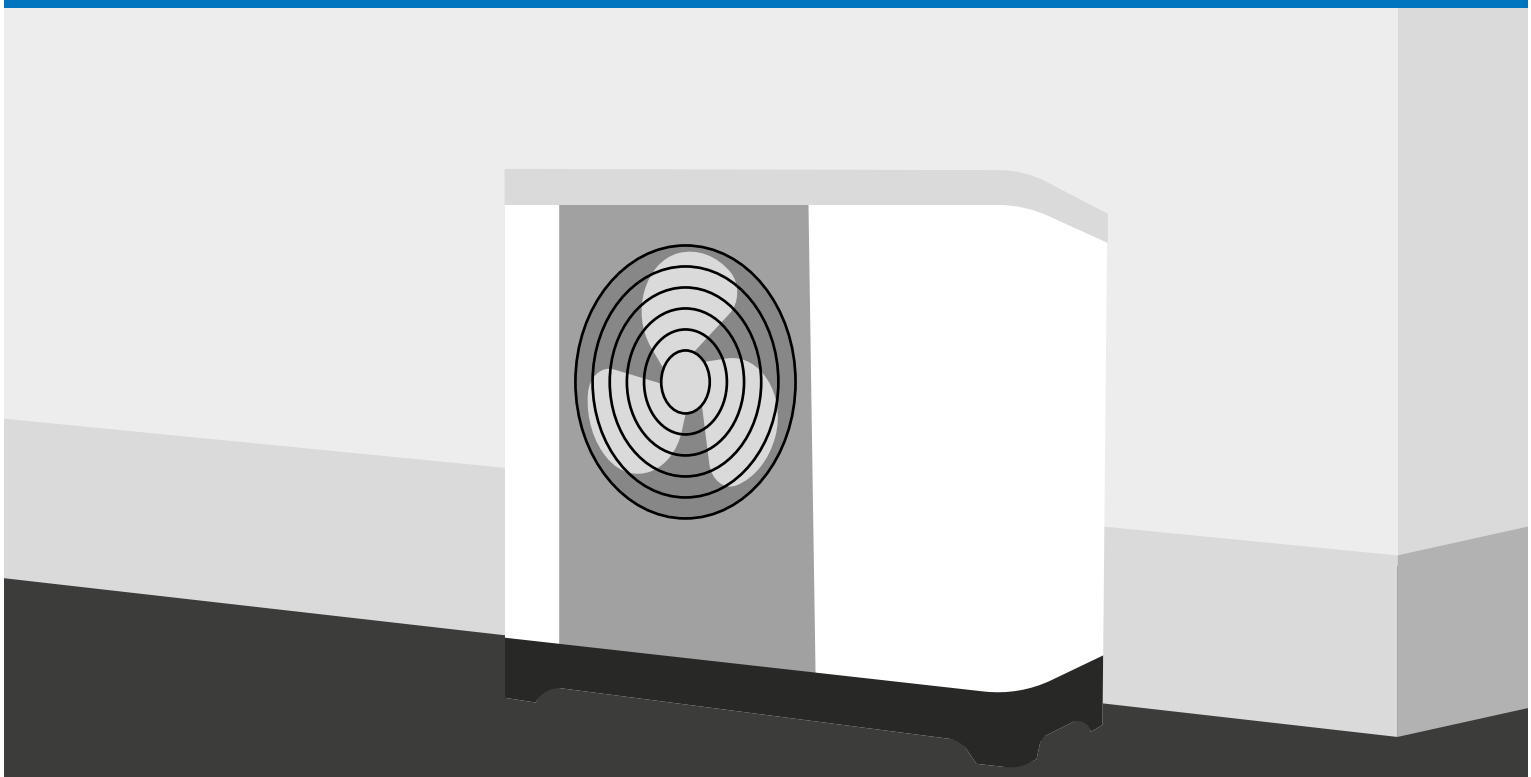
utilita home

Heat Pump Ready Programme

Stream 1, Phase 1: A Feasibility Study of Solutions for High-Density Heat Pump Deployment



November 2022

Executive Summary

The high-density deployment of domestic heat pumps is integral to the UK meeting its legally binding commitment to achieve net zero carbon by 2050[1,2]. For Phase 1 of the Heat Pump Ready (HPR) Programme Utilita were awarded funding of £192,860 to produce a feasibility study which aims to outline Utilita's solution for the delivery of high-density heat pump deployments in Sunderland. This study investigates the feasibility of Utilita's customer centric, whole-market solution to facilitate the high-density deployment of domestic heat pumps in Sunderland. This study will explore the innovative methodology proposed by Utilita to deliver domestic heat pumps fully in-house.

The study investigated the existing heat pump market and compared current customer costs of installing and operating a heat pump for twenty years vs a gas boiler. This was selected as market research and customer surveys demonstrated that gas boilers were the most common and currently affordable heating solution. The study proposes a set of innovations that Utilita will implement into a new customer journey as part of the Heat Pump Ready programme (HPR), with a resulting target lifetime cost to the consumer.

Combining these innovations with the funding from the HPR programme, has enabled Utilita to offer customers a heat pump, saving £4,503.74 over a twenty-year period when compared to heating a home with a gas boiler based on current energy prices.

There is a near 200% decrease in the difference between the lifetime costs of a heat pump compared to a gas boiler, making heat pumps the cheaper domestic heating option.

This significant cost reduction paired with an improved customer experience contributes to Utilita's proposition that installing heat pumps at high-density is feasible. Utilita is able to offer an attractive solution to a new market; customers who do not qualify for existing public sector funding for the application of heat pumps in the home, but also cannot afford the current costs of a heat pump.

Our feasibility study has shown that the key barriers to uptake can be overcome by using our methodology of an in-house delivery mechanism and as such, Utilita intend on applying for further funding for Phase 2, the mobilisation and deployment phase of the Heat Pump Ready Programme. For Phase 2 of the HPR and future developments, we plan to use the size and scale of our purchasing arrangements and internal delivery process to pass on significant upfront savings to the consumer. Utilita will manage the entire process for the customer working closely with the LA and DNO. Throughout Phase 2 and beyond, Utilita will take responsibility for all MCS compliance giving customers taking part in the move to a greener future, a simplified, stress free and fully supported journey to carbon free heating.

Introduction

This project forms part of the BEIS Heat Pump Ready (HPR) Programme, which sits within the Net Zero Innovation Portfolio (NZIP). NZIP aims to accelerate the commercialisation of innovative clean energy technologies.

Using the Small Business Research Initiative (SBRI) Utilita were awarded funding of £192.860 for Phase 1 of the Heat Pump Ready Programme to produce this feasibility study which aims to outline Utilita's solution for the delivery of high-density heat pump deployments. Heat pumps are a key solution for decarbonising homes and will therefore be critical for meeting the UK's legally binding commitment to achieve net zero by 2050.

The overarching goal of the HPR Programme is to create an enabling environment for heat pump deployment at an increased density and scale than the current deployment level.

High upfront costs are often a barrier to the deployment of heat pumps at high-density. A large part of the upfront costs associated with a heat pump install are down to the additional margin that is charged between different steps of the supply chain and getting the home to a heat pump ready status. To date, this may have remained high due to a lack of scale and the ability to coordinate across the supply chain.

Utilita are in a unique position where a lot of the supply chain can be centralised and provided 'in-house.' Through the internalisation of the full installation process (recruitment through to commissioning), and the ability to bulk purchase heat pumps, Utilita believe the margin can be substantially reduced. Coupling this with Utilita's established customer communications and outreach, which can be used to inform and help customers to access heat pump subsidy schemes, Utilita aim to provide the installation of heat pumps at a competitive market price.

This study summarises the research Utilita has undertaken to understand the feasibility of bringing this offering to market. The primary aims are to understand whether Utilita can:

- ✔ Provide a customer offering that enables households, who are not currently eligible for public funding, but otherwise would not be able to afford a heat pump, to benefit from the low carbon heating technology.
- ✔ Deliver this offering in a geography with enough of these types of households to deploy the heat pumps on mass, satisfying the requirements set out in the HPR Programme for Stream 1, Phase 1, Category B[3].

The first step was to identify a location within Sunderland that would be deemed feasible for the deployment of heat pumps at high density (Ward 011QS E05001157 Fulwell Sunderland)[4]. Stakeholders who would add value to the project were mobilised (see Figure 1) and the project scope and milestones agreed. The stakeholders selected for this feasibility study consisted of Utilita, Gemserv, Sunderland City Council and Northern Powergrid. Project aims, roles and responsibilities were then set (see Table 1), with associated costs (see Table 2). The local area was evaluated to ensure that customers would be targeted with relevant information and the local electricity grid impacts were understood. Market research was completed to understand the current challenges customers face. From which, the existing cost to consumer of obtaining and operating a heat pump were derived.

Bringing this information together allowed the project team to develop a set of innovative efficiencies encompassing the whole customer journey, which are set out in the Proposal section.

These innovations were designed to bring the cost to consumer to a level that would meet the aims of the project, enabling households who cannot access existing public funding, but otherwise would not be able to afford heat pumps, to access the technology.

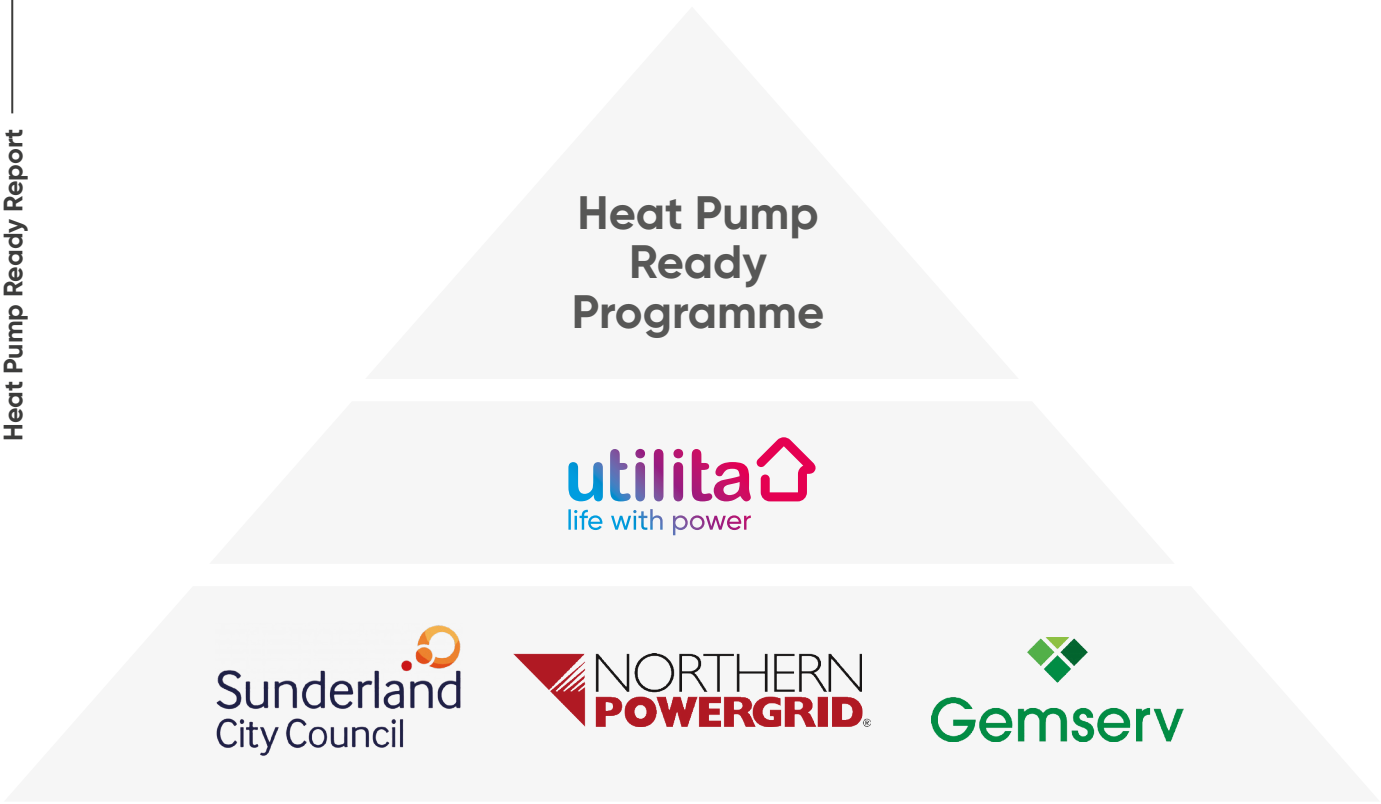


Figure 1: stakeholders' diagram.

Stakeholder	Organisation Description	Website	Responsibility
Utilita (Lead Organisation)	SIC (Standard Industrial Classification): 35140 Energy retailer	utilita.co.uk	Lead Organisation: responsible for delivering the completed feasibility study
Sunderland City Council	Local authority	sunderland.gov.uk	Customer profiling/engagement and planning decisions
Northern Power Grid	SIC: 35130 Distribution of electricity	northernpowergrid.com	Reviewing impact to nominated substation and local electricity network
Gemserv	SIC: 70229 Management consultancy	gemserv.com	Overarching project consultant and project management

Table 1: List of stakeholders and responsibilities.

Workstream	Work Packages	Output
Mobilisation	Project Management Consortium kick off	Assign roles and responsibilities, Consortium kick off meeting, Creation of project documentation, completion of NDA and DSA agreements, Maintain project documentation: Project plan, RAID, Decision log, Action Log, Reporting.
Deployment Strategy	Geographic Location Identification Local area network evaluation Report of qualifying properties	Evaluation of geographic data from Sunderland CC, Market research and tenure type comparisons, analysis of selected areas.
Consumer Funding Strategy	Consumer Funding evaluation	Determine funding options available within Sunderland, comparison of HP funding with eligibility, review of finance options.
Market Research	Project life cycle evaluation	Report of Utilita customers in Sunderland, Consumer Challenge matrix, collate case studies and previous scheme information, Market Research package, Market Research workshop, Consumer Questionnaire, Consumer profiling, Research of existing customer journey, Creation of Utilita customer journey, customer journey process map, process for lead gen, install, handover and aftercare research.
Proposal	Marketing proposal Consumer engagement strategy Supplier evaluation Engineer resourcing and logistics Upskill programme	Marketing surveys, replicability for wider marketing strategy, customer profiling, Consumer recruitment planning, Resourcing allocation, recruitment plan, upskill and training at training centre strategy, solutions for consumer challenge matrix, customer profile results, Utilita Marketing proposal with Sunderland CC, Supplier identification and engagement, Product comparison, offering comparison.

Method

In this section the 5 staged method used to obtain information necessary to complete this study is described in detail. Costs associated across the stages to complete this method total £192,860.

2.1 Stage 1: Project Mobilisation

The mobilisation phase of the project started with a full consortium kick-off meeting in person. This involved all members to ensure that they were aware of the project scope and milestones. The project team confirmed the project aims, agreed a communication plan which clearly outlined what information should be communicated, who should receive the information, when the information should be delivered and in what format. Work packages were confirmed and divided and allocated amongst the project team with the roles and responsibilities established.

The core project team would hold a daily stand up to ensure all work is interlinked while ensuring actions and decisions are being captured, a project plan was created, and key milestones were agreed, subsequently highlighted in a weekly milestone report and discussed in a bi-weekly project review. This project plan was maintained as a 'live' document and updated throughout the project as required. Gemserv provided support with project management, including maintaining project documentation consisting of the decision and action log, the continuous improvement log, and the RAID log.

2.2 Stage 2: Deployment strategy

A key factor in the deployment strategy was understanding where areas were which would be able to meet the target density for heat pump deployment in Sunderland. Our aim was to concentrate our efforts on targeting clusters of properties which share similar characteristics allowing us to standardize our offering which would primarily help to reduce costs by benefiting from bulk purchasing discounts from manufacturers. Sunderland City Council shared potential areas for regeneration along with the known funding streams available in each location, which were cross referenced with tenure type maps. [5] Target areas were then selected where a high percentage of properties where owner occupied and had a similar archetype characteristic; these characteristics include EPC efficiency rating, current heating system types, building fabric type, property ages and footprints.

From the initial search we were able to complete further desktop surveys to determine further property archetypes where there were minimal expected restrictions for permitted development, adequate space for an outdoor air source heat pump and adequate space for a domestic hot water cylinder and internal components. These target areas were then shared with Northern Powergrid, who were able to provide a high-level insight on the areas with information on the secondary substations which showed if grid reinforcement would be required in the target area. This information was subsequently used to make our decision to target Fulwell, aid our heat pump product selection and to design our targeted communication and heat pump offering. Our selected target area in Fulwell consists of a total of 1,056 properties, all of which are semi-detached with similar footprints and construction methods.

2.3 Stage 3: Consumer Funding Strategy

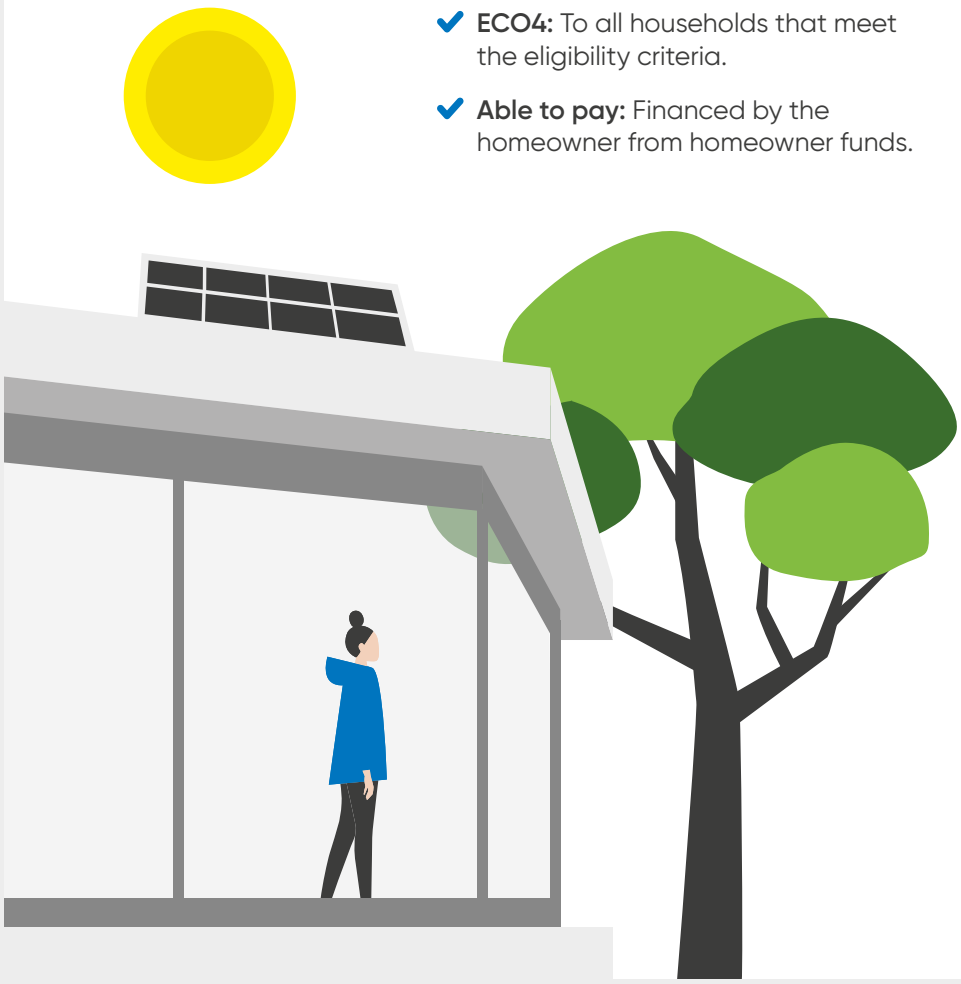
Stages 1-3 allowed different customer profiles to be identified, so that appropriate funding routes could be developed. The plan is for households to be primarily assessed for qualification of ECO4 funding, where a consumer has been identified as ECO eligible, they will be put through Utilita's existing ECO process and receive all recommended measures at no cost to the consumer. Our proposal aims to offer all customers an appropriate solution for a heat pump installation to ensure consumers living in fuel poverty also have the option of a renewable heating system in the transition to the electrification of heat. In these cases, properties where a heat pump is installed under ECO4 will be included in the Heat Pump Ready Programme which will help us to achieve the density requirements of the HPR, but no costs will be attributed to the programme. Where this is not applicable, an "able-to-pay" offering can be provided using the funding associated with the HPR financing.

Five different routes have been identified:

- ✔ **ECO4:** To all households that meet the eligibility criteria.
- ✔ **Able to pay:** Financed by the homeowner from homeowner funds.
- ✔ **Able to pay:** Financed by the homeowner through means of a fixed term finance package.
- ✔ **Private/Social Landlord:** ECO4 funding to all households that meet the eligibility criteria.
- ✔ **Private/Social Landlords:** Financed by the landlord from landlord funds.

2.4 Stage 4: Market Research

A customer-centric, whole-market review forms the main body of this study. This review adapts the PAS 2050 standard, using the product life cycle assessment (LCA)[6] framework and the information provided by the stakeholders and Utilita's own research to evaluate the challenges currently faced by customers pursuing installation of heat pumps. Each LCA stage is defined (Figure 2) and contains an evidence-based discussion on the challenges customers face. The operating environment this LCA sits within is also considered i.e., the supply chain and electricity grid.



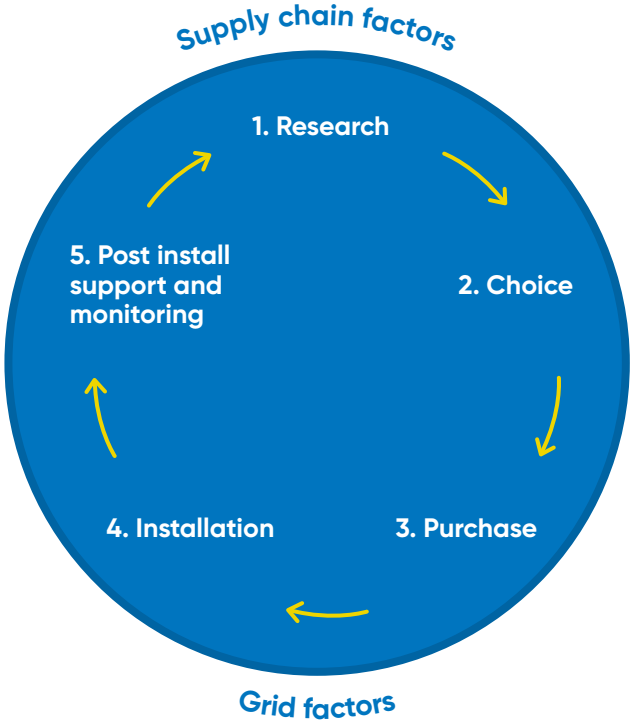


Figure 2: Customer LCA

This LCA accumulates into a cost-stack, consisting of capital expenditure (CAPEX) and operational expenditure (OPEX) which customers must pay for a heat pump, over a twenty-year technology lifetime. This is compared to the cost-stack of the most common domestic heating source, gas central heating[7]. This forms the baseline cost to the consumer.

2.5 Stage 5: Proposal

Having looked closely at the product LCA combined with the results of our market research, a better understanding of each stage was gained, and through a series of workshops, innovations were identified across the life cycle of the product to address several of the barriers for mass deployment of heat pumps. Utilita's innovative and cost-effective proposal to achieve high-density heat pump deployment in Sunderland is to provide a 'one stop shop' for the installation of a domestic heat pump. The entire offering to consumers and associated activities from lead generation through to aftercare will be completed 'in-house' by Utilita.

Through the means of bulk purchasing to in-house storage arrangement with manufacturers and suppliers we will be able to achieve significant discounts across our supply chain, resulting in lower costs to consumers. We have the capacity to store significant quantities of equipment and installation materials at our warehousing facility in Warrington, relieving logistical constraints and handling costs to both manufacturers and suppliers. Discussions with one heat pump manufacturer have led to an agreement of a 45% discount rate from list price on all products if purchased in this manner as opposed to a 21% discount rate on smaller or singular orders

Through a combination of bulk buying stock and providing all services inhouse, a cost to consumer for obtaining and operating a heat pump is set and compared to that of a gas boiler, which also highlighted areas for further innovation.

Current LCA

This section reviews the existing heat pump market. Through our market research we identified each stage of the customer LCA and have reviewed sequentially.

3.1 Research by Consumers

This is the first stage of a customer's journey to obtaining and operating a heat pump. At this stage, the customers primary objective is to understand more about what the process of replacing their heating system might look like. A customer is likely to start by reviewing what heating systems are available. As gas central heating accounted for 78% of domestic heating methods in the UK in 2022[7], it is reasonable to think a direct replacement would be preferable for customers. Compounding this, almost half of customers are not familiar with heat pumps and are not confident on how they work[8,9]. More broadly, only 5% of customers believe they "know a lot" about the broader concept of "renewable heating systems"[8].

A survey to a small sample of 50 engaged Utilita customers suggest these trends are prevalent in Sunderland[9]. Survey questions can be found in annex 2. Sunderland falls in the Northeast, which has the lowest gross disposable income per head[11] and the highest share of households receiving benefits of any region in the UK[12]. Low economic prosperity negatively impacts customer perception of accessibility of low carbon technologies such as a heat pump. Households which believe they have a low disposable income are five times less likely to be planning an investment in a low carbon technology in the next 12 months compared to households which believe they have a high level of disposable income[13]. For heat pumps specifically, this figure is near double[13].

The survey found that households in Sunderland estimated the cost of heat pump installation to be higher than that estimated by the general sample. Moreover, the survey sound that consumer generally have lack of understanding regarding the cost of a heat pump with most respondents suggesting that a heat pump was lower cost compared to the market rate. This presents a significant barrier to adoption as they progress through the decision making process.

Moreover, households in Sunderland had less awareness of heat pumps and are slightly less confident about their knowledge of heat pumps compared to the general sample, indicating a need to provide more information and education in the region regarding low carbon heating options.

Nevertheless, if a customer is aware of the technology, and believes heat pumps are an accessible domestic heating option, they will start to consider which heat pump could be right for them.

3.2 Choice

Once a customer's research leads them to deciding that a heat pump could be their preferred domestic heating solution, they have multiple considerations to choose the right supplier and type of system. Chief consideration among these is cost, especially for low-income households. The two next most significant factors are "finding a trustworthy installer" and "how easy the system is to control"[9].

However, these considerations, are predicated on where to source providers. Over half of this information comes from the internet and word of mouth, combined[8]. With these sources comes the opportunity for misinformation[14–16]. Similarly, common review websites, heat pump providers and/or manufacturers were not able to show results specifically for heat pumps[17].

Alongside these general review websites, are those specific to installers and engineers. Using platforms such as Check-a-Trade, Which? and Trust-a-trader to find engineers did not match results of using MCS accredited installers where only seven were identified through the MCS find a contractor map in Sunderland[18–21].

Finding a trusted source has implications on the second most significant consideration, "how easy the [heating] system is to control"[9]. This relates to research showing that few customers believe they know a lot about renewable energy heating systems[9]. Responsible heat pump providers can educate customers on how a heat pump works throughout the customer journey, simplifying the technical language of heating engineers and experts[22]. Having a trusted source that can provide clear education on how a heat pump works is evidentially important to customers.

Finding an appropriate provider and understanding how to operate the new heating system can be stressful for consumers. Most consumers think about investing in a new heating system only when their old one has broken[8]. Moreover, very few customers would consider replacing their existing heating system before the end of life of the new system[8] . Such 'distress purchasing' can drive consumers to make decisions without having considered all necessary elements. Our market research found that households in Sunderland were more likely to state that they would only consider a heat pump when their current heating system breaks compared to the general public.

Furthermore, simply replacing heating systems when they break or reach the end of their life, will not allow heat pump deployment at a rate high enough to deliver the net zero carbon target by 2050[23]. With the expected ban on the installation of gas boilers in new build properties from 2025[24] it is reasonable to think that spare parts and suitable engineers will become scarce, driving the maintenance costs associated with gas boilers higher, resulting in further distress for consumers. However, these elements come after customer's chief consideration of understanding the "upfront and ongoing costs"[9].

3.3 Purchase

A customer in the 'purchase' stage of their journey will have a preference to have a heat pump installed over alternative heating systems. The next stage is to further understand cost and gather quotes from a range of suppliers. There are further challenges associated with understanding the upfront and ongoing costs of running a heat pump.

Heat pump prices cover a wide range and are offered by a variety of sources (see tables 3 and 4). The variability of these prices can challenge the customer because the reasons why they differ is often not immediately apparent, particularly if the customer is not familiar with heat pump technology. Some of the language and assumptions can be technical, for example knowledge of the existing home heating system, including the heating source, type of emitters and storage. Further considerations at this stage include the differing inclusions and exclusions of quotations, and whether the offering comes with public funding or not. Further options are presented when considering the variety of ways a consumer can pay for a heat pump, as detailed in table 5, which covers both front loaded or financed offers. Further disparity is caused by multiple stakeholders adding margin at each LCA stage. It appears that the more vertically integrated or all-inclusive an offer is, the cheaper it is. This is demonstrable by comparing quotes from Octopus Energy with E.ON (next page).

3-bedroom Semi-detached	
Brand	**Cost inc. VAT**
Octopus Energy	£ 4,000 – BUS voucher included
British Gas	From £ 4,999 – BUS voucher included
E. ON	£16,207
eBay Samsung air source heat pump	£11,999
The Heat Pump Warehouse	£3,596 (ex. Vat, Unit only)
Check A Trade	£9,800
Which?	£10,000
Renewable Energy Hub	£11,000
Energy Saving Trust	£10,000

Table 3: summary of quotations obtained from desktop research. Source: [25–33]

House type	Benchmark cost to be used by Heat Pump Ready
Small flat	£5,000
Ground-floor flat	£6,500
Mid-floor flat	£10,500
Top-floor flat	£11,000
Bungalow	£11,000
Mid-terrace with cavity walls	£13,000
Mid-terrace with solid walls	£14,500
Compact semi-Detached	£15,000
End-terrace with cavity walls	£15,000
Semi-D with solid walls	£13,000
Detached with cavity walls	£14,500
Detached with solid walls	£13,000

Table 4: benchmark reference cost for HPR. Source[34]

60 months	48 months	36 months
9.9% APR	9.9% APR	9.9% APR
£136.46/month	£163.24/month	£208.13/month
Purchase amount £12,995.00	Purchase amount £12,995.00	Purchase amount £12,995.00
Deposit £6,497.49	Deposit £6,497.49	Deposit £6,497.49
Credit amount £6,497.51	Credit amount £6,497.51	Credit amount £6,497.51
Cost of credit £1,690.08	Cost of credit £1,337.91	Cost of credit £995.33
Total repayable amount £8,187.59	Total repayable amount £7,835.42	Total repayable amount £7,492.84

Table 5: summary of different ways to pay for a heat pump. Source[35]

3.4 Installation

During this study our desktop research of the housing stock in Sunderland revealed that central areas of Sunderland did not meet the archetype characteristics outlined in our deployment strategy. Large sections of the housing stock are terraced housing with limited room for air source heat pumps to be installed. The proximity of these households meant that trying to achieve the requirements of permitted development in relation to keeping each system under the 42db(A) sound pressure levels would have provided a near insurmountable challenge. On the suburban areas of Sunderland, the housing stock became larger, and a higher percentage of these household were semi-detached housing and detached housing. The larger footprints of these household and the larger footprints of the land the land they sat on provided more space for the installation of an air source unit and allowed for the unit to be distanced further from neighbouring buildings allowing for the systems to remain under the 42db(A) sound pressure levels at the nearest assessment point allowing these installations to fall under permitted development, increasing the probability of success for mass deployment along with the likelihood of an increase in uptake as it would provide a smother installation process for the homeowner. Another key deciding factor for establishing our target areas for the HPR scheme, included our expectations for there to be a suitable amount of space inside these properties for internal components such as; domestic hot water cylinders, and ancillary components. The expectation was that the larger the household and the inclusion of properties with adjoining garages would increase the probability of being able to successfully located adequate space for an air source heat pump installation.

Customers are often unfamiliar with heat pumps [8] and concerned about the installation day and the disruption it may cause them. Nationally, eight in ten households reportedly have been discouraged by high levels of disruption associated with installation.[36] With 58% of customers saying if a heat pump was easier to install than a gas boiler, this would positively influence their decision to choose a heat pump[36]. In our Sunderland Specific survey [9] 7% of homeowners answered "The length of the installation process" when asked to "please select your top three considerations you would have if you were to replace your heating system with a heat pump".

In Utilita's experience, unit size or outdoor area required, need for an indoor cylinder, gaining planning consent and DNO approval or potentially upgrades to pipework can make the installation more complex than that of a gas boiler. The duration of an installation is expected to be at least two days and during this period customers may experience limited access to hot water or heating in the property. However, research shows that even adding one week to the installation time has been shown not to significantly dissuade customers from having the intention to install a heat pump[37].

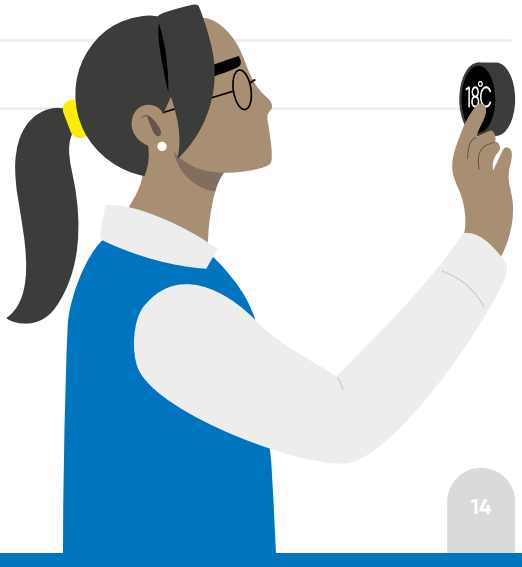
These barriers could be caused by having separate suppliers involved in the pre-home survey phase and the installation phase, resulting in fragmentation of information passed from one party to the next.

3.5 Post Install Support and Monitoring

Once the install is complete, there are a range of service packages available to maintain the optimal functionality of the heat pump. It was found that some installers will offer a period of free servicing after installation. While others, offer service plans for a monthly subscription. Historically, the service cost for a heat pump ranges between £150-£200 [38–40] per visit, which is currently greater than servicing a gas boiler, averaging £90 per visit[41–44]. Like boilers, heat pumps require an annual service to keep the manufacturer warranty valid. This can be an added responsibility for the buyer to organise and not arranged as part of the installation package. Currently, there are limited options for post-install support and monitoring services, especially from energy providers, as described in Table 6.

Brand	Service Package
Alto Energy	Service plan starting from £ 30.00 per month
EDF	N/A
Scottish Power	2 years free annual service as part of the installation package
British Gas	5-year warranty, plus central heating cover for the first year
E.ON	N/A
The Eco Experts	£175/year
Household Costs	£188/year
Tradesmen Costs	£188/year
Octopus	£108/year

Table 6: Service packages sourced online. Source [38–40, 45–51]



3.6 Operating Environment

The extent to which these challenges discussed in sections 3.1-3.5 occur, and some more novel challenges not yet discussed, depend on the operating environment of the supply chain and the local electricity grid. These factors have many indirect implications for customers.

3.6.1 Supply Chain Factors

The single largest supply chain factor that needs addressing is the availability of installers. From research conducted throughout the programme MCS indicates there are only seven qualified installers in Sunderland[21]. There is a national target of 600,000 heat pumps installed annually by 2028[52]. The current national capability is 100 times short of this[53,54].

In addition to the lack of installers available to meet customer demand, there is the issue of availability of stock. Utilita has experienced supply issues with a range of manufacturers for heat pumps and other heating products which results in longer lead times. Reasons for this have been indicated as a result of Brexit and the global pandemic.

Similarly, the availability of stock for ancillary equipment is of concern. Each home is different even if they were built to similar specifications. In Utilita's experience, each home could require a different set of parts and requirements, ranging from any combination of the below list. Part of the challenge around managing stock of heat pump units, and the below ancillary devices, is that current market players do not have the capacity to hold stock, resulting in a just-in-time supply chain model that leaves itself open to disruption[55].

List of ancillary equipment:

- ✔ Consumer board upgrades or additions
- ✔ Existing household emitters upgrades
- ✔ Additional pipe work for hot and cold feeds
- ✔ Additional pipe work for heating circuits
- ✔ Upsizing pipework on the heating circuits (if microbore and flow rates are not achievable)

3.6.2 Electricity Grid Factors

Currently, in Sunderland the electrical network will need reinforcing to satisfy the additional demand for electrical capacity that will stem from the future electrification of domestic heating system[56]. Reportedly, some basic changes are required to around a third of UK homes and local grids[57]. If not addressed at an early stage, these could significantly delay the customer journey and more than double the costs to the customer[57] (Table 8).

By using Northern Power Grid's auto design tool[67], Utilita were able to get an understanding of the impacts that the additional loading of heat pumps can cause on low voltage feeders on the local network. Northern Power Grid suggest that the additional loading on a low voltage network could lead to overheating and damage to supply cables before a voltage drop becomes an issue. Overheating of the low voltage feeders could lead to power cuts, damage to power lines and even an overloading of a secondary substation. These are the consequences of applying the connect and notify approach on large scale projects especially those with a high concentration of deployment. Our solution is to work closely with the Northern Power grid to inform them of upcoming marketing campaigns so they could allocate resources to the upcoming upgrade requirements that would be expected if mass deployment was to go ahead in a specific location.

3.7 Summary of Current LCA

From researching different domestic heating options through to the experience of install support and monitoring, customers encounter many challenges in the current heat pump market. These are outlined below in annex 3. During the initial research phase, the consumer faces a number of challenges including conflicting or biased information and a general lack of awareness. Most initial research is undertaken online however, Utilita's survey shows that 19% of respondents state that knowing friends/family who have installed a heat pump would improve their confidence about having a heat pump installed in their home, highlighting the benefit of local case studies yet few exist in the Sunderland area. Another 24% state that accessing unbiased information from a government website would improve their confidence. This finding reflects the BEIS study in 2020 that the most trusted source of advice would be non-government organisations and government advice services followed by a trades' person or professional[1].

It is important to note that the timing of a decision to replace a heating system is often triggered by a breakdown or renovation. This means that many purchases are deemed to be distress purchases and thus the lead in time required to research and review options is not available. This means that awareness of the options is needed before a trigger point is reached so that an informed decision can be made quickly. Without increased awareness, the majority of households will default to a like-for-like replacement.

If a consumer has made the decision to investigate heat pump technology, they will then need to approach a local heat pump installer to understand what would work for their property. However, finding a qualified installer locally can be challenging due to a limited availability of installers within the region. This means there is very little choice for the household in terms of a competent local installer base and therefore the advice provided could be biased if the installer base does not have the appropriate knowledge. In some cases, home efficiency upgrades may be needed which may involve additional advisors or retrofit assessors to provide guidance to the consumer.

There are a range of heat pump products on the market which can add complexity to the decision-making process and a need to consider these options in the context of consumer need and property characteristics. There is a lack of publicly available information on heat pump installation costs and the high costs can deter consumers from investing. The variation in quotations and online estimates can also cause confusion.

Once a heating system has been selected and installed, there is a need to ensure the installation is completed to a high standard. However, given the nascent market, the process is unfamiliar to most customers and thus there is a reliance on the installer to ensure that the installation meets relevant standards and a need for guidance on how to gain planning consent.

Once the installation is complete, there is limited opportunity for consumers to provide feedback on system operation. A lack of understanding also impedes the ability for a consumer to correctly monitor the performance of their system and the main source of advice is the installer during the installation. Due to the unfamiliarity with the technology, the handover to the consumer is an important step. Anecdotally, this is often not as detailed as required which can lead to sub-optimal outcomes for consumers.

Within the market there are wider challenges including the low number of competent installer and the availability of stock in terms of heat pump units, ancillary measures and replacement parts. This can lead to delays and increase costs for consumers.

[1]Transforming heat: public attitudes research report (publishing.service.gov.uk)

Current Cost to Consumer

The current LCA described in section 3 and summarised in figure 3 demonstrates how many challenges a consumer may face when looking to purchase a heat pump. These challenges are reflected in the current cost to consumer.

A model was created to investigate the current cost to consumers versus the installation of a gas boiler, our model assumes no funding was applied to the boiler. A preliminary benchmark indicating customers willingness to pay was researched and the results of modelling assessed against the cost of heat pump for a customer.

Customers in the UK are shown to have a set of expectations around how much they are willing to pay, and how quickly this expense should be recouped from the savings made on energy bills. 18% of consumers show intention to purchase low carbon items with an upfront cost greater than £2000 within the next 18 months, 36% in the next 2-5 years and 16% in the next 10 years[58]. 17% of customers claim they would need to see a net cost saving within the first few months after purchase, 35% within a year and 38% within 2-5 years[58]. Furthermore, this expectation differs between consumer groups. Consumers that perceive themselves to have a high-level disposable income are eight times more likely to consider investing in an "electric heat pump" in the next 12 months, Figure 3[13].

Proportion of customers intending to invest in low carbon technologies within the next 12 months

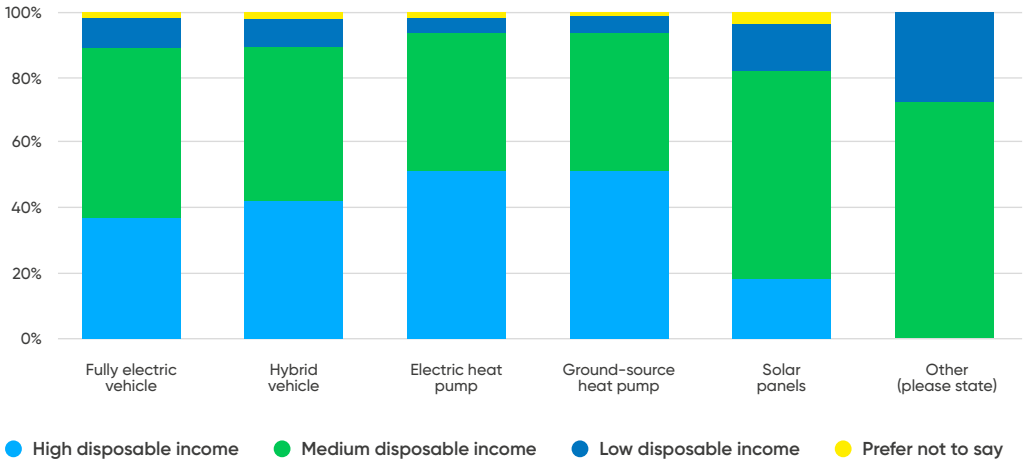


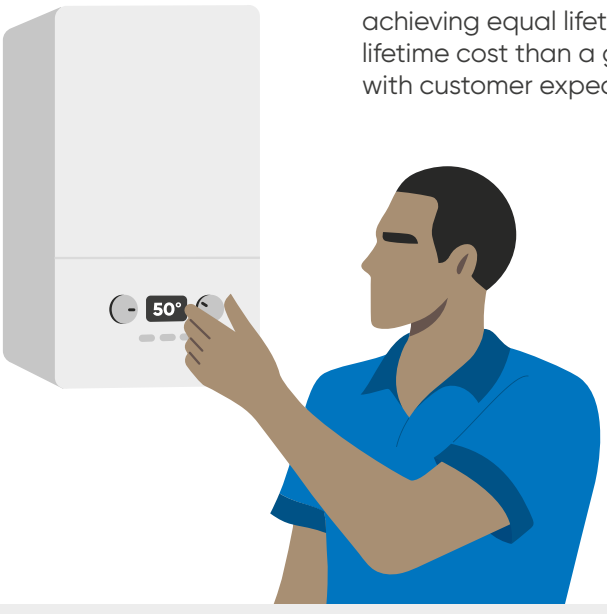
Figure 3: Results from Utilita's Household Energy Behaviour index – 2022. Source[13]

Utilita can use this data to assess how close the current heat pump market is to meeting customer expectations. Table 7 shows the inputs used in the model.

Input Variable	Heat Pump	Gas Boiler
Import (£/kWh)	£0.34	£0.10
Technology Lifetime (years)	20	20
SCOP	3.67	90%
Interest Rate	3.50%	3.50%
Heat Demand (kWh/year)	10000	10000
Energy Consumed (kWh/year)	2724.80	11111.11
$kgCO_2e/kWh$	0.085393	0.21364
CAPEX Unfunded	£10,200.00	£3,518.90
Annual OPEX Unfunded (Servicing and maintenance only, not including fuel costs)	£164.50	£88.75
CAPEX Funding	£5,000.00	£0.00
CAPEX Funded	£5,200	£3,519
Annual OPEX Funded (Servicing and maintenance only, not including fuel costs)	£164.50	£88.75
Customer Repayment Term (years)	5	5

Table 7: input values used in modelling of current heat pump and gas boiler costs. Source, see supporting model.

From these inputs and those contained in tables 3, 4 and 6, the lifetime accumulating costs of both a gas boiler and a heat pump were calculated both with and without the capital subsidy of £5,000 from the HPR programme. Figure 4 shows that a heat pump in current market conditions, without HPR or equivalent public funding wouldn't achieve cost parity with a gas boiler over a 20-year lifetime. By applying the HPR funding, CAPEX can be reduced by £5,000. A heat pump in current market conditions would be cheaper than a gas boiler, achieving equal lifetime cost in year 16, resulting in a lower lifetime cost than a gas boiler, by of £436.54. This is not aligned with customer expectations of repayment in 2-5 years[58].



Cumulative Lifetime Costs: Heat Pumps Vs Gas Boiler

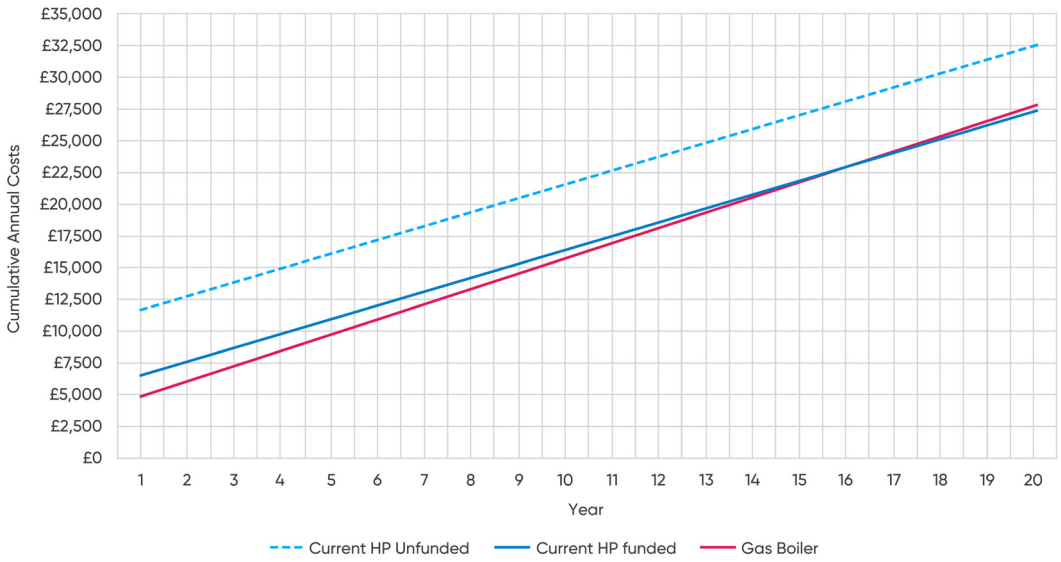
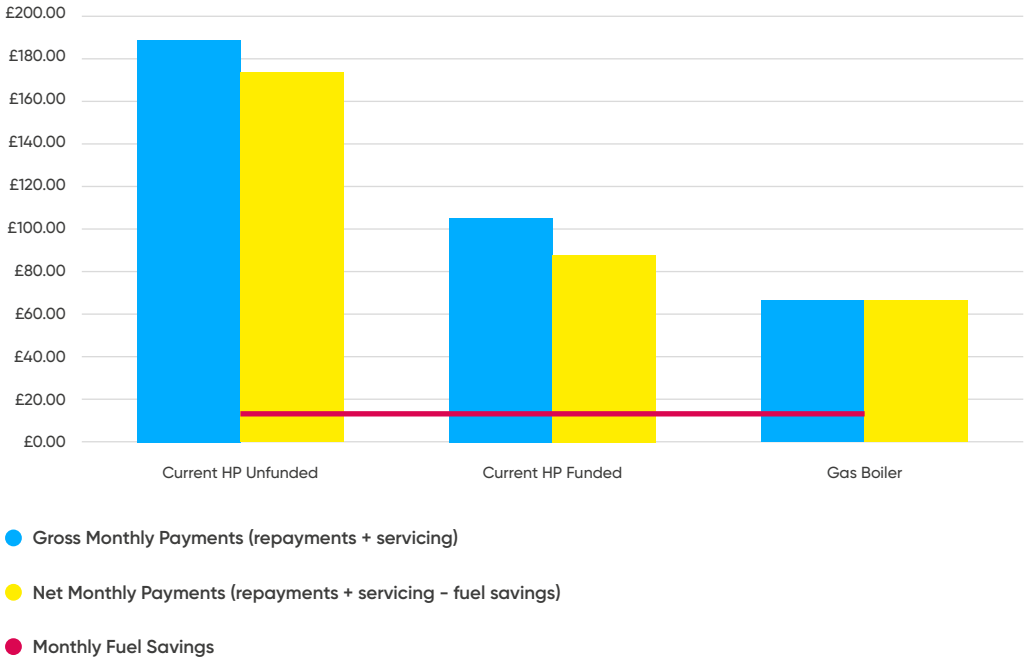


Figure 4: results of modelling to compare the lifetime costs to consumers of purchasing and operation an ASHP to a gas boiler. Source, see supporting model.

Another way to view the cost to the consumer is how customer monthly expenditure might be affected by purchasing a heat pump at this cost. Figure 5 shows gross monthly payments consisting of the monthly repayments from financing the capital cost of a heat pump and monthly servicing subscription, and net payments once fuel savings of £15.39/month are considered. The ideal situation is that net monthly payments are zero, in that financing repayments and monthly fuel savings are equal so that the customer notices no change to their monthly outgoings. However as is shown in Figure 6, this is not the case.

Monthly Outgoing vs Fuel Savings



Alongside calculating financial viability, the model calculates carbon reduction and uses the financial element to calculate a £/tCO_2e that can be compared to alternative methods to assess the opportunity cost of heat pumps as an opportune decarbonisation method. It is shown that a heat pump could reduce a household's carbon footprint by 2.141 tCO_2e/year, or 42.822 tCO_2e over a 20-year lifetime. This assumes that the electricity grid decarbonises linearly from current levels to zero in 2035, Figure 6.

Net Zero UK Electricity Grid

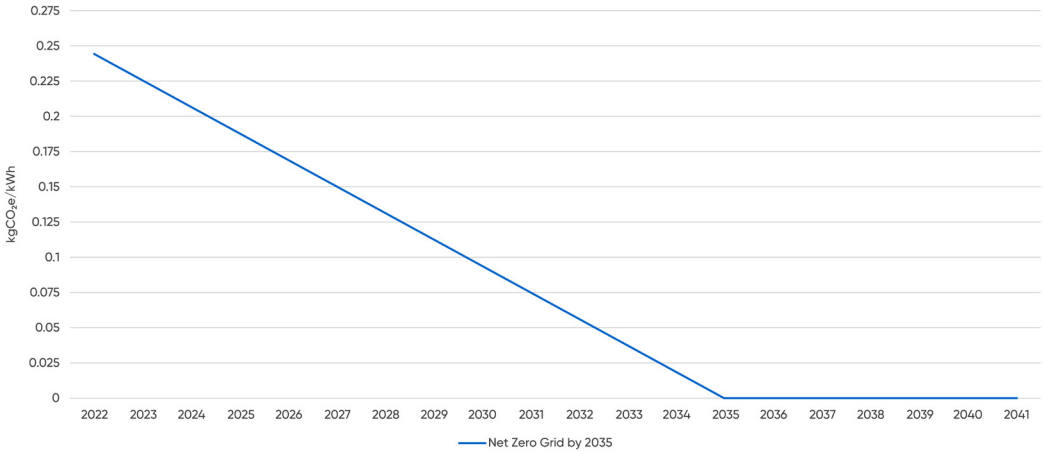


Figure 6: a linear progression from current electricity grid carbon intensity levels to zero grid carbon intensity in 2035. Source[59, 60], see supporting model.

Figure 7 shows the results of this decarbonisation assessment. The current cost of the cheapest decarbonisation methods on hand, the voluntary carbon offset market, can achieve prices of £10 for every tCO_2e reduced[61]. Similarly, there is a stark difference between what most customers are willing to pay and what they would currently have to pay to obtain a heat pump. Hence, the conclusion of this section is that the current heat pump market is in need of cost-cutting innovation. This must reach a level that consumers are not just able to accept but would prefer over the higher carbon alternative. This would encourage investment prior to existing heating systems reaching the end of their life. Likewise, without this innovation, the UK economy will struggle to meet net zero in domestic heating, due to the integral nature of heat pumps in achieving net zero[23].

Marginal Abatement Carbon Cost

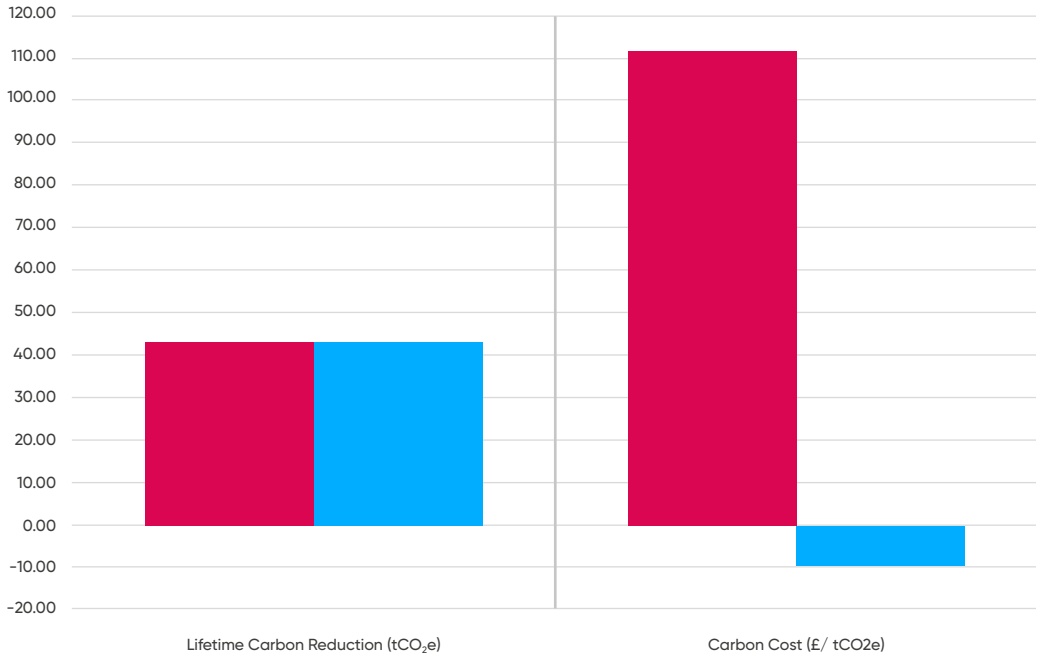


Figure 7: lifetime quantity of carbon reduction for a heat pump versus a gas boiler and the resulting cost per unit of carbon.

Proposal

As was shown in sections 1-4, the heat pump market requires significant innovation to make it a cost-effective way to decarbonise the domestic heating market. Utilita's aim is to bring these necessary innovations to market at scale, across the customer journey to develop a customer offering that enables households who would benefit from a heat pump but do not fit the criteria of existing public sector funding and cannot afford the current costs. Utilita's innovative proposal to achieve high-density heat pump deployment is to provide a 'one stop shop' for the installation of a heat pump. This would mean that entire offering to consumers and associated activities from lead generation through to aftercare will be completed 'in-house' by Utilita.

In this section, the customer LCA is revisited and at each stage, Utilita's solution for the high-density deployment of domestic heat pumps in Sunderland for phase 2 of the HPR are explored addressing the challenges identified. This culminates in a thorough review of the extent to which this reduces the cost to consumer, benchmarked against customer willingness to pay. An assessment on how sensitive the cost to consumer is to changes of influencing factors such as energy prices and energy efficiencies and costs of heating systems. Lastly, the extent to which heat pumps are a cost-effective decarbonisation method for domestic heating from the customer's perspective is investigated.

5.1. Research

To improve the challenges consumers face in accessing information during the research phase, Utilita's solution revolves around a localised, community-based marketing campaign. Initially, Utilita and the local authority, in this case Sunderland, will create dual branded leaflets informing 1056 properties of the coming availability of Utilita's heat pump offering to the area. After these letters have been digested by customers, Utilita will use the existing infrastructure of the Mobile Hub[62] (a mobile version of Utilita's high street shop, the Utilita Energy Hub) and face-to-face Utilita Hub Employees: Energy Experts to provide residents with the opportunity to learn about the benefits of heat pumps. This method is largely based on Utilita's track record of cost-effective door-to-door sales compared to digital channels. For example, a two-week campaign in Rotherham for Utilita's ECO 3 services generated over 1000 leads from approximately 8000 properties. To address the challenges customers face as identified during our research into the customer LCA and results of our customer survey[9] the general content of this marketing campaign will be as follows:

- ✔ Introducing Utilita and the partnership with the local borough council, in this case Sunderland, with dual branded leaflets.
- ✔ Brief overview of a heat pump as an electrical, carbon friendly alternative to a gas boiler.
- ✔ Sell benefits of the product such as its energy efficiency and cost reduction.
- ✔ Spotlight the government funding available to assist with upfront cost, in terms of both ECO4 and HPR routes.

In addition to having access to experts face-to-face, customers will have access to Utilita's heat pump area of the website[63]. This will be updated to provide more in-depth, technical information about heat pumps including an FAQs section. Similarly, customers will also have access to a dedicated area of the Utilita Online Community[64] where customers can talk to one another and gain insight from customers with heat pumps in real-time.

Based on the outputs of the research, combining the community focused, in-person campaign with digital elements provides residents with access to clear and concise information to overcome the barriers consumers are facing.

5.2. Choice

The communications channels mentioned in the research phase will focus on dispelling the core areas of concerns for customers[9], focused on communicating the legitimacy of Utilita's service with relevant evidence. The campaign will achieve this by being transparent and sympathetic toward common customer concerns, showing clearly and concisely how Utilita aims to mitigate these concerns. Topics that the communications will endeavour to address will be as follows:

- ✔ Concise summary of the return-on-investment calculation in simplified language.
- ✔ Transparency on how the government funding improves return on investment, both in terms of eligibility check to ECO4 and funding associated with HPR.
- ✔ Quality assurance and warranty processes.
- ✔ Details on potential drawbacks of heat pumps and advice on how to avoid these.
- ✔ Concise summary of the positive environmental benefit of heat pumps through decarbonisation.

This stage will go further than the communications provided in the research phase. Once a customer registers interest in having a heat pump installed, a skilled Utilita Home Advisor will complete a desktop survey and contact them to provide the customer with further detailed information on the process with a view to arrange an inhouse survey with a Retrofit Assessor. Having someone available to answer questions will provide reassurance for customers when considering financial investment and property alterations.

Utilita will utilize existing processes and systems currently used to deliver our ECO obligation in-house. Directly employed retrofit Assessors will undertake a suitability assessment of each household for the installation of a low temperature heat pump. These retrofit assessors will have a thorough understanding of both the physical space and technical requirements to comply with permitted development, building regulations, MCS standards and the minimum insulation levels required to access public funding. Once a full assessment has been undertaken any fabric improvement measures required to make a property heat pump ready will be communicated to the homeowner with costings and a programme of works to efficiently carry out a home improvement plan.

If a property is deemed suitable (or will be deemed suitable after other measures have been carried out) for a heat pump installation, a dedicated in-house design team will collate the information gathered by the retrofit assessors and produce a comprehensive system design, with a focus on improving system efficiency through the means of lowering operating temperatures to improve the seasonal coefficient performance of the system. This design will be communicated in a non-technical manner to the homeowner within a home-improvement pack, along with manufacturer product and warranty information specific to their product, consumer code, payment protection policy and our workmanship

warranty information. By providing the homeowner with a suitable amount of information about the proposed technology to help them decide whether to make the purchase, and access to our skilled home advisors via a telephone and web chat.

Customers with functional heating systems who may not have considered upgrading to a heat pump is expected to represent a significant proportion of the customers approached. Hence, the superiority of a heat pump to a gas boiler from an environmental perspective but also from a cost perspective will need to be evidential and clear. The elements of time limited access to public funding and longer-term implications of a gas boiler due to their imminent redundancy will be made clear.

Supporting this, contact options for both Utilita advisers and local council representatives trained to answer customer enquiries will be provided. As a final element, customers will be provided with the link to Utilita's 'Trustpilot' page, where they can access a great volume of reviews from current and previous Utilita customers[65].

5.3. Purchase

Initially the communications strategy and solutions to both the research and choice sections of the customer LCA will place Utilita on an excellent footing to overcome the core challenges customers face when deciding where to purchase a heat pump from, as well as the broader considerations bespoke to their home. These are summarised below:

- ✔ Lots of options/packages available which can cause confusion
- ✔ Confusion around which heat pump technology suits the customer
- ✔ Lack of data showing price comparison between heat pumps and installers

Going further than these communications the bespoke 'home improvement' pack developed in the previous stage will enable the thorough calculation of transparent costs to the customer. These will be provided and talked through with the customer:

- ✔ Total upfront cost (with interest if applicable)
- ✔ Length of repayment term (if not purchased outright)
- ✔ Total monthly repayments (if applicable)
- ✔ Total monthly servicing charge
- ✔ Total fuel savings
- ✔ Total net monthly outgoings (monthly repayments plus servicing minus fuel savings)
- ✔ Comparison to a gas boiler

Alongside this and prior to install, Utilita will provide pre-install training sessions with Utilita Home advisers who will talk customers through how to operate a heat pump, use it efficiently and what the install process will look like. All this information will also be contained in the 'home improvement' pack.

5.4. Installation

As before, the previous stages of the customer LCA provided a powerful foundation for a successful installation phase to overcome the challenges consumers face, summarised below:

- ✔ Unknown levels of disruption associated with installation (heating/hot water)
- ✔ Need for planning and DNO consent
- ✔ Unclear what 'good' installation looks like
- ✔ No opportunity for customer feedback

Utilita's solution is focused on two fronts, the customer and the installer. After the completion of the property analysis and throughout the previous stages of research, choice and purchase, customers will be informed on details of the installation process. This will be evident once the property analysis is completed, whereby the customer will receive information on the suitability of their property for a heat pump and the associated requirements. Examples of associated requirements include additional upgrade requirements, timescales for completion and an estimate for how long they might be without heating and hot water. Our in-house team of designers manage the planning and DNO approval as soon as we receive the post survey details needed for this whilst our advisors ensure the customer is aware of the timeframes throughout. To date, Utilita's engineers have extensive experience in this area having fit hundreds of heating systems as part of ECO applications. All engineers will undergo comprehensive audit processes and customers can access reviews of prior fittings which is expected to instil trust in the onsite engineers, surveyors, and customer service team from an impartial source.

5.5. Post Install support and monitoring

Much advice on the operation of heat pumps has been provided to the customer at this stage. The intention being that customers are now heat pump experts in their own right. However, this may not alleviate all challenges customers face post installation, which are summarised below:

- ✔ Customer unsure of what to monitor
- ✔ Unfamiliar with using the new technology
- ✔ Unsure of rights for servicing and maintenance
- ✔ Unsure of how to communicate with supplier

To consistently provide customers with the information they need to live with a heat pump, Utilita will provide a post install pack with information of all guarantees and warrantees. Two months after install, a Utilita Home advisor will call the customer, providing an opportunity to have any questions answered, as well as asking for feedback. Six months after the heat pump is installed, the customer will receive correspondence inviting them to book a heating measure service. The first annual service will be free as part of installation. After the engineer attends the first service, a customer will be offered an ongoing annual servicing package. Additionally, Utilita will register all units for guarantee with manufactures and will offer a seven-year manufactures guarantee. This regular contact will help customers feel supported through the after-care process, and they will know who to contact should they need to. Throughout all customer interaction, appointment confirmations, reminders and feedback surveys will be automatically confirmed via email. All customer enquiries will be responded to with an automatic confirmation of receipt email and followed up within 24 hours.

5.6. Operating Environment

Dealing with the challenges that can directly affect customers is not enough. As described in section 3.6, there are risks to the timely onboarding of customers and installation process associated to the supply chain of heat pumps and managing the local electricity grid. If left unaddressed, these can have more indirect impacts for customers.

5.6.1. Supply chain factors

The challenges of the supply chain laid out in section 3.6.1 pertained to three keys areas:

- ✔ Availability of qualified domestic heating engineers
- ✔ Stock management of heat pumps
- ✔ Stock of ancillary equipment

To overcome these challenges Utilita aims to utilise and enhance its existing infrastructure. Utilita's Warrington training academy is an LCL (Logic Certification Limited)

accredited training facility, capable of training heat pump operatives. Experienced team members with extensive knowledge on the industry are capable of guiding and developing candidates into fully fledged heat pump installers. In addition, there are plans to recruit and train staff members in all areas of the heat pump installation journey such as retrofit assessors and coordinators, heat loss experts, system designers, installers, and aftercare engineers.

Currently, the team consists of 11 fully trained and 2 ready-for-training professionals, with the training academy being capable to qualify 6 engineers a week and hiring new engineers with a 1-month lead time. Utilita is considering training external engineers, which will support alleviation of the challenges faced by the wider industry.

As the availability of installers in the Sunderland region appears to be limited. Our research indicates that there are only 7 MCS accredited installers based in the targeted region. Utilita will be looking to recruit engineers in the area and utilizing our training facilities to fulfil demand. For Phase 2 we anticipate hiring and training 10 additional engineers to meet the required demand, we expect that the addition of Utilita will enable higher numbers of installations and stimulate competitive pricing in the region.

However, as the number of qualified engineers increase to meet demand, the ability to meet this demand with suitable stock management, customer profiling and onboarding measures becomes increasingly important.

Utilita has proven track record in delivering a best in industry smart meter installation process where over 90% of Utilita's customers have smart meters, double the industry average. This is in part due to the existing stock management processes used in the smart meter installations. This will form the foundation for the new heat pump installation process. A minimum level of stock for heat pump units and ancillary devices will be maintained to match maximum possible installations within the delivery window. This minimum stock level will act as a 'trigger point' for ordering more stock. The demand will be monitored and managed to avoid any delays related to the installation date. Utilita has confirmation from a heat pump manufacturer that for bulk orders the 'lead time' would be 3-5 working days for delivery. As demand increases, it is feasible that investment would be made into new warehousing, strategically located to increase logistical efficiency.

Good stock management is predicated on effective demand forecasting from internal systems. This comes down to feeding the outputs of customer onboarding into stock management. In the first instance the breadth of customer profiles and subsequent requirements for stock can be managed by somewhat constraining the customer profiles onboarded.

5.6.2. Housing stock requirements

For Phase 2 of the HPR Utilita will preferably target housing stock that displays the below attributes:

- ✔ Appears to be constructed at either a similar time or preferably under a single development to standardise the installation processes, making these properties "heat pump ready".
- ✔ A high probability of having indoor space for a hot water cylinder, and other installation components. For example, dwellings with attached garages, or with cylinders already installed, or that used to have cylinders.
- ✔ Semi-detached or detached dwellings, these dwellings pose the least amount of foreseeable installation restrictions regarding location of outdoor units, permitted development rights and accessibility for the installation for pipe and electrical routes.
- ✔ Between 10 and 30 years old. The newer the housing stock the less likely for other prohibiting factors or complications such as lack of cavity wall insulation, loft insulation, older electrical consumer units and the presence of asbestos.

- ✔ Areas or locations that have data indicating the installation of immersion heated hot water. These properties already have hot water cylinders with appropriate space for a new cylinder. This indicates that these properties are likely to benefit the most from a heat pump, increasing take up opportunities.

5.6.3. Electricity grid factors

The challenges of the electricity grid laid out in section 3.6.2 pertains to one key area:

- ✔ Inadequacy of the current connect and notify process

Connect and notify is essentially informing the DNO once a heat pump has been installed. As described in section 3.6.2, with mass high-density deployment this has significant negative consequences for the local electricity grid and ultimately for customers. By using the DNO's pre-notification process and submitting the 'EVCP and HP Connections form' to the DNO, it keeps them informed of any intentions to add substantial loading to the network ahead of the installation. Utilita and the DNO can align their respective programme of works to ensure an unencumbered customer journey.

For the HPR programme, Through a combination of using NPG's auto design tool[67] and advice from a Smartgrid Development Engineer from NPG Utilita have selected a target area with little indication that works are needed on primary substations. Lead times on carrying out works could pose an unsurmountable challenge to achieving the deadlines of this scheme (Table 8). By deploying heat pumps in a specific area, Utilita will notify the DNO ahead of time so appropriate resources can be allocated. Moreover, Utilita will prioritise the disconnection of direct electrical heating and hot water systems first Which will reduce the current loading on the network.

Customer Fuse	Replace Fuse	4 weeks
Customer Fuse	Replace Fuse	4 weeks
Customer termination	Replace cut-out	4 weeks
Service cable replacement/de-loop	Provide new service	8 weeks
LV network reinforcement	Reinforce LV network	12 weeks
HV/Substation reinforcement	Reinforce HV network, replace substation	24 weeks

Table 8, local electricity grid upgrade work schedule. Source Northern Power Grid.

5.7. Summary of new customer LCA

From completing extensive market research Utilita have been able to identify the core issues which customers, installers, heat pump manufactures, and local electricity networks face when heat pumps are delivered en masse and at high density. This has enabled Utilita to develop a suite of solutions, constituting a whole-system approach. This set of innovations are summarised in Figure 8.

Research

Consumer centric comms strategy
Marketing campaign including leaflets, mobile hub, site visits, introductory letter
All information in an easily digestible format
Utilita partnering with Sunderland CC to add to consumer trust
Clear outline of process provided, covering what to expect, reassuring customer with quality checks
Customer access to Utilita website with further information and FAQ section

Choice

Concise summary of the return-on-investment calculation in laymen terms
Transparency on how the government funding improves return on investment, both in terms of eligibility check to ECO4 and funding associated with HPR.
Quality assurance and warranty processes
Details on potential drawbacks of heat pumps and advice on how it avoid these
Concise summary of the positive environmental benefit of heat pumps through decarbonisation.
Property analysis
Home improvement pack
Direct access to Utilita and LA heating experts

Purchase

Transparent cost breakdown
Pre install training sessions

Installation

Information provided ahead of installation covering detail on additional upgrades, timescales for completion
Available trained Utilita customer service team
Relevant literature readily available
Install carried out by experienced Utilita engineers

Post install support and monitoring

Quality assurance checks and feedback sessions included in aftercare
Opportunity for customers to sign up and engage through Utilita 'Community forum' to share questions and feedback
First annual service free for ECO customers
2 year Workmanship guarantee
Utilita registers heat pump unit with manufacturers for guarantee
Post-install survey to provide feedback for continuous service improvement
Direct point of contact provided for after care
Priority on future call-outs

Supply Chain Factors

Training academy
Improved stock capacity and capabilities
Customer profiling and demand forecasting

Electricity Grid Factors

No connect and notify
Careful profiling of local areas suitability

Figure 8: Set of innovations Utilita will deliver to deploy heat pumps on mass and at high density.

High-density deployment strategy

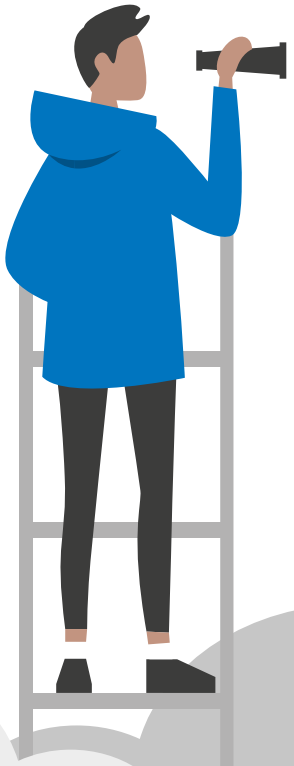
With these innovations in place, Utilita plans to scale the capabilities developed and deploy in other local authorities in the Northeast and Sunderland area. In time leading to national scale deployment.

To facilitate this, Utilita plans to utilise wider Northern Power Grid data, consisting of secondary substation and LV feeder data to understand current electricity load from the domestic housing stock and how a high-density, mass deployment of heat pumps in those areas might affect the local grid. This data will create an understanding of possible reinforcement works necessary and will feed into a forecast of demand for heat pumps in the area.

Sunderland City Council's housing tenure data as well as data gathered from Gentoo will add to the information necessary to create a database of suitable households in the area. These data sets combined will provide for a full profiling of households in the area in terms of factors relevant to heat pump readiness. Eligibility for funding and local income data will be added to this information, sufficing for a forecast of uptake in the targeted area.

Utilita will then notify Northern Power Grid of intentions to deploy heat pumps in targeted areas. This will allow Northern Power Grid to allocate resources in advance for any reinforcement works that may be required.

This accurate customer demand forecast will enable the placement of an initial order with heat pump suppliers. This way, manufacturers will be able to allocate resources and implement a programme to meet the demand of the projects. After these actions are complete the communications strategy and customer LCA will be replicated in the targeted areas.



New Cost to Consumer

Key to the success of Utilita's innovations is the implications on cost to consumer. Analysis by The Behavioural Insights Team shows that "reducing the upfront cost is still the most impactful solution policy-makers can use to promote heat pump adoption". However, "halving installation cost, reducing running costs and providing financing options could increase overall uptake of heat pumps by around 44 pp"[37]. Furthermore, as stated in section 4, most customers expect to recoup investments in low carbon systems from energy expenditure savings in 2-5 years.

Utilita's set of innovations does make significant progress in all these areas of customer expectation. Most notably is the significant reduction in upfront costs, alongside the development of financing options and a clear estimation of reduced running costs. Table 9 summarises these cost reductions. As well, compared to a gas boiler a heat pump would reduce household expenditure on energy by 16.62% compared to a gas boiler, or £15.39/month. Aggregated to total lifetime costs this means Utilita's innovations can reduce the cost of obtaining and operating a heat pump by 13%.

Input Variable	Current HP	Utilita HP	Change
CAPEX Unfunded	£10,200.00	£7,713.00	-24.38%
Annual OPEX Unfunded (Servicing and maintenance only, not including fuel costs)	£164.50	£90.00	-45.29%

Cumulative Lifetime Costs: Heat Pumps Vs Gas Boiler

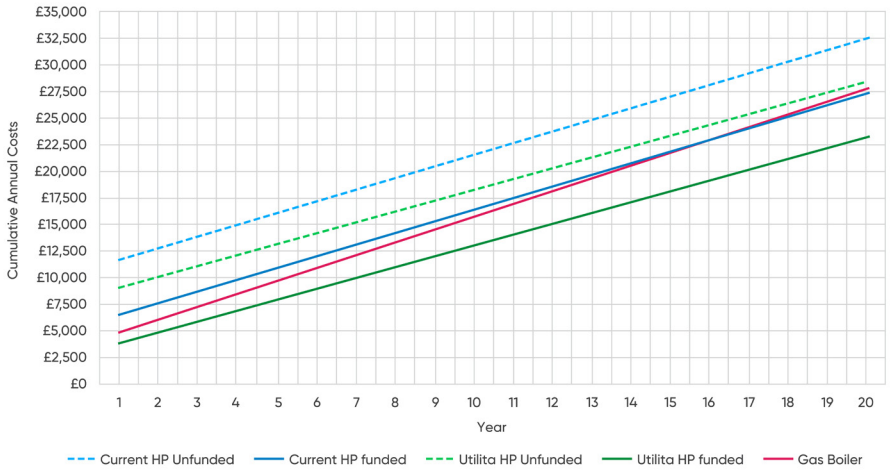


Figure 9: results of modelling to compare the lifetime costs to consumers of purchasing and operation a heat pump to gas boiler. Source, see supporting model.

These cost reductions have been used to complete the same modelling exercise as in section 4. Figure 9 shows the results. The key finding is that with public funding, Utilita's cost reductions mean a heat pump is cheaper than a gas boiler, from day 1. Meaning it is cheaper to install and operate.

This is an impactful result. It means over the course of 20 years a heat pump will save a customer £4,503.74 compared to heating a home with a gas boiler which is a near 200 percentage point decrease in the difference between lifetime costs of a heat pump compared to a gas boiler. This will have significant implications on the speed of heat pump rollout, nationally.

Upon a successful completion of a roll out utilizing the HPR scheme's funding, we intend to continue this offering using BUS (Boiler Upgrade Scheme) funding as it offers an equivalent amount of cost reduction to the consumer. Alongside this we will look to take our learnings and innovative methodology and apply this to other types of consumers under the various other funding schemes such as LAD (Local Authority Delivery scheme) and SHDF (Social Housing Decarbonisation Fund).

Nevertheless, the result should come with caution. Firstly, without public funding, a heat pump does not suffice customer expectations. For the "Utilita HP Funded" to achieve cost parity with a gas boiler from day one, at least £4,194.10 of public funded CAPEX is needed. Therefore, more cost efficiencies are required for similar customer take up in rollouts without subsidy. The opportunity of this subsidy should be used to find further cost efficiencies through the rollout in Sunderland.

A further cause for caution is that despite this cost reduction, customers net monthly outgoings when purchasing a heat pump are still greater than the fuel savings made whilst the CAPEX repayments are being made, albeit less so than installing a new gas boiler, see Figure 10.

Monthly Outgoing vs Fuel Savings

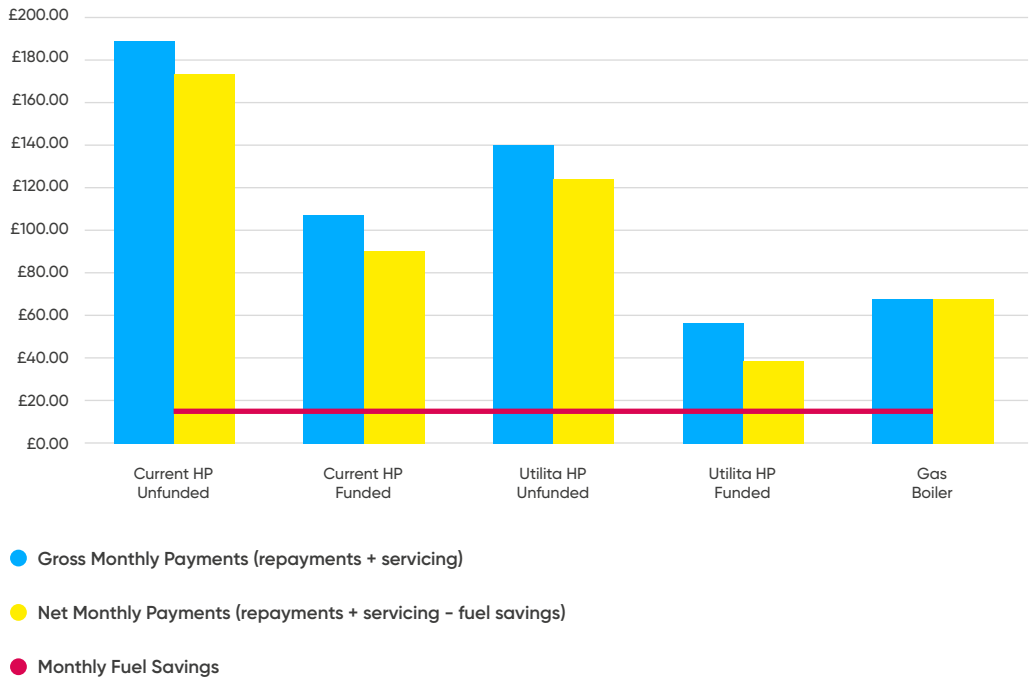


Figure 10: effect of financing a heat pump to monthly consumer expenditure versus fuel savings and a gas boiler. Source, see supporting model.

Variable	Min	Max
Electricity price (£/kWh)	£0.10	£1.00
Gas price (£/kWh)	£0.01	£0.20
Technology life span (years)	10	30
Boiler efficiency (%)	70%	95%
SCOP	3.00	5.00
Customer Repayment Term	2	10
CAPEX - Current HP	£5,100	£20,400
OPEX - Current HP	£82.25	£329
CAPEX - Utilita HP	£3,856.5	£15,426
OPEX - Utilita HP	£45	£180
CAPEX - Gas Boiler	£1,759.45	£7,037.8
OPEX - Gas Boiler	£44.38	£177.5

Table 10, ranges of input values used for sensitivity analysis.

A final yet significant cause for caution is that the input values associated with this analysis are subject to variability. Accordingly, a sensitivity analysis was completed to understand thresholds at which a heat pump becomes a sensible investment for a consumer, compared to a gas boiler. The input values from Table 7 are changed within a range, independently whilst all other vales remain constant. Table 10 shows the ranges used for the input values.

The detailed graphs for the sensitivity of the model to each variable are shown in Annex 1 and summary tables are show below. The following example shows how these tables can be interpreted.

Example of interpretation of tables for sensitivity analysis results:

- Table 11, row 1: with every electricity price increase of £0.01/kWh, net monthly outgoings from using a heat pump vs a gas boiler increase by £2.27, on average.
- Table 12, row 1: with every electricity price increase of £0.01/kWh, lifetime savings of using a heat pump vs a gas boiler decrease by £544.96, on average.
- Table 11, row 2; with every gas price increase of £0.01/kWh, net monthly outgoings from using a heat pump vs a gas boiler decrease by £9.26, on average
- Table 12, row 2: with every gas price increase of £0.01/kWh, lifetime savings of using a heat pump vs a gas boiler increase by £2,222.22, on average.
- Table 13 row 1, for the Current HP Unfunded, the net monthly outgoings will be zero, in that the golden rule will be achieved when electricity prices are negative, -£0.4283/kWh. This is evidently unrealistic. A more achievable scenario is the Utilita HP Funded, where the golden rule is achieved at an electricity price of £0.16839/kWh.
- Note, the relationships between variables and net monthly outgoings and lifetime savings are not always linear. As well, in some cases the golden rule is unachievable, where the results are greyed out in table 4. More detailed analysis of these relationships is available in the supporting model and Annex 1.

Carbon implications

These reductions in cost to consumer result in the need to review whether this is a cost-effective method to decarbonise domestic heating, from the customers perspective. Figure 11 shows that with the HPR programme funding, the heat pump costs of Utilita present a negative decarbonisation cost, because the measure saves the customer money over the lifetime of the technology compared to the alternative, a gas boiler. Even without the funding, Utilita's costs present a far more suitable cost of decarbonisation that makes the opportunity cost of decarbonising through the voluntary carbon offset market less attractive[61], accordingly the well reported pitfalls of carbon offsetting are not considered[66].

Despite this optimism, this is from the consumers perspective. From the perspective of the cost effectiveness for public funding, this view may be different. Considering the grant per heat pump installed and the funding the successful phase 1 and 2 applicants. Nevertheless, funding research and development in low carbon technologies so they become cost competitive with high carbon alternatives is arguably a role of government. Hence, the investment being made by public financing i.e. the HPR scheme, is clearly suitable based on the results conveyed in section 7.

Marginal Abatement Carbon Cost

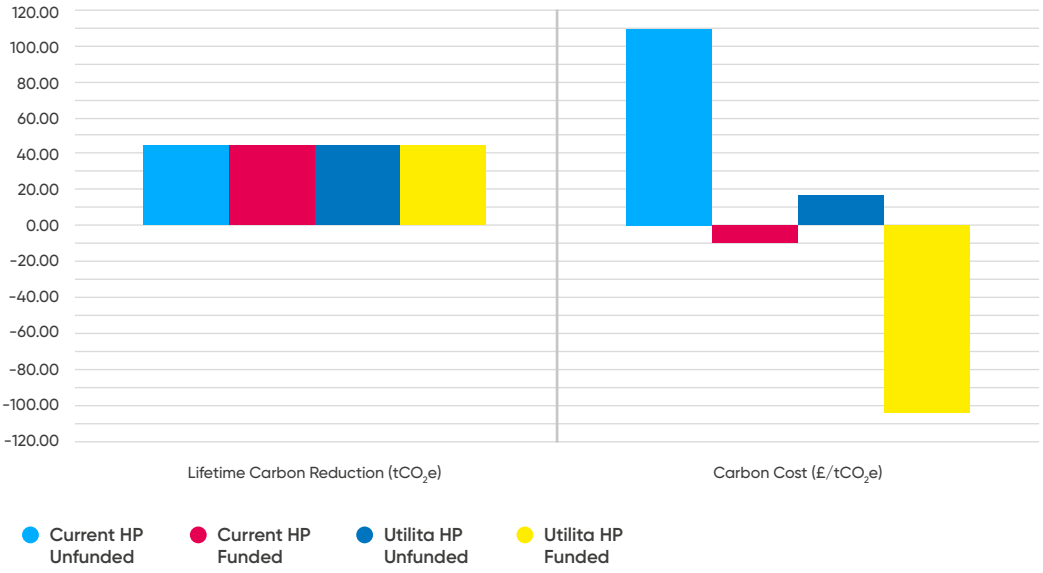


Figure 11: annual quantity of carbon reduction for a heat pump versus a gas boiler and the resulting cost per unit of carbon.

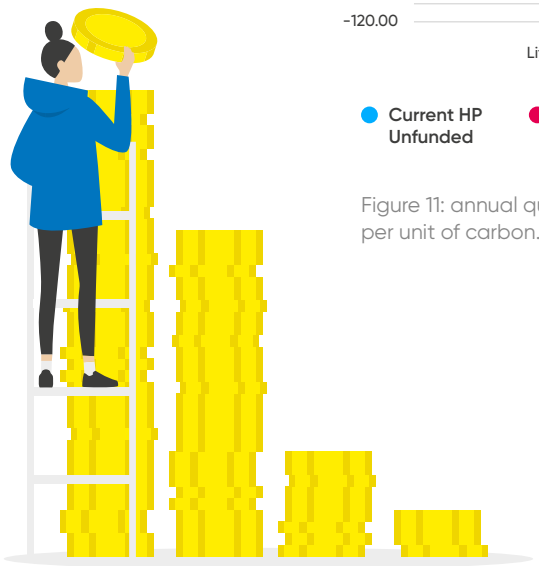


Table 11: Senstivity Results: Δ Net Monthly Change to Out-goings/interval

Variables	Likely	Min	Max	Interval	Current HP Unfunded	Current HP Funded	Utilita HP Unfunded	Utilita HP Funded
Electricity price (£/kWh)	£0.34	£0.10	£1.00	£0.01	£2.27	£2.27	£2.27	£2.27
Gas price (£/kWh)	£0.10	£0.01	£0.20	£0.01	-£9.26	-£9.26	-£9.26	-£9.26
Technology life span (years)	20	10	30	1.00	£0.00	£0.00	£0.00	£0.00
Boiler efficiency (%)	90%	70%	95%	1.00%	£1.25	£1.25	£1.25	£1.25
SCOP	3.67	3.00	5.00	0.5	-£9.44	-£9.44	-£9.44	-£9.44
Customer Repayment Term (years)	5	2	10	0.5	-£21.93	-£11.18	-£16.59	-£5.83
CAPEX - Current HP	£10,200.00	£7,187.50	£28,750.00	£500.00	£4.32	£4.32		
OPEX - Current HP	£164.50	£75.00	£300.00	£50.00	£4.17	£4.17		
CAPEX - Utilita HP	£7,713.00	£3,856.50	£15,426.00	£500.00			£4.32	£3.89
OPEX - Utilita HP	£90.00	£40.00	£160.00	£50.00			£4.17	£4.17

Table 12: Senstivity Results: Δ Net Lifetime Savings/interval

Variables	Likely	Min	Max	Interval	Current HP Unfunded	Current HP Funded	Utilita HP Unfunded	Utilita HP Funded
Electricity price (£/kWh)	£0.34	£0.10	£1.00	£0.01	-£544.96	-£544.96	-£544.96	-£544.96
Gas price (£/kWh)	£0.10	£0.01	£0.20	£0.01	£2,222.22	£2,222.22	£2,222.22	£2,222.22
Technology life span (years)	20	10	30	1.00	£108.93	£108.93	£183.43	£183.43
Boiler efficiency (%)	90%	70%	95%	1.00%	-£300.64	-£300.64	-£300.64	-£300.64
SCOP	3.67	3.00	5.00	0.5	£2,265.16	£2,265.16	£2,265.16	£2,265.16
Customer Repayment Term (years)	5	2	10	0.5	£0.00	£0.00	£0.00	£0.00
CAPEX - Current HP	£10,200.00	£7,187.50	£28,750.00	£500.00	-£518.13	-£518.13		
OPEX - Current HP	£164.50	£75.00	£300.00	£50.00	-£1,000.00	-£1,000.00		
CAPEX - Utilita HP	£7,713.00	£3,856.50	£15,426.00	£500.00			-£518.13	-£467.39
OPEX - Utilita HP	£90.00	£40.00	£160.00	£50.00			-£1,000.00	-£1,000.00

Table 13: Sensitivity Results: Zero Intersects

Variable	Net Monthly Out-goings				Lifetime Savings			
	Current HP Unfunded	Current HP Funded	Utilita HP Unfunded	Utilita HP Funded	Current HP Unfunded	Current HP Funded	Utilita HP Unfunded	Utilita HP Funded
Electricity price (£/kWh)	-0.42843	-0.04812	-0.21192	0.16839	0.25293	0.34801	0.32757	0.42264
Gas price (£/kWh)	0.28844	0.19518	0.23535	0.14208	0.12135	0.09804	0.10305	0.07973
Technology life span (years)	-	-	-	-	-	16.00	24.00	-
Boiler efficiency (%)	31.2%	46.1%	38.2%	63.3%	74.2%	91.8%	87.3%	112.9%
SCOP	-	-	-	-	4.93	3.59	3.81	2.95
Customer Repayment Term (years)	523.6	267.0	84.4	29.7	-	-	-	-
CAPEX - Current HP	£97.37	£97.37	£456.83	£456.83	£5,621.26	£5,621.26	£7,059.11	£7,059.11
OPEX - Current HP	-£1,929.31	-£893.04	-£1,413.87	-£377.60	-£72.74	£186.33	£56.12	£315.19

Conclusion

Mass adoption of domestic heat pumps is integral to the UK meeting its legally binding commitment to achieve net zero carbon by 2050 [1,2]. This study investigated the feasibility of Utilita's customer centric, whole-market solution to facilitate the deployment of high-density domestic heat pumps in Sunderland. Based on our research conducted throughout Phase 1 of the Heat Pump Ready Programme, Utilita conclude that our proposal is feasible for high density deployment in Sunderland and replicable over the UK. Utilita intend on applying for further funding of £2,543,919.56 for Phase 2 of the HPR, which will see us complete the mobilisation and deployment of the proposal outlined in the Phase 1 feasibility study.

The existing heat pump market was investigated and the current cost to the customer of installing and operating heat pumps for twenty years was compared to a gas boiler. Subsequently, a set of innovations that Utilita plan to deliver across the customer journey as part the HPR programme were discussed and a resulting lifetime cost to the consumer was-calculated.

Utilita's innovative and cost-effective proposal to achieve high density heat pump deployment is to provide a 'one stop shop' for the installation of a domestic heat pump. The entire offering to consumers and associated activities from lead generation through to aftercare will be completed 'inhouse' by Utilita. Our approach considerably improves the consumer experience whilst simultaneously reducing the upfront cost to consumer. Utilita's methodology addresses several barriers for mass deployment of heat pumps in Sunderland which have been identified and outlined in this study.

This study showed that these innovations combined with the funding of the HPR programme lead to a heat pump saving a customer £4,503.74 over a twenty-year period compared to heating a home with a gas boiler. A near 200 percentage point decrease in the difference between lifetime costs of a heat pump compared to a gas boiler, making a heat pump the cheaper domestic heating option. It was shown that customer expectations around the cost of delivering low carbon technologies were met, to an extent. As well, it was shown that heat pumps and the HPR funding is a cost-effective method of decarbonisation and reducing the environmental impact.

This significant cost reduction shows that Utilita's aim is feasible, to establish an offering acceptable to customers who do not fit the criteria of existing public sector funding but also cannot afford the current costs of a heat pump, thereby opening a whole new market.

Nevertheless, this feasibility is predicated on public funding of at least £4,194.10 this can be funded through the boiler upgrade scheme in the short and medium term and applied to the CAPEX of a heat pump, the stability of factors such as fuel prices, and fuel efficiencies of heating systems. Therefore, current public funding should be utilised to find further cost efficiencies. In time bringing heat pump costs to parity with a gas boiler and customer expectations, without the need for public funding. As well, the variability of input values should be monitored to ensure business models adapt as values change.

1. CCC. The Sixth Carbon Budget. Published online 2020:67. Accessed April 23, 2022. https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

2. UK Government. The Ten Point Plan for a Green Industrial Revolution. Gov.uk. Published 2020. Accessed November 7, 2022. https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution/title#point-7-greener-buildings

3. BEIS. HEAT PUMP READY: STREAM 1-SOLUTIONS FOR HIGH-DENSITY HEAT PUMP DEPLOYMENT PHASE 2.; 2022. www.nationalarchives.gov.uk/doc/open-government-licence/

4. Fuel poverty report for Sunderland. Accessed November 17, 2022. https://www.sunderlandvsa.co.uk/article/23347/Fuel-poverty

5. Sunderland City Council, Gentoo. Tenure Maps. Tenure Maps. Published 2022. Accessed November 18, 2022.

6. BSI., Carbon Trust., Great Britain. Department for Environment F& RAffairs. Guide to PAS 2050 : How to Assess the Carbon Footprint of Goods and Services. BSI; 2008.

7. Statista, BEIS. What is the main way you heat your property during the winter? Statista. Published 2022. Accessed November 17, 2022. https://www.statista.com/statistics/426988/united-kingdom-uk-heating-methods/

8. BEIS. BEIS_PAT_W36_-_Key_Findings. Published online 2020:20. Accessed November 17, 2022. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959601/BEIS_PAT_W36_-_Key_Findings.pdf

9. Utilita, Gemserv. Utilita Survey Analysis.; 2022. Annex 3

10. BEIS. Annual Fuel Poverty Statistics LILEE Report 2022 (2020 Data). Accessed November 17, 2022. https://www.gov.uk/government/statistics/annual-fuel-poverty-statistics-report-2022

11. Statista. statistic_id697950_gross-disposable-household-income--gdhi--per-head-in-the-uk-in-2018-by-region. Statista. Published online 2018. Accessed November 17, 2022. https://www.statista.com/statistics/697950/regional-gross-disposable-household-income-gdhi-uk/

12. Statista. statistic_id382858_share-of-households-receiving-benefits-in-the-uk-2021-by-region. Statista. Published online 2021. Accessed November 17, 2022. https://www.statista.com/statistics/382858/uk-state-benefits-by-region/

13. Utilita. Consumer Energy Behaviour Index - Results. The Household Energy Behaviour Index 2022 - Results. Unpublished 2022.

14. Heat Pumps Scotland. Heat Pump Misconceptions. Published 2020. Accessed November 17, 2022. https://www.heatpumpsscotland.org/heat-pump-misconceptions/

15. Kirkman W. Six reasons not to buy a heat pump in 2022. The Telegraph. Published 2022. Accessed November 17, 2022. https://www.telegraph.co.uk/money/consumer-affairs/buy-heat-pump-cost-install-gas-boiler-green-technology-2022/

16. Mars. THE HONEST VERDICT ON THE EFFICIENCY AND SUSTAINABILITY OF AIR SOURCE HEAT PUMPS IN THE UK. My Home Farm. Published 2020. Accessed November 17, 2022. https://myhomefarm.co.uk/verdict-on-air-source-heat-pumps-in-the-uk

17. Trust Pilot. Trust Pilot. Published 2022. Accessed November 17, 2022. https://uk.trustpilot.com/

18. Check A Trade. Check A Trade. Air Source Heat Pumps. Published 2022. Accessed November 17, 2022. https://www.checkatrade.com/Search?page=1&categoryId=1973&location=SR1%201AF

19. Which? Trusted Traders. Air Source Heat Pump in Sunderland - Which? Published 2022. Accessed November 17, 2022. https://trustedtraders.which.co.uk/air-source-heat-pump--in-sunderland/

20. Trusted Traders. Air Source Heating Specialists in Sunderland. Trusted Traders. Published 2022. Accessed November 17, 2022. https://www.trustatrader.com/search?trade_name=Air+Source+Heating+Specialists&location_str=sunderland

21. MCS. Find a Contractor. MCS Certified Find A Contractor. Published 2022. Accessed November 17, 2022. https://mcscertified.com/find-an-installer/

22. Cradden J. The PH+ guide to air source heat pumps. Passiv House Plus. Published online 2018. Accessed November 18, 2022. https://passivehouseplus.ie/magazine/guides/the-ph-guide-to-air-source-heat-pumps

23. CCC. The Sixth Carbon Budget: Sector Summary Buildings.; 2020. Accessed June 17, 2022. https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Buildings.pdf

24. EDF Energy. UK Gas Boiler Ban – Everything You Need to Know. www.edfenergy.com. Published 2022. Accessed November 18, 2022. https://www.edfenergy.com/heating/advice/uk-boiler-ban

25. E.ON. Get an Online Quote. Published online 2022. Accessed November 18, 2022. Get an online quote | Heat pumps | E.ON (eoninstall.com)

26. British Gas. Discover our eco-friendly air source heat pumps. Published online 2022. Accessed November 18, 2022. Discover our eco-friendly air source heat pumps - British Gas

27. Octopus Energy. Get a heat pump with Octopus Energy. Published online 2022. Accessed November 18, 2022. Get a heat pump with Octopus Energy | Octopus Energy

28. Samsung, eBay. SAMSUNG AIR SOURCE HEAT PUMP AND HOT WATER CYLINDER, SUPPLIED & INSTALLED. Published online 2022. Accessed November 18, 2022. SAMSUNG AIR SOURCE HEAT PUMP AND HOT WATER CYLINDER , SUPPLIED & INSTALLED | eBay

29. The Heat Pump Warehouse. Vaillant aroTHERM plus 3.5kW - The Heat Pump Warehouse. Published 2022. Accessed November 18, 2022. Vaillant aroTHERM plus 3.5kW - The Heat Pump Warehouse

30. Energy Saving Trust. Air source heat pumps. energysavingtrust.org.uk. Published 2022. Accessed November 18, 2022. https://energysavingtrust.org.uk/advice/air-source-heat-pumps/

31. Renewable Energy Hub. ARE HEAT PUMPS WORTH THE INVESTMENT. renewableenergyhub.co.uk. Published 2022. Accessed November 18, 2022. https://www.renewableenergyhub.co.uk/main/heat-pumps-information/are-heat-pumps-worth-the-investment/

32. Which?, Lawrence K. Air source heat pump costs and savings. Which.co.uk. Published 2022. Accessed November 18, 2022. https://www.which.co.uk/reviews/ground-and-air-source-heat-pumps/article/ground-and-air-source-heat-pumps/air-source-heat-pump-costs-and-savings-akySY6N5Y6Dd

33. Check A Trade. Air Source Heat Pump Costs. checkatrade.com. Published 2022. Accessed November 18, 2022. https://www.checkatrade.com/blog/cost-guides/air-source-heat-pump-cost/

34. BEIS. Heat Pump Ready Reference Costs. Published online 2022.

35. Effective Home. Affordable Air Source Heat Pumps. Published 2022. Accessed November 18, 2022. https://effectivehome.co.uk/boilers-and-heating/air-source-heat-pumps/finance-options/

36. The Behavioural Insights Team. How much are we willing to pay to make home heating greener? Published March 2022. Accessed November 18, 2022. https://www.bi.team/blogs/how-much-are-we-willing-to-pay-to-make-home-heating-greener/

37. The Behavioural Insights Team. How Can We Boost Uptake of Heat Pumps beyond the Effect of Subsidies?; 2022. Accessed November 18, 2022. https://www.bi.team/blogs/how-can-we-boost-uptake-of-heat-pumps-beyond-the-effect-of-subsidies/

38. Household Costs. Air Source Heat Pump Servicing Costs. householdcosts.co.uk. Published 2022. Accessed November 18, 2022. https://householdcosts.co.uk/air-source-heat-pump-servicing/

39. Tradesmen Costs. Air Source Heat Pump Servicing Cost: 2022 Price Guide UK. tradesmencosts.co.uk. Published 2022. Accessed November 18, 2022. https://tradesmencosts.co.uk/air-source-heat-pump-servicing/

40. The Eco Experts. Air Source Heat Pumps: Maintenance Tips. theecoexperts.co.uk. Published 2022. Accessed November 18, 2022. https://www.theecoexperts.co.uk/heat-pumps/air-source-heat-pump-maintenance#link-how-much-maintenance-does-a-heat-pump-need

41. Household Quotes. Boiler Service Costs: How Much and How to Save in 2022. householdquotes.co.uk. Published 2022. Accessed November 19, 2022. https://householdquotes.co.uk/boiler-service-cost/

42. Home Now. Boiler Service Costs. https://www.homehow.co.uk/costs/boiler-service. Published 2022. Accessed November 19, 2022. https://www.homehow.co.uk/costs/boiler-service

43. Check A trade. How much does a boiler service cost? checkatrade.com. Published 2022. Accessed November 19, 2022. https://www.checkatrade.com/blog/cost-guides/boiler-service-cost/

44. Energy Guide. How Much Does The Average Boiler Service Cost In The UK? energyguide.org.uk. Published 2022. Accessed November 19, 2022. https://energyguide.org.uk/boiler-service-costs/

45. Octopus Energy. Our market-leading heat pump service plans. octopus.energy. Published 2022. Accessed November 18, 2022. https://octopus.energy/heat-pump-service-plans/

46. E.ON. Air Source Heat Pumps. https://www.eonenergy.com/air-source-heat-pumps.html. Published 2022. Accessed November 18, 2022. https://www.eonenergy.com/air-source-heat-pumps.html

47. British Gas. Winter-proof your home with boiler & heating cover. britishgas.co.uk. Published 2022. Accessed November 18, 2022. https://www.britishgas.co.uk/home-services/boilers-and-heating/boiler-and-heating-cover.html?excess=60

48. Scottish Power. Air source heat pumps from £6,000*. Scottishpower.co.uk. Published 2022. Accessed November 18, 2022. https://www.scottishpower.co.uk/air-source-heat-pumps?gclid=CjwKCAjws--ZBhAXEiwAv-RNL5e3iE3YAxVe3CfrQIcNSSzw0S4StXfJZgQJavWHgN98SY6oKmK9SRoCXLkQAvD_BwE&gclsrc=aw.ds

49. EDF Energy. Air source heat pumps - the future of heating. edfnergy.com. Published 2022. Accessed November 18, 2022. https://www.edfenergy.com/heating/electric/air-source-heat-pump

50. Green Match. Compare Air Source Heat Pumps Offers from Local Installers in the UK. greenmatch.co.uk. Published 2022. Accessed November 18, 2022. https://www.greenmatch.co.uk/heat-pump/air-source-heat-pump/air-source-heat-pump-cost

51. Heat Collector. Service and Maintenance plans. https://www.heatcollector.co.uk/service.html.

52 Government H. The Ten Point Plan for a Green Industrial Revolution.; 2020.

53. Rolt A. Shortage of trained heat pump installers could "put a spanner" in net zero targets. Business Green. Published online July 2022. Accessed November 18, 2022. https://www.businessgreen.com/news/4052590/shortage-trained-heat-pump-installers-spanner-net-zero-targets

54. Heat Pump Association. BUILDING THE INSTALLER BASE FOR NET ZERO HEATING.; 2020.

55. Investopedia. What Are the Main Problems With a JIT (Just in Time) Production Strategy? Investopedia.com. Published 2021. Accessed November 18, 2022. https://www.investopedia.com/ask/answers/040215/what-are-main-problems-jit-just-time-production-strategy.asp

56. Energy D, for BEIS E. IEA HPT Programme Annex 42: Heat Pumps in Smart Grids.; 2018.

57. Mavrokefalidis D. One-in-three homes need £15k upgrade to install heat pumps. Energy Live News. Published online February 1, 2022. Accessed November 18, 2022. https://www.energylivenews.com/2022/02/01/one-in-three-homes-need-15k-upgrade-to-install-heat-pumps/

58. Utilita, KPMG Nunwood. New Product Survey, Research Summary.; Unpublished 2022.

59. BEIS. Plans unveiled to decarbonise UK power system by 2035. https://www.gov.uk/government/news/plans-unveiled-to-decarbonise-uk-power-system-by-2035.

60. BEIS. Conversion factors 2021: condensed set (for advanced users) - revised January 2022. Greenhouse gas reporting: conversion factors 2021. Published online 2022. Accessed April 25, 2022. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1049333/conversion-factors-2021-full-set-advanced-users.xlsm

61. Gold Standard. OFFSET your emissions. goldstandard.org. Published 2022. Accessed November 18, 2022. https://marketplace.goldstandard.org/collections/projects

62. Utilita. Energy Hub. https://utilita.co.uk/energy-hub. Published 2022. Accessed November 19, 2022. https://utilita.co.uk/eco

63. Utilita. Utilita Home. https://utilita.co.uk/eco.

64. Utilita. Utilita Community. utilita.co.uk. Published 2022. Accessed November 19, 2022. https://community.utilita.co.uk/forum.php

65. Trust Pilot. Utilita. trustpilot.com. Published 2022. Accessed November 19, 2022. https://uk.trustpilot.com/review/www.utilita.co.uk

66. Oliver J, Last Week Tonight. Carbon Offsets: Last Week Tonight with John Oliver (HBO). Published online 2022. Accessed November 19, 2022. https://www.youtube.com/watch?v=6p8zAbFKpW0&ab_channel=LastWeekTonight

67. Northern Powergrid auto design tool

Auto Design | Northern Powergrid

Detailed graphs of the sensitivity analysis

Figure 13: Effect of Electricity Price on Net Monthly Outgoings & Lifetime Savings

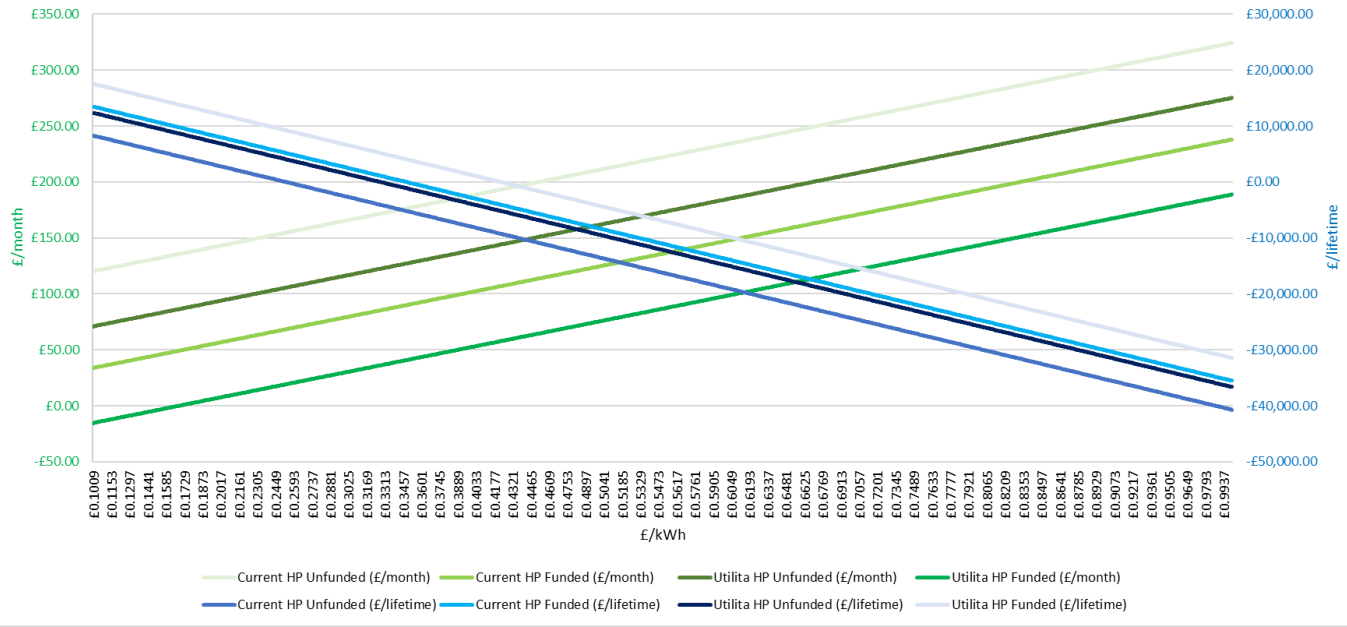


Figure 14: Effect of Gas Price on Net Monthly Outgoings & Lifetime Savings

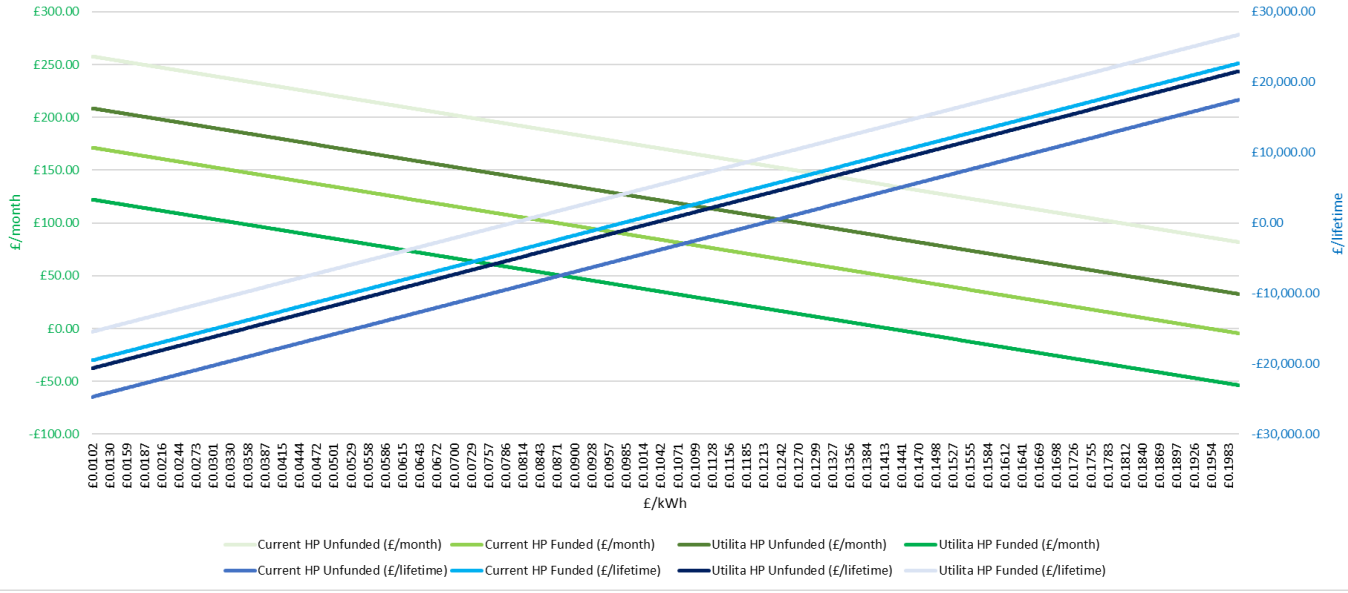


Figure 15: Effect of Technology Life Span on Net Monthly Outgoings & Lifetime Savings

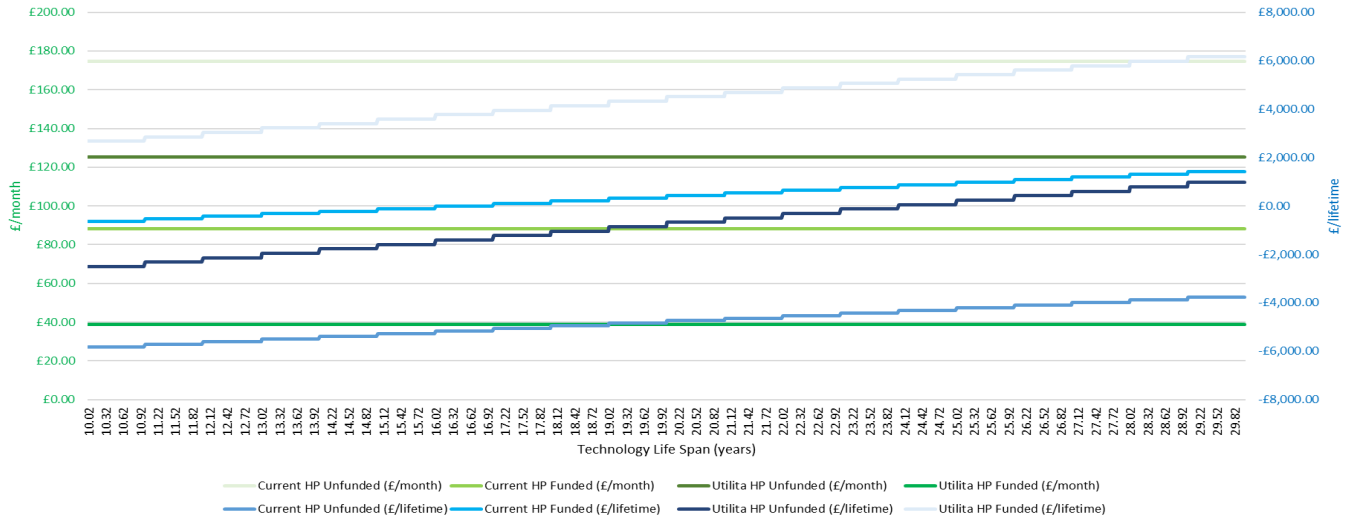


Figure 16: Effect of Boiler Efficiency on Net Monthly Outgoings & Lifetime Savings

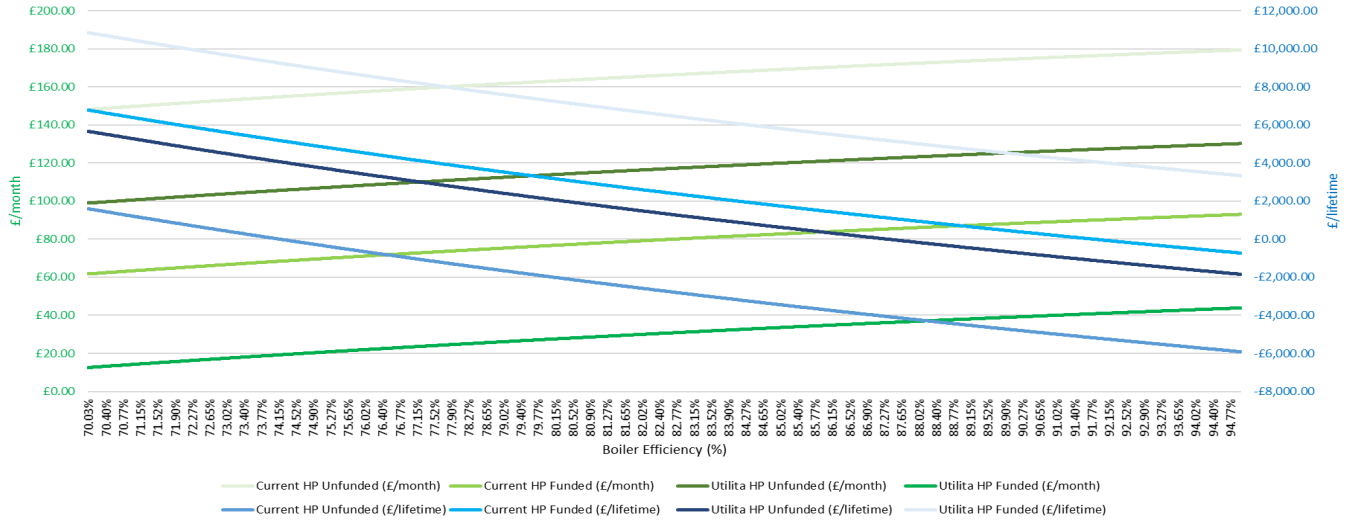


Figure 17: Effect of SCOP on Net Monthly Outgoings & Lifetime Savings

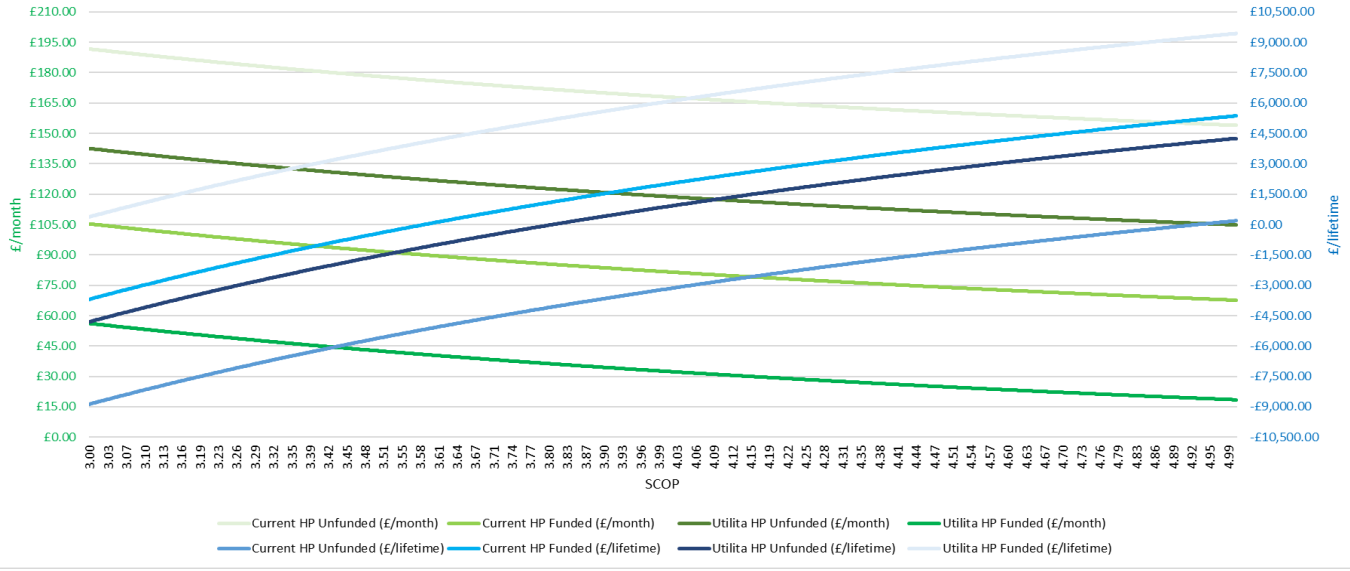


Figure 18: Effect of Repayment Term on Net Monthly Outgoings & Lifetime Savings

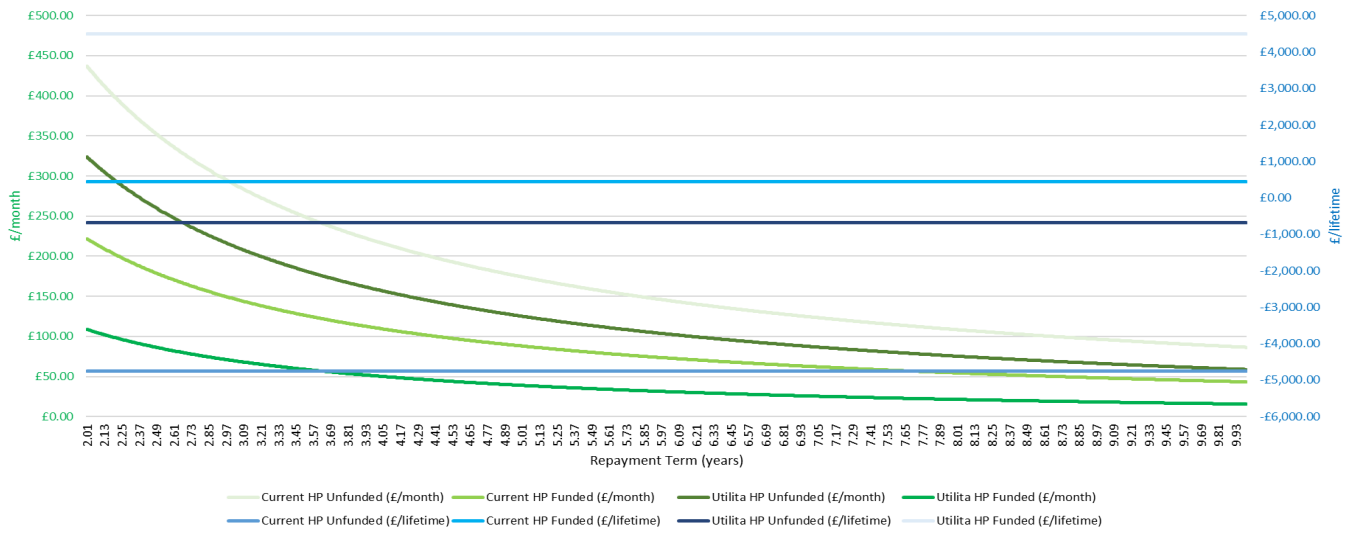


Figure 19: Effect of CAPEX on Net Monthly Outgoings & Lifetime Savings

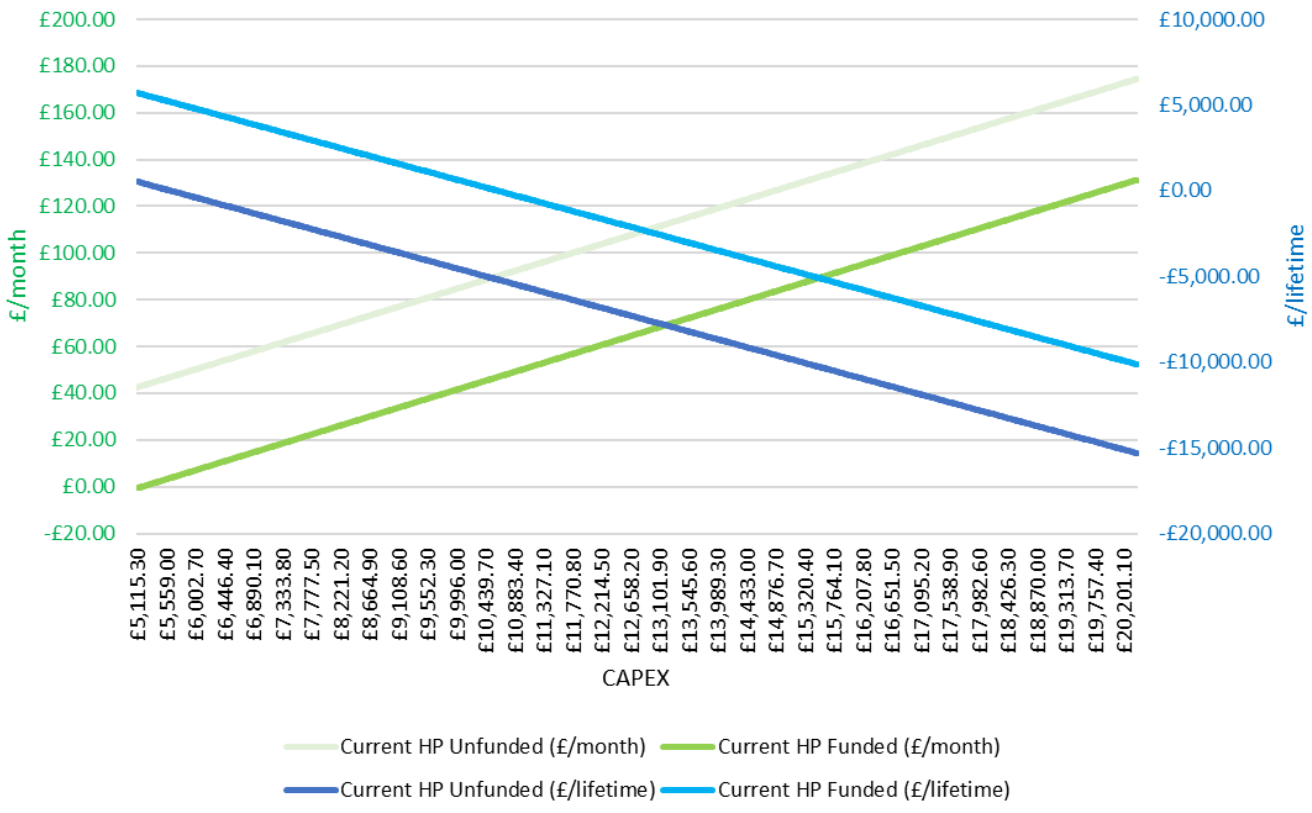


Figure 20: Effect of OPEX on Net Monthly Outgoings & Lifetime Savings

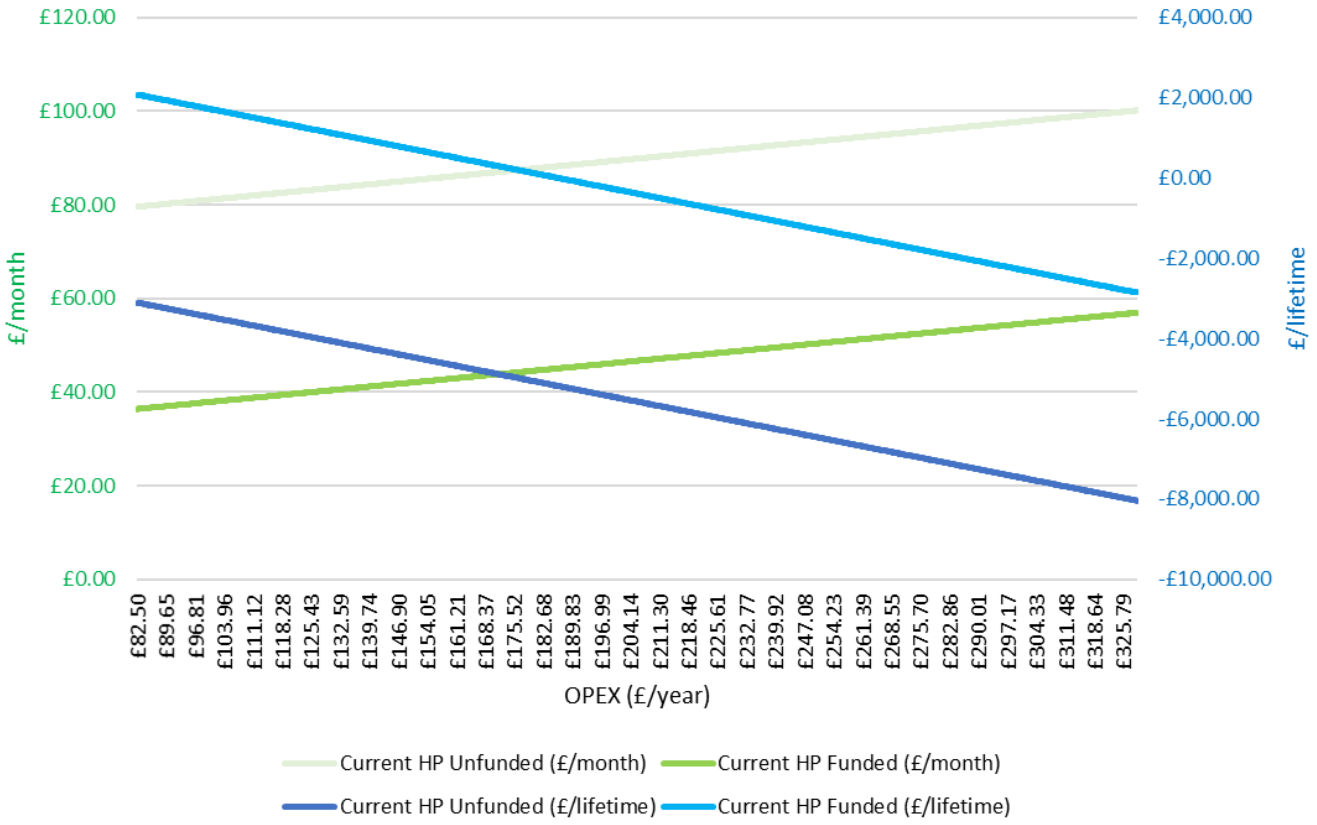
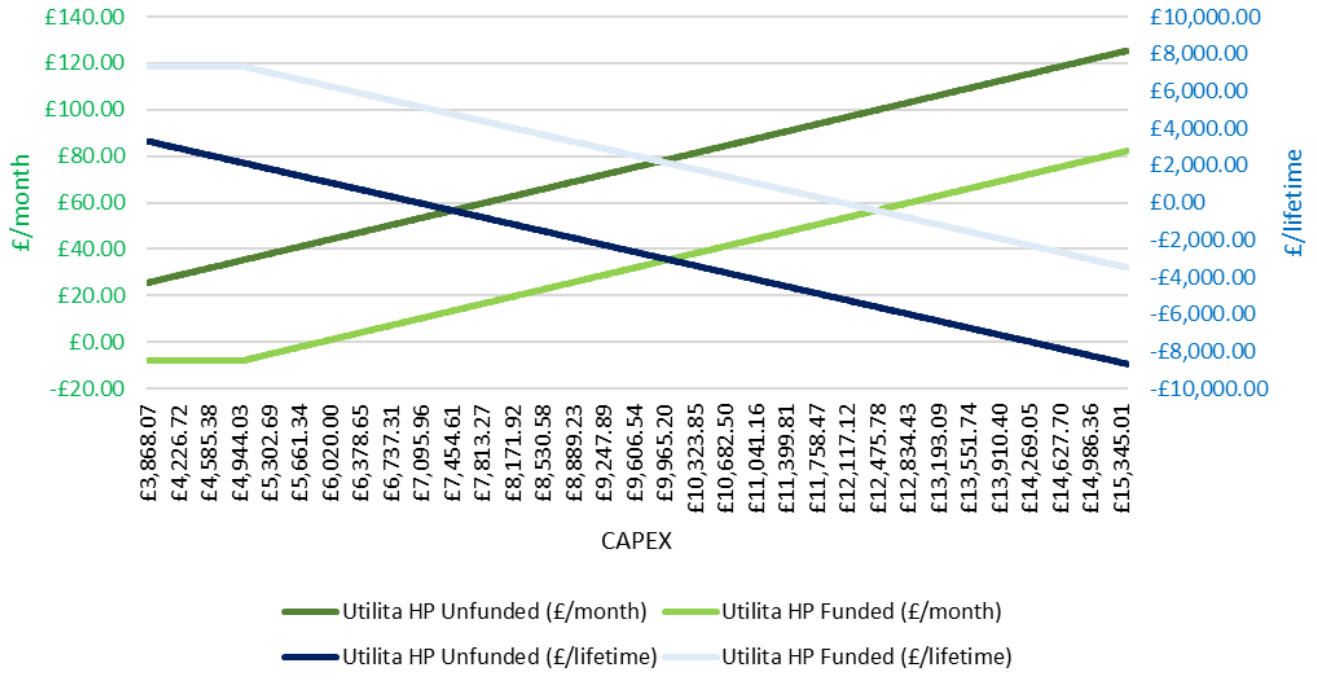


Figure 21: Effect of CAPEX on Net Monthly Outgoings & Lifetime Savings



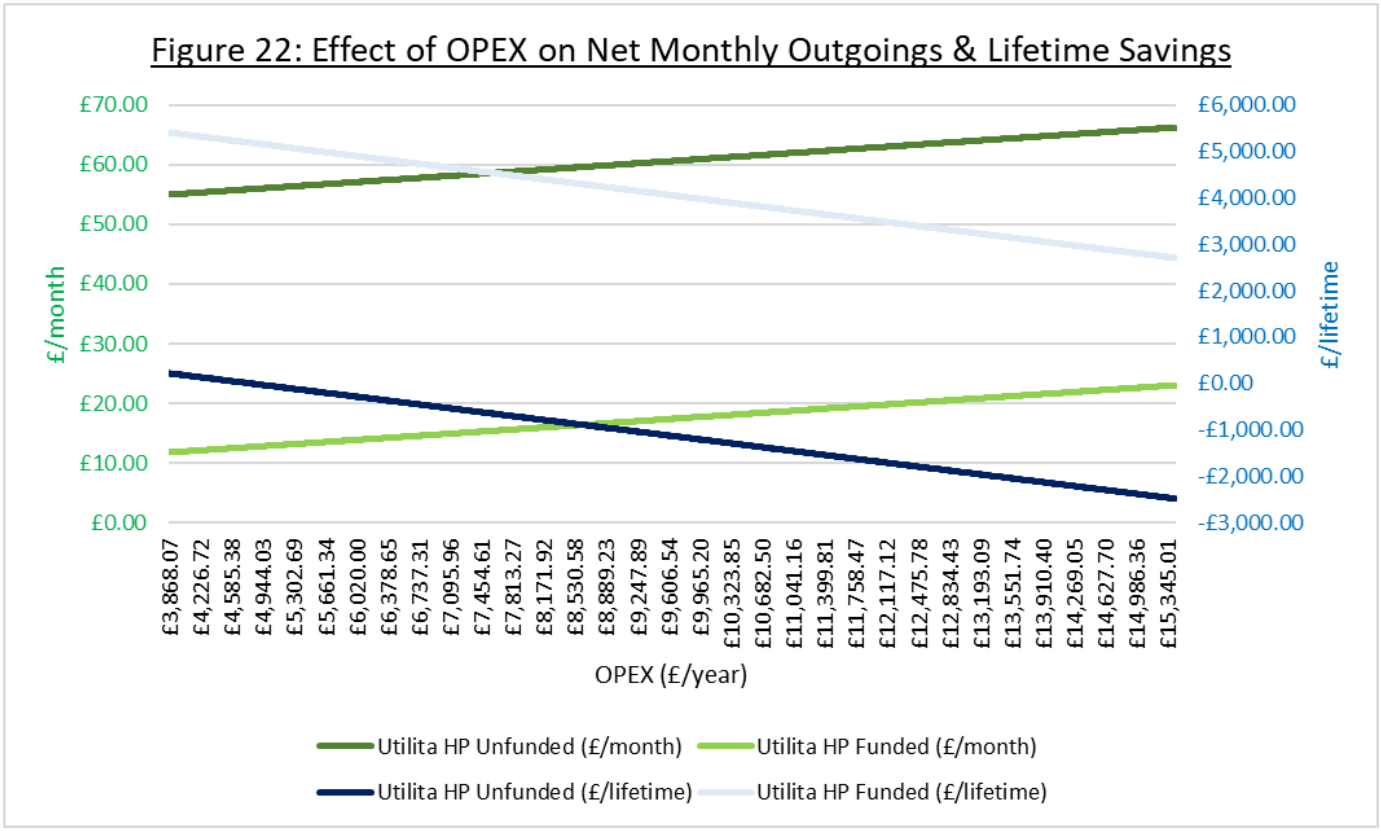
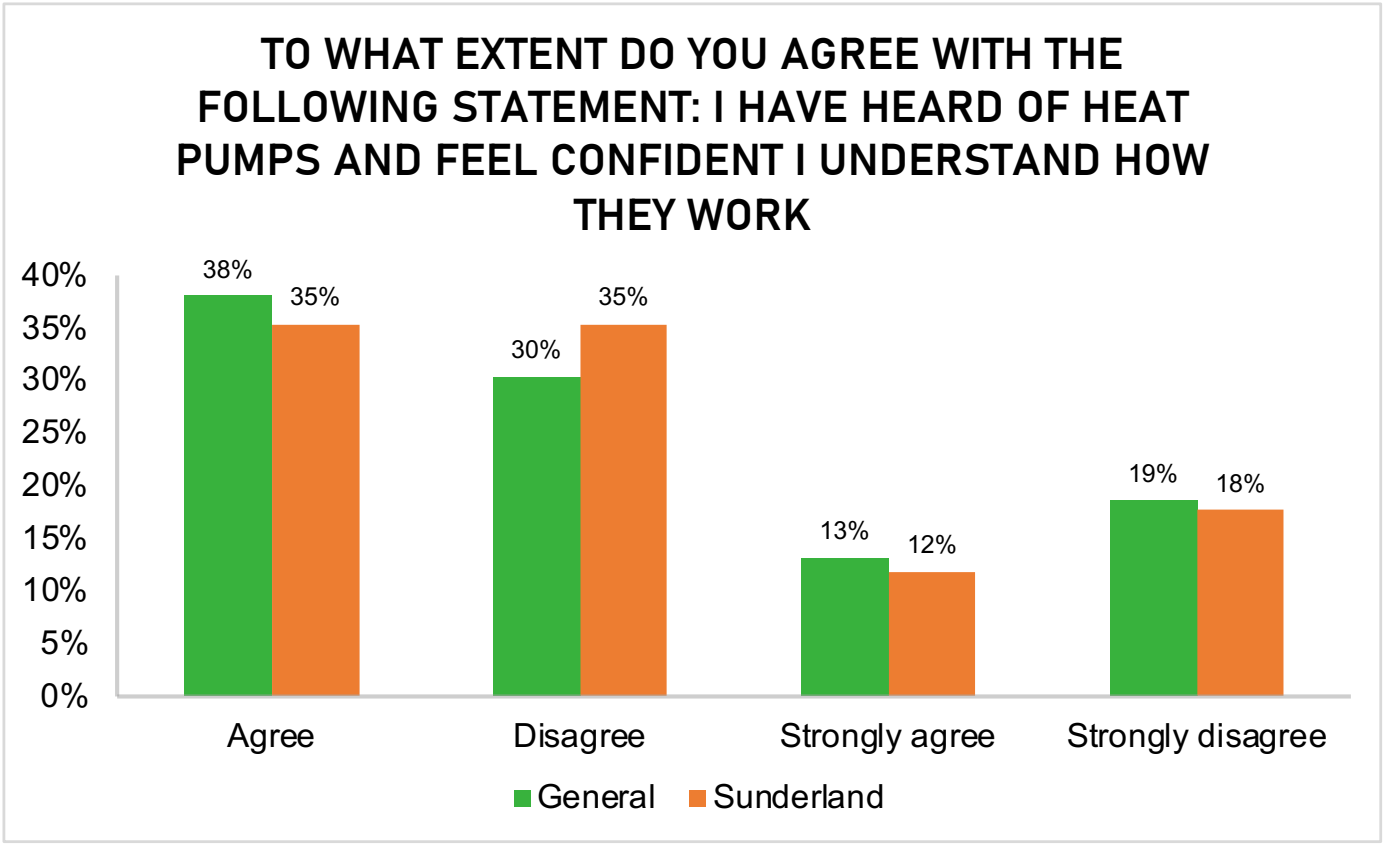
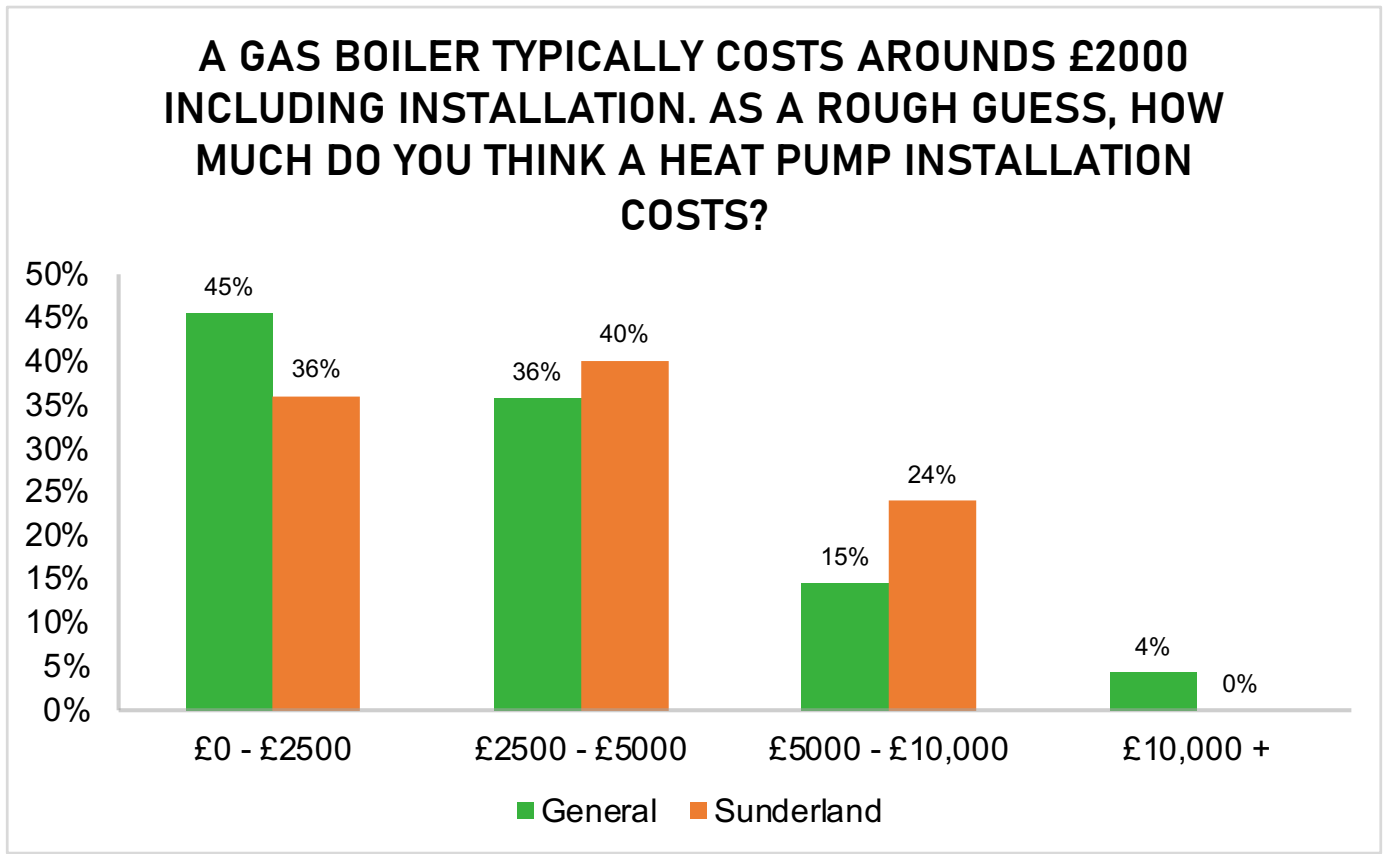
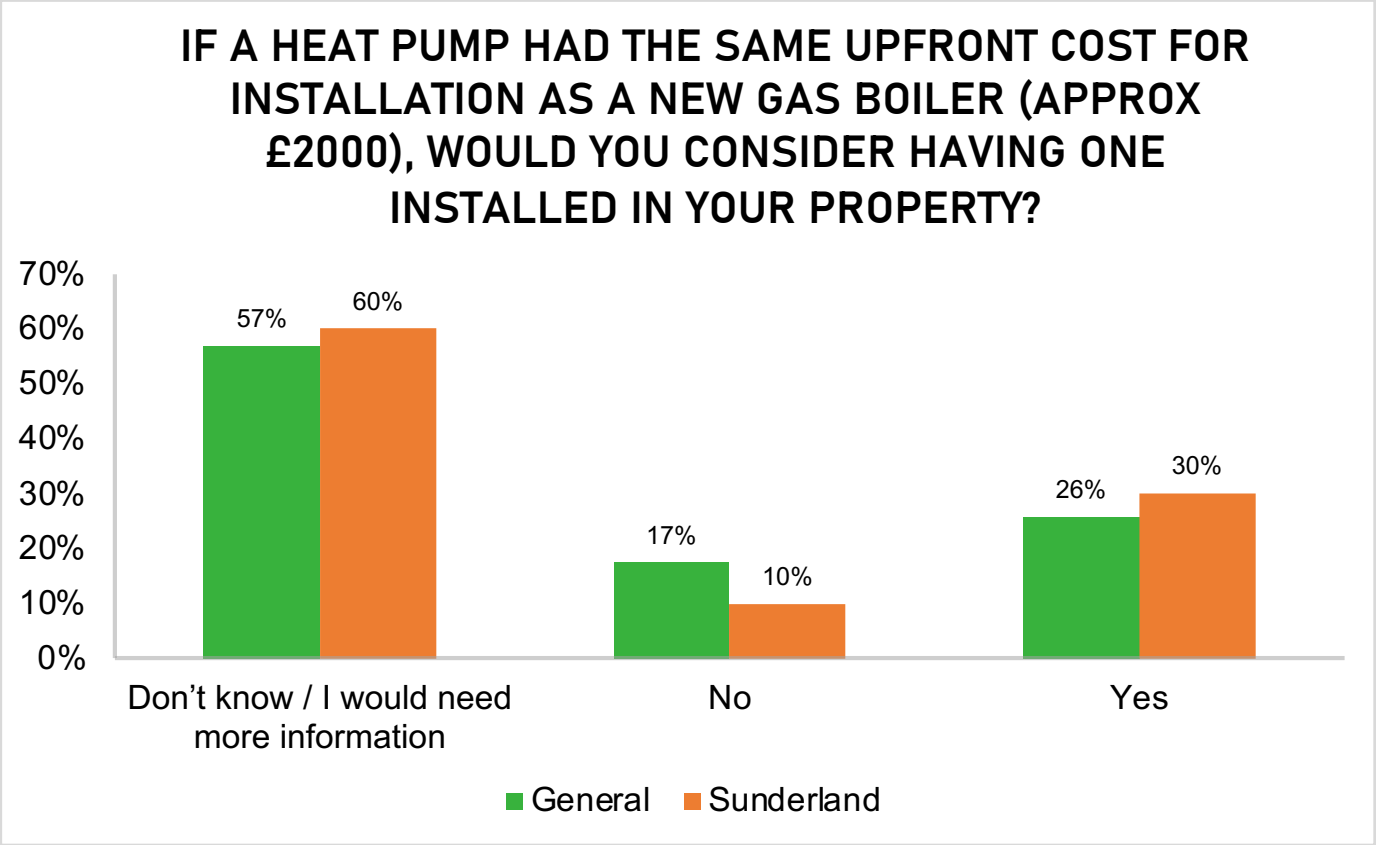


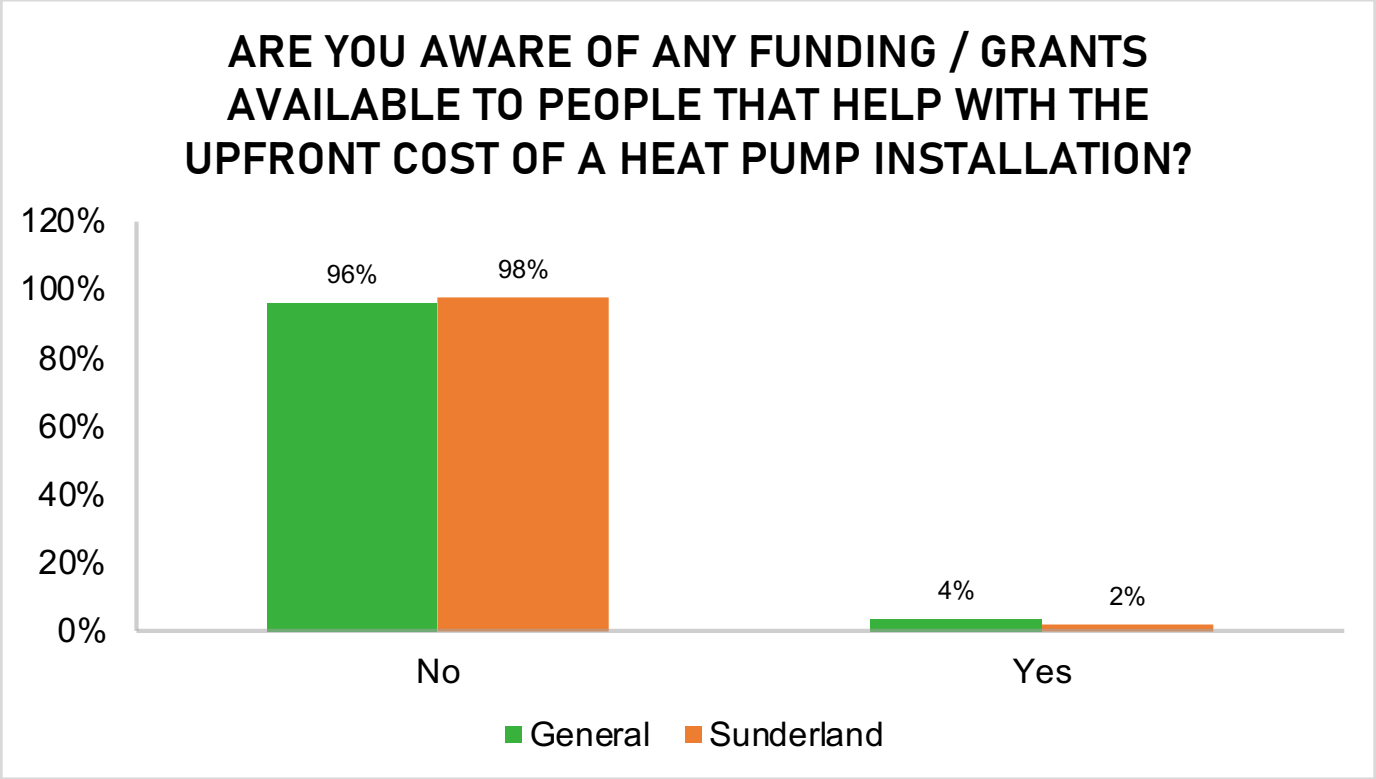
Figure 22: Effect of OPEX on Net Monthly Outgoings & Lifetime Savings
£70.00
£60.00
£50.00
£40.00
£30.00
£20.00
£10.00
£0.00
£/month
£6,000.00
£5,000.00
£4,000.00
£3,000.00
£2,000.00
£1,000.00
£0.00
-£1,000.00
-£2,000.00
-£3,000.00
£/lifetime
£3,868.07
£4,226.72
£4,585.38
£4,944.03
£5,302.69
£5,661.34
£6,020.00
£6,378.65
£6,737.31
£7,095.96
£7,454.61
£7,813.27
£8,171.92
£8,530.58
£8,889.23
£9,247.89
£9,606.54
£9,965.20
£10,323.85
£10,682.50
£11,041.16
£11,399.81
£11,758.47
£12,117.12
£12,475.78
£12,834.43
£13,193.09
£13,551.74
£13,910.40
£14,269.05
£14,627.70
£14,986.36
£15,345.01
OPEX (£/year)
Utilita HP Unfunded (£/month)
Utilita HP Funded (£/month)
Utilita HP Unfunded (£/lifetime)
Utilita HP Funded (£/lifetime)

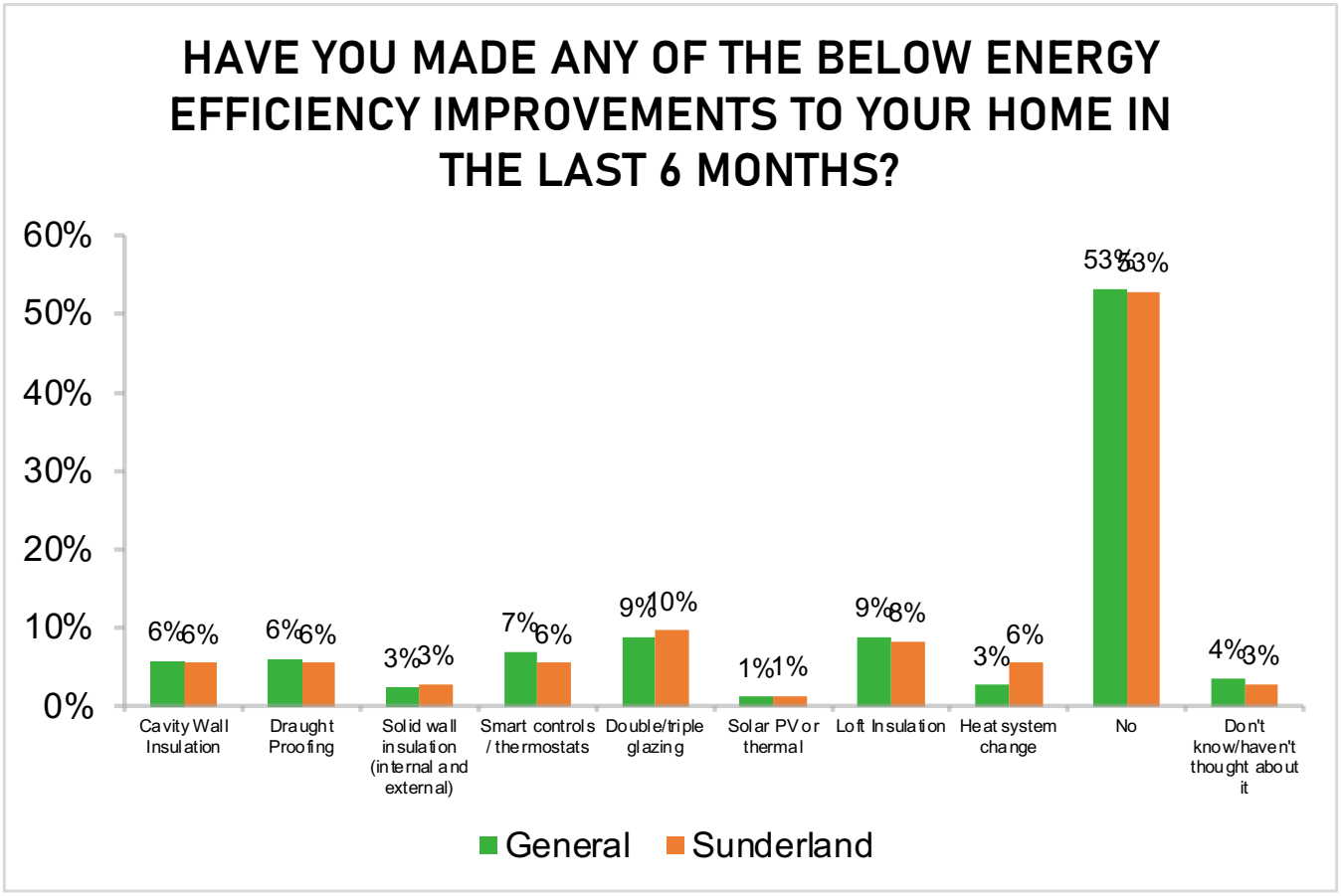
Utilita Heat Pump Survey Questions

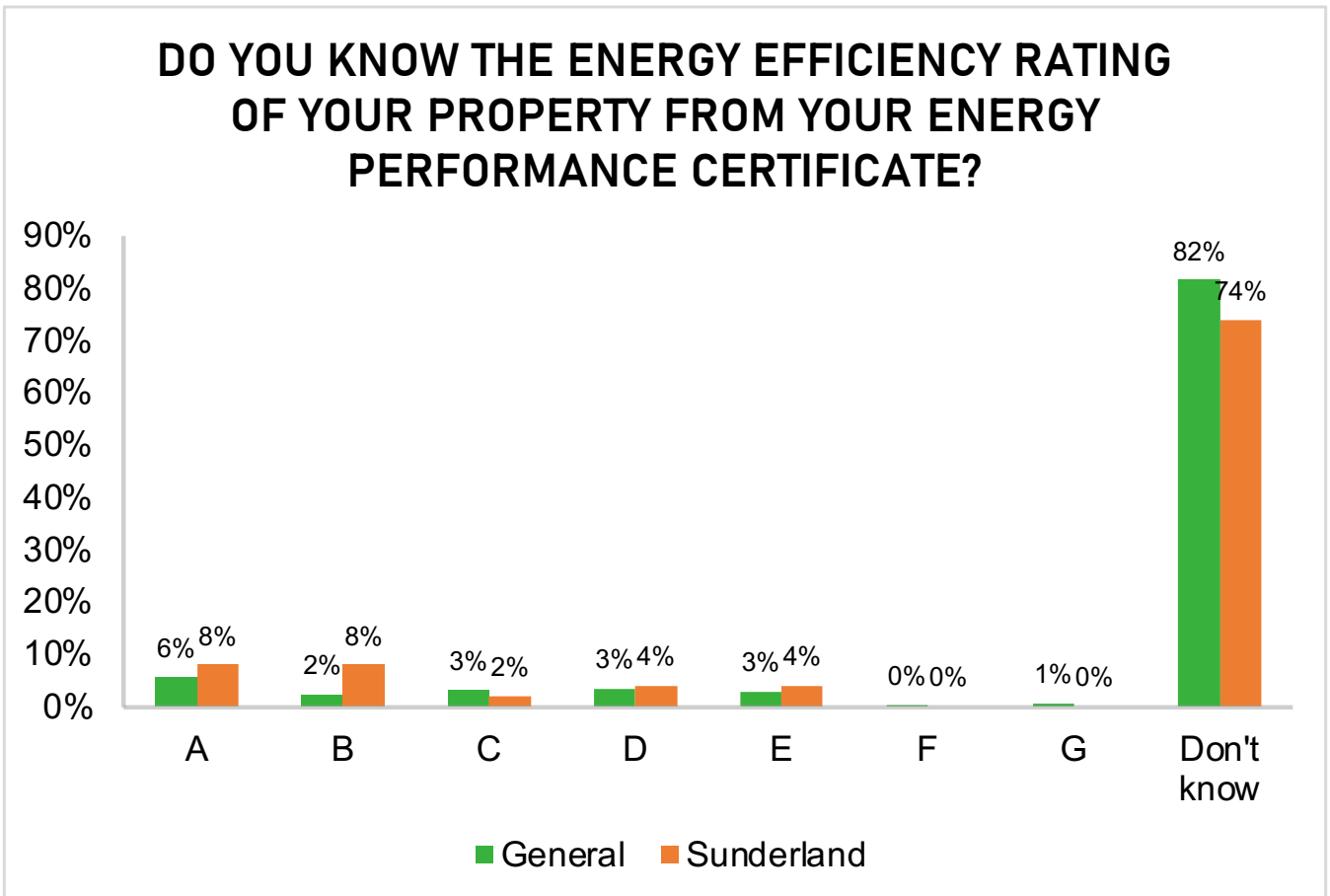




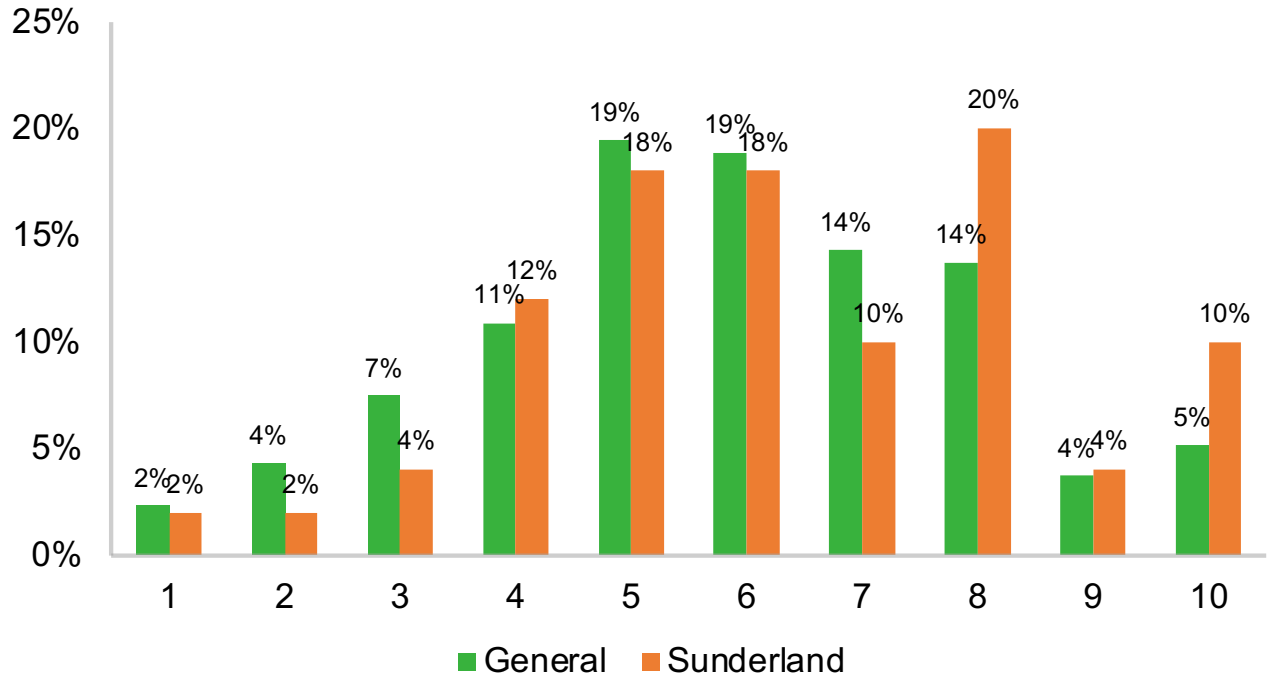

IF A HEAT PUMP HAD THE SAME UPFRONT COST FOR INSTALLATION AS A NEW GAS BOILER (APPROX £2000), WOULD YOU CONSIDER HAVING ONE INSTALLED IN YOUR PROPERTY?
70%
60%
50%
40%
30%
20%
10%
0%
57%
60%
17%
10%
26%
30%
Don't know / I would need more information
No
Yes
General
Sunderland


ARE YOU AWARE OF ANY FUNDING / GRANTS AVAILABLE TO PEOPLE THAT HELP WITH THE UPFRONT COST OF A HEAT PUMP INSTALLATION?
120%
100%
80%
60%
40%
20%
0%
96%
98%
4%
2%
No
Yes
General
Sunderland

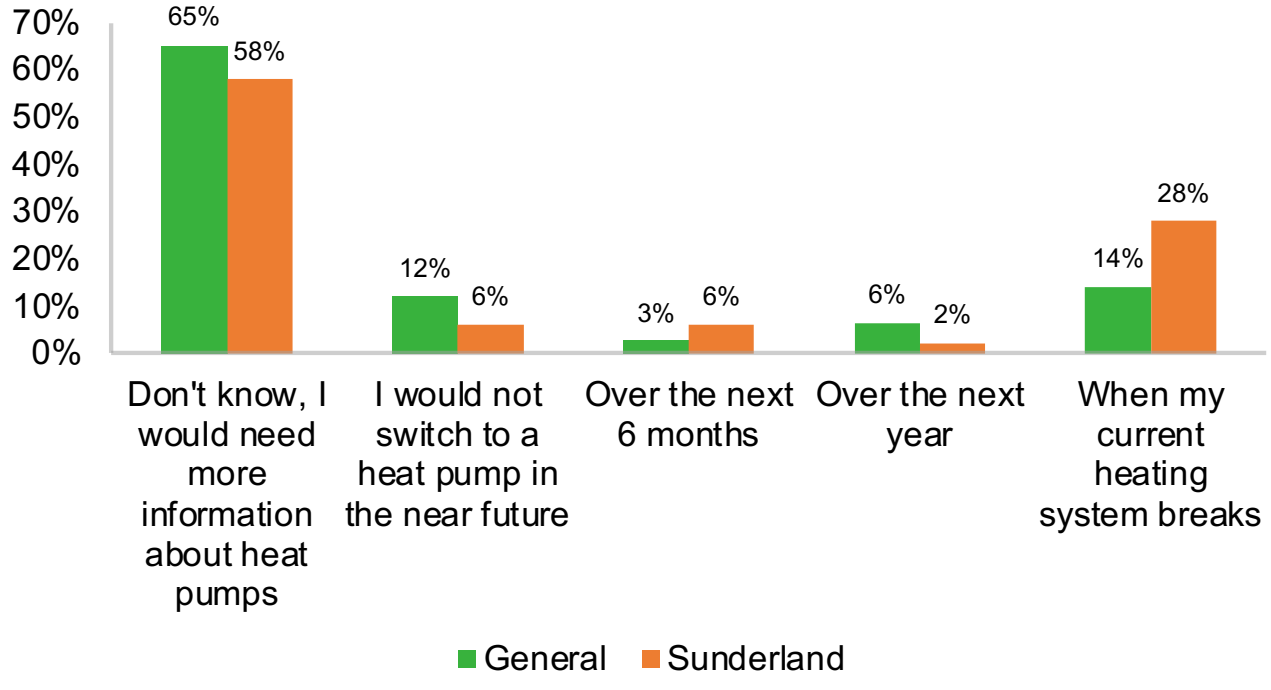

HAVE YOU MADE ANY OF THE BELOW ENERGY EFFICIENCY IMPROVEMENTS TO YOUR HOME IN THE LAST 6 MONTHS?
60%
50%
40%
30%
20%
10%
0%
6% 6%
6% 6%
3% 3%
7% 6%
9% 10%
1% 1%
9% 8%
3% 6%
53% 53%
4% 3%
Cavity Wall Insulation
Draught Proofing
Solid wall insulation (internal and external)
Smart controls / thermostats
Double/triple glazing
Solar PV or thermal
Loft Insulation
Heat system change
No
Don't know/haven't thought about it
General
Sunderland

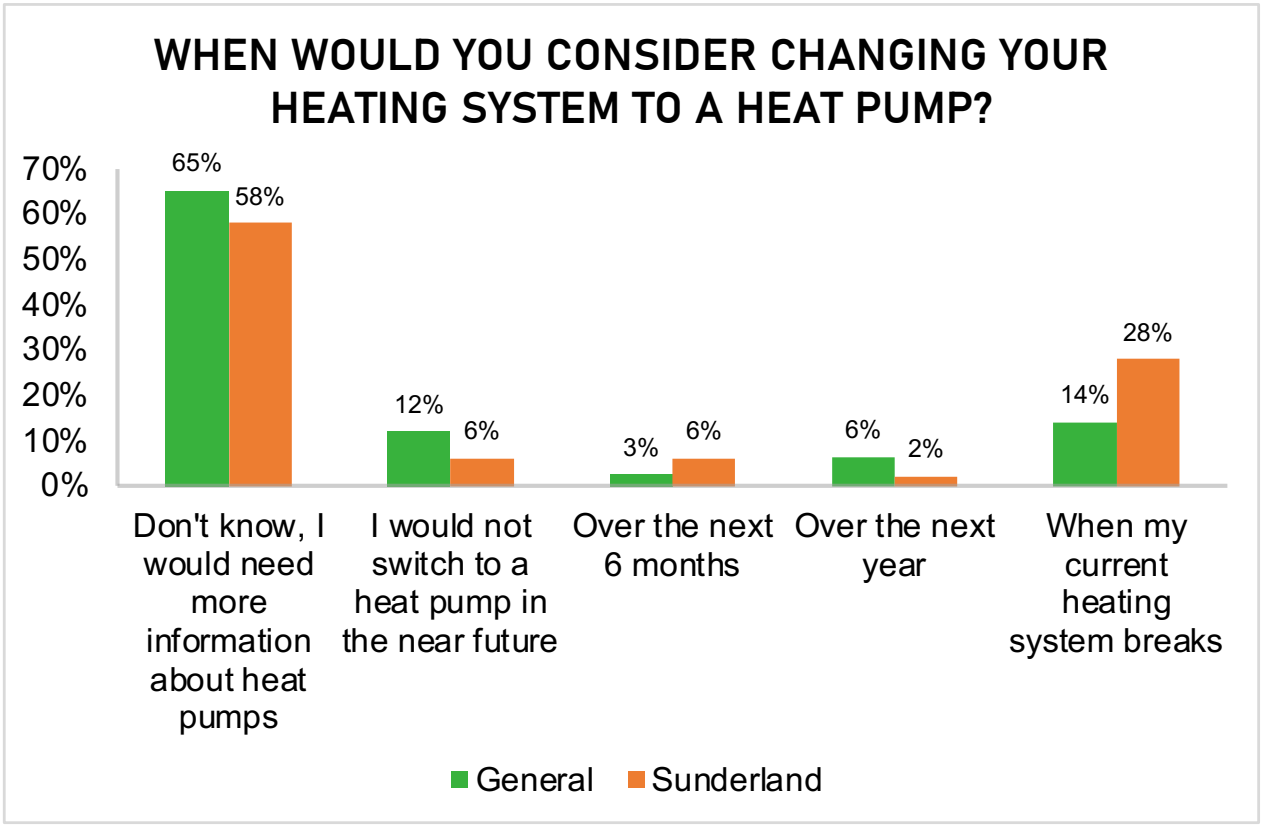

DO YOU KNOW THE ENERGY EFFICIENCY RATING OF YOUR PROPERTY FROM YOUR ENERGY PERFORMANCE CERTIFICATE?
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
6% 8%
2% 8%
3% 2%
3% 4%
3% 4%
0% 0%
1% 0%
82% 74%
A
B
C
D
E
F
G
Don't know
General
Sunderland

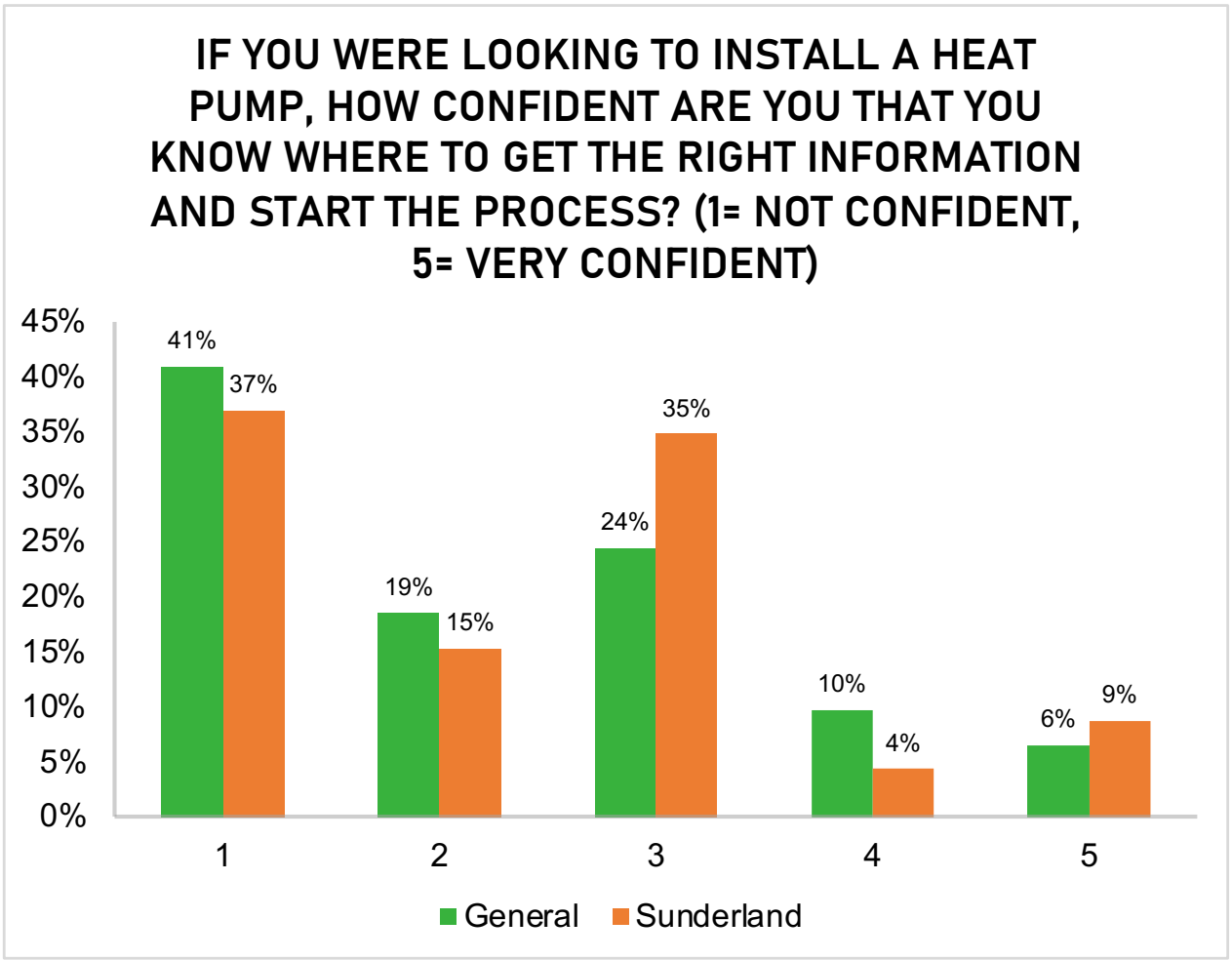
ON A SCALE FROM 1-10 (10 BEING HIGHLY EFFICIENT, 1 BEING NOT EFFICIENT AT ALL), PLEASE RATE HOW ENERGY EFFICIENT YOU FEEL YOUR PROPERTY IS?



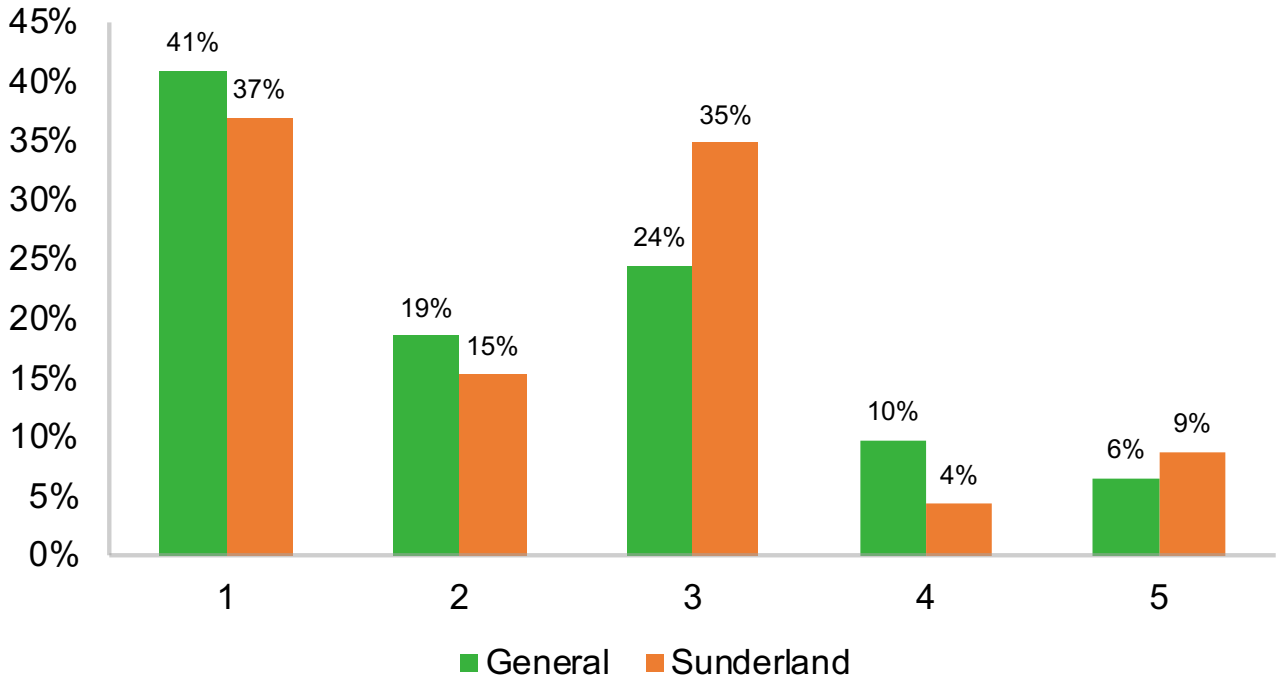
WHEN WOULD YOU CONSIDER CHANGING YOUR HEATING SYSTEM TO A HEAT PUMP?



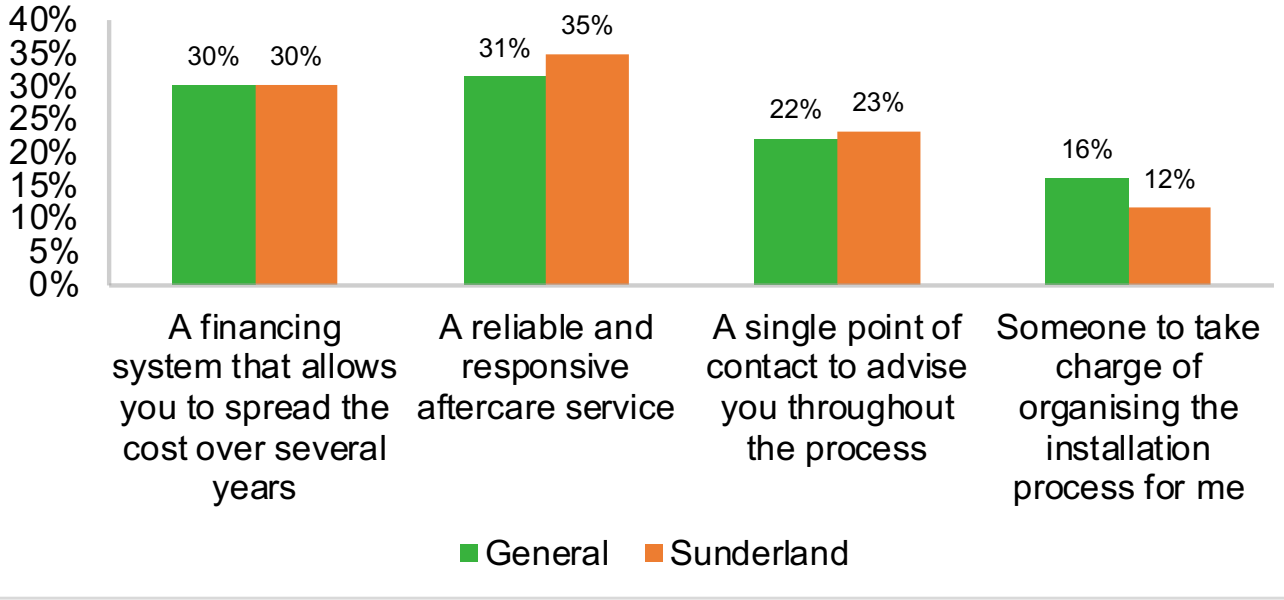

WHEN WOULD YOU CONSIDER CHANGING YOUR HEATING SYSTEM TO A HEAT PUMP?
70%
60%
50%
40%
30%
20%
10%
0%
65%
58%
12%
6%
3%
6%
6%
2%
14%
28%
Don't know, I would need more information about heat pumps
I would not switch to a heat pump in the near future
Over the next 6 months
Over the next year
When my current heating system breaks
General
Sunderland

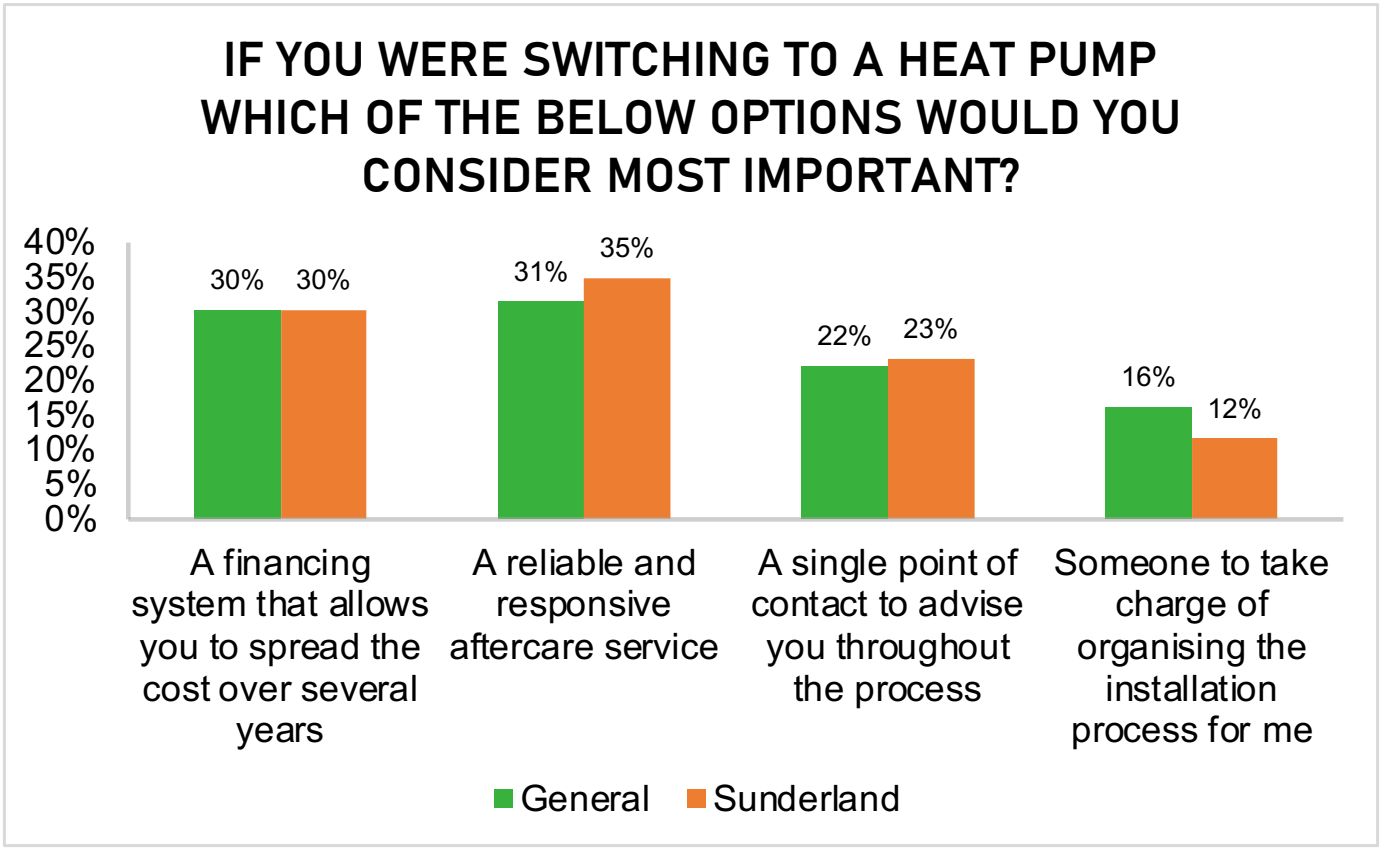

IF YOU WERE LOOKING TO INSTALL A HEAT PUMP, HOW CONFIDENT ARE YOU THAT YOU KNOW WHERE TO GET THE RIGHT INFORMATION AND START THE PROCESS? (1= NOT CONFIDENT, 5= VERY CONFIDENT)
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
41%
37%
19%
15%
24%
35%
10%
4%
6%
9%
1
2
3
4
5
General
Sunderland

IF YOU WERE LOOKING TO INSTALL A HEAT PUMP, HOW CONFIDENT ARE YOU THAT YOU KNOW WHERE TO GET THE RIGHT INFORMATION AND START THE PROCESS? (1= NOT CONFIDENT, 5= VERY CONFIDENT)



IF YOU WERE SWITCHING TO A HEAT PUMP WHICH OF THE BELOW OPTIONS WOULD YOU CONSIDER MOST IMPORTANT?




IF YOU WERE SWITCHING TO A HEAT PUMP WHICH OF THE BELOW OPTIONS WOULD YOU CONSIDER MOST IMPORTANT?
40%
35%
30%
25%
20%
15%
10%
5%
0%
30%
30%
31%
35%
22%
23%
16%
12%
A financing system that allows you to spread the cost over several years
A reliable and responsive aftercare service
A single point of contact to advise you throughout the process
Someone to take charge of organising the installation process for me
General
Sunderland

Summary of the challenges faced during the customer LCA for heat pumps

Research	Customer uses search engine to gather information Customer speaks to friends/ family/ neighbours/ local electrician asking for advice Uninformed about heat pumps and how they work (especially low income households) Not sure where to go for information / no obvious platform or service to use Relevant information is not easily accessible or available
Choice	Customer uses information available to make a choice Heat pump specific online literature can be hard to find, contradictory and confusing Lack of trust in new technology Difficult to find unbiased reviews Few MCS accredited installers in Sunderland Distress purchasing
Purchase	Customer spends time choosing between packages Lots of options / packages available which can cause confusion Confusion around which heat pump technology suits the customer Lack of data showing price comparison between heat pumps and installers
Installation	Customer has heat pump installed without understanding the process fully Unknown levels of disruption associated with installation (heating/ hot water) Need for Planning and DNO consent which is not a familiar process for consumers No idea what 'good' installation looks like No opportunity for customer feedback
Post install support and monitoring	Customer has heat pump installed Customer unsure of what to monitor Unfamiliar with using the new technology Unsure of rights for servicing and maintenance Unsure of how to communicate with supplier
Supply Chain Factors	Availability of qualified domestic heating engineers Stock management of heat pumps Stock of ancillary equipment
Electricity Grid Factors	Inadequacy of Connect and Notify Provision of home upgrades

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