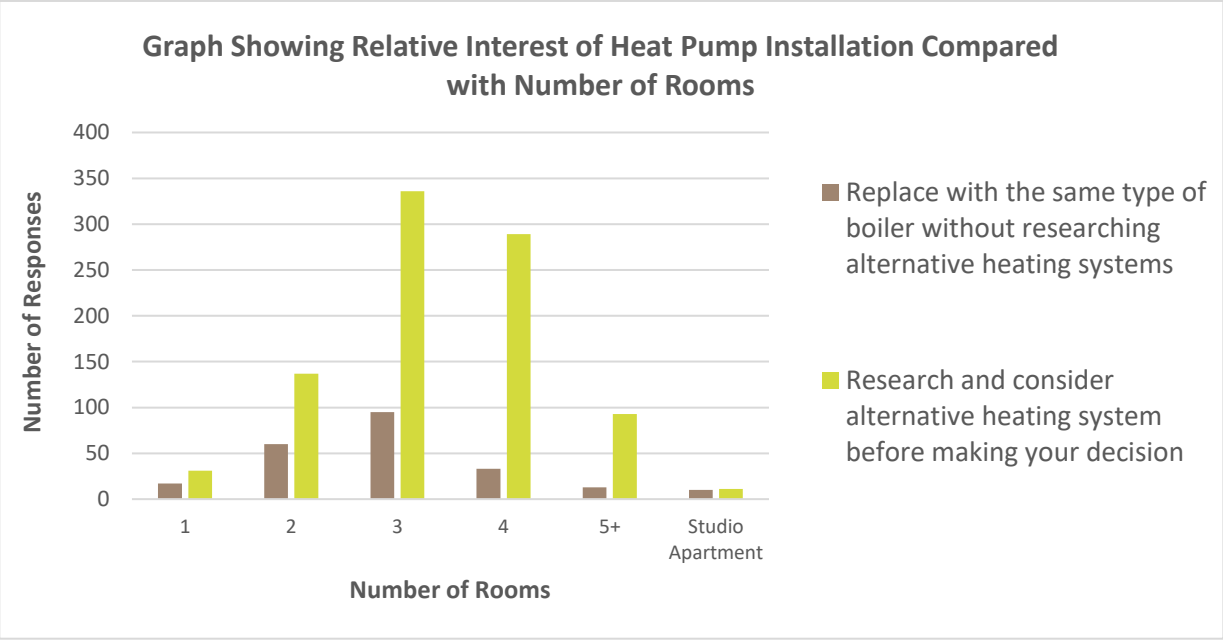
Household Occupancy levels and Relative Interest



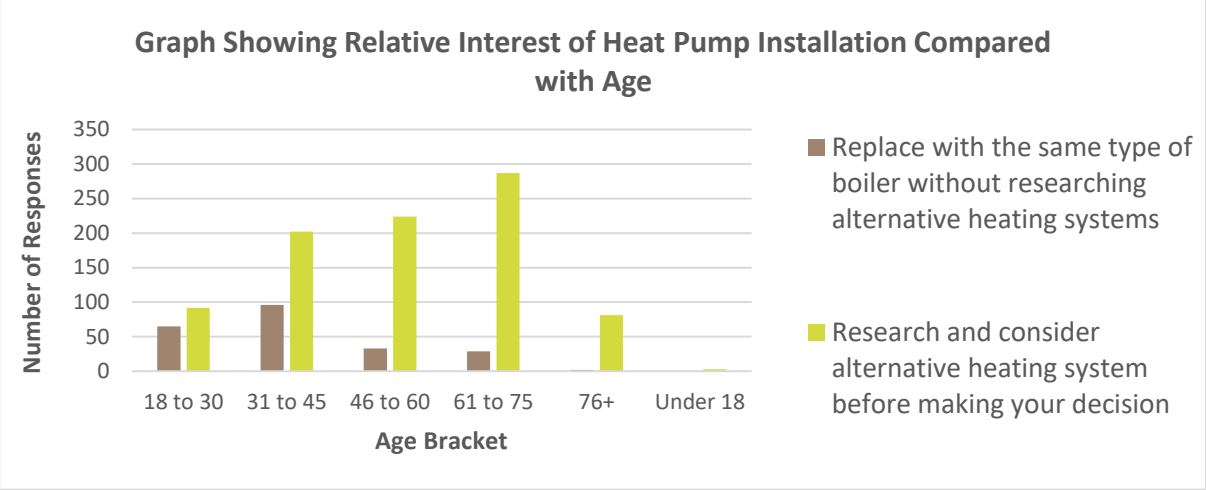
It may have been a reasonable assumption to suggest that higher occupancy levels would increase the willingness to invest in a more expensive central heating system, e.g. because their household energy demand would likely be high the potential savings more significant. However, the results above show that this is not necessarily the case.

The graph below does show that respondents living in homes with 3 or more rooms are more likely to consider an alternative heating system irrespective of household occupancy. For this reason, it is likely that owners of larger homes will be more engaged with the project aims, even if they have un-occupied rooms.

Number of Rooms and Relative Interest

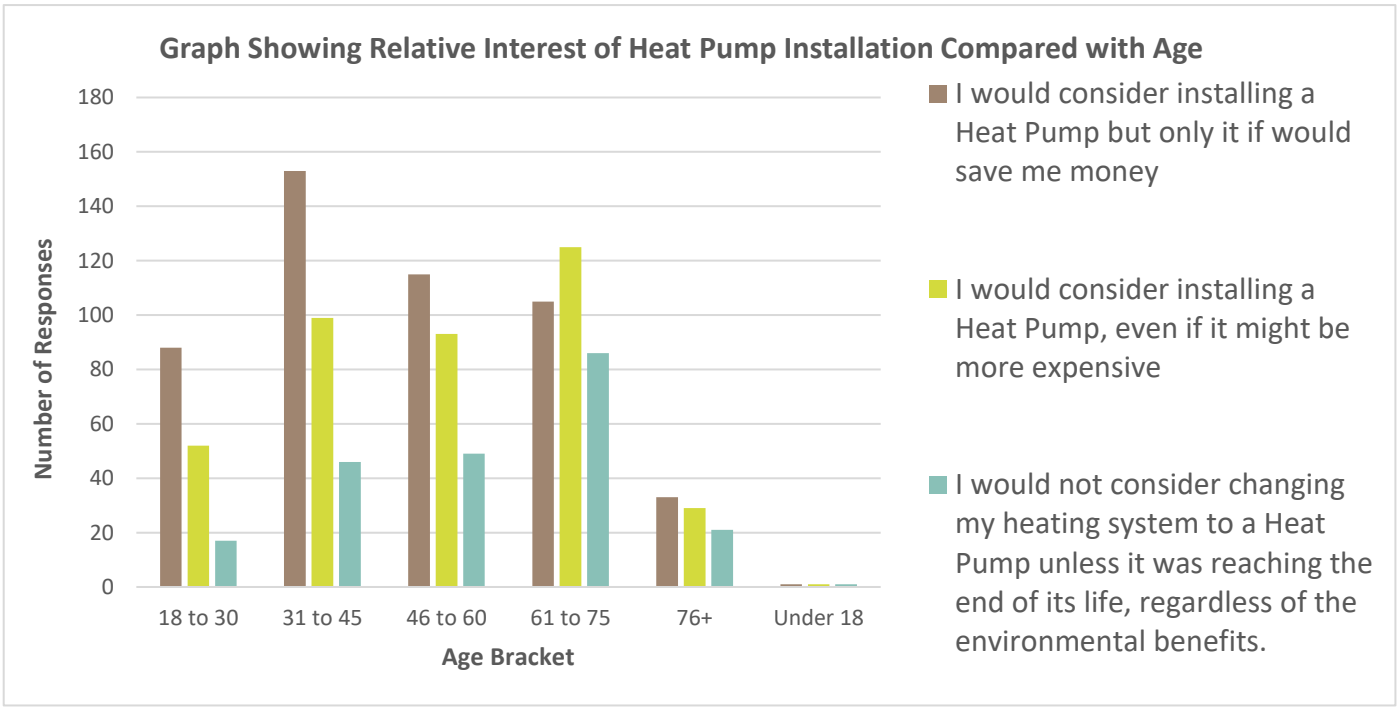


Age of Respondents and Relative Interest

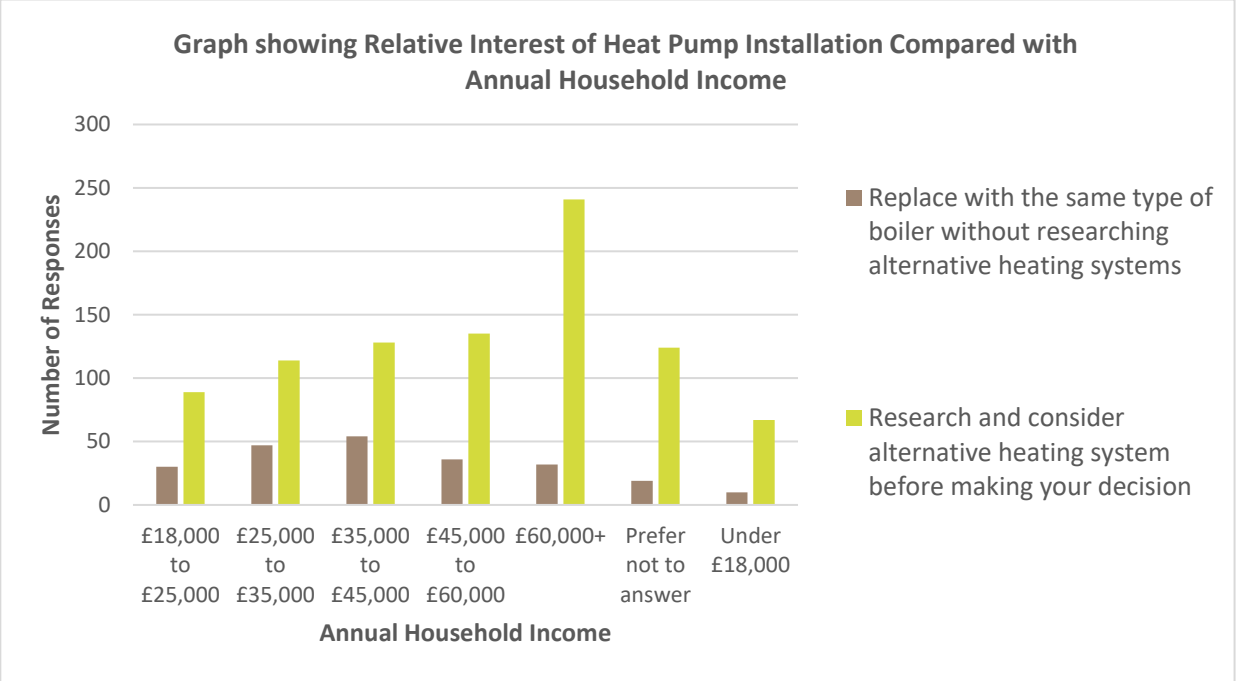


Across all age groups, there appears to be a healthy willingness to consider alternative heating systems. The 18 to 30 category look to be more cautious, however this is also likely to be as a result of this group having less disposable income. The 61 to 75 category will include retired homeowners, e.g. empty nesters, who are likely to have more disposable income. It is encouraging that this age group and above do not appear to be overly risk adverse to change.

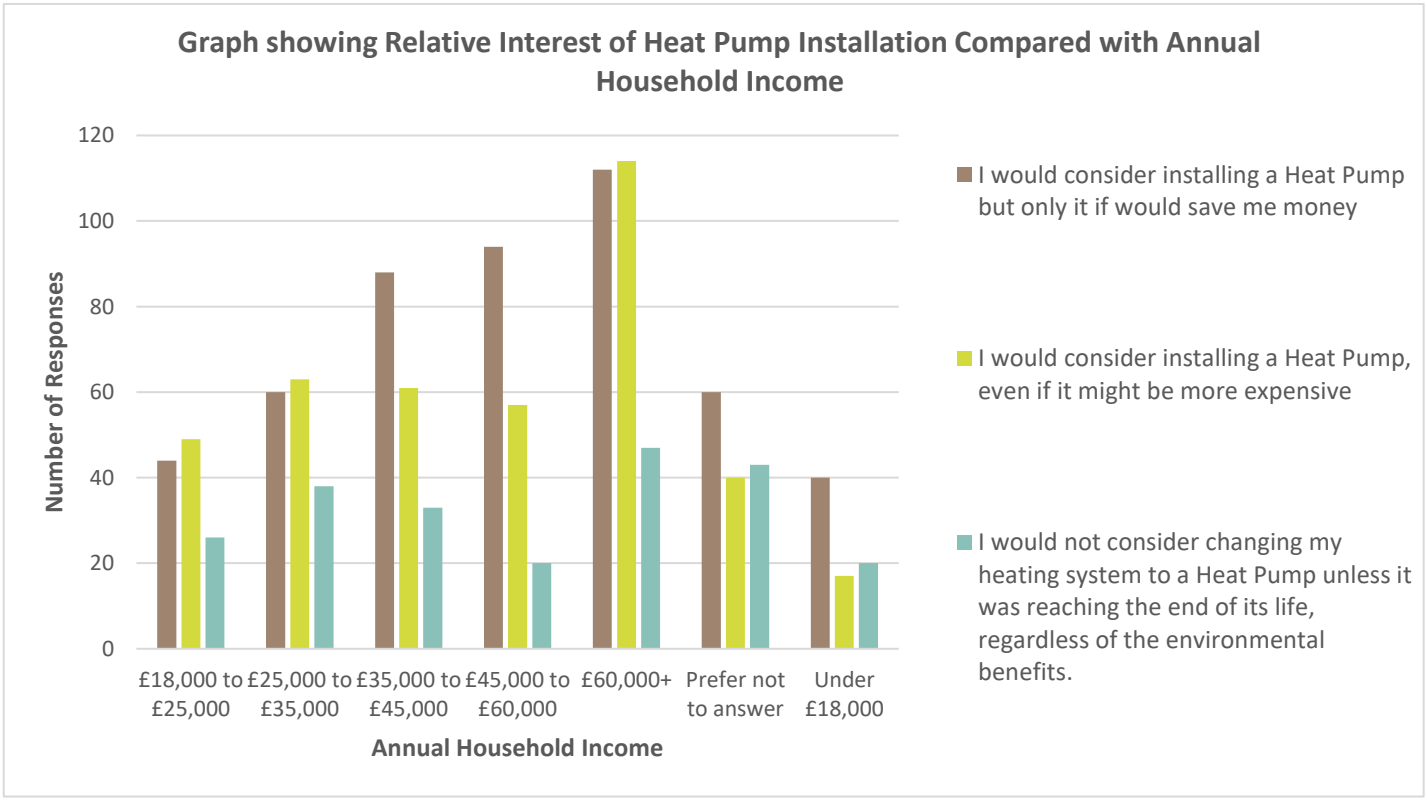
There is similar evidence in the graph below to show that respondents in the 61 to 75 age bracket are less concerned with the running costs of heat pumps, however it appears that they are more inclined to wish to get the full value from their existing heating system by only replacing it at the end of its life.



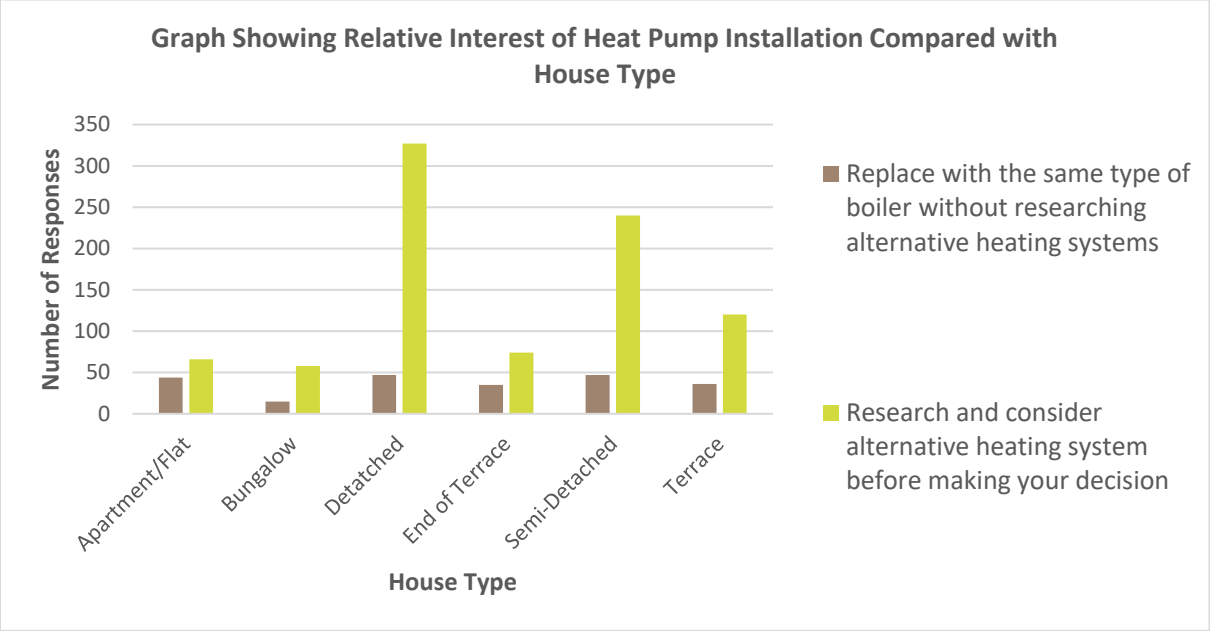
Household Income and Relative Interest



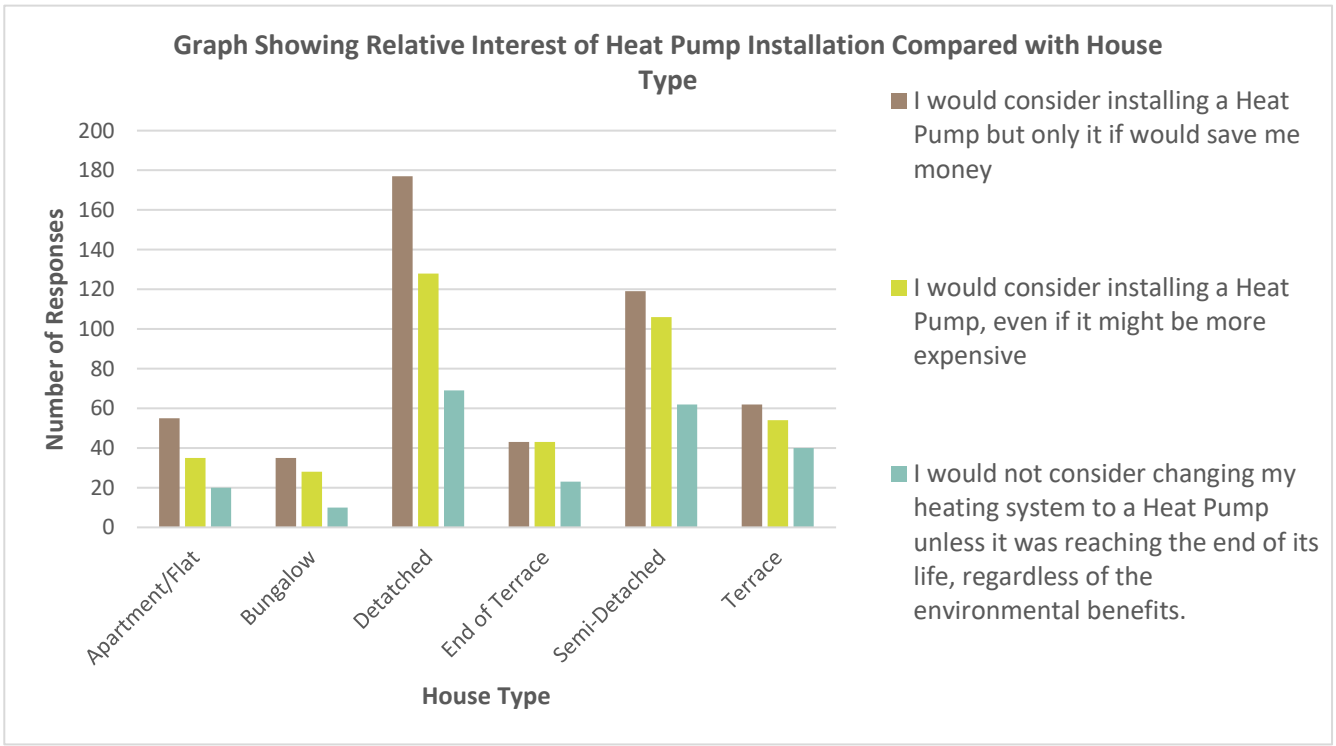
Generally speaking, the above graph shows that respondents with a high annual income are more likely to consider an alternative heating system in the event of their gas boiler breaking down beyond repair. However, this is countered by the graph below that predominately shows that given time to make a decision, respondents want to save money on their heating bills if they were to make a significant investment.



House Type and Relative Interest

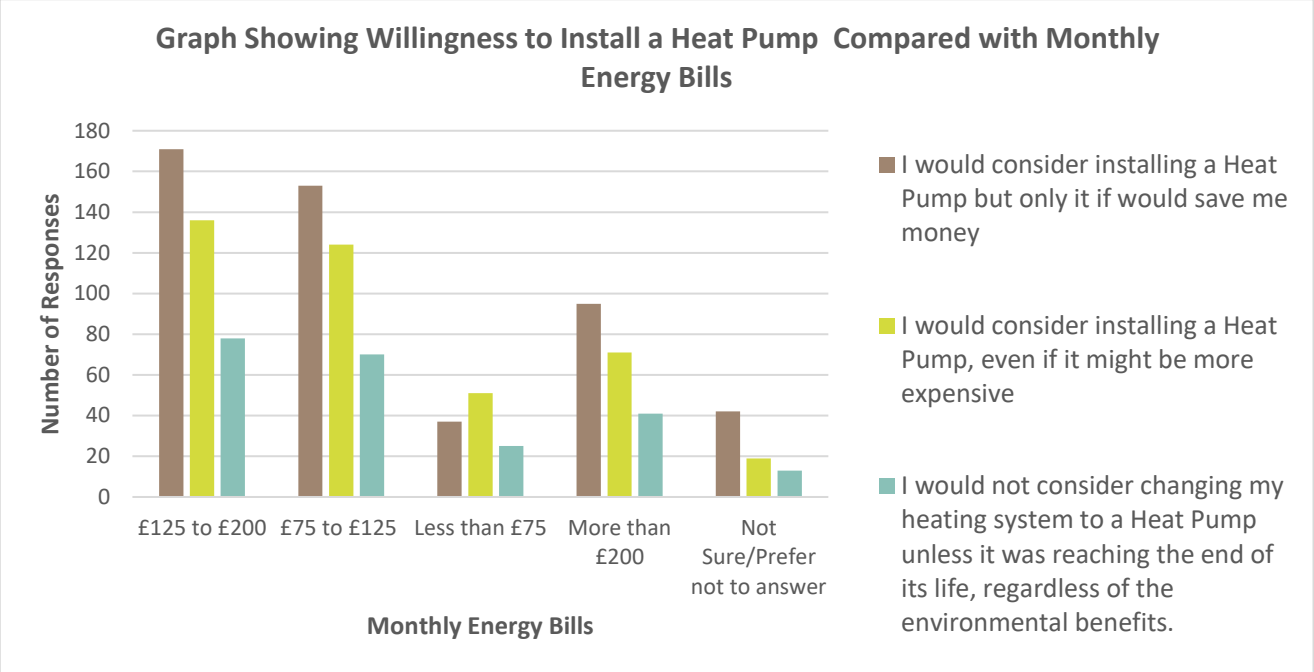


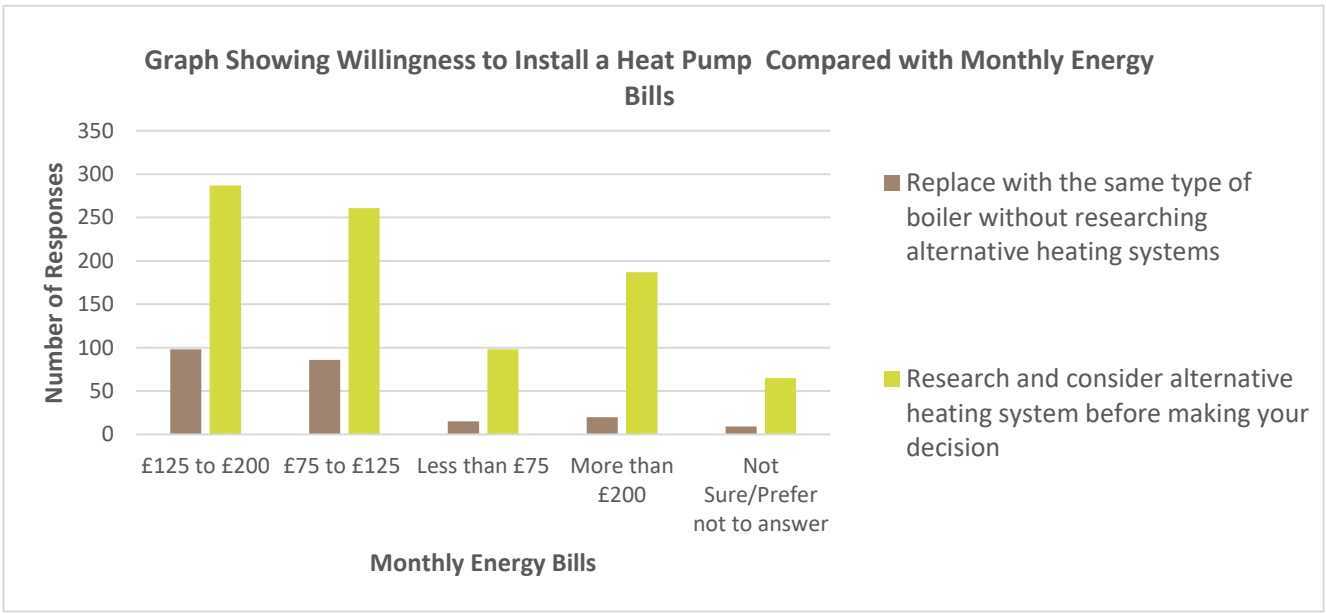
There is clear evidence that homeowners living in detached and semi-detached homes are more inclined to consider an alternative heating system. For this reason, the project is likely to benefit from focusing engagement on larger homes, where installations are generally easier. Regardless of the house type, there is a trend showing respondents want to save money on their running costs if they are investing in a heat pump. It can be expected to be a hard sell to customers unless they will achieve reduced running costs or some form of incentive is provided to make the installation costs neutral as compared with a like for like replacement.



Is there a relationship between the amount people currently pay for energy with their willingness to install a heat pump?

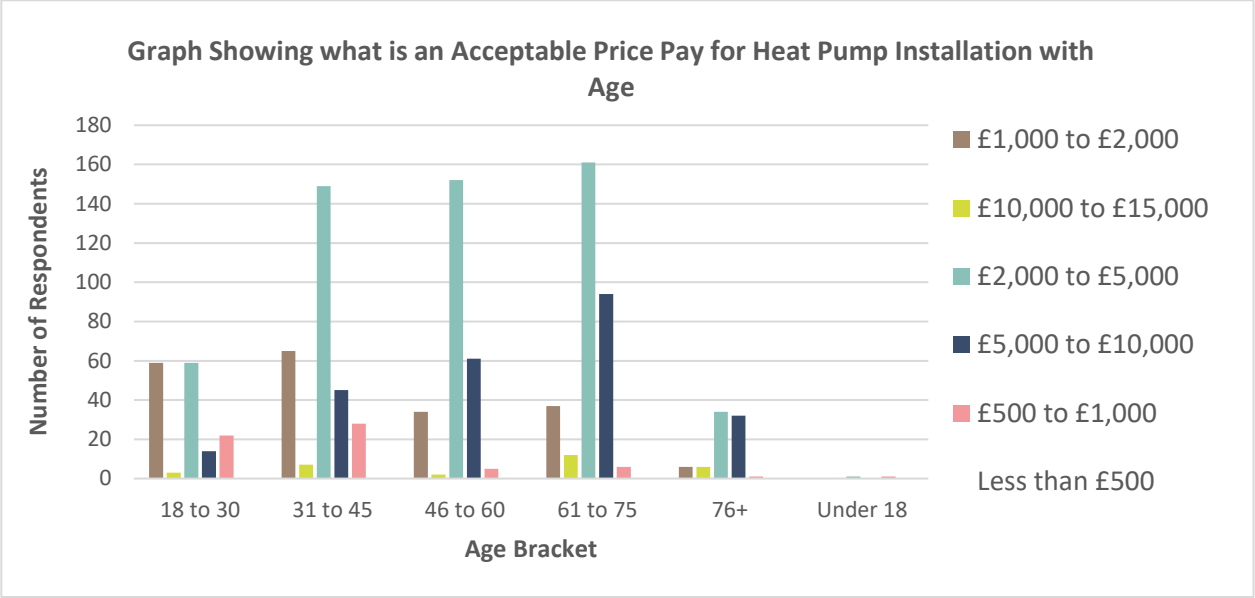
The graph below shows that respondents paying over £75 or more for their energy bills per month, would only consider changing to a heat pump if it would reduce their running costs. This was also the most common barrier for this question.

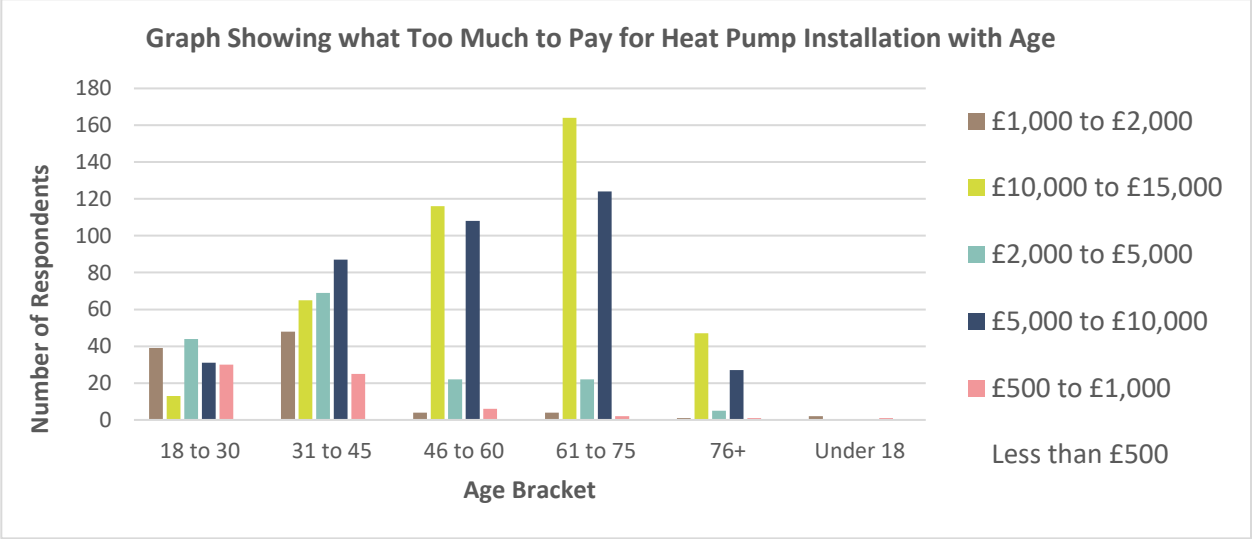




Comparison of what is considered an acceptable price to pay vs too much to pay for a heat pump (Growth Guides suggested that the real willingness to pay value is halfway between the two answers). Do these correlate with certain demographics?

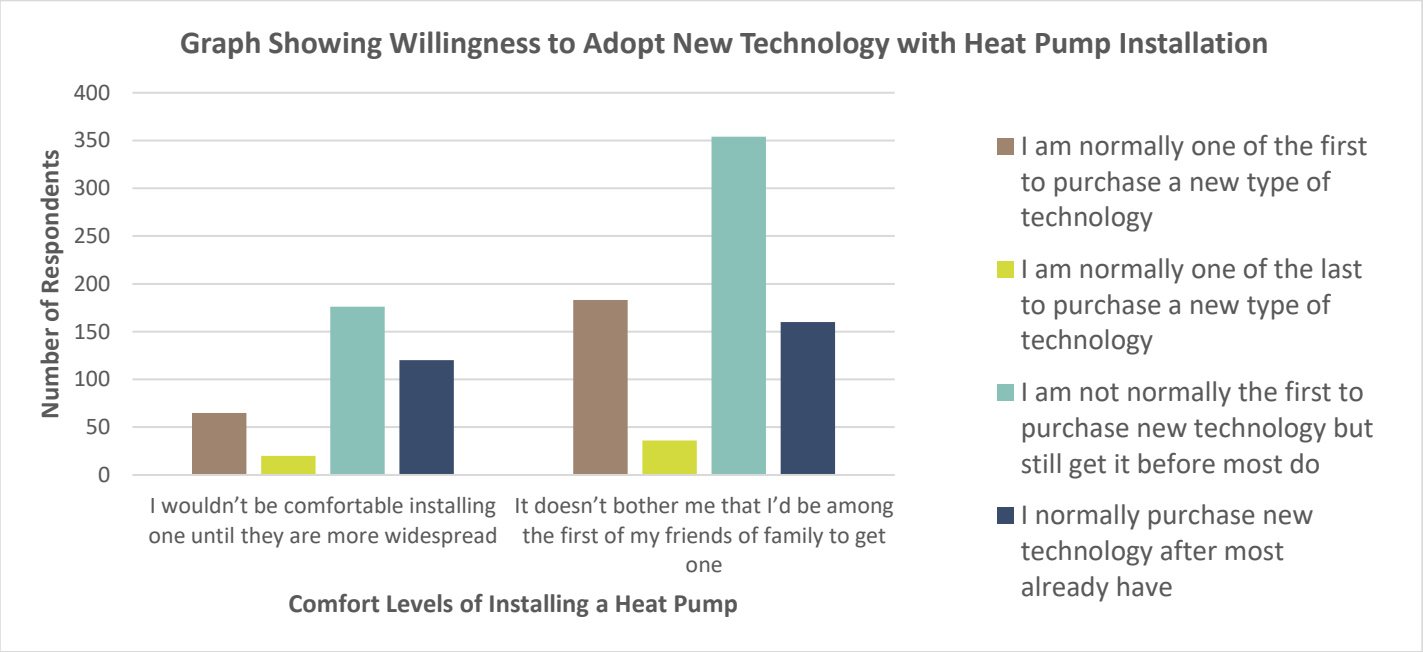
The graph below shows that those in the younger age brackets are prepared to pay less for heat pump installation in comparison with those aged 46-60 and 61-75, who would pay the highest amount, possibly due to having more disposable income. It can be seen that across age groups, most respondents would not be prepared to pay more than £5,000 for heat pump installation.





Is there a difference in attitudes towards HPs comparing those who say they are normally the first to get a new technology versus those who are laggards?

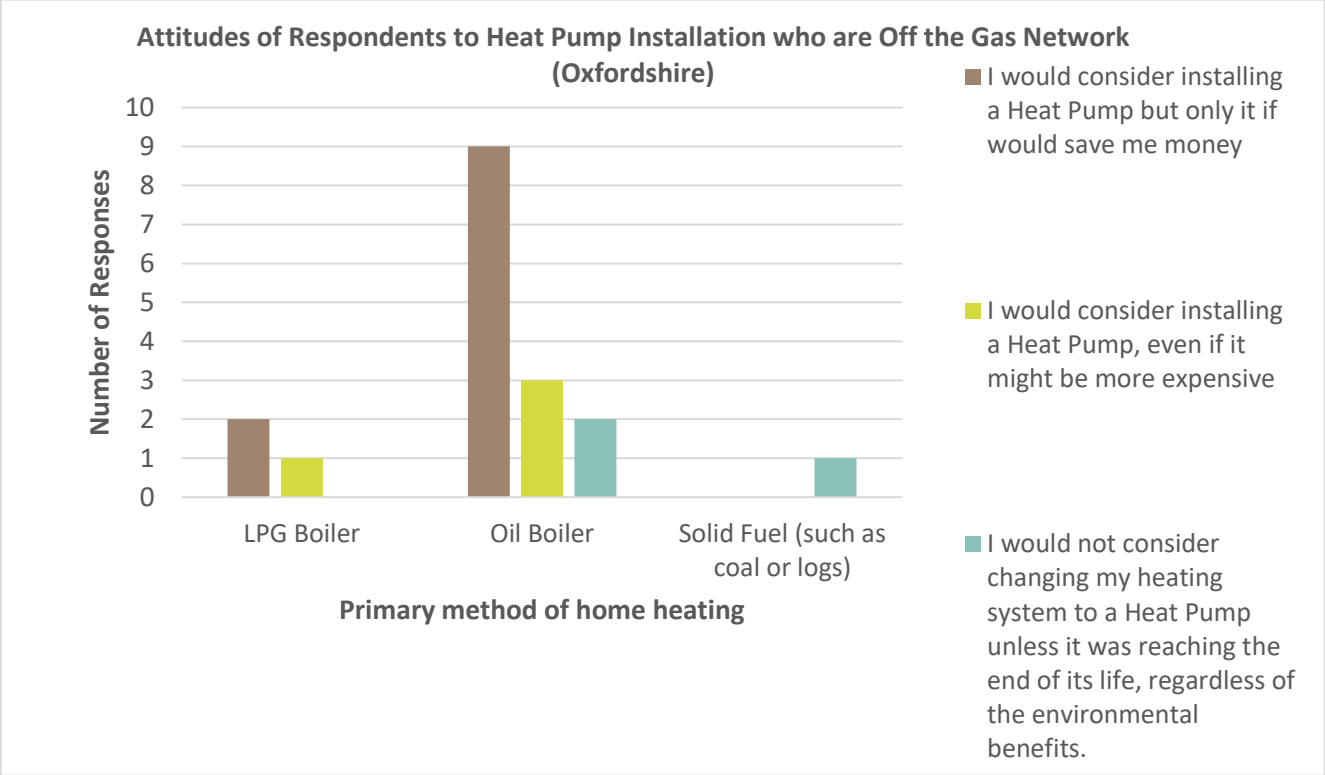
There seems to be a higher proportion of people who are willing to have a heat pump installed as an early adopter or soon after, compared to those who would not move until the technology is more widespread. In regard to heat pumps as a technology, this would appear promising.



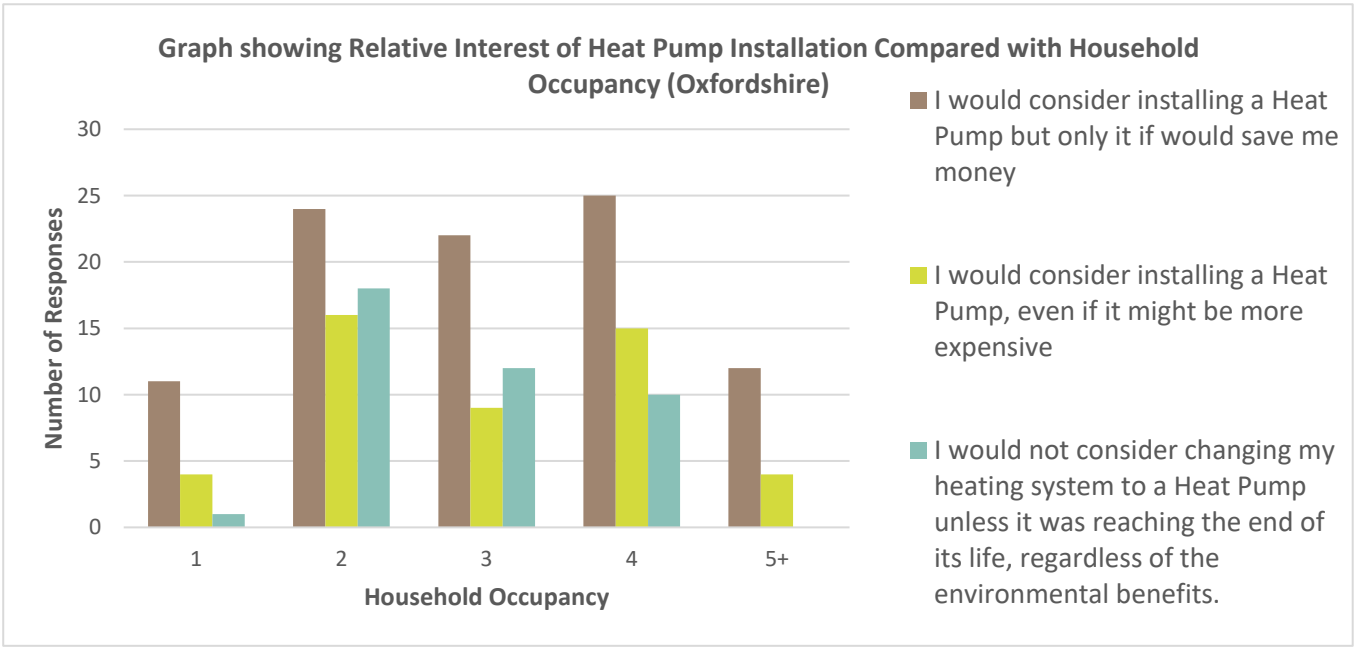
Oxfordshire Specific Graphs

NEF has carried out a comparison of all the graphs from the national survey with the Oxfordshire specific responses and did not observe any significant differences in attitudes.

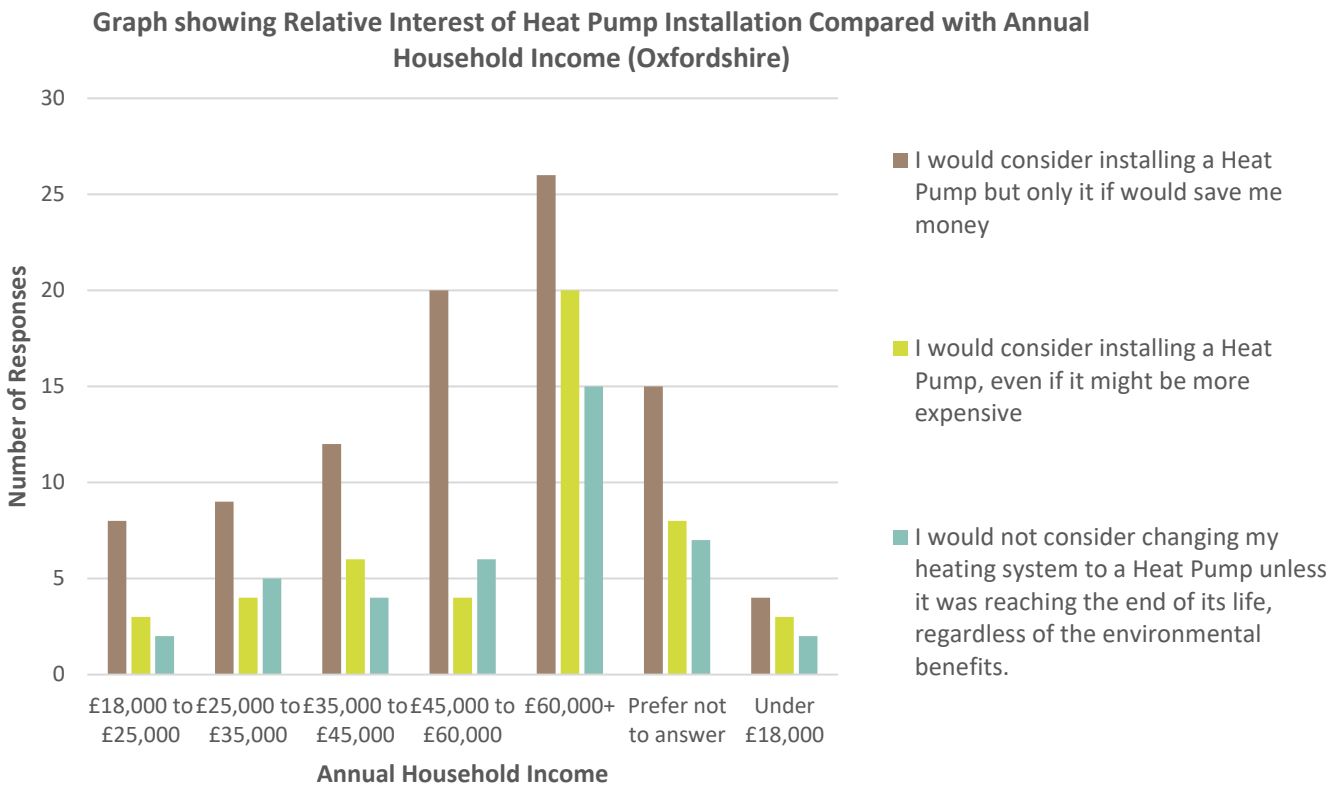
The existing primary heating fuel to see if those off gas / on oil / LPG etc are more interested in making the change.



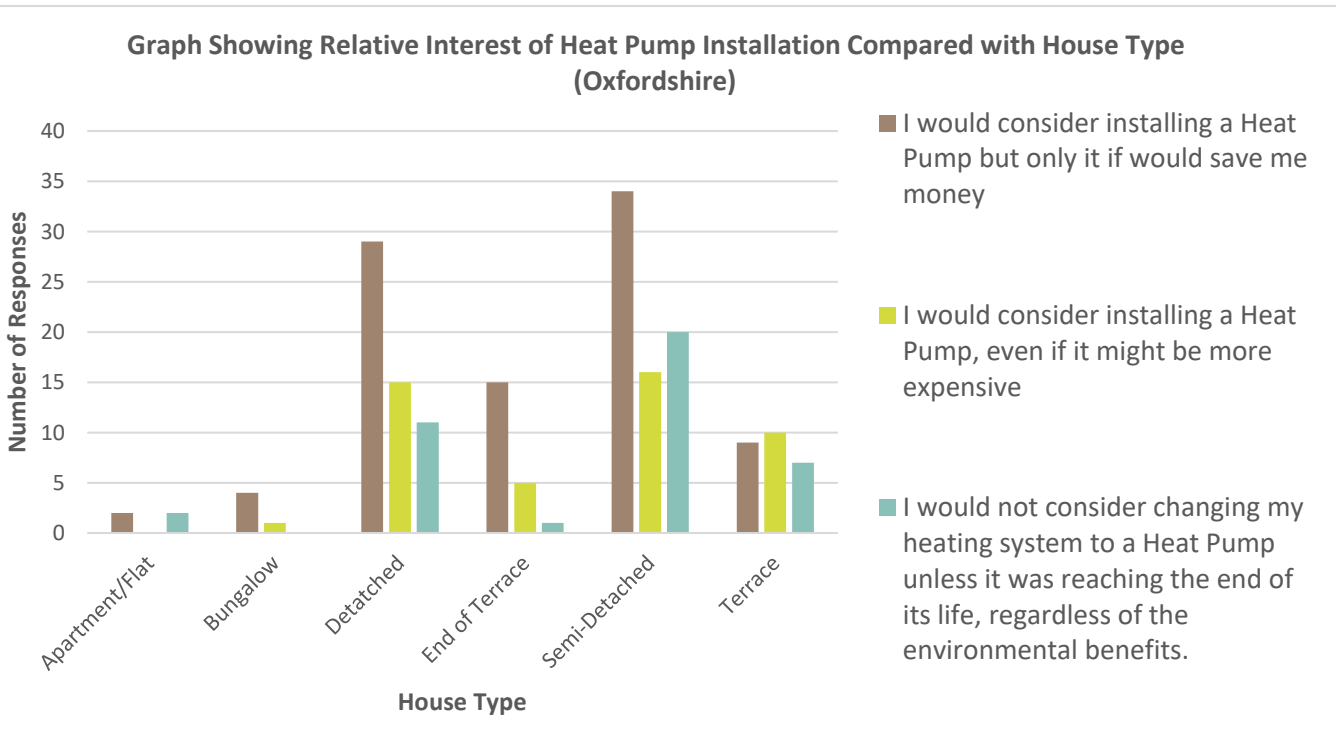
Household Occupancy Levels and Relative Interest



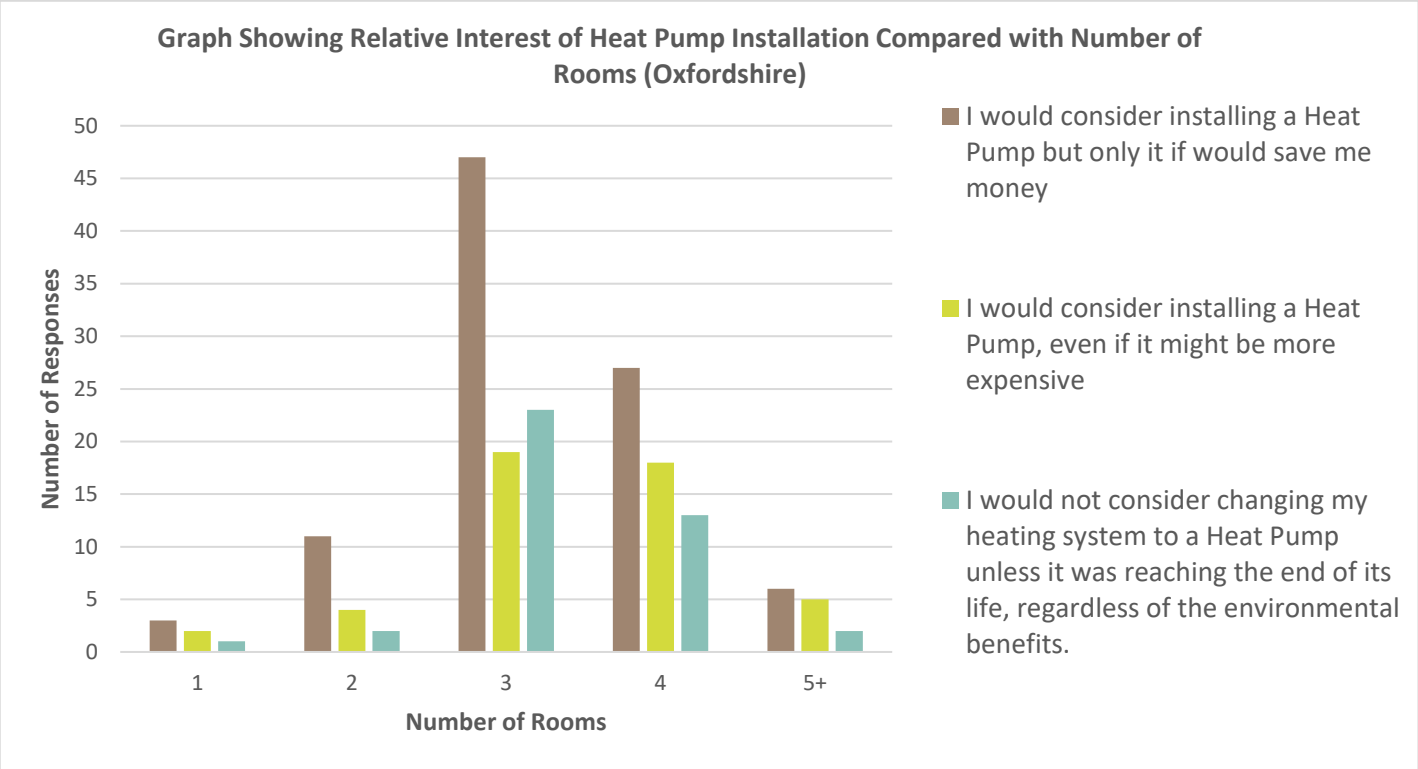
Household Income and Relative Interest



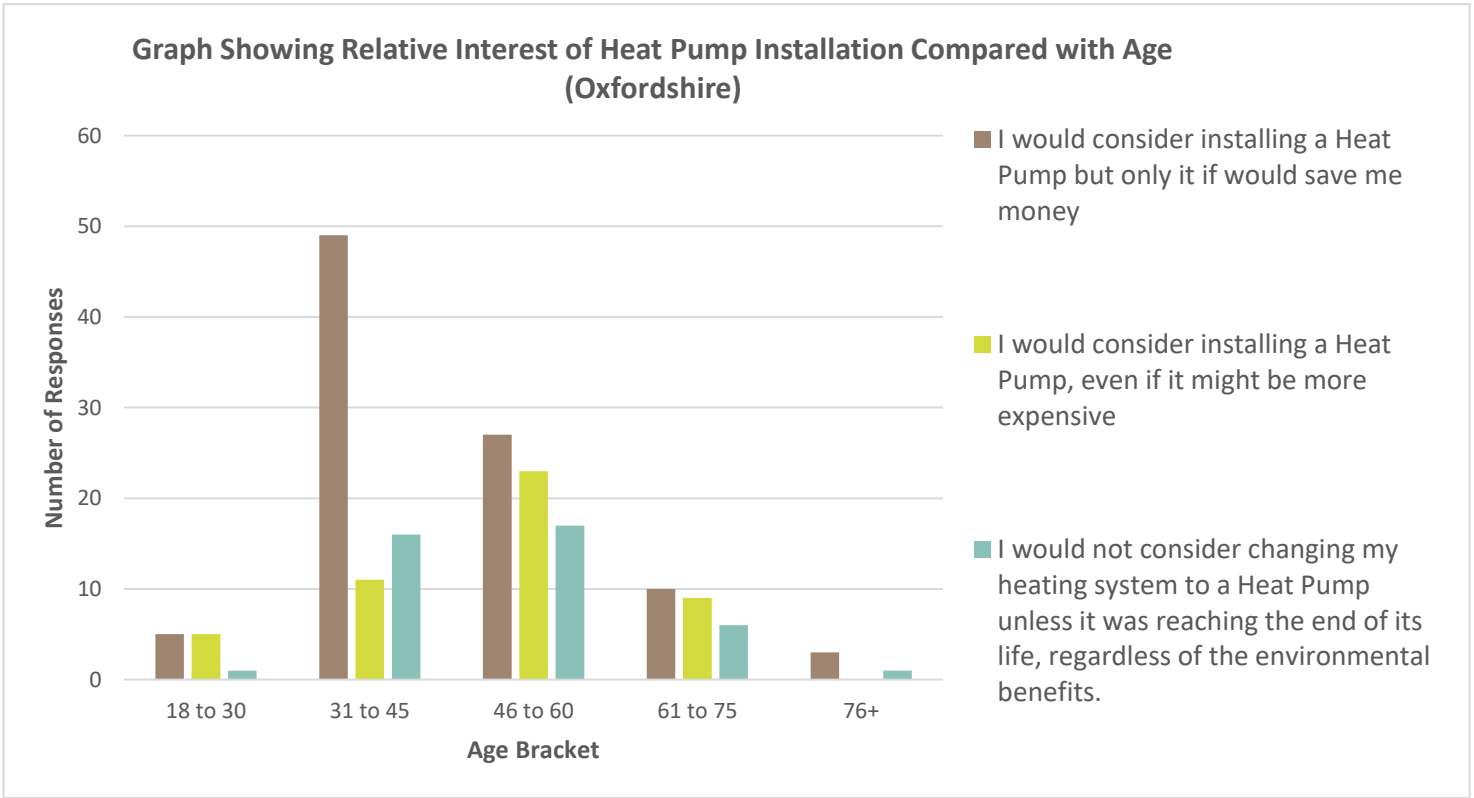
House Type and Relative Interest



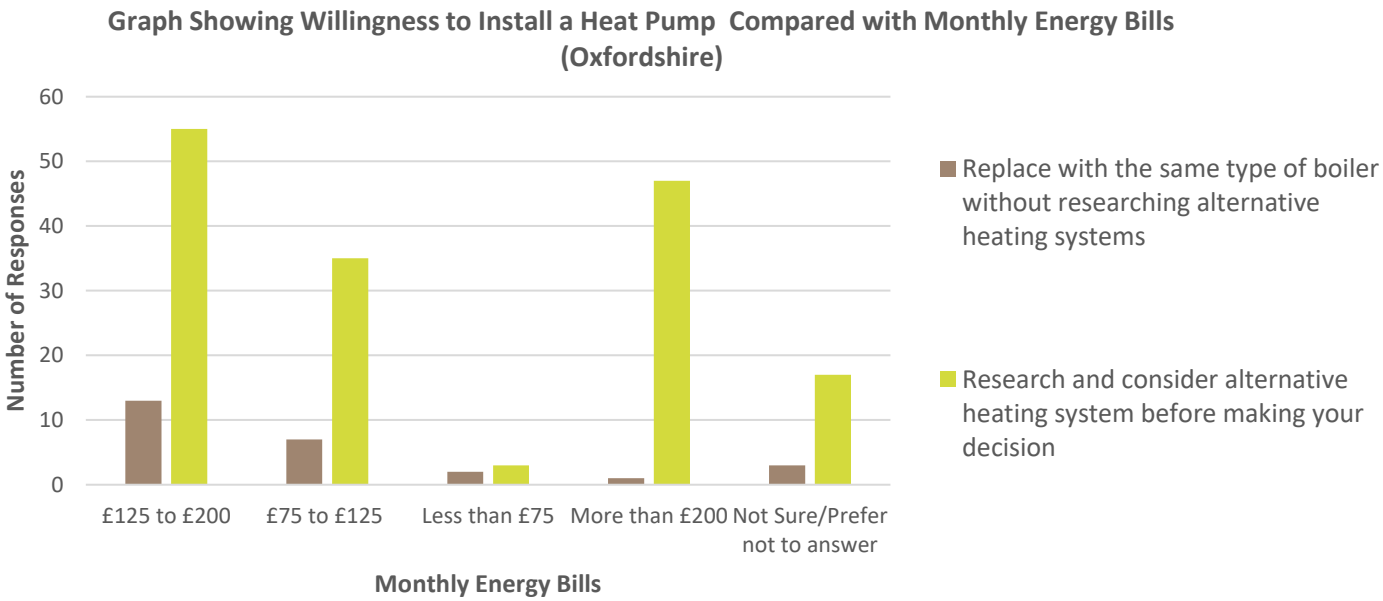
Number of Rooms and Relative Interest



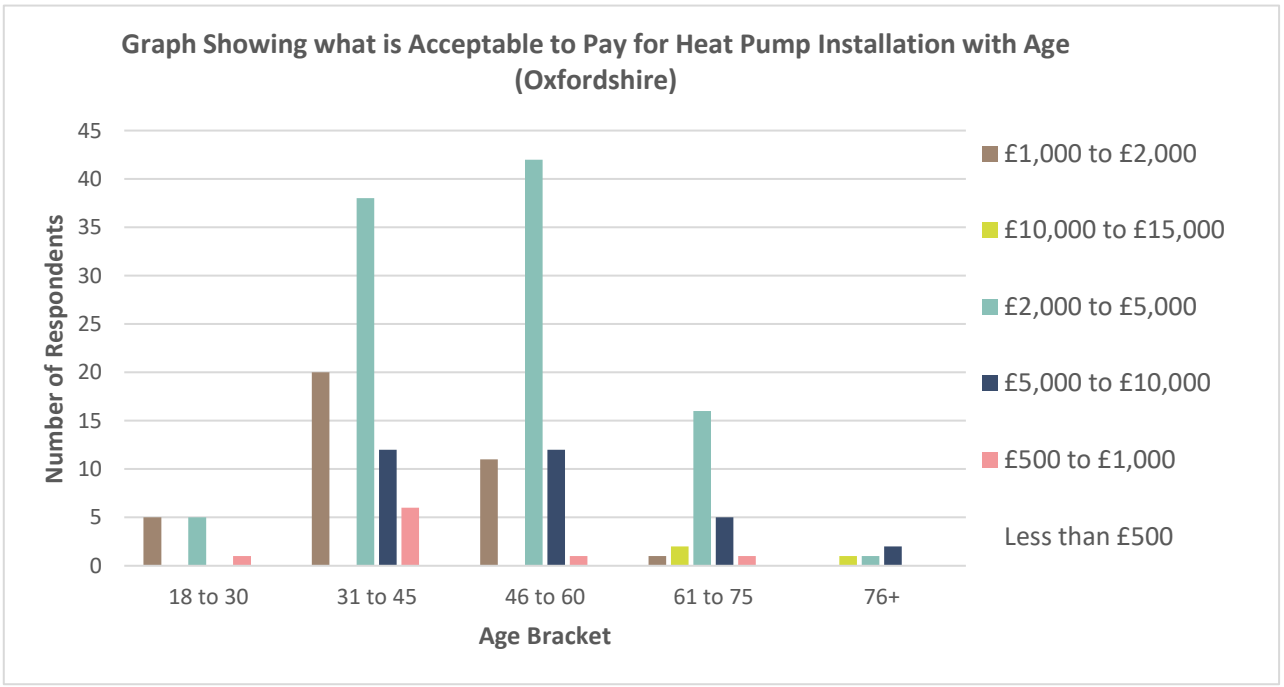
Age of Respondents and Relative Interest

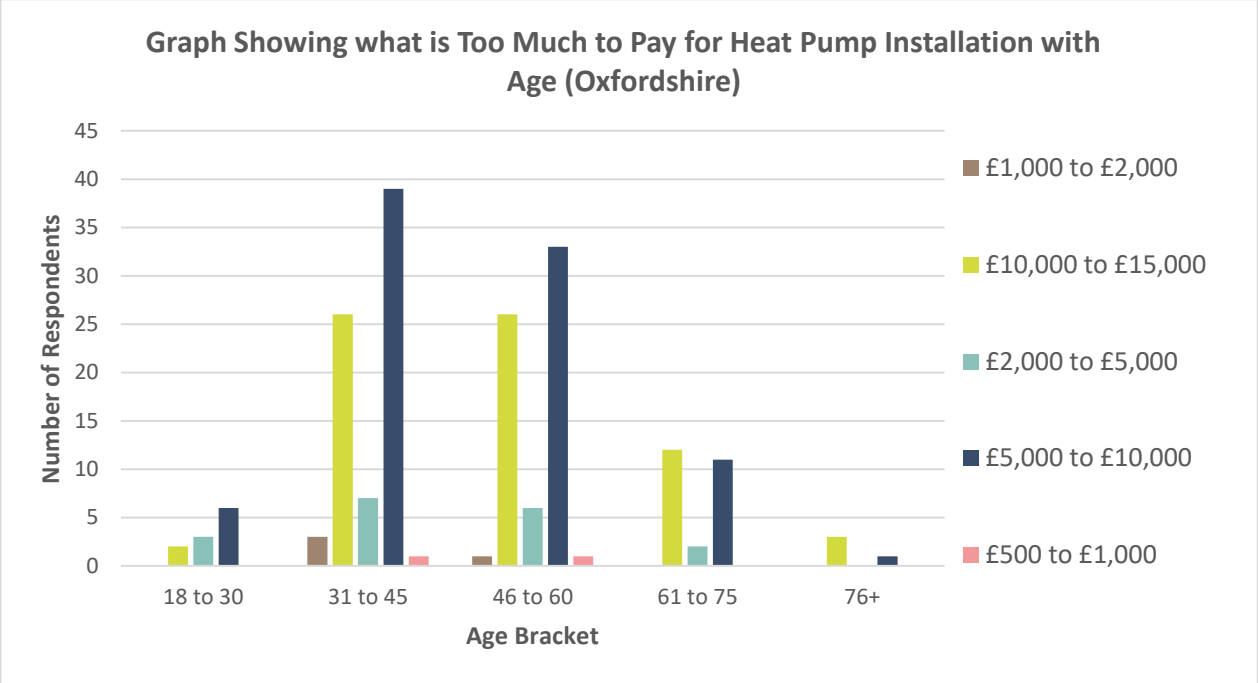


Is there a relationship between the amount people currently pay for energy with their willingness to install a heat pump?

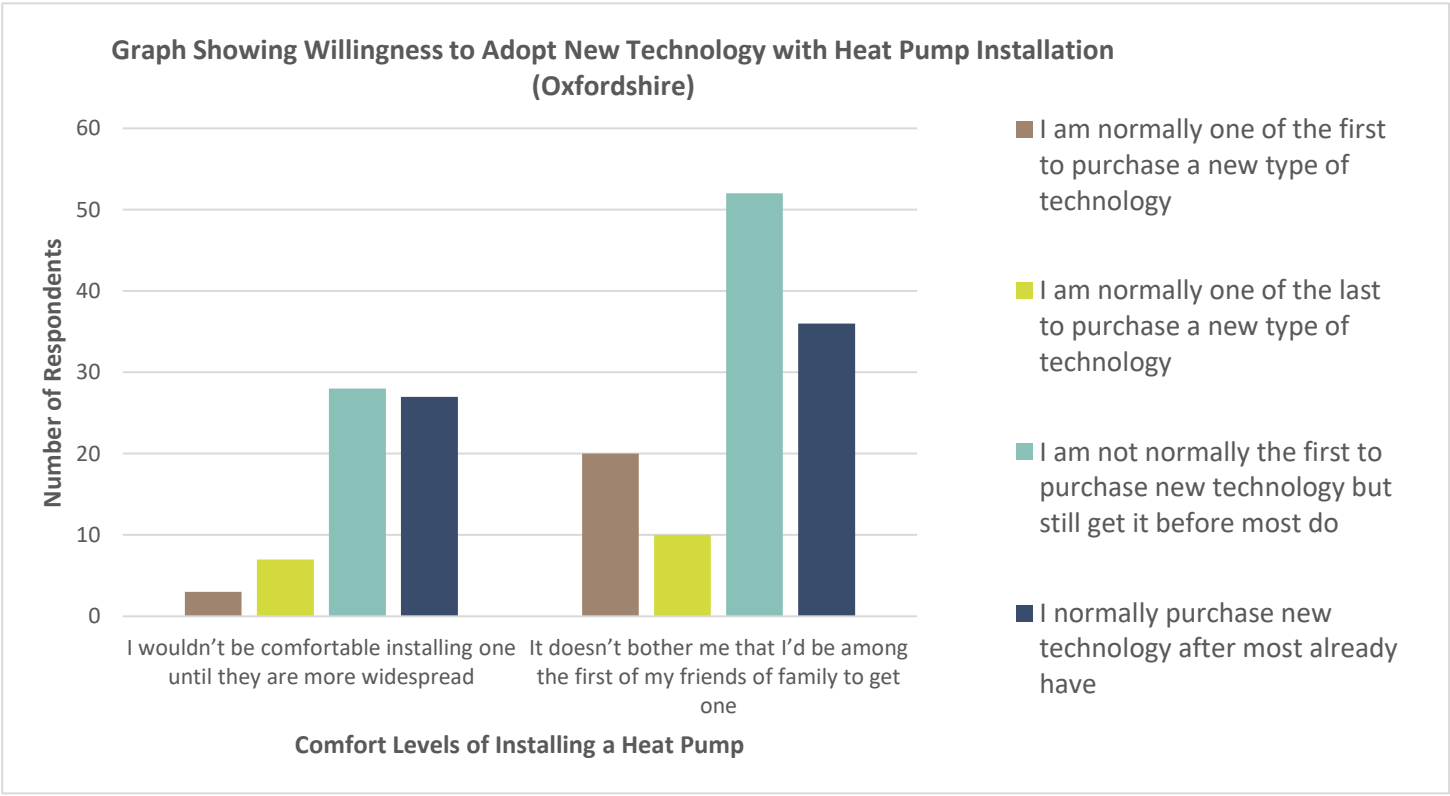


Comparison of what is considered an acceptable price to pay vs too much to pay for a heat pump (Growth Guides suggested that the real willingness to pay value is halfway between the two answers). Do these correlate with certain demographics?





Is there a difference in attitudes towards HPs comparing those who say they are normally the first to get a new technology versus those who are laggards?



15.4.2 Door to Door Findings

Introduction

As part of the Customer Engagement work package, The National Energy Foundation (NEF) were tasked with undertaking door to door surveys in a pre-selected community based in NW Bicester, part of Cherwell District Council area.

Following analysis by project partners, a community of some ~530 homes were identified for inclusion as a cluster in terms of their suitability to meet the various Phase 1 & 2 Heat Pump Ready project requirements. The objective of the door-to-door surveys were principally twofold:

To ascertain the relative levels of interest in the proposed Ph2 project

To test out the Prosumer Model which is advocated.

This section sets out the survey methodology taken, the findings and conclusions from the door-to-door surveys.

Methodology

NEF mobilised its Whole Home Project Team of four staff plus a Community Engagement Officer to broaden the potential insights. The door-to-door surveys took place throughout the week 10-14th October.

Of the list of ~530 properties, a target of 50 door-door-surveys was set with the aim of completing 100. Ten survey person days were agreed upon from the team of five. Approx. 50 (+/- ~5) homes were allocated to be 'door knocked' per day broadly on a street-by-street basis. Prior to commencement, a briefing session of the team of five was held for the purposes of survey consistency in the approach.

It was expected the successful completion rate of surveys would be challenging, nonetheless, 50-100 seemed a reasonable rate of return to target and adequate to gain the required insights. Prior to the surveys, to counter concerns of 'cold calling', a mail shot introducing the project and surveys was issued jointly signed by NEF and Oxfordshire County Council (OCC). This gave the option for interested homeowners to request a survey by appointment in advance. Only two requests were made, however, during the actual surveys a reasonable proportion of those surveyed recalled receiving the mail out letter. The team carried Photo ID and a copy of the letter.

The survey questions were pre-agreed by project partners. In total 14 questions were asked and these together with the findings are summarised below. To assist with initial engagement and explaining the concept of a Prosumer Model, a simple graphic was produced by Growth Guides (this included photographic images) which proved a useful aid on the doorstep. Surveys were traditional paper forms with a clipboard. The average anticipated time for surveys was 15 minutes duration.

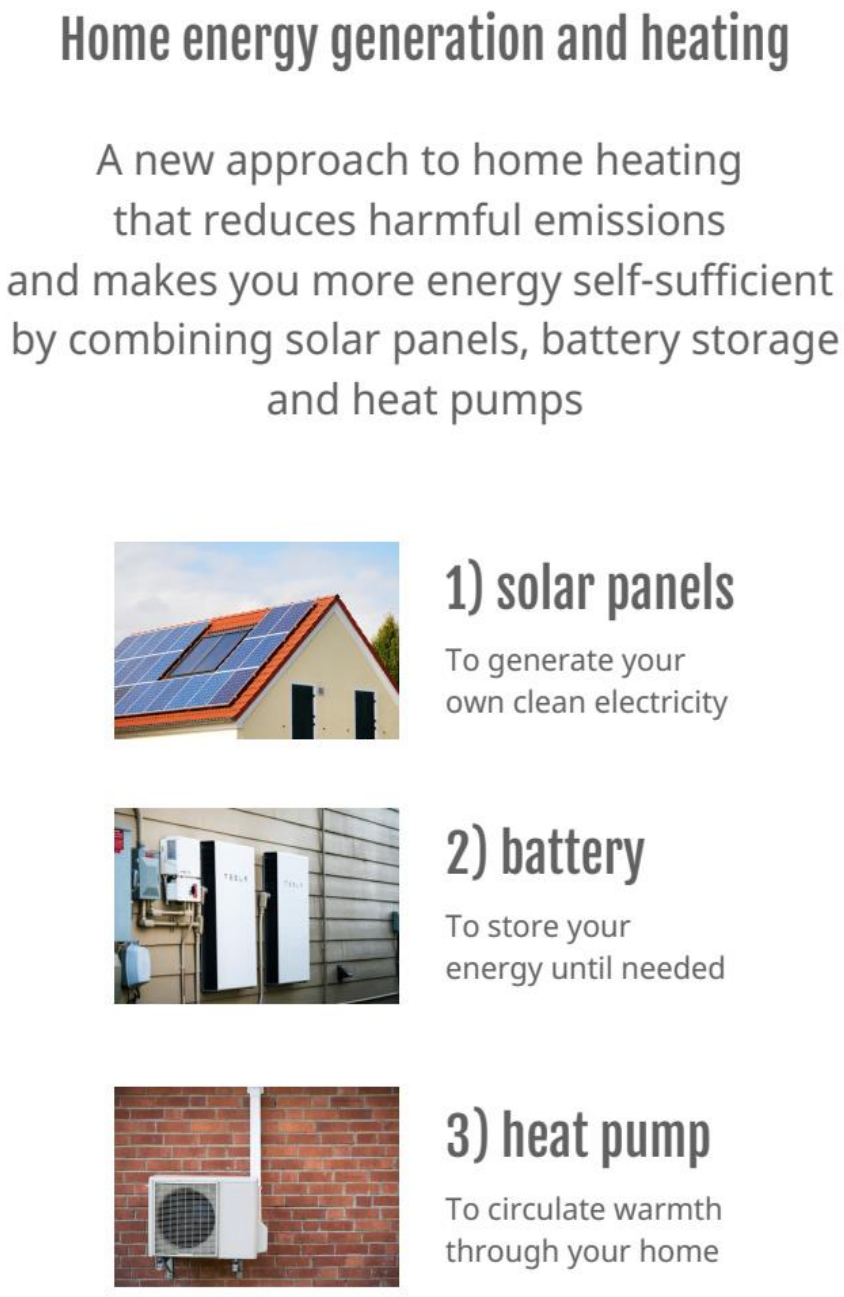


Figure 1.0 – Prosumer Model Graphic

Findings

In total, 83 door-to-door surveys were successfully completed. This is 16% of the overall sample of approx. 530 homes which were knocked. As expected, a high proportion of occupants, estimated at 55%, were not at home during normal working hours / the head of the household was not in. In

addition, a significant proportion of those who answered were simply not interested in the project or participating in the survey and this is estimated at 25%. Homes for sale and those with 'no cold calling' signs were generally disregarded. In a number of cases, based on how the survey questioning was progressing, the full 14 questions were not always completed and this should be borne in mind when interpreting the findings.

Question 1 (ice breaker):

Do you already have an electric vehicle or micro generation?

Response	Number	Proportion from surveys completed
Yes	13	16%
No	70	84%
Total	83	

Comments / findings - Evidence exists that homeowners in the community who were surveyed have begun to embrace elements of the prosumer model.

Question 2

Are you already actively thinking of / interested in installing renewables or installing insulation to improve home energy efficiency?

Response	Number	Proportion from surveys completed
Yes	32	39%
No	40	48%
Not sure	11	13%
Total	83	

Comments / findings – It was encouraging that of those surveyed, 39% are actively looking or would like to become a prosumer. Those who were more familiar with elements of the prosumer model were found to be more willing to engage in surveys.

Question 3

If yes to Question 2, which measures?

Response	Number	Proportion from total measures desired (77) i.e. popularity
Solar PV	26	33%
Battery	16	21%
Heat pump	15	19%
Improved fabric insulation	7	9%
EV charger	11	14%
Other(s)	2	4%
None / no reply		
Total	77	100%

Comments / findings – Note that of the 32 who answered yes to question two, many would ideally like to install more than one measure of the prosumer model. In total, desire existed to install 77 measures in the 83 homes surveyed. Solar PV proved to be the most popular, however, this technology is more established / familiar and visible. Many participants were aware of the benefits of deploying PV in conjunction with battery storage following recent electricity supply price hikes.

Heat pumps were the prosumer element with the third highest popularity at 19%. In terms of the 83 completed surveys, 18% of homeowners were interested in installing a heat pump which is 7% lower than the target deployment rate of min 25%. This, upon the first occasion of community engagement in the project, could be seen to be promising (see barriers however).

Question 4

On a scale of 1-10, how interested would you be in moving towards adopting the home energy generation and heating system?

Score	0	1	2	3	4	5	6	7	8	9	10
Number of respondents	1	10	9	4	6	9	4	4	8	4	5
RAG distribution (total)		Low 30				Medium 17			High 17		
RAG proportion (of		46%				27%			27%		

64 responses to question)				

Comments / findings – Interest in moving towards a prosumer model with heat pump has been shown above using a RAG system. Of 64 responses received, 17 homeowners (or 27%) were very interested in adopting the model (however, see barriers). With further community engagement, potential to win over some of the amber respondents could be assumed.

Question 5

What, if any, do you see as the barriers to becoming an adopter of a home energy generation and heating system and what support or assistance would be most helpful?

Barrier / reason	Number of this response	Category	Category total	Proportion of all responses (115)
Installation cost / affordability	45	Cost related	78	68%
Payback / not knowing how long it will take to give ROI / years expected to remain in house	15	Cost related		
Running costs could be higher than existing heating	2	Cost related		
Government need to make it cheaper	1	Cost related		
Too old, don't want to spend money on it	15	Cost related		
Hassle / inconvenience / disruption	7	Disturbance /practicality	7	6%
Lack of information	7	Information	10	9%
Noise concerns	1	Information		
Uncertain energy market	1	Information		
Haven't thought about it and don't understand it	1	Information		

Newness of technology	5	Lack of confidence	8	7%
Heat pumps take too long to arrive / supply chain	1	Lack of confidence		
Performance	2	Lack of confidence		
Existing heating working ok	5	Existing heating system	7	6%
Recently replaced heating	2	Existing heating system		
No suitable location for HP	1	Design constraints	4	3%
Told house not suitable (microbore pipework)	3	Design constraints		
PV is ugly and expensive, see it as politically corrects, don't want to do it	1	Preference / aesthetic / other	1	1%
TOTAL	115			

Comments / findings – Note that many respondents cited more than one barrier / reason.

Overwhelmingly, the highest rated barrier (68%) was cost. Cost was cited for various reasons including:

- Level of installation costs
- Ability to find the funds
- Insufficient grant incentive
- Length of pay back / no payback
- Fear of running costs increasing above existing heating system
- High proportion of the bungalows visited being lived in by the elderly and the infirm (responding that investment was not appropriate at their time of life).
- 6% of those surveyed were happy with their existing heating or had recently had it replaced.

The lack of appropriate information to consider the offer was stated by 9% of respondents as to 7% had a lack of confidence in what they viewed as a new technology. Disturbance wasn't mentioned as significantly as expected at 6% of the total although this may be due to lack of knowledge. 3% of homeowners had been advised their home was not suitable for a heat pump.

The demographic, the type / mix and standard of maintenance of existing homes did not suggest an especially affluent community. This coupled with the current cost of living crisis is likely to make sign ups in Ph2 challenging to reach the minimum 25%. This is however expected to generally be the case in other communities and the area surveyed is typical of communities where mass heat pump installations will ultimately need to be undertaken.

Question 6

On a scale of 1-10, how likely would you welcome a locally-based 'Green Home Energy Advice' service that guided and supported you through the process of installing a heat pump and other measures from beginning to end to make the journey as simple and hassle free as possible?

Score	No reply	1	2	3	4	5	6	7	8	9	10
Number of respondents		12	11	9	1	6	5	4	12	2	7
RAG distribution (total)		Low 33				Medium 15			High 21		
RAG proportion (of 70 responses to question)		47%				22%			30%		

Comments / findings – Of the 70 responses, using a RAG system, 30% said that they strongly believed a local project Energy Advice service would be beneficial and welcomed. 47% see very little benefit to the service and are unlikely to engage in Phase 2 in any event, while 22% were reasonably indifferent to the concept of a support service.

Question 7

On a scale of 1-10, would a project where your neighbours / the local community are engaged with moving en masse towards becoming an adopter of a home energy generation and heating system make you more or less likely to proceed?

Score	1	2	3	4	5	6	7	8	9	10
	12	9	10	6	9	5	5	9	0	5

Number of respondents										
RAG distribution (total)	Low 37				Medium 19			High 14		
RAG proportion (of 70 responses to question)	53%				27%			20%		

Comments / findings – While 20% of respondents liked the idea and feel of a community project, (7% of whom were extremely positive), this did not seem to be an essential prerequisite. Some homeowners were happy to proceed more independently.

It should be noted that benefits of a community project approach have not been communicated at this stage and interest could therefore increase if benefits are available and imparted. One respondent mentioned that neighbours in his street tend to carry out similar home improvements once someone has taken the lead and shared positive feedback. The visibility of an improvement became a talking point.

Question 8

If you are not interested in the project, can you give a brief reason as to why?

Reason for not being interested in project	Number of people mentioning the same reason
Elderly	17
Cost / payback and investment	12
Simply not interested / no reason	7
Recently replaced gas boiler	4
Prefer to do it without neighbours	2
Private person / do not wish to say	1
Don't own property / renting	1
Don't trust technology	1

Don't know much about technology	1
Disruption	1
Moving soon	1
On key meter for heating	1
Bigger priorities for Government to address, funding won't be made available	1

Comments / findings – The above reasons are ranked in order of commonality. The high proportion of elderly persons living in bungalows in the community who do not wish to engage in the project but were willing to be surveyed may have skewed the responses. Cost factors are again a clear reason before disinterest. Four reasons of the 50 were where homeowners advised they had recently replaced their heating system and wouldn't be changing it again. It is not known within the overall sample of 530 homes how many homeowners may have replaced their heating recently, but this is expected to equate to ~10% or ~50 homes based on the expected lifecycle of boilers and replacement habits.

Question 9

On a scale of 1-10, would you have more confidence in proceeding if, as part of a 'Green Home Energy Advice' service, contractors / installers had been pre-vetted by the local authority and monitored by an independent authority as opposed to you having to find your own contractors / installers?

Score	1	2	3	4	5	6	7	8	9	10	Don't know	Other*
Number of respondents	9	3	5	5	7	4	4	14	2	7	1	1
RAG distribution (total)	Low 22				Medium 15			High 25				
RAG proportion (of 62 responses to question)	35%				23%			40%			1%	1%

Comments / findings – Overall, the majority of respondents (40%) felt strongly that having independently pre-vetted installers presented to them rather than their having to source contractors would be an attractive offer via a local service and would provide more confidence. A further 23% saw some benefit with this approach whereas 35% saw little benefit.

*One respondent thought that social media / trust-a-trader scheme would be more effective.

Question 10

If you were buying a home energy generation and heating system through a 'Green Home Energy Advice' service, how many competitive quotations from different installers would you wish to see as a minimum?

Number of quotations	Number of respondents
1	1
2	3
3	38
4	6
5	2

Comments / findings – For homeowners to feel they would be obtaining good value for money, a minimum of three quotations was overwhelmingly the number that respondents wish to see. This is 76%. It will be important for this to be given close consideration under the Ph.2 One Stop Shop offering.

Question 11

If interested, how soon do you estimate that you will / would want to move towards becoming an adopter of a home energy generation and heating system in terms of retrofitting actual measures?

Timeframe	Number of respondents	Proportion of those considering installation in short term installation (42)	Proportion of total number of surveys (83)
Within 12 months	17	40%	20%
2-3 years	15	36%	18%
Over 3 years	10	24%	12%
Total	42		

Comments / findings – It is promising that from a sample of 83 surveys that 17 homeowners or 20% are seriously interested in adopting elements of a prosumer model within the next 12 months (albeit that solar PV is more popular than heat pumps, see question 3). If a portion of those 15 homeowners reached by surveys who are looking at a 2-3-year installation window could be brought into Ph2 of the project, then there would appear to be an opportunity for the minimum 25% deployment target to be reached.

If a similar response was obtained from the 55% of homeowners who were not at home (~290 homes) then based on 83 surveys, the numbers interested could be factored up by ~x3.5 meaning 60 homes plus the 17 surveyed would be looking at becoming a prosumer in the next 12 months which totals 77 homes and with more considering the 2-3-year window.

Question 12

If this support (project support and the grant funding) were available in the next 12 months, would you be interested in the offer, and what might hold you back from accepting such an offer and proceeding?

Answer	Numbers	Classification	Number of responses	Proportion of total responses (39)
I would be interested	11	Warm lead	12	30%
More likely	1	Warm lead		
It depends how much is the grant	8	Undecided require more information	12	30%
Need to know the total cost	1	Undecided require more information		
Would want to review info	1	Undecided require more information		

Information and assurance of quality	2	Undecided require more information		
No	4	Negative	14	37%
No, too soon	3	Negative		
We're moving house so it's not worth the investment	3	Negative		
No, not enough funding	2	Negative		
No, running costs more important than initial funding	1	Negative		
No, technology should be able to be viable without funding	1	Negative		
Would have been but going ahead on own now	1	Missed opportunity	1	3%
Total	39		39	100%

Comments / findings – Of 39 responses, 12 (30%) of homeowners confirmed that they were interested in joining a Ph.2 of the project, while a further 12 (30%) may be interested subject to receiving further information. Customers who stated they wouldn't wish to join the project accounted for 37%.

Question 13

Based on what you have heard during this survey, would you be interested in?

Option	Number
Remaining informed about the development of the local project?	42
Participating in a newly launched project or trial?	11
Neither of these options	17

Comments / findings – 42 homeowners asked to be kept informed of developments with the project from which 11 stated they would actually be interested in participating in a trial. Email addresses were recorded where the homeowner was willing to share.

Are there any other comments you wish to make (or do you have any questions)?

The following comments were received:

Comment	Number of responses / similar responses
More information would help improve things and more general info about products and installers.	1
High cost is a barrier, and for those who are single occupancy, there has to be a cost benefit.	1
People need to be motivated to start with this. Good to look at the whole house	1
75 years old, been in home for 40years, coped fine without it so far	1
Worry about damage to roof with PV	1
Would like to see scheme available to everyone	2
Cost of maintenance	1
Ownership, some people were renters	1
It would help if there was a finance scheme to help with the capital costs	1
Government need a long-term strategy that residents can trust	5
Getting advice from family who have a HP already	1

Too difficult for us to transition from gas	1
Would like to make negative comments about the Govt	2
Uncertainly of general economic situation	2

Comments / findings – The comments are self-explanatory. The week of the surveys coincided with significant central Government turmoil. One comment related to affordable finance which is being looked at under the project.

Conclusion

Undertaking the door-to-door surveys was the first engagement exercise within the selected community and has provided invaluable insights with some positives to be found.

Successfully carrying out door-to-door surveys at scale was expected to be challenging and completing 83 surveys was pleasing at 15% of the community sample whereby ~530 doors were knocked in the period of one week.

It is estimated that circa 290 of the 530 homes knocked did not have anyone at home (no reply) meaning more than half the community remain to be engaged at all other than by the mailshot. This also suggests that a significant number of homeowners would have been at work because the surveys took place during normal weekly working hours. Of the 240 replies to door knocking where a survey was verbally offered, approx. 30% at 83 were achieved, however, not all 83 surveys were fully completed.

The positives to be taken are that 32 homeowners said they were interested in becoming a prosumer with 17 of them serious about doing so in the next 12 months and 11 of whom expressed interest in participating in a Ph.2 trial even at this early stage in the life of the project. Yet more homeowners indicated interest who were looking at a slightly longer window prior to installation, however, in some cases this would potentially still fit with the Ph.2 project timescales. It was found that more homeowners are considering solar PV over heat pumps currently as would be expected given its previous market penetration. There was clear evidence from those most interested that they wished to live a prosumer model lifestyle and also bought into the tech and IT aspects.

The concept of a local Green Energy Advice Service via a One Stop Shop model was generally well received and having pre-vetted installers was also viewed positively. The strength of a community type project moving ‘on mass’ was felt to be less important although some respondents were very keen on this and it remains to be tested out against a peer group.

It should be remembered that as the first proper project engagement exercise, momentum would be expected to build as more coherent information becomes available and similarly the emergence of common branding in a relatively compact community area would likely garner more interest over time.

On the negative side, the overwhelming barrier to adoption of a prosumer model is cost. The level of grant would need to be adequate to incentivise investment and early adoption of the prosumer model. Homeowners would be seeking value for money supported by their desire to see a minimum of three competitive quotations. This suggests that a minimum of 3 suppliers would be required

under the One Stop Shop model. The ability to offer attractive and affordable finance packages as is planned would help to overcome the cost barrier to some extent. It should be remembered that expressing keen interest in participating in a project and making an actual investment can be very different.

The community generally cannot be described as an especially affluent one and the cost of living and energy supply crisis was on the minds of many participants. There is a high number of bungalows invariably occupied by the elderly who generally did not express a motivation to become a prosumer. This said, the community could be described as being typical and as such would make for a good test bed location.

As with any community a certain proportion of residents will simply just not wish to engage with the project whatsoever – even at the level of an initial conversation - and this could potentially be expected to be between 25-50% of homes but is yet to be determined. The number of homeowners who have recently replaced their heating system is also hard to estimate and where this is the case they are highly unlikely to wish to join the project.

It is anticipated that it would be a challenge to reach the minimum 25% threshold in a relatively short period of time (one year) in the targeted community, however, this can likely be said of numerous other communities. Some homeowners who are keen to progress may not wish to wait to move together unless the benefits to them are clear and highly favourable.

Through a coordinated and sustained approach to community engagement supported by effective marketing activity in Ph.2, there is every opportunity the service offer would progressively generate and build more interest leading to adoption of the prosumer model in the community. The door-to-door surveys have revealed that the whole service offer must be desirable, high quality, independently backed, trusted and affordable. The ability to carry out further testing prior to implementation in Ph.2 would be worthy and beneficial to both the project team and members of the community.

15.5 One Stop Shop Operations Summary (Authored by City Science and Trust Power)

The Heat Pump Ready Programme supports the development of innovative solutions across the heat pump (HP) sector. HPs are a key solution for decarbonising homes and will be critical for meeting the UK's commitment to achieve net zero by 2050.

Heat Pump Ready Oxfordshire is part of Stream 1 of the programme and is currently in Phase 1, the feasibility stage. In this stream, projects devise solutions for high-density HP deployment, support the development and trial of solutions and develop methodologies for the optimised deployment of domestic heat pumps at high-density.

The project seeks to understand the viability for HP deployment in Cherwell, Oxfordshire and identify suitable locations. In addition, it will consolidate evidence relevant to HP delivery, develop a supply chain strategy and create a blueprint for a One-Stop-Shop. The project also considers the viability of achieving the required density of HP deployment in Phase 2, which requires householders to fund 60% of the dwelling's HP installation. For this reason, the project considers a Prosumer Model (which combines HP installation with solar photovoltaic (PV) generation and battery storage) to make the offering more financially attractive to householders.

The purpose of this report is to summarise the Operational & Delivery tasks work conducted in Work Package 6 of the project. The report details the operational delivery design of the One Stop Shop and the Customer Journey.

15.5.1 Heat Pumps & Prosumer

In 2019, the UK became the first major economy to adopt a legally binding obligation to reach net-zero greenhouse gas (GHG) emissions by 2050 (HM Government, 2020). Buildings accounted for 30% of the national GHG emission mix in 2019, with 56% of these emissions resulting from heating homes (HM Government, 2021), therefore decarbonisation of residential heating is central to meeting national climate targets. One option is a significant increase in the electrification of heating, with HP technology identified as being the most efficient energy option at a residential scale (Love et al., 2017), therefore individual HPs are likely to be a key technology in the decarbonisation of the national heating sector (Vorushylo et al., 2018). The popularity of domestic HPs is echoed in national policy, with the UK government aiming for 600,000 HP installations per year by 2028 (HM Government, 2020). HP technology works by absorbing low temperature thermal energy from the environment and using electrically driven compressors to 'pump' it to a higher temperature using the refrigeration cycle (Vorushylo et al, 2018).

However, modelling from the Heat Pump Ready Oxfordshire project has shown that considering current and projected gas and electricity prices, alongside the high initial cost of HP installation, switching to a HP system is significantly more expensive than retaining a gas boiler over a 30-year period. For this reason, the project is exploring the viability of increasing HP uptake by offering householders a Prosumer system. This is where on-site solar photovoltaic (PV) generation and energy storage is installed alongside the HP to minimise ongoing energy costs. The project's modelling suggests that under the Energy Price Guarantee, the Prosumer system has the potential to be 6% - 24% cheaper than retaining a gas boiler over a 30-year period. Depending on the typology.

15.5.2 One Stop Shop Operational Delivery Design

The Prosumer System and the One Stop Shop

Commissioning and installing a Prosumer system is complex and often requires a householder to liaise between multiple suppliers to ensure the retrofit, home upgrades, the HP, solar PV and battery storage are installed in the correct order. For this reason, the Heat Pump Ready Oxfordshire project develops a design for a One Stop Shop to support this process, therefore enabling an accelerated uptake of HPs.

The term 'One Stop Shop' is used to describe a trusted service to householders that removes barriers for complex projects, making them more easily achievable. In this case, a One Stop Shop offers trustworthy, expert advice to enable householders to understand how to install a Prosumer system in their home. The One Stop Shop enables the householder to obtain tailored advice and product/supplier recommendations. If the householder wants to go ahead, the One Stop Shop can provide access to trusted suppliers, help with project management, and assess the quality of work undertaken. The service provided includes providing advice on how to run the new system effectively once it is installed.

Heat Pump Ready Oxfordshire's One Stop Shop Objective

To encourage an increased uptake of Heat Pumps as part of a wider Prosumer system, by providing a trusted and transparent end-to-end service that smoothens, simplifies, and supports the customer journey.

One Stop Shop and Heat Pump Ready Phase 2 Considerations

The One Stop Shop has been designed to be feasible for a Phase 2 trial. It is proposed that in Phase 2, trial volunteers are gathered via targeted communications and will then be asked to utilise the One Stop Shop website /service offering so that it can be tested and refined. In the Phase 2 trial, the location scope for the One Stop Shop will be Oxfordshire, with only applicants living in our target area within Cherwell District being granted access to BEIS heat pump funding.

In Business as Usual (BAU), it is expected that the customers will land on the site from a variety of marketing methods. These may include organic discovery via Search Engine Optimisation (SEO) which ensures the One Stop Shop ranks highly in relevant searches, and via paid targeted marketing advertisements (such as social media advertising).

Although the Phase 2 One Stop Shop will be built for Oxfordshire, the One Stop Shop has been designed in a way that is replicable to the rest of the UK at BAU and can be used in partnership with any Local Authority in the future.

This section details the operational recommendations that will support delivery of the Phase 2 trial One Stop Shop.

15.5.3 Design Specification

The key overarching design specification for the website/service offering includes:

- The design must be realistically deliverable within Phase 2 constraints
- The design must provide an end-to-end service that enables customers to obtain a low carbon heating system to include: a heat pump, solar PV, battery storage and associated retrofit and home upgrades
- The website must be easy to navigate with easy-to-understand language

- The website must motivate the customer to adopt a Prosumer system
- The product offering must include sufficient product choice to suit a majority of households whilst not being overwhelming for the customer
- The website must be trustworthy and transparent

15.5.4 Operational Delivery Design

Table 5 describes the operational delivery design elements of the One Stop Shop and the associated requirements that must be delivered at the beginning of phase 2. The table utilises research into existing One Stop Shops (see Growth Guide's Initial Recommendations Report) to detail the Gold Standard Offering and Minimum Offering the project could consider. The table then details the confirmed project offering and the operational delivery requirements associated with delivering the offering.

Table 5: Key Operational Delivery Design and Requirements

	Gold Standard One Stop Shop Offering	Minimum One Stop Shop Offering	Confirmed One Stop Shop Offering for the Project	Operational Delivery Requirements
Key Design Features				
One Stop Shop Website A website to support the end-to-end customer process	• Dedicated website • Dedicated brand	• Extension of existing website (such as Cosy Homes) • No dedicated brand	• Dedicated website • Dedicated brand	1. Development of website (utilising suitable available white label back-end elements where possible) 2. Development of branding (utilising branding work in Phase 1)
Customer Service To provide expertise and support at key stages of the customer journey	• One point of contact that serves the customer throughout the entire process • Manages contractors etc on behalf of the customer. • Expertise in prosumer system	• Multiple points of contact throughout the process. • Dedicated account manager for the detailed planning, commissioning and installation stage. • Customer manages contractor relationship. • Some expertise in prosumer system	• Multiple points of contact up until detailed planning stage • Dedicated account manager from detailed planning stage • Account manager manages the contractor relationship but not the relationship with the finance lenders.	1. Develop partnership with a company who can provide customer service advisors that have heat pump, solar and battery storage expertise and experience in coordinating installations. The company should have customer service processes ingrained. 2. Source upfront financial cover for the account manager for the duration of the trial. (In BAU this will be covered by a % commission.)

Technology & Inclusions The prosumer model products offered in the One Stop Shop	• A sufficient number of each product to provide for the vast majority of customers Included: • Solar PV • ASHPs • Battery storage • Retrofit measures • Home upgrades (such as radiators, HW Cylinder) • Any other components that allow the system to interact (inverter, charge controller) Excluded: • None	• The One Stop Shop provides one or two options of each technology Included: • Solar PV • ASHPs • Battery storage • Home upgrades (such as radiators, HW Cylinder) • Any other components that allow the system to interact (inverter, charge controller) Excluded: • Retrofit measures	• A sufficient number of each product to provide for the vast majority of customers • As few options as possible from as few suppliers as possible (for greater buying power) • Small number of options shown at feasibility stage, detailed stage may show further options Included: • Solar PV • ASHPs • Battery storage • Retrofit measures • Home upgrades (such as radiators, HW Cylinder) • Any other components that allow the system to interact (inverter, charge controller) Excluded: • None	3. Aim to develop a partnership with a larger supplier who can provide multiple components of the system 4. Curate a supplier mix that can collectively offer all the included technologies 5. The specific product models offered is dependent on confirming the suppliers. The product model offering will be curated from the suppliers' existing offerings 6. Account managers with knowledge of all the technologies and with ability to liaise between multiple suppliers 7. Decide whether to allow customers to purchase solar only.
Customer Journey Steps				
Awareness & Consideration	• Informational page clearly explaining what a Prosumer	• Informational page clearly explaining what a Prosumer	• Informational page clearly explaining what a prosumer model is, its components, the	1. Development of informational pages, drawing from the collateral produced in phase 1

Awareness: Support initial awareness of the concept **Consideration:** Actively learning more about the prosumer model, starting to evaluate the potential benefits and costs.	model is, its components, the benefits/disbenefits and cost savings • Offer of having a phone or web chat conversation with a dedicated account manager	model is, its components, the benefits/disbenefits and cost savings • No offer of phone call or web chat at this stage	benefits/disbenefits and cost savings • Will aim to include case studies to show social proof • Will aim to create different landing pages based on different marketing links (such as an environmentally focused page and a page that focuses on cost-benefit) • No option for phone call	2. Development of case studies (preferably in Oxfordshire) 3. Consideration of how we inspire/motivate the customer to move forward 4. Call to action to enter their email and use the feasibility tool 5. Integration of email capture and process to contact the customer
Suitability/Feasibility Understanding whether their home and finances might be suitable and whether the offering is desirable	• Includes an intelligent assessment via a web tool covering: ○ Detailed suitability criteria for their property ○ Ability to input priorities (carbon, cost etc) ○ Provide initial indication of suggested measures to implement and indicative costs ○ Financing options assessment ○ Estimated impact on running costs and carbon ○ Likely disruption • Option to speak to dedicated account manager (via call or	• Page with explanation of suitability criteria so that the user can make their own assessment • Provide contact details for suppliers who can provide more bespoke information	• The project will Replicate the Cosy Homes Free Plan Builder tool to include: ○ Detailed suitability criteria for their property ○ Ability to input priorities (carbon, cost etc) ○ Provide initial indication of suggested measures to implement and indicative costs ○ Financing options assessment – high level overview ○ Estimated impact on running costs and carbon ○ Likely disruption • No option to speak to expert at this stage. • Will capture partial results and emails at this stage so future contact can be made.	1. Build a similar tool to the Cosy Homes Free Plan Builder tool 2. Development of a webpage for tool integration 3. Integrate the ability/process to capture contact details at this stage 4. Conduct research into how to present environmental benefit (carbon reduction as a percentage or units, comparison to number of trees planted, lighting a house for a year etc). 5. Develop collateral for the page. 6. Consider how to manage user expectations of cost savings.

	web chat for expert advice)			
<u>Detailed Planning</u> **Moving forward from initial assessment.**	• Dedicated account manager provides the user with a number of options for products and suppliers • Organises a trusted supplier to provide a site assessment • Web chat/phone calls with dedicated account manager	• Page where customers can view different product and supplier options (with contact details for suppliers) • Customer organises the site visit directly with the suppliers • Offer of phone call with expert advisor who can answer questions	<u>Prosumer Planning</u> • Provide a house survey, aiming for £49 price point. The user books the survey themselves through an integrated booking system, preferably via a customer portal. • Provide an option for a phone call with an expert advisor (but not a dedicated account manager) • Potential to offer a whole house retrofit plan (PAS2035).	<u>Prosumer Planning</u> 1. Obtain quotes from a supplier to cover the cost of having 1 - 2 dedicated surveyors to cover the Oxfordshire project for the whole period (to include white labelled/One Stop Shop branded uniform. 2. Develop a page with a booking system that integrates with supplier's booking system or if unfeasible, develop process for making bookings via the site 3. Develop customer portal if possible 4. Develop page collateral 5. Investigate how the project can offer site surveys at £49 6. Explore the option of developing new, streamlined site survey 7. Consider how to manage the user's expectations of cost savings 8. Develop feedback mechanism 9. Explore potential to offer a whole house retrofit plan.
	<u>Financial Planning</u> • Integrated financial planning via a web tool and inhouse expertise • Account manager organises the financial product.	<u>Financial Planning</u> • Site links out to the various options so they can organise with the provider directly.	<u>Financial Planning</u> • Site provides links out to the various options so they can organise with the provider directly	<u>Financial Planning</u> 1. Develop relationships with financial providers 2. Consider FCA regulations if we offer certain financial advice

	• Web chat/phone calls with dedicated account manager	• No offer of assistance from One Stop Shop.	• No offer of assistance from One Stop Shop.	
Commissioning & Installation **Commissioning: After the site visit, the customer is provided with product options and the relevant suppliers are contracted to provide the install.** **Installation: The suppliers conduct the installation.**	Commissioning • Online portal shows the customer the product and supplier recommendations • Dedicated account manager organises contracts between the customer and supplier • One Stop Shop manages risk • Web chat/phone calls with account manager • Online portal where the documents are uploaded and can be digitally signed and also provides a timeline of the works	Commissioning • Customer proposal sent via email • Customer/supplier organises contracts, installation arrangements • Offer of phone calls with dedicated account manager	Commissioning • Aim for a page or portal which shows product and supplier recommendations to the user • Aim to provide functionality for the user to view the recommended package and to book it online. However, given the complexity of installation an account manager is likely required to coordinate the installation bookings • Offer of phone calls with dedicated account manager • Contracts are sent to the customer via email from the account manager	Commissioning 1. Development of page or portal which enables the account manager to upload recommendations and for the customer to select their choice. Page should include the option to print the recommendations 2. Develop page collateral 3. Investigate how the proposition can be simplified and not overwhelming to the customer. Look to Cosy Homes for best practice 4. Decide whose responsibility it is for the project and installation
	Installation • Dedicated account manager provides the point of contact for the suppliers • Customer provides on site contact with the contractors	Installation • Customer provides on site contact with the subcontractors • Phone calls with dedicated account manager to address	Installation • Account manager provides the point of contact for suppliers where possible • Customer provides on site contact • Phone calls offered to address queries/concerns	Installation 3. Develop a process for supplier contact/flow of information to the customer 4. Develop mechanism for feedback

	• Web chat/phone calls with dedicated account manager to address any questions, concerns	any questions, concerns		
Quality Assurance & Aftercare **QA: Provides reassurance that the system has been installed correctly.** **Aftercare: Ongoing support for the running and maintenance of the system**	Quality Assurance • The service sends an independent assessor to provide a home visit and check the work has been undertaken correctly on every home • Assessor provides a demo showing how to use the control panel	Quality Assurance • No QA offered.	Quality Assurance • QA important for monitoring the success of the project, customer experience and reputation • The project will send an independent assessor to provide a home visit and check the work has been undertaken correctly • This will be completed on random audit basis, not every home • Consumer can pay for an additional assurance/independent assessment if they want to • Provide a white-labelled surveyor and aim to have a quality process better than MCS • Aim to have a function to analyse the performance post installation (e.g. via apps)	1. Investigate how to build in audit process for the contractors 2. Develop partnership with surveying company who can provide the site analysis (in detailed planning) in addition to the quality audit 3. Develop a process for issues (e.g. issues are reported to the Account Manager, faults in equipment go back up through the supply chain) 4. Develop mechanism for feedback
	Aftercare • Self-diagnostic, FAQ tool. • Web chat/phone calls with dedicated account manager to address any questions, concerns.	Aftercare • Text-based FAQ/troubleshooting page Detailed questions are referred back to the supplier	Aftercare • For the purpose of the trial, include 1 call after installation to answer questions. • Preferably develop a self-diagnostic, FAQ tool • For BAU there would be an ongoing helpline available. • Provide a transfer pack	Aftercare 1. Develop a transfer pack 2. Include one call in the package agreed with the customer service company 3. Develop self-diagnostic tool if possible. Develop a text-based FAQ as a backup option 4. In the procurement of installers, require them to offer ongoing support post project (e.g. 7 year warranty)

				5. Develop a process for end of project support 6. If a customer portal is used, develop functionality to include aftercare information in the portal

15.5.5 Cross Cutting Operational Requirements

Funding

Sufficient funding for the One Stop Shop is required for the following applications:

- Website and tool development and maintenance
- Marketing/collateral development
- Upfront financial cover for the account manager for the duration of the trial
- Subsidy for the site surveys
- Development of new site survey methodology
- Funding for insurance to mitigate risk

Key Risk: Not all the above costs may be eligible for BEIS Phase 2 funding

Website & Tool Development

The following website and tools should be developed:

Must Have

- Website/platform
- Text based pages
- Suitability tool
- Interactive product pages
- Feedback mechanisms

Nice to Have

- Customer portal
- Booking integration
- Self-diagnostic tool

Key Risks:

- Time required to develop and test the website and tools and test them
- Complexity of data integration/booking functionality

Commercial Partnerships & Contracts

Customer Contracts: At BAU, to enable a seamless customer journey a contract should be set up between the user and the One Stop Shop, and a contract between the One Stop Shop and the supplier(s). However, given the short-term nature of the trial and possible dissolution of the One Stop Shop, it will not be possible for the One Stop Shop to be the intermediary as it exposes the user to risk. Therefore, during the trial, a contract will be held directly between the customer and the supplier(s). In addition, this will reduce project risk as the team will not be legally responsible for the quality of installation.

Supplier Contracts: During the project and BAU, partnership contracts will need to be set up with the following companies to ensure that the required level of quality is delivered for the required duration.

- Customer service company
- Financial providers
- Surveyor company
- Installation companies

- Website host

Key Risks:

- After the trial/dissolution of the Phase 2 project, the customers do not receive the required aftercare
- Consideration of the project's legal liability of the suppliers' work
- FCA regulations to consider if we offer financial advice

15.5.6 Customer Journey

The customer journey map charts the journey from a customer first becoming aware of the Heat Pump Ready Project through to completing their home installation. It maps the positive and negative emotions through each stage. The events that trigger negative emotions are focussed in on – we challenge ourselves to support a customer through these pain points on the journey and minimise drop-outs at pain points in the journey.

Personas are used to provide a realistic personification of the customers we'll be targeting. Understanding and documenting their wants, needs and fears gives us a consistent view of the customer that we can reference throughout the design of the customer journey and ensure that we build an attractive product for our target market.

Methodology

The personas chosen reflect two key demographics in the home-owner market: the retired and the young family. In order reach 25% of homes on a single substation to install heat pumps in Cherwell, the offer needs to be widely attractive. Two quite different personas were chosen, with different backgrounds that spanned the two main motivations for making these changes: economic motivation and a motivation to reduce environmental impact. The previous project outputs including the choice of geography, barriers research, one stop show research and one-stop shop blueprint all fed into the personas, as did Trust Power's experience of testing energy related digital products on the general population.

The customer journey map was heavily influenced by Section 2 of this document. We took the decisions from the output and then mapped how this could be delivered digitally and how each step of the process affects the customer and the customer's decision to proceed. This was cross-referenced against the personas to ensure we're reflecting the users we're building the product for.

Customer Personas

Figures 1 and 2 show the two personas created, as described in 3.2 above. The two personas are Jonathan Kent and Nova West. The personas are to be used throughout the project as a realistic interpretation of potential customers. The personas are meant to be touchpoints for any major decisions and we should always ask "How would Jonathan react to this?", "Would Nova be okay with this solution?". Each of the personas have details about their lives and their spending habits, in order to make them as fully-formed as possible.

Figure 8: Persona 1 - Economically Driven

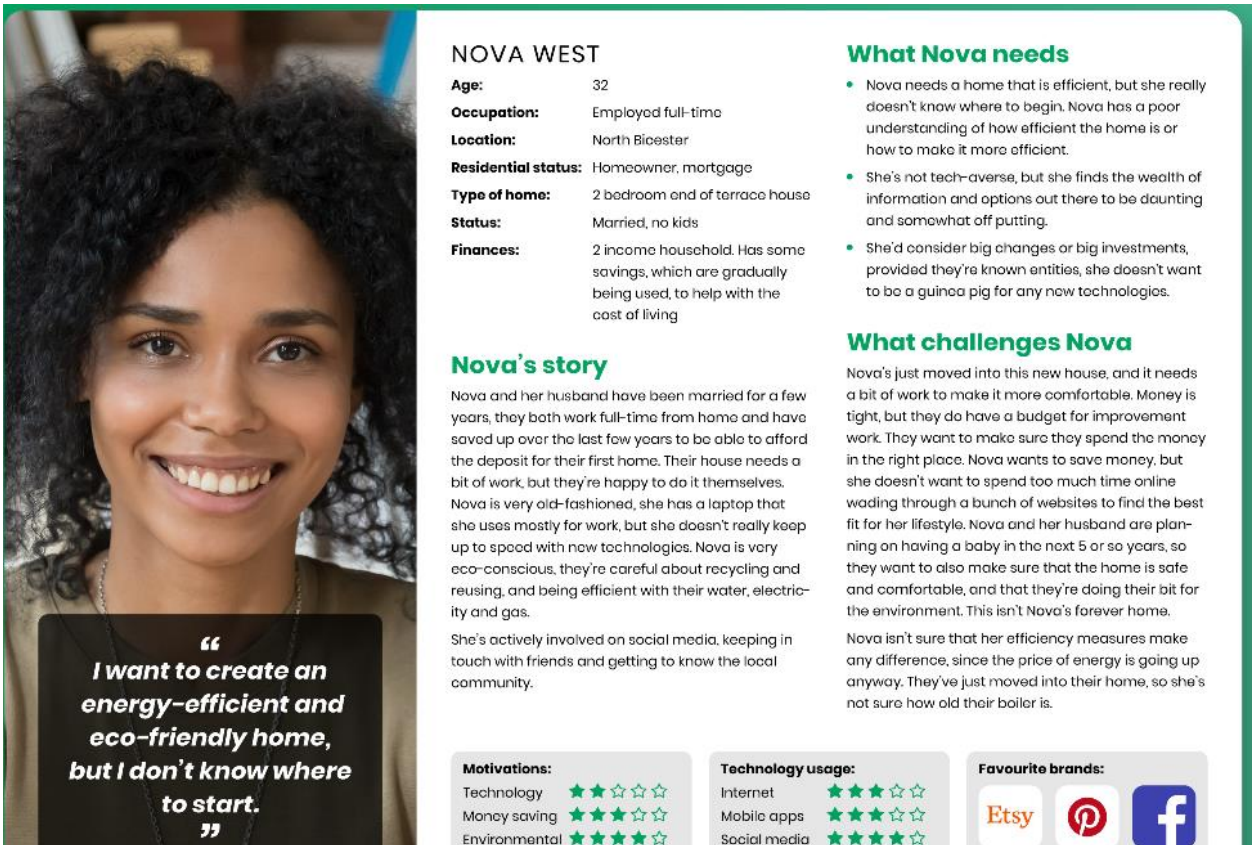


Figure 2: Persona 2 - Environmentally Driven

Customer Journey

Figure 3 shows the 5 stages of the customer journey, from first awareness of the project all the way through to purchase and aftercare:

Figure 3: Five Stages of the Customer Journey

- **Awareness & Consideration**: The customer becomes aware of the project, finds the landing page, and reads through the high-level explanation of what the service is
- **Suitability & Feasibility**: The customer uses the online tool to check if the service is suitable for them
- **Detailed Planning**: After completing the suitability tool, the customer books a home survey where more detailed planning is given, as well as costs and timelines
- **Commissioning & Installation:** The customer decides on the installation and financing options and is contacted by a dedicated account manager in order to book the installations
- **Quality Assurance & Aftercare:** Post-installation, the customer is provided with supporting materials in order to use their new system effectively

Customer Journey Map

Below is the customer journey map, as it relates to one of the personas – Nova West. There are 5 main stages in this journey (as outlined above), each with two sub-stages. At each stage we ask what Nova could be thinking in order to identity any major pain points. This allows us to address them and give the Nova the highest chance of a successful journey.

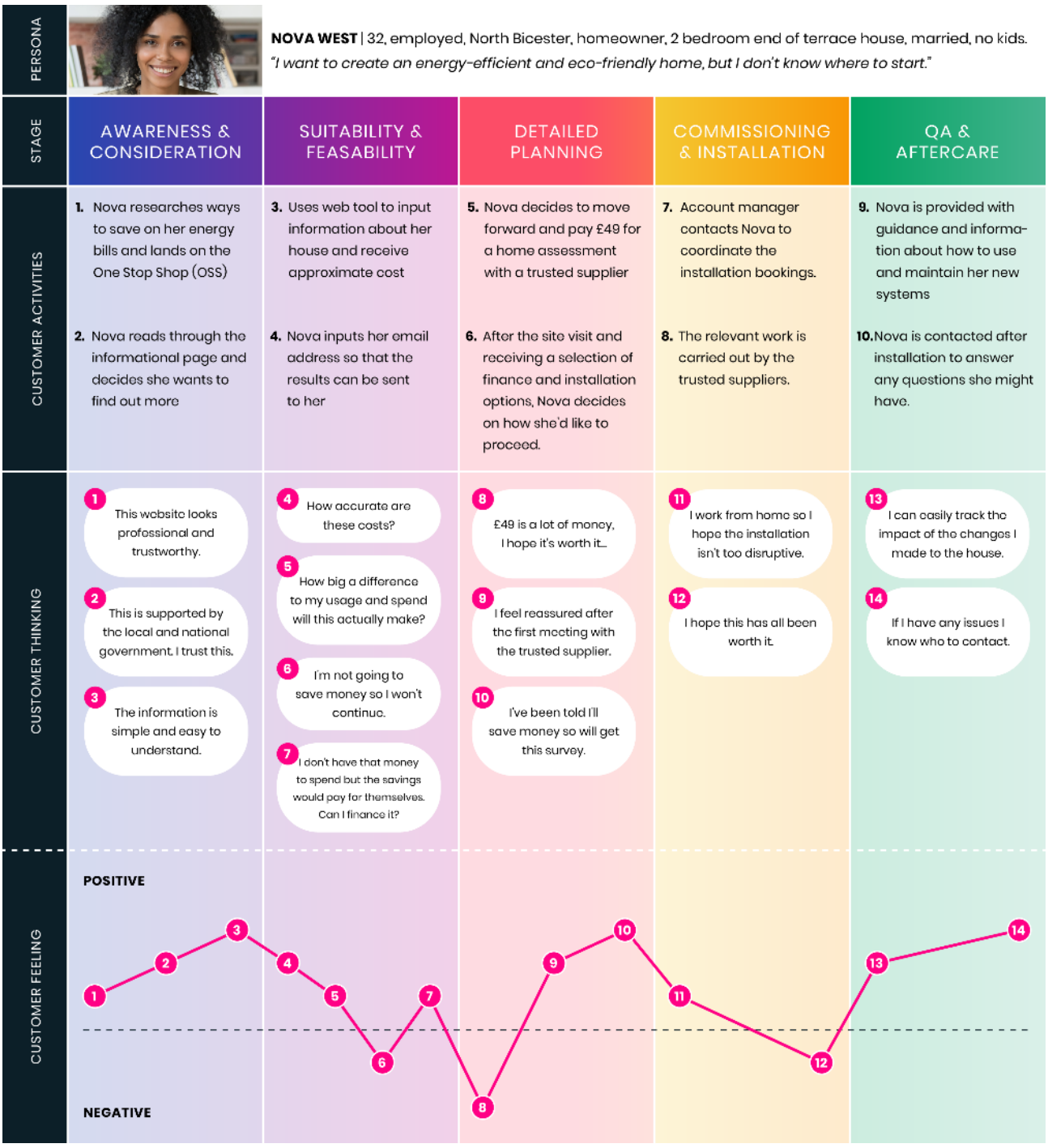


Figure 4: One Stop Shop Customer Journey

15.5.7 References

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Love, J., Smith, A., Watson, S., Oikonomou, E., Summerfield, A., Gleeson, C., Biddulph, P., Chiu, L., Wingfield, J., Martin, C., Stone, A. and Lowe, R., 2017. The addition of heat pump electricity load profiles to GB electricity demand: Evidence from a heat pump field trial. *Applied Energy*, [online] 204, pp.332-342. Available at: <https://www.sciencedirect.com/science/article/pii/S0306261917308954?via%3Dihub> [Accessed 4 September 2022].

Vorushylo, I., Keatley, P., Shah, N., Green, R. and Hewitt, N., 2018. How heat pumps and thermal energy storage can be used to manage wind power: A study of Ireland. *Energy*, [online] 157, pp.539-549. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0360544218303931> [Accessed 4 September 2022].

15.6 Cost & Barriers Summary (Authored by City Science and National Energy Foundation)

15.6.1 Supply Chain Cost Analysis

As part of Phase 1, we have developed a cost model which models the lifetime cost of owning an Air Source Heat Pump (ASHP), compared to the counterfactual of owning a mains gas boiler. This model calculates the lifetime cost for a number of common house typologies. There are a number of purposes for this model:

- To identify whether there is a lifetime cost benefit to transitioning to an ASHP
- To identify which typologies perform better/worse in terms of lifetime costs
- To identify and model the sensitivity of key variables

The accuracy of the model is highly reliant on the accuracy of the costs it uses. To ensure these costs are accurate, we have undertaken a cost validation exercise as outlined below.

Methodology

Our methodology for validating costs is split into two phases. Phase 1 involved a desk-based review of publicly available resources, and a collation of identified cost types and their value. Phase 2 involved validating these costs with local suppliers to both identify any omitted costs, and confirm the values used are accurate.

Our Phase 1 methodology consisted of:

- Utilising BEIS / government websites to identify resources which provide relevant ASHP and retrofit costs
- Extracting relevant costs from identified resources
- Contacting BEIS to obtain underlying spreadsheet with cost data for the CODE report
- Looked for other ASHP/retrofit cost data/reports online - from research bodies and consultancies conducting heat pump research
- Looked for leads via the MCS website as this site has the most abundant data on ASHPs - all installed heat pumps go through this portal

Our Phase 2 methodology consisted of:

- Identifying a long list of ASHP and retrofit installers that service the target area
- Developing an excel-based form to send to installers to validate costs collated in phase 1, as well as identify any omitted costs
- Utilise responses to identify any inaccurate costs in the model and update for most accurate/reliable source

Validation Sources

Desktop review sources

During our desktop review, the following sources were utilised:

Ref.	Source	Year	Title
1	BEIS	2021	Cost-Optimal Domestic Electrification (CODE)
2	BEIS DELTA energy & environment	2018	The Cost of Installing Heating Measures in Domestic Properties
3	NESTA	2022	How to reduce the cost of heat pumps
4	BEIS	2016	Evidence Gathering – Low Carbon Heating Technologies
5	Carbon Trust	2020	Heat pump retrofit in London
6	Carbon Trust	2020	Options appraisals for heat pump retrofit in 15 London buildings
7	BEIS	2021	PHASING OUT THE INSTALLATION OF FOSSIL FUEL HEATING IN HOMES OFF THE GAS GRID
8	Heat Pump Association	2019	DELIVERING NET ZERO: A ROADMAP FOR THE ROLE OF HEAT PUMPS
9	Heat Pump Association	2020	RETROFITTING HOMES FOR NET ZERO HEATING
10	Centre for Sustainable Energy	2020	Bristol net zero by 2030: Heat decarbonisation report
11	Imperial College London	2022	The future of home heating: The roles of heat pumps and hydrogen
12	Imperial College London	2016	Comparing the impacts and costs of transitions in heat infrastructure
13	Robert Sansom, Imperial College London		DECARBONISING LOW GRADE HEAT FOR A LOW CARBON FUTURE
14	Scottish Government	2020	Low carbon heating in domestic buildings - technical feasibility: cost appendix
15	BEIS	2016	Evidence gathering – Low Carbon Heating Technologies. Domestic High Temperature Heat Pumps
16	Imperial College London	2018	Analysis of Alternative UK Heat Decarbonisation Pathways
17	SPONs	2020	SPON's mechanical and electrical services price book 2020
18	Colin Meek	2021	Heat pumps and UK's decarbonisation: lessons from an Ofgem dataset of more than 2,000 domestic installations. Context – Methodology – Analysis – Discussion – Recommendations
19	Energy Policy	2019	The economics of heat pumps and the (un)intended consequences of government policy
20	BEIS	2017	Hybrid heat pumps. Final report.
21	BEIS	2018	Non-Domestic and Domestic Renewable Heat Incentive (RHI) monthly deployment data: 2018
22	BEIS	2020	HEAT PUMP MANUFACTURING SUPPLY CHAIN RESEARCH PROJECT FINAL REPORT
23	Clean energy manufacturing analysis centre	2016	Heat Pump Supply Chains and Manufacturing Competitiveness Considerations
24	DECC	2016	Potential Cost Reductions for Air Source Heat Pumps

25	Technical innovation fund	2017	Heat Pumps for Park Homes, Basingstoke YES Energy Solutions Technical Evaluation Report
26	BEIS	2020	Cost of installing heating measures in domestic properties SPREADSHEET DATA
27	BEIS	2017	Domestic cost assumptions - what does it cost to retrofit homes?
28	Currie & Brown, Committee on Climate Change	2019	A report for the Committee on Climate Change. The costs and benefits of tighter standards for new buildings. Final report
29	Joseph Lingard	2021	Residential retrofit in the UK: The optimum retrofit measures necessary for effective heat pump use
30	WWF, Scottish Power	2022	Better Home, Cooler planet - How low-carbon technologies can reduce bills and increase house value

Supply chain validation sources

To assist in the validation of costs, the following installers/professionals were contacted:

INSTALLER NAME	CATEGORY
Steve Cross Plumbing	Accredited Heat Pump Installers
Elgis	Trustmark Building Contractors
Ben	Accredited Solar PV & Battery Installers
Jonny	Accredited Solar PV & Battery Installers
Matthew	Accredited Solar PV & Battery Installers
Next Generation Renewable Energy	Accredited Solar PV & Battery Installers
Powersun	Accredited Solar PV & Battery Installers
UK Solar Generation	Accredited Solar PV & Battery Installers
Environmental Building Services	Accredited Solar PV & Battery Installers
UKHeatPumps	Accredited Heat Pump Installers
Scott	Accredited Heat Pump Installers
Daikin	Accredited Heat Pump Installers
Edward	Accredited Heat Pump Installers
CCS	Accredited Heat Pump Installers
HBRE	Accredited Heat Pump Installers
PBT Installations	Accredited Heat Pump Installers
Rendesco	Accredited Heat Pump Installers
OPC Energy	Accredited Heat Pump Installers
Swindon Heating and Cooling	Accredited Heat Pump Installers
CDP M&E	Accredited Heat Pump Installers
Alto Energy	Accredited Heat Pump Installers
Aura	Accredited Heat Pump Installers
Curtis and Carder Services	Accredited Heat Pump Installers
Earth Save Products	Accredited Heat Pump Installers
EnergyMyWay	Accredited Heat Pump Installers
GDI Cooling	Accredited Heat Pump Installers
H&R Services	Accredited Heat Pump Installers
Next Generation Renewable Energy	Accredited Heat Pump Installers
M Mcghie Plumbing and Heating	Accredited Heat Pump Installers
Mike	Accredited Heat Pump Installers
Oxford Renewables	Accredited Heat Pump Installers
Stocks Plumbing & Heating LLP	Accredited Heat Pump Installers
Xpert Energy Installations	Accredited Heat Pump Installers

INSTALLER NAME	CATEGORY
T W S Plumbing & Heating	Accredited Heat Pump Installers
CP Jefferies Heating and Plumbing Engineers	Accredited Heat Pump Installers
Heidi Air Conditioning	Accredited Heat Pump Installers
Oxon Energy	Accredited Heat Pump Installers
Dixons	Accredited Heat Pump Installers
Total Home Environment	Accredited Heat Pump Installers
Regen Renewables	Accredited Heat Pump Installers
Plumb-Line	Accredited Heat Pump Installers
PJH Plumbing	Accredited Heat Pump Installers
M2 Mechanical	Accredited Heat Pump Installers
Retrotech Home Installations	Accredited Heat Pump Installers
M HALE	Accredited Heat Pump Installers
Cosmos Energy	Accredited Heat Pump Installers
Meadham Energy Solutions	Accredited Heat Pump Installers
Nick	Accredited Heat Pump Installers
Micro-Renewable Solutions	Accredited Heat Pump Installers
A.P. Faulkner Heating	Accredited Heat Pump Installers
Heat Collector	Accredited Heat Pump Installers
Binfield Renewable Solutions	Accredited Heat Pump Installers
Compass technical	Accredited Heat Pump Installers
Jupiter Underfloor Heating	Accredited Heat Pump Installers
New Heat Solutions	Accredited Heat Pump Installers
VitoEnergy	Accredited Heat Pump Installers
Cool Projects	Accredited Heat Pump Installers
Hello Renewables	Accredited Heat Pump Installers
Neater Heat Central Heating Services	Accredited Heat Pump Installers
Jewel Renewables	Accredited Heat Pump Installers
Echo Energy	Accredited Heat Pump Installers
Redblue Energy	Accredited Heat Pump Installers
Your Energy Your Way	Accredited Heat Pump Installers

Validated Costs

Heat Pump Installation

Technology/ Measure	Value	Unit	Notes/description	Source	Link
Low Temperature ASHP (fixed component)	£1,870.00	£	HP cost the summation of the fixed and variable component. Variable component is per kW of heating capacity. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Low Temperature ASHP (variable component)	£690.00	£/kW		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf

Technology/ Measure	Value	Unit	Notes/description	Source	Link
High Temperature ASHP (fixed component)	£1,870.00	£	HP cost the summation of the fixed and variable component. Variable component is per kW of heating capacity. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
High Temperature ASHP (variable component)	£880.00	£/kW		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Air-to-air HP (fixed component)	£910.00	£/room	HP cost the summation of the fixed and variable component. Fixed component is per room. Variable component is per kW of heating capacity. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Air-to-air HP (variable component)	£175.00	£/kW		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
GSHP (fixed component)	£8,370.00	£	HP cost the summation of the fixed and variable component. Variable component is per kW of heating capacity. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
GSHP (variable component)	£1,030.00	£/kW		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Hybrid HP with existing boiler (fixed component)	£1,870.00	£	HP cost the summation of the fixed and variable component. Variable component is per kW of heating capacity. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Hybrid HP with existing boiler (variable component)	£690.00	£/kW		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
ASHP Annual Service	£182.00	£		Carbon Trust, Options appraisals for heat pump	https://www.london.gov.uk/sites/default/files/options-appraisals-for-heat-pump-retrofit-15-london-buildings.pdf

Technology/ Measure	Value	Unit	Notes/description	Source	Link
				retrofit in 15 London buildings	
GSHP Annual Service	£210.00	£		Carbon Trust, Options appraisals for heat pump retrofit in 15 London buildings	https://www.london.gov.uk/sites/default/files/options-appraisals-for-heat-pump-retrofit-15-london-buildings.pdf
Hybrid HP Annual Service	£280.00	£		Carbon Trust, Options appraisals for heat pump retrofit in 15 London buildings	https://www.london.gov.uk/sites/default/files/options-appraisals-for-heat-pump-retrofit-15-london-buildings.pdf

Heating System Upgrades

Technology / Measure	Value	Unit	Notes/description	Source	Link
Hot-water cylinder	£2,190.00	£	For houses where this is not already present. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Larger radiators	£270.00	£	Where radiators are already present. Cost per radiator, includes labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Thermal store	£1,760.00	£	Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Underfloor heating (flat)	£5,480.00	£	Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Underfloor heating (detached house)	£12,600.00	£	Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Instantaneous electric	£350.00	£	For flats which do not have a hot water cylinder	BEIS, Cost-Optimal Domestic	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment

Technology / Measure	Value	Unit	Notes/description	Source	Link
water heaters			already). Costs include labour costs but exclude VAT.	Electrification (CODE)	_data/file/1018772/code-research-study.pdf
Whole new wet heating system (house)	£4,380.00	£	For houses where this is not already present. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Whole new wet heating system (flat)	£2,190.00	£	For flats where this is not already present. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf

Building Fabric Upgrades

Technology/ Measure	Value	Unit	Notes/description	Source	Link
Draught proofing cost	£400.00	£	Draught-stripping to achieve 0.5 ac/h. Fixed cost per dwelling (not variable with size). Includes labour but excludes VAT	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Top-up loft insulation cost (fixed component)	£175.00	£	Top-up insulation the summation of the fixed and variable component. Variable component is per unit roof area. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Top-up loft insulation cost (variable component)	£6.00	£/ m^2		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Flat roof insulation	£80.00	£/ m^2	Per m2 of roof area. Includes labour but excludes VAT	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf

Technology/ Measure	Value	Unit	Notes/description	Source	Link
Floor insulation	£3,835.00	£	Adjusted -20% to +40% based on floor area. Includes labour but excludes VAT	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Triple glazing	£320.00	£/ m²	Per m2 of window area. Includes labour but excludes VAT		
Internal wall insulation cost (fixed component)	£1,800.00	£	Internal wall insulation the summation of the fixed and variable component. Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Internal wall insulation cost (variable component)	£90.00	£/ m²		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
External wall insulation cost (fixed component)	£4,490.00	£	External wall insulation the summation of the fixed and variable component. Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
External wall insulation cost (variable component)	£40.00	£/ m²		BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Top-up loft insulation cost (fixed component)	£175.00	£	Top-up insulation the summation of the fixed and variable	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf

Technology/ Measure	Value	Unit	Notes/description	Source	Link
Top-up loft insulation cost (variable component)	£6.00	£/ m²	component. Variable component is per unit roof area. Costs include labour costs but exclude VAT.	BEIS, Cost-Optimal Domestic Electrification (CODE)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018772/code-research-study.pdf
Cavity wall insulation cost (fixed component) (large flat)	£430.00	£	Cavity wall insulation the summation of the fixed and variable component. Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (variable component) (large flat)	£6.00	£/ m²		BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (fixed component) (bungalow)	£650.00	£	Cavity wall insulation the summation of the fixed and variable component. Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (variable component) (bungalow)	£6.00	£		BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (fixed component) (large mid-terrace)	£505.00	£	Cavity wall insulation the summation of the fixed and variable component. Variable component is	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost	£6.00	£		BEIS, Domestic cost assumptions - what	https://www.gov.uk/government/publications/domestic-

Technology/ Measure	Value	Unit	Notes/description	Source	Link
(variable component) (large mid-terrace)			per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	does it cost to retrofit homes?	cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (fixed component) (large semi-detached)	£660.00	£	Cavity wall insulation the summation of the fixed and variable component.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (variable component) (large semi-detached)	£6.00	£	Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (fixed component) (large detached)	£950.00	£	Cavity wall insulation the summation of the fixed and variable component.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes
Cavity wall insulation cost (variable component) (large detached)	£6.00	£	Variable component is per unit net wall area (total external wall area minus windows and doors). Costs include labour costs but exclude VAT.	BEIS, Domestic cost assumptions - what does it cost to retrofit homes?	https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes

Solar PV

Technology/ Measure	Value	Unit	Notes/description	Source	Link
Solar PV panels cost per kWp (0-4kWp)	£1,876.00	£/kWp	Wholesale costs, not retail cost paid by consumer. Cost includes the solar photovoltaic generation equipment, plus direct costs of fixing panels to roof/ground mount, any performance displays and connecting to electricity supply, including VAT but excluding (a) the cost of any extended warranty; and (b) the cost of any other materials, works or other items whatsoever (such as, but not limited to, any cost of general rewiring at a property or tracker systems).	BEIS, Solar photovoltaic (PV) cost data	https://www.gov.uk/government/statistics/solar-pv-cost-data
Inverter cost	£1,000.00	£		Assumed	

Batteries

Technology/Measure	Value	Unit	Notes/description	Source	Link
Li-ion battery cost 3-4kW	£3,410.00	£	Unknown if cost includes labour and associated fittings (wall mount, wiring etc)	Green Match	https://www.greenmatch.co.uk/blog/2018/07/solar-battery-storage-system-cost#how-much-do-solar-batteries-cost
Li-ion battery cost 4-7kW	£4,288.00	£	Unknown if cost includes labour and associated fittings (wall mount, wiring etc)	Green Match	https://www.greenmatch.co.uk/blog/2018/07/solar-battery-storage-system-cost#how-much-do-solar-batteries-cost
Li-ion battery cost 7-9kW	£5,185.00	£	Unknown if cost includes labour and associated fittings (wall mount, wiring etc)	Green Match	https://www.greenmatch.co.uk/blog/2018/07/solar-battery-storage-system-cost#how-much-do-solar-batteries-cost
Li-ion battery cost 9-13.5kW	£5,920.00	£	Unknown if cost includes labour and associated fittings (wall	Green Match	https://www.greenmatch.co.uk/blog/2018/07/solar-battery-storage-system-cost#how-much-do-solar-batteries-cost

Technology/Measure	Value	Unit	Notes/description	Source	Link
			mount, wiring etc)		
Battery installation cost	£1,000.00	£	Labour to install battery	Assumed	

15.6.2 Supply Chain Experiences Engagement Analysis

The purpose of the supply chain experience engagement was to understand the experiences of four different suppliers and what their insights of installing eco measures are in the current market. It was also to gauge their interest in future collaboration/partnership for Phase 2 of the project.

Methodology

NEF reached out to suppliers in 3 key areas of interest to the project: Heat Pump installation, solar Photovoltaic (PV) & battery storage installation, and retrofit. A brief overview of the project's aim and objectives were provided to the lead contacts at each supplier. 1:1 interviews were arranged with engaged suppliers.

The suppliers interviewed included:

- Supplier 1: Prosumer System Installer
- Supplier 2: Solar Systems Installer
- Supplier 3: Heat Pump Installer
- Supplier 4: Prosumer System and Retrofit Installer

Prior to the interview, the insight interview questions (split into four sections) were written and a review was conducted by project partners. At the start of each interview, we provided detailed insight into the project and how engagement with suppliers fits in with the various work packages, in addition to the possibility of being awarded funding for Phase 2 of the project. During the interview, one interviewer led the session and asked questions and a second interviewer transcribed.

15.6.3 Acronyms

ASHP – Air Source Heat Pump

GSHP – Ground Source Heat Pump

WSHP – Water Source Heat Pump

RHI – Renewable Heat Incentive

IWI – Internal Wall Insulation

EWI – External Wall Insulation

WHRP – Whole House Retrofit Plan

DNO - Distribution network operator

BUS – Boiler Upgrade Scheme

Supply Chain Experiences Analysis

Contextual Supplier Information

This section provides contextual information for each of the suppliers interviewed. Table 1 provides a summary of this information. All suppliers expressed an interest in being engaged in future stages of the project.

Supplier	Service Offering	Location	Domestic HP Installations Per Annum	Customer Journey Inclusions
1	ASHP and GSHP installation Solar PV and Battery installation	South West England (Surrey)	50-60 ASHP 20-30 Solar PV	Detailed Planning, Commissioning & Installation QA & aftercare
2	Solar PV and Battery installation Solar Thermal Panels EV charging	South West England (Oxford & Wales)	Couple of hundred (100-150)	Detailed Planning, Commissioning & Installation QA & aftercare
3	ASHP installation	South West England (Basingstoke)	100-120	Detailed Planning, Commissioning & Installation QA & Aftercare
4	ASHP installation Solar PV and Battery installation Fabric insulation measures	Watford	52 (based on 1 installation per week) 52 (based on 1 installation per week) 312 (based on doing 5-7 per week)	Detailed Planning, Commissioning & Installation QA

Table 6: Contextual information of the suppliers interviewed

Service Offering: The types of energy efficiency service offerings provided by the suppliers vary depending on their specialism. Supplier 3's installations consist of 100% ASHP installations, whereas 30% of Supplier 1's heat pump installations are air source, and 50-60% are ground and water source. They do not offer any air-to-air heat pump installations. Supplier 3 stopped doing ground source installations after the RHI ended. Suppliers 1, 2 and 4 offer solar PV and battery installation, and Supplier 2 also provides EV charging that works with both PV and batteries and solar thermal panel

installation. Supplier 4 offer ASHP installations as well as all types of fabric insulation measures, including internal wall, external wall, cavity wall, rooms in roof and loft.

In relation to performance monitoring and evaluation of these suppliers' installations, all but one provides ongoing maintenance and servicing to their customers. Periodical checks are done to ensure the customer is happy with the installation. One supplier does not provide this service, however, guides the customer towards the manufacturer if it is needed. This supplier also said that with demand having increased for energy efficiency measures, the manufacturers are starting to gear up towards onward servicing and maintenance.

Company Size & Location: All four of the suppliers we interviewed were of small to medium size, with Supplier 4 having the largest number of employees (100), due to the fact they install all types of energy efficiency measures. The geographical locations of Supplier 1 and Supplier 3 are in the South-West, with Supplier 3 having two main offices in Oxford and Wales. Supplier 4 is located in Watford and carry out work in the surrounding area. We have found that all four suppliers mainly keep their work in-house, except for some work such as scaffolding and some electrical work (for solar panels) and specialised items, such as asbestos and chimney removal. All suppliers keep heat pump installation in-house.

Domestic Installations: Suppliers 2 and Supplier 3 carry out the greatest number of domestic installations across technologies per annum – averaging between 100-120. With Supplier 2's installations, they stated that "80% of PV installation jobs have batteries installed with them at the same time".

Supplier 4 on average do 1 solar PV installation per week and said installation of ASHP is more "sporadic." Supplier 1 does 50 or 60 ASHP installations per year, 20 or 30 solar PV installations and are looking to ramp up air to air heat pump installations in the coming year.

Customer Demographics & House Types

The results from customer age group categories are interesting. Suppliers 1, 2 and 3 stated that the primary age groups they deal with are those 41-60 and 61+, but Supplier 4 stated that the hardest customers they find to engage with for heat pump installations are those in retirement age as they do not want to change technology and do not see why they should replace a gas boiler that has been reliable for 10-20 years. This links directly to an insight from Supplier 4 which informed us that they usually deal with two types of customers – those who are fully informed on heat pumps and understand low temperature heating, and those who are against heat pumps and do not understand low temperature heating nor the fact heat pumps are left on constantly compared to gas boilers where they are turned off and on periodically. It seems that the first three suppliers are dealing with customers who are fully informed but do fall into the older age groups, whereas Supplier 4 customers are of a younger demographic. All suppliers stated that those under 40 are still interested in heat pump and solar PV but are drawn to it more for the technological side and the connection to apps and performance monitoring.

All suppliers predominantly carry out work in the private sector, focusing on detached properties with 3 or more bedrooms. Supplier 4 found that those living in smaller homes with fewer bedrooms are immediately put off the prospect of having a heat pump installed due to the fact if there is no space for the hot water cylinder. However, semi-detached and terraced houses with 3 bedrooms or

less are common EWI installations according to Supplier 4. These insights link to the heat pump barrier survey findings (see User Evidence Summary Report), as the majority of respondents had 3+ bedrooms are lived in detached homes. This helps focus where heat pump installation will be most successful for this project. Suppliers 1 and 2 have carried successful installations across all home age ranges; Supplier 4 finds that older homes have more successful EWI installations and find they install heat pumps in homes built in the 1970s and 1980s most often.

It was interesting to hear the varying responses from the suppliers about whether they have needed to reject any homes from beyond initial investigation and how common this is for eco measure installations. Supplier 1 stated this was only done for customers wanting to have an ASHP installed on a high-rise flat. They said that flats are hardest to treat for standalone solutions. Suppliers 3 and 4 mentioned that in general older properties may not be found to be suitable for installation with Supplier 4 going on to say that they also refuse heat pump installations where the customer wants it mounted on a high gable wall due to the fact the vibrations through the wall cannot be stopped and if the customer complains about this, the issue cannot be resolved. Furthermore, Supplier 4 has found people who have had a kitchen extension done with bifold doors have reduced the amount of space available for a heat pump due to the units being too close to other property boundaries and going over the requirements. Supplier 2 stated they rarely reject homes for solar PV because of the technology, and also said they are now putting panels on north facing roofs because it helps with the generation of electricity and use optimised systems to mitigate against shading issues. This was a surprise to learn but in the context of the energy crisis and the huge increase in demand for solar panels, it does make sense that this supplier, and possibly others, are doing things to allow more homes to install solar panels.

Key Outcomes:

- Age 40+ and those with existing heat pump knowledge are key demographics to target
- When targeting younger groups there should be an emphasis on connection to apps/performance monitoring
- Those living in detached properties with 3 or more bedrooms are more likely to invest in heat pumps
- Householders living in flats should not be targeted
- The age of the home may not generally correlate with heat pump installation success

Customer Motivations & Retention

The two main motivations amongst the suppliers' customers to install a heat pump or solar PV system are reducing running costs/saving on energy bills, and becoming more self-sufficient and more energy secure as a household. Many customers prefer schemes that are subsidy-driven (according to suppliers 3 and 4). According to Supplier 4, they expect to see many more off-gas properties to install heat pumps using funding from HUG and ECO4. This is a positive insight to gain as it means the 40% BEIS-funded subsidy offered by this project could be used to motivate Bicester residents successfully. The top motivator for solar PV installation according to Supplier 2 is self-sufficiency and not relying on the grid. This also supports the importance of developing the prosumer model within this project.

Climate change and environmental motivations were less prevalent than cost savings motivations. For suppliers 1 and 2, climate change/environment was third and fifth on the order of motivations.

Supplier 3 listed climate change as being second behind subsidies. Supplier 4 didn't mention environmental motivations explicitly in their answer.

All suppliers said that their customers are looking to combine additional retrofit improvements to their home when they are having a heat pump installed. It is encouraging that solar PV, battery and EV charging were the most common technology type people were looking to have according to all four suppliers. Supplier 1 said that 70% of its customers are doing more than one measure, and it was interesting to heat from Supplier 4 which measures are less common to pair up – EWI and heat pump installations is a large outlay, as are installing both these measures on their own. The responses to whether the suppliers' customers are actively moving towards a Prosumer model revealed that the majority of customers have done their research about renewable technologies and so want to install solar PV and also batteries. This is also because customers are worried about long term energy security and so are looking to future proofing their homes. These responses imply that customers could be receptive to a Prosumer model. In contrast to this receptiveness, the number of customers the suppliers have dealt with that have had a WHRP is very few or are not aware of this in the first instance.

It is encouraging that the drop out rate of customers is very low across all suppliers. Usually, the customer already knows what they are signing up for meaning that Supplier 1 has a 90% acceptance rate once a quote is written to the customer, Supplier 2 said that 5% of customers do not go ahead and the reason for this is down to a change in personal circumstance such as redundancy rather than a change of heart about the technology. Supplier 4 said around 60% of their customers go ahead with heat pump installation, with the note that some customers do not realise the raw cost of a heat pump, which is why they drop out. All four suppliers cited cost is the most common reason cited for customer drop outs, with Supplier 1 saying it is occasionally being related to DNO upgrades.

Again, all suppliers had high customer satisfaction levels, which is promising to hear as their satisfaction rates and successful case studies can be used to spread a positive message about heat pumps, solar panels and fabric insulation installations. Supplier 4 highlighted where there is a situation of a customer being dissatisfied, it is down to user knowledge of heat pumps settings. For example, a customer has tampered with the controls and does not know what has gone wrong – this tends to be more with those in the older demographic.

Key Outcomes:

- Marketing strategy and collateral should focus on reducing costs/saving on energy bills and becoming more self-sufficient/energy secure
- The project team should expect traction when marketing the 40% BEIS funding
- Prosumer model is likely to increase uptake of heat pumps compared to offering heat pumps alone
- The One Stop Shop must offer retrofit measures in addition to the prosumer system components
- Customer attrition rate at detailed planning stage can be minimised by being upfront regarding costs early in the process
- Energy crisis and potential recession is likely to increase customer attrition rate
- Aftercare is vital to ensure customers understand how to optimise the system and avoid bad word-of-mouth experiences for heat pumps

Prevailing Market Conditions and Supply Chain

All suppliers are facing significantly higher levels of demand for heat pumps and solar PV installations. As an example, around a year ago, supplier 4 previously conducted one PV installation per day, it is now six. Demand for EWI has increased by 30-40% and all other suppliers had a 100% increase in heat pump demand.

In terms of the suppliers' capacity for accepting more heat pump and solar PV referrals, two stated that finding good installers is proving to be a challenge (supplier 4 outsources roofing and solar PV to a subcontractor). Suppliers 3 and 4 are currently conducting training with engineers to provide competence in heat pump installation, with Supplier 3 doing this in partnership with a local college. However, training is time consuming and while growth of the team is important, the suppliers want to maintain the same high levels of quality and knowledge across all staff. This point was emphasised by Supplier 2, who also stated there are hardly any PV installer courses anywhere nowadays, so it is a struggle to find somewhere nearby for clients. Supplier 1 said that they hire to meet demand and so can control internal delivery resource, a benefit of not relying on subcontractors.

Supplier 2 also spoke about their development of a franchise model, which could be rolled out more widely in order to scale up and increase uptake of solar PV systems. The premise of the franchise model is being demonstrated in a Welsh town currently and Supplier 2 are in the process of purchasing a shop in this area where members of the public can find out about the technology, have a consultation, and generate a proposal with an expert about the kind of system their home would suit. This shop would also have a show room meaning people can see how the different aspects of solar PV systems, batteries, and EV charging work.

A unanimous response was given by all suppliers when asked how easy it is to recruit good installers as staff. All stated it is a challenge, driven by a range of different factors including: there being a premium on salaries currently, other competitors offering a higher salary (which makes retention also a challenge), and finding people with the right attitude and ability. Supplier 4 said it is hard to find a good mix of staff and they have found those who are older, are less likely to change their attitudes about gas heating systems and are less receptive to retaining in low carbon technologies. However, Suppliers 1 and 4 stated they have a good network of recruiters to help and the ties with Daikin and Fujitsu do help to find competent installers. As well as finding competent heat pump installers, Suppliers 1 and 2 are struggling to recruit design teams due to them being in short supply; this had led to Supplier 2 outsourcing this work to a team in Mumbai. By contrast, Supplier 4 said finding designers was the easiest thing for them at the moment, as many engineering graduates want to be in the renewables sector.

The lead times for installation are dictated by the delivery of major components. All suppliers said it has increased from around 4-6 weeks to 2-3 months, with the suppliers stating they are now going directly to the manufacturer now. Supplier 4 said that because of the various models of heat pumps, it is difficult to obtain large quantities of heat pumps at the same time. For lead times of enquiry to installation, Supplier 3 says it us volatile, but an average is 3 months. For Supplier 2 it is 10-12 weeks due to the time it takes to get connection approval from the DNO, for Supplier 1 it is around 6 weeks, and for Supplier 4 it is around 3-4 weeks. Some of the suppliers are having to turn work away or refer

on to a partner. This is only if the customer is too far away or if the supplier knows the technology won't work.

All suppliers said it is not a challenge to secure work compared to 12 months ago because interest levels and demand are so high. All suppliers are open and honest about the lead times, so they do have the capacity to take on work, but they make the customer aware that thorough designs take time. It was interesting to hear that not all customers pursue the BUS grant, Supplier 1 said it is a headache for lots of customers and said around 75% of their customers think about BUS at some point and 25% are uninterested in it. Supplier 1's opinion of BUS is that it is not well organised – their first application came through to them 3 months after the consumer applied. However, Suppliers 3 and 4 said that their customers are always wanting to know if they can get some discount, but it is not always specific to BUS. However, in the suppliers' minds, they do not feel that the level of BUS funding is enough and do not see it as a market driver, especially with the scheme having replaced the RHI. The project will need ensure that the funding offered to Oxfordshire residents is worthwhile and enough to drive the market.

Key Outcomes:

- Customer demand for heat pumps and solar PV is increasing
- Availability and skill of installers presents a risk to the project and installation lead times
- There is a need for simplified access to funding

Barriers to Widespread Adoption

We asked the suppliers what they see as the three biggest barriers to large scale deployment of heat pumps and solar PV. A key issue raised by Suppliers 1 and 2 is the supply chain crisis and the availability of the product, in particular batteries. Supplier 1 expressed how heat pumps are not manufactured in the same volume as boilers are, and that components and raw materials are hard to resource because the supply chain is comparatively immature.

A skills and knowledge gap was raised by Suppliers 3 and 4, particularly with regards to it hindering correct design. Supplier 4 surmised this issue perfectly by stating "unknowledgeable installs will damage the sector as a whole." This is key, particularly as the discreet lobbying against heat pumps continues to permeate through the sector. Ultimately, the renewables narrative needs to be stronger than the fossil fuel one if we are to have success in deploying heat pumps en masse.

Another barrier that Supplier 1 raised, which is important to this project is customer awareness of heat pumps and their suitability. The market needs good intelligence for it to grow but sadly the general UK household consumer does not know what a heat pump is and believes they are excluded from the narrative about renewables in comparison to solar and wind power generation.

Key Outcomes:

- Supply chain crisis and availability of the product technologies are likely to affect the project's deployment speeds
- Requirement to involve multiple suppliers in Phase 2 to ensure demand can be met
- Phase 2 will benefit from a targeted marketing approach that educates the householders on heat pump technologies and their benefits

15.6.4 Concluding Recommendations

The key recommendations have been collated below.

Customer Demographics & House Types:

- Age 40+ and those with existing heat pump knowledge are key demographics to target
- When targeting younger groups there should be an emphasis on connection to apps/performance monitoring
- Those living in detached properties with 3 or more bedrooms are more likely to invest in heat pumps
- Householders living in flats should not be targeted
- The age of the home may not generally correlate with heat pump installation success

Customer Motivations & Retention:

- Marketing strategy and collateral should focus on reducing costs/saving on energy bills and becoming more self-sufficient/energy secure
- The project team should expect traction when marketing the 40% BEIS funding
- Prosumer model is likely to increase uptake of heat pumps compared to offering heat pumps alone
- The One Stop Shop must offer retrofit measures in addition to the prosumer system components
- Customer attrition rate at detailed planning stage can be minimised by being upfront regarding costs early in the process
- Energy crisis and potential recession is likely to increase customer attrition rate
- Aftercare is vital to ensure customers understand how to optimise the system and avoid bad word-of-mouth experiences for heat pumps

Prevailing Marketing Conditions:

- Customer demand for heat pumps and solar PV is increasing
- Availability and skill of installers presents a risk to the project and installation lead times
- There is a need for simplified access to funding

Barriers to Widespread Adoption

- Supply chain crisis and availability of the product technologies are likely to affect the project's deployment speeds
- Requirement to involve multiple suppliers in Phase 2 to ensure demand can be met
- Phase 2 will benefit from a targeted marketing approach that educates the householders on heat pump technologies and their benefits

15.7 Supply Chain Support Strategy Summary (Authored by City Science)

The core theme of this project is to identify and alleviate as many barriers as possible, to ensure heat pump deployment can occur smoothly and efficiently. One of the most significant barriers identified is the juvenile state of the supply chain.

This report examines the key barriers identified during our supply chain engagement activities, and seeks to identify mitigations (via support mechanisms) to elevate these barriers where possible.

15.7.1 Barriers and supply chain support mitigations

Barrier	Description	Unmitigated Impact (1 = low, 5 = high)	Supply chain support mitigations	Mitigated Impact (1 = low, 5 = high)
Demand outstripping supply	Customer demand for heat pumps, building fabric upgrades, and PV are increasing. As this is a growing market, demand is currently outstripping supply in certain areas. Due to this increased demand, the availability of suitably skilled/experienced installers is low. The impact of this is increased cost and longer lead times.	**4**	One way of ensuring supply matches demand, is by providing installers, and the wider supply chain, with certainty over the quantity and timing of demand. Due to the quantitative data held on target areas, and the known density requirements and stage gates for Phase 2, the quantity and timing of installs can be predicted with greater certainty that if installers were selling to single households in a broader area. By providing installers with this certainty, they are able to invest in scaling up their operations with reduced commercial risk. Beyond Phase 2, this approach is repeatable by continuing to target hyper-local areas, and grouping/managing installations to ensure the supply chain has greater predictability over future demand.	**2**
Slow & Complex funding mechanisms	Current mechanisms for funding (grant and/or debt finance) are complex and slow. This is primarily due to current funding mechanisms not being designed with the sector in mind, and therefore often being unsuitable.	**3**	As part of Phase 1, we have engaged with a broad spectrum of funders to identify opportunities to modify existing lending mechanisms to provide tailor-made financing products for the sector. As part of Phase 2, we propose imbedding these	**1**

			financial options into the One-Stop-Shop to effectively connect funders with household requiring finance. In doing so, this will significantly reduce the (perceived) complexity of taking out additional borrowing and also reduce the application time.	
Difficulty in sourcing components	Sourcing components (particularly batteries) is challenging, resulting in increased costs and longer lead times.	3	Similar to the mitigation outlined for managing supply/demand inefficiencies, by providing predictability over the quantity and timing of demand, lead times can be built into and accommodated. Through grouping installations into 'batches', our approach also has the opportunity to engage directly with technology/component suppliers as it increases buying power. Through discussions with heat pump manufacturers, we have identified an opportunity to purchase heat pumps directly from a single manufacturer (Daikin). In doing so, this has two key benefits: 1. The cost to consumer is reduced through eliminating installer margins and achieving greater quantity discounts. 2. Reduces the burden on installers having to source heat pumps and therefore they can focus on installation. We propose similar relationships are developed during the mobilisation of Phase 2 with other key technologies/components, including solar panels, batteries, and insulation.	1

Low quality installation damaging technology reputation	Negative customer experience from poorly installed heat pumps can significantly damage reputation and lead to reduced uptake.	4	Effective quality assurance procedures will be built into both the procurement stages and post installation checks of our Phase 2 approach. This will ensure installers are suitably qualified and experienced. By only accepting installers that have industry recognised qualifications, this will inform the sector of the need to invest in appropriate training and development. In doing so, we aim to encourage all installers to raise quality levels in order to access lucrative, high value contracts. Through discussions with the local and district authority, we have identified opportunities to signpost companies to suitable training providers in the area, to allow them to mee the qualification requirements. Through encouraging the enhancement of quality, we aim to increase credibility within the sector, which will ultimately lead to faster uptake, and potentially increased pay for skilled staff. Despite these activities, residual risk will remain through 'bad experience' stories from other areas of the UK (and abroad) which are currently outside of the scope of influence for Phase 2. However, if the approach is deployed nationally beyond Phase 2, then the scope of influence will filter throughout the UK and have greater impact on overall quality within the sector.	2
Lack of skill in identifying suitable properties	Many heat pump installers are diversifying into the sector from parallel sectors (gas/heating engineers, air conditioning engineers). Whilst they are often suitably qualified to install equipment, they are not always suitably	4	Our proposed approach incorporates a two phase survey. The first will be an online suitability tool which will combine publicly available data, with consumer provided information, to determine the potential suitability of the property in a fast and	1

	qualified/experienced in identifying which properties are/aren't suitable.		cost effective way. For those properties that are determined to be potentially suitable, an in person survey will be offered to accurately determine the suitability, as well as confirm the specific package of retrofit measures which best suit the property and its occupants. By incorporating these surveys into the customer acquisition stages of the approach, installers are not required to asses/advise on suitability and can focus on installation. This will increase their capacity for installations, as well as reduce their risk of miss-identifying suitable properties.	
Lack of 'full scope' installers	There are a limited number of 'full scope' installers who can provide heat pumps, fabric retrofit, PV and battery installations. This increases the disruption to householders through needing to co-ordinate multiple suppliers.	3	As the market develops from a transitional market (i.e. the slow transition from gas, to electric heating systems), to a more developed, stable market, we expect there to be an increase in the number of companies which are able to offer a 'full scope' offering. However, as this is currently rare, our One-Stop-Shop approach effectively creates this 'full scope' offering through actively managing the supply chain on behalf of the consumer. Through the delivery of this service, we aim to stimulate uptake trough reducing disruption, which will ultimately result in the sector maturing quicker.	1
Reliance on government policy	The deployment of heat pumps at scale is being driven by government policy, through the phasing out of fossil fuelled boilers and the recommendation of heat pumps as a decarbonising solution. As the market is heavily reliant on these policies (rather than organic consumer demand), there is a heightened risk that a change of policy and/or government could significantly reduce the market. This risk	3	To avoid overreliance on government policy, it is important to educate consumers on the benefits of heat pumps so that the decision to purchase is based on desire, rather than necessity. Central to our One-Stop-Shop approach is the delivery of reliable, trusted information on the operational, environmental, and economic advantages of heat pumps and the associated	2

	contributes to the reluctance of some companies heavily investing in the sector.		retrofit measures. Our aim is to use this information sharing to stimulate customer desire to install a heat pump, regardless of government policy. Through achieving this, the supply chain will obtain greater certainty over the growth of the sector, resulting in lower risk investment.	

15.7.2 Conclusion

As detailed above, we have identified a number of practical supply chain support mitigations for the key supply chain barriers identified during our engagement with companies operating in the sector. These mitigations have been discussed during interviews with companies operating both in the local area and nationally, who have validated that they would have a positive impact on the sector.