



Understanding how to motivate whole-house retrofit

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Executive summary



As part of its *Accelerator Cities* programme, conducted with the support of EIT Climate-KIC, The UK Green Building Council (UKGBC) commissioned in-depth consumer research to understand better how to encourage householders to take a 'whole-house' retrofit approach, rather than just specific energy-saving measures. *New Experience* conducted 10 in-depth interviews in December 2020 with house owners across England who were considering, or had already undertaken, measures aimed at improving energy efficiency.

KEY FINDINGS

- Most householders are attracted to the idea of a whole-house plan once it is explained to them, especially the benefits of knowing upfront how to sequence measures and ensure forward compatibility. Those contemplating more extensive works indicate they would willingly pay for the service.
- Householders believe that installing a modern gas boiler is an 'energy-efficient' thing to do. Echoing findings from previous research, they were not aware of the impact boilers have on carbon emissions, even those expressing a strong commitment to the environment. The research indicated that once participants know, they may think again.
- There seems to be an opportunity at the intersection of electric vehicle (EV) ownership and renewable-electricity generation. Householders can be very attracted to the idea of self-sufficiency and what they see as driving for 'free'. This suggests opportunities to incentivise these elements together as a package.
- This appeal of 'free' energy might also extend to encouraging take up of heat pumps by those who can use onsite renewable-energy generation to power them.
- Findings suggest that a feeling of 'future proofing' is appealing to householders. They recognise that taking measures to increase energy efficiency will protect them from energy price rises, flattening or declining income, e.g., in retirement, and from possible future legislation. This suggests an opportunity to shift the narrative from a focus on short-term payback.
- Householders' decisions are strongly affected by the length of time they expect to stay in their current home.
- Findings suggest that householders categorise measures according to three stages of a whole-house retrofit 'journey', with a perception that benefits decline as costs increase. For example, replacing a working gas boiler with renewable heating falls into the third stage of 'Paying for little perceived gain', where householders can currently feel there is a risk they may be paying more for potentially-less-effective heating systems.

SUPPORTING HOUSEHOLDERS THROUGH THE WHOLE-HOUSE JOURNEY

Offering whole-house retrofit planning

- Householders were shown details of a real whole-house retrofit planning service providing holistic and strategic recommendations for improving energy efficiency aimed at ensuring forward compatibility of earlier measures with possible later ones.
- Becoming aware of the forward-compatibility issues of retrofit is a revelation to householders who almost unanimously latch on to such guidance as a key benefit, encouraging those contemplating more extensive works to report they would willingly pay for the service.
- Such a service can make householders aware of available measures, should ideally tie in with non-energy-related improvements householders may wish to make, and could help check the customer's eligibility for grants.
- Association with a local authority brings reassurance to householders that a service is impartial and trustworthy.

Communication of 'experiential benefits' to start the journey

- These benefits are improved comfort, health, aesthetics, security and product performance; they are directly experienced by householders.
- Experiential benefits are motivators for undertaking the first-stage. Enhanced living, lower bills measures but the benefits are not always salient to householders who have not yet undertaken such measures.
- Communication of these benefits will help people start on the journey and encourage them to take up more of these measures.



Tilting the narrative from payback to future proofing and lower bills; mitigating against perceived high upfront costs

- As householders move through the journey, upfront costs increase while perceived benefits decrease, causing them to look increasingly for payback over and above lower bills.
- Policies that reward householders financially, such as cutting council tax for greener homes will help householders see payback through their reduced outgoings as well as potentially through a relative increase in property value.
- As householders move through the journey and take up more measures energy bills should steadily reduce. Communication aimed at conveying the future-proofed-finances feeling of minimising energy bills may help tilt motivation away from payback towards the future proofing of lower bills.
- Householders are often unclear about their eligibility for grants and may not attempt to find out. They can also wonder if it is worth waiting for better grants and deals to come along. Householders need better support in relation to finding out about grants. The research suggests a commitment to future grants being retrospective might overcome householders' concerns about missing out later.
- The high perceived cost of heat pumps, and other measures that may be required to ready a home for a heat pump, suggest an opportunity for bundled deals such as 'Heat as a service' where upfront costs are bundled into an ongoing contract to deliver heat outcomes.

Leveraging householders' environmental commitment

- All householders had a degree of environmental commitment with the more committed reporting they would be prepared to make some financial sacrifice.
- Reflecting other research there is widespread ignorance over the significant contribution made by gas boilers to carbon emissions, even among the more environmentally committed.
- Addressing this confusion while better communicating the extent of carbon emission savings from new measures will help move householders along the journey and in particular encourage switching from boilers to more sustainable technologies like heat pumps.

Harnessing the appeal of 'free' energy and self-sufficiency

- Householders gain satisfaction from generating their own electricity to charge EVs for 'free', driving and running appliances for 'free', washing and drying of clothes and dishes.
- Ownership of solar may drive EV acquisition and conversely EV ownership may drive solar acquisition, suggesting an opportunity for initiatives to incentivise acquisition of the two together.
- This appeal of self-sufficiency may also work to move householders along the journey by communicating an ultimate situation of onsite renewable electricity powering a heat pump, so offering 'free' heating as well as electricity.

Anticipated length of tenure affects householders' willingness to move forward

- Householders are much more likely to go forward with measures, especially those further along the journey, if they plan to stay in their home for a significant length of time.
- Policies that help to ensure money spent on energy-efficiency measures translate into higher relative property values should increase motivation to act when anticipated tenure is relatively short.



1. Introduction



1.1 BACKGROUND

The UK Green Building Council (UKGBC) is aiming to support local authorities in leading mass-scale 'whole-house' retrofits of existing homes. Only through whole-house retrofits will the UK's housing stock be in a position to support the government's target of achieving net zero. UKGBC commissioned this research to better understand the motivations and barriers to householders taking a whole-house approach as opposed to just undertaking specific measures.

There is no single definition of a whole-house retrofit as it depends on the build and age of house, and what work has already been done. From the industry perspective conducting a whole-house retrofit is a strategic process, ideally involving an expert conducting a detailed survey and creating a tailored, whole-house plan, to recommend measures to be taken to bring the home close to net zero, and ensuring measures are future-proof, such as making sure a hot water cylinder is compatible with a renewable heat source like a heat pump or solar thermal that may be installed at a later date.

1.2 RESEARCH QUESTIONS

1. What is the awareness and understanding of measures required to achieve a whole-house retrofit?
2. How do householders respond to being shown the measures they might need to take, and the costs involved?
3. What are the main barriers/ obstacles that householders report in relation to going beyond specific measures and for those who have or are taking a whole-house approach?
4. How do householders respond to the idea of an expert laying out a whole house plan with steps to take and the order to take them?
5. What are the reported benefits of taking more of a whole-house approach? What motivates some to take more of a whole-house approach and what are the implications for messaging to encourage others to take this approach?
6. What implications do householders' reported experiences have for local authority initiatives in terms of obstacles to be overcome?
7. What implications arise for language used in messaging and communications around whole-house retrofit?

1.3 METHODOLOGY

One-on-one 60-minute remote in-depth qualitative interviews were conducted over Zoom with 10 house owners in different regions of England who had either undertaken or were planning measures aimed at improving energy efficiency. The interviews first explored the underlying motivations and experience of undertaking or planning their actual works, then explored attitudes towards undertaking additional works required for a whole-house approach, and finally captured responses to a whole-house planning service using extracts from the website of a real service based in Oxfordshire¹. A pilot session took place on 14 December, then fieldwork ran from 16 to 21 December 2020.

1.4 HEALTH WARNING

As small-scale qualitative research that was exploratory in nature conclusions should be considered preliminary in some areas. In particular only one participant had installed solar although some others were considering the measure. Important conclusions are drawn from findings about solar but should be treated as tentative and material for further exploration at this time. Other areas of findings would also benefit from follow-up studies and are listed in [Section 3.0](#).

¹ <https://cosyhomesoxfordshire.org/homeowners/homeowners-how-it-works/>

2. Overview of retrofit experience

1.5 PARTICIPANTS RECRUITED TO THE STUDY

Code	House	Period	Measures taken	Planning/considering
P1	Detached	1981-99	Boiler, solar and solar thermal, doors, windows, smart heating and lighting	Battery, EV
P2	Detached	1981-99	EV	Cavity-wall insulation, loft insulation, windows, solar
P3	Detached	1951-80	Boiler, radiators, induction hob, loft insulation, cavity-wall insulation (in last house)	
P4	Detached	1981-99	Loft insulation, windows, cavity-wall insulation	
P5	Terraced	Pre 1900		Damp coursing, loft insulation, windows, oil-fired boiler although will look into heat pump, ventilation
P6	Detached	1901-50		Solar, insulation measures in an extension
P7	Semi	1951-80	Radiators	Windows, boiler, cavity-wall insulation, under-floor insulation, loft insulation
P8	Semi	1981-99	Cavity-wall insulation, windows, loft insulation, boiler	
P9	Detached	1981-99	Loft insulation, radiators	Windows, solar
P10	Semi	1901-50	Front door	Windows



2.1 A HOUSEHOLDER-CENTRIC TYPOLOGY OF ENERGY-EFFICIENCY MEASURES

Fundamentally this research was looking at how householders might be encouraged to undertake whole-house retrofits. Although everyone in the recruited sample had or was considering undertaking energy-efficiency measures no one was thinking in terms of whole-house retrofits to achieve net zero, and no one was taking a whole-house approach designed to ensure the forward-compatibility of measures with ones that may be taken later.

The industry talks about whole-house measures according to how they bring about energy efficiency, e.g., fabric and renewable-energy, or by their incremental impact on achieving net zero, but another way to look at them is from the perspective of householders, according to perceived benefits and costs.

This research suggests three householder-centric categories as 'journey stages', each different from the others, with inclination to act declining from the first to the third stage. Such a categorisation may help identify and focus differing messaging and policy requirements to support uptake of measures comprising a whole-house retrofit. Implications for messaging and policy appear in [Section 3.0](#).

Although householders did not start with a whole-house point of view they became attracted to the whole-house approach of ensuring the forward-compatibility of measures, once it was brought to their attention as an important consideration.

The three householder-centric, journey-stage categories of measure are:

Enhanced living, lower bills	Free-for-life energy	Paying for little perceived gain
Replacement doors and windows	Solar panels	Ground and air-source heat pumps
Loft/roof insulation	Solar thermal	Waste-water heat recovery
Under-floor insulation	Battery storage	
Solid wall insulation	Micro-wind	
Party-wall insulation	'Smart' appliance use	
Cavity-wall insulation		
Draft proofing		
Smart heating		
Induction hob		
Low-energy lighting		
New combi boiler		



Enhanced living, lower bills, journey stage 1

These measures offer easy-to-grasp, experiential benefits of improved comfort, health, aesthetics, security and product performance, as well as reductions in energy bills. The measures in this category include most fabric measures, and also efficiency measures such as smart heating, induction hobs and low-energy lighting. From a householder's point of view a modern gas boiler is also such a measure as it provides heating and hot water in a more energy-efficient manner. *Echoing previous research, even the more environmentally committed are mostly not aware of boilers' significant contribution to carbon emissions.*

Although the appeal of individual measures varies, this category is the easiest 'sell' to householders and has the broadest appeal.

Free-for-life energy, journey stage 2

This category comprises renewable-energy measures, and the focus of discussion in the research was on solar. While solar does not bring real experiential benefits, it offers 'free' energy after an initial investment. It has appeal partly because it offers reduced bills and potential payback over a meaningful period, but also because householders get satisfaction from maximising use of the 'free' energy through (smart) appliances and EVs. Smart appliances appear in this category of measures as they can be programmed to synchronise with home-generated energy. 'Smart' appears above in parentheses as householders talked about their own 'smart' use of 'dumb' appliances, for example running them when their solar electricity was generated.

Onsite renewable energy does not appeal to everyone but this category can be a relatively easy 'sell' to some householders, and potentially more so in future.

Paying for little perceived gain, journey stage 3

This category comprises heat pumps and waste-water heat recovery both of which are perceived to have high upfront costs to install. Although both measures promise reductions in future energy bills, neither offers any perceived 'experiential' benefits to householders and in the case of heat pumps there can be a perception of less-effective heating compared to a gas boiler.

This category is currently the hardest 'sell' to householders who may not be motivated to take action unless payback over a meaningful period can be guaranteed. The exception might be for householders who are extremely committed to cutting their carbon emissions and reaching net zero and who can afford the upfront costs, but there was no one like this in the sample even though they were all, to a greater or lesser degree, motivated to reduce carbon emissions.

2.2 MOTIVATING FACTORS THAT INFLUENCE ADOPTION OF MEASURES

The research has identified four motivating factors that influence householders in their decision to adopt measures.

Experiential benefits

Improved comfort, health, aesthetics, security and product performance as salient benefits directly experienced by householders.

Financial benefits

Payback over a defined period through a potential increase in property value; benefiting from lower future energy bills, and possibly fiscal incentives.

Environmental commitment

Commitment to playing a part in reducing carbon emissions wherever reasonable and possible. When other motivations do not apply, environmental commitment becomes increasingly important as a motivator.

Synchronicity and self-sufficiency

Gaining satisfaction from being able to generate one's own 'free' energy and maximising the benefits by synchronising the use of appliances and charging of EVs with sunshine or wind.



2.3 OTHER HOUSEHOLDER FACTORS THAT INFLUENCE ADOPTION OF MEASURES

This research identified a range of other factors that influence householders in their decision to adopt measures:

Awareness and knowledge

Awareness and knowledge of measures is a prerequisite for taking any action and for taking a more whole-house approach.

Financial wherewithal

Resources available: money that a householder is willing and able to spend on energy-saving measures after considering competing demands, including non-energy-related improvements they may wish to make to their home.

Access and willingness to tap grants and finance: having awareness and access to grants and finance and being willing to make the commitment that an offer of finance may require.

Barriers to undertaking measures

Beyond financial constraints some other potential barriers to undertaking measures include lack of any perceived problem to solve when it comes to boiler replacement, anxiety around finding a high-quality contractor, disruption due to works, current fear of having tradespeople in the home due to Covid, and impact on aesthetics in relation to solar.

Forward-compatibility whole-house considerations

Householders are not aware of the value of ensuring appropriate sequencing and forward compatibility when undertaking measures but once they become aware, this has potential to influence decisions and encourage a whole-house approach.

Length of anticipated tenure

The length of time a householder expects to be in their home has a big impact on their willingness to undertake energy-saving measures. If they only intend to spend a few years in the home they are less inclined to spend money on measures that they will only benefit from for a limited period, unless they can be sure of recouping their money, for example by feeling confident that the measures will lead to an equivalent increase in property value. Those that expect to keep their home for many years, seeing it as their 'forever home', are less concerned about payback or increasing the property value, and are more motivated by the feeling that their energy costs will be lower forever, particularly beneficial when they eventually retire. This can be seen as a form of future proofing expenditure.

3. Supporting a whole-house retrofit approach



This section describes how motivational and other householder factors differently influence the adoption of measures within each householder-centric category, and suggests implications for messaging and policy below. Suggestions should be not be viewed as either definitive or exhaustive.

3.1 ENHANCED LIVING, LOWER BILLS

These measures offer easy-to-grasp experiential benefits such as improved comfort, health, aesthetics, security and product performance, as well as reductions in energy bills.

Motivations

Experiential benefits

'Enhanced living, lower bills' measures are defined by the salience of the benefits they bring. This can be feeling warm when you used to feel cold, the elimination of mould and damp, improved aesthetics and security as well as thermal comfort of new doors and windows, and product performance of an induction hob and low-energy lighting. Because such measures create salient, experiential benefits, householders are more positively disposed towards them and more motivated to undertake them. The benefits of these measures are only motivating when there is awareness and knowledge. There was some awareness of induction hobs but limited knowledge that they offered better performance than gas or electric, and even less knowledge that they were the most energy-efficient way to cook.

Experiential benefits are more compelling when they have been previously experienced. One householder moved to their current house from a new-build that they had been renting. They had a clear idea in mind of the sort of thermal comfort they were now missing and wanted to recreate, but others who have never had that experience were not always as aware of what they could achieve by taking the right measures. Covid-related working from home has increased the salience of problems that can be addressed by such measures.

Implications for messaging: Messaging needs to convey the full extent of experiential benefits that can be experienced after measures are undertaken. It is not just a case of being able to keep warm for less but that the comfort experience is qualitatively improved e.g., by not having to wait long for the house to warm up, by staying warmer for longer after heating has gone off, and by banishing unpleasant draughts.

CASE STUDY

Steve lives with his wife and children in a 1980s semi. The house used to get very cold in winter with visible damp and mould on the ceiling. Steve found builders through Checkatrade to deal with a subsidence issue causing cracks in an outside wall and to sort out the damp. They also recommended and installed cavity-wall and loft insulation, and put him in touch with another contractor to replace his windows. Steve had been putting off commissioning the work but was finally persuaded to go ahead a few weeks before the March 2020 lockdown. This winter Steve and his family have been delighted with the outcomes commenting how warm and dry the house feels and how they are spending so much less on heating. He sees the money savings as an 'added bonus' and commented that he wasn't thinking at the outset 'When do I get value out of this?'. With lockdown and

working from home Steve is especially glad that he had the work done. He didn't look into any grants assuming that he wouldn't be eligible as he was earning. He would rather not know now if he might have qualified. Having also installed a new boiler Steve feels that they have 'finished the job' and does not see any need to go further. He could not see the point of installing waste-water heat recovery unless he could 'turn a profit'. He doesn't like the look of solar panels; he was more interested in roof tiles but didn't like the idea of paying more for them. He wasn't interested in paying a premium for a heat pump when a gas boiler gives you the same or better heating. Despite his lack of real interest in going down the whole-house route Steve would have happily paid £175 for a whole-house planning service given the problems he had had and to help him think about and plan for the future.



Financial benefits

When experiential benefits are salient, as they are for 'Enhanced living, lower bills measures', they can be sufficiently compelling that the relative importance of financial benefits is reduced, perhaps to being seen as an added benefit rather than the primary motivation for undertaking the measure. Where the cost of the measure is not particularly high such as for cavity-wall or loft insulation, and the salience of the experiential benefits is high, having future lower energy bills offers a financial motivation with or without payback being assured. Higher-cost measures such as internal and external wall insulation may shift the calculus back towards payback.

Current householder knowledge and concern about their home's EPC rating is low; it was not a key factor in the purchase decision, or necessarily seen to affect the value of the home. Other aspects of the home were more important in the buying decision, with the knowledge that energy efficiency could be improved after the purchase. This attitude contrasts with householders' attitudes towards buying an appliance where several mentioned always looking to buy the most energy-efficient A-rated machines.

Implications for messaging: The research demonstrated that if the EPC rating added value to a home, it might encourage householders to invest in higher-cost measures feeling more confident they will get payback when they sell. Another way to do this might be through a reduction in council taxes for greener homes that would provide a form of payback during ownership and possibly a premium in the price of the property when selling it. The suggestion of such a discount went down well with householders who felt they would be being rewarded for doing the right thing. One likened it to the exemption they got from road tax for their EV.

CASE STUDY

Lizzie lives with her partner and baby in a pre-1950s semi. They bought it as their first home to get on the ladder and were planning to move to a bigger house in a couple of years. With the pandemic Lizzie and her partner who now work from home will both shortly be made redundant potentially delaying their plans to move. They were finding the front door very draughty and that it was making the whole house cold. Lizzie had been wanting to get the door replaced since they moved in but her partner was more reluctant. Finding out they were being made redundant and feeling that their energy bill was excessive pushed them into replacing the door and they now are hoping to see the difference in the bills. They feel the new energy-efficient composite door has made a massive difference to their comfort in the house. Lizzie did look into grants but found the information confusing and it looked like they would have had to fit a new boiler to qualify for a grant for the door.

The windows are also cold and draughty but she was told by a contractor that to qualify for a grant the existing windows would have to be single glazed. There is no way they can afford the £6000 quoted for replacement windows even though the upstairs ones are a fire risk as they don't open. With their original desire to move quite soon Lizzie and her boyfriend were reluctant to spend money on the new front door. Financial constraints apart this is another reason why they feel reluctant to spend on windows or to make their very-cold kitchen more comfortable. At present a whole-house planning service is not something that Lizzie could afford to pay for, although she saw some benefits if you were planning extensive works.



Environmental commitment

With Enhanced living, lower bills measures there is potential for householders to experience the serendipity of experiential and financial benefits while also knowing they are reducing carbon emissions, which to a greater or lesser degree householders want to play a part in. In line with previous research findings, householders were mostly not aware of the significant contribution that domestic gas boilers make towards carbon emissions, suggesting they may also not be clear on the impact different energy-efficiency measures like insulation can have on cutting carbon emissions, as opposed to simply saving energy and money.

Implications for messaging: Messaging should raise awareness of the contribution made by gas boilers to carbon emissions and then highlight the effectiveness of different measures in reducing heat loss and therefore carbon emissions due to reduced boiler use. Ideally householders would switch from boilers to more sustainable heating and this is discussed later in relation to heat pumps. Messaging could also raise awareness that induction hobs are the most energy-efficient way to cook as this was not generally realised.

Synchronicity and self-sufficiency

This does not apply to 'Enhanced living, lower bills' other than synchronising use of appliances like induction hobs to work with home-generated electricity from wind or solar.

Awareness and knowledge

Awareness and knowledge is high around cavity-wall and loft insulation, energy-efficient doors and windows, draught proofing, smart heating and low-energy lighting. It is much lower around solid-wall, party-wall and under-floor insulation, smart appliances and induction hobs. When awareness and knowledge of measures is low, then motivations should be considered 'latent' rather than active.

Implications for messaging: This is an area where a whole-house plan and advisory service could be particularly effective in raising awareness and knowledge of all measures, and at a time when it is not too late to avoid forward-compatibility issues.

Financial wherewithal

Resources available

Householders have a limited amount of money they are able or willing to spend on energy-efficiency measures. When costs are not considered high and the experiential benefits are salient, householders may prioritise such measures over competing demands on resources like a new bathroom. When a boiler breaks down the experiential benefit of acting to replace it, i.e., feeling warm again, is highly salient, and the disadvantages so huge that the need can exceptionally override a limit on financial resources, even if it might involve going into debt.

CASE STUDY

Sarah has recently bought a pre-1900 mid-terrace stone cottage in the middle of a national park and area of natural beauty. She lives with her partner in his city flat which they plan to retain and let out once they have renovated and moved into her cottage. Sarah wants to make the cottage as eco-friendly as possible and has seen in the news that there may be grants available which as a first-time buyer she hopes she might be eligible for. She thinks she earns too much to qualify on that basis but wonders whether she might be eligible for a Green Homes Grant based on the property and work she needs to do. She is aware there is no damp course and knows she will have to have the plaster removed and a damp course injected, along with some tanking at the back of the property. The roof leaks and when it is repaired she wants to get as much insulation as possible installed. The current double glazing has failed and is ugly so needs replacing. In fact she has a 'massive long to-do list' and is prioritising measures to see how far down it she can afford to go. She was interested in and hadn't been aware of the option of internal-wall insulation but

the cost might be prohibitive. She doesn't expect the cottage to be their 'forever home' so worries about it not being worth as much as she might put into it from an investment point of view. The EPC was 'the worst you can have' and she would like to raise it to the level where they might be able to rent out the cottage if they move somewhere bigger. She has looked into heat pumps as an environmentally-friendly way to heat their home. She is aware it will take heat from the garden and is worried that her mid-terrace narrow garden won't be big enough. She needs to do more research but expects that for financial and practical reasons she will install oil-fired heating although she knows it's not environmentally friendly. She is attracted to the idea of solar from an environmental point of view but doesn't feel panels or even tiles would be acceptable in her conservation area. Sarah was very attracted to the idea of whole-house planning and thought a £175 fee was 'a bargain' to find out about things like internal-wall insulation and how the best time to do it might be just after the damp-course treatment and before replastering.



Access and willingness to tap grants and finance

Householders can assume that because they are in work they are not eligible for grants and so do not make much effort to check, and local authorities are not seen as a place to go for help. Take up of grants was more common when householders were approached by contractors with offers that incorporated grant discounts although this can also induce wariness on the part of the householder if the deal looks too good to be true. Finance deals had not been taken up and may be affected by anticipated length of tenure exceeding the period of finance.

Implications for messaging: Grants and finance may encourage householders with limited resources to take more measures but householders need to be made aware of grants and be able to easily establish eligibility. A whole-house planning service could support householders in identifying grants for which they would be eligible.

Barriers to undertaking measures

Householders in the sample generally felt confident that they could find good contractors through rating sites, or from recommendations from friends, associates and other contractors. Beyond standard concerns about disruption caused by works householders were reluctant to commission any work inside their home during the Covid pandemic. At a measure-specific level householders reported being put off induction hobs because they would need to buy new pans.

Implications for messaging: Householders were attracted to the idea of an organisation offering whole-house planning being backed or working in association with their local authority. This gave them confidence that the organisation was professional and would not be recommending work to get commission from contractors. A whole-house approach may also reduce future disruption by helping to plan the sequencing of measures to avoid extra work and costs at a later date.

Forward-compatibility, whole-house considerations

Forward compatibility is not currently a consideration that householders think much about but once it is drawn to their attention it becomes a compelling and key benefit of having a whole-house plan with related advice. A householder about to renovate a countryside stone cottage was aware they would have to have the walls replastered after installation of a damp-proof course. They were not aware that this might be the ideal time to have internal-wall insulation installed and reported they would have found such advice through a whole-house planning service invaluable. This householder, along with two others who had already undertaken extensive works, indicated they would have readily paid the £175 whole-house-plan fee charged in the example service they were shown. Other householders were more reticent liking the idea but feeling that the service should be free.

Implications for messaging: Promotion of whole-house planning should focus on the key benefit of forward-compatibility. This finding also highlights the need for whole-house plans to tie in with broader renovations being undertaken, beyond just energy efficiency.

Anticipated length of tenure

A shorter anticipated length of tenure may be less of a barrier to undertaking measures in this category as experiential benefits are immediate and payback may be less of a concern, however a longer anticipated tenure will increase willingness to undertake measures.

Implications for messaging: Policies that help to ensure money spent on energy-efficiency measures results in higher relative property values should increase willingness to act when anticipated tenure is relatively short.

Householders anticipating longer tenures stand to gain most from whole-house planning. They are likely to start by undertaking Enhanced living, lower bills measures and the planning service would help ensure forward compatibility with other types of measure they may wish to take in the future.

3.2 FREE-FOR-LIFE ENERGY

Measures such as solar offer 'free' energy once a householder has made the initial installation investment.

Motivations

Experiential benefits

Solar and wind do not bring experiential benefits of comfort, health or enhanced security but aesthetics can be salient, although not always in a positive way. Several householders reported not liking the look of solar panels and would be deterred from fitting them, or worried that a future buyer might be put off making an offer for their house. On learning about solar roof tiles householders became more interested but the extra cost could be a barrier.

Other householders were more positive about the aesthetics. One householder, interested in getting solar, reported that they had become 'desensitised' to the look of panels when living abroad and now quite liked their appearance.

Implications for messaging: Greater awareness of solar tiles will overcome some aesthetic concerns and may lead to greater uptake, especially if prices come down.

Financial benefits

The findings tentatively suggest that the free-for-life nature of solar and wind, and the potential for maximising use of free energy through synchronicity, as well as the idea of future proofing finances may have significant latent appeal beyond straightforward payback although it is important to note that data points were limited in this research. The householder with solar panels reported financial savings, with the expectation of recouping their investment within 10 years, as a primary motivation for undertaking the measure; installing solar was one of the first things they did in order to reap the benefits for as long as possible. However their responses also indicated that they gained significant satisfaction from maximising the ways in which they could use their 'free' energy. Both this householder and one considering installing solar panels wanted to enjoy 'free' driving by using solar to home-charge an EV. Another householder, planning to stay in their house for life, and considering solar, described how they wanted to future proof their finances so that in retirement they could live on less income. However they still saw payback as a key motivator.

Implications for messaging: Messaging could aim to convey the 'free' nature of home-generated energy and how this can be maximised through synchronised use with appliances and EVs. It could also aim to shift the focus of potential buyers of solar from payback to the future-proofing benefit of free-for-life energy no matter what happens in terms of prices, legislation, or changes in personal circumstances and income level.

CASE STUDY

Ricky lives with his partner and children in a 1980s detached house. Soon after moving in he had solar panels installed. He did this early to maximise his financial return and is expecting to get his money back in 10 years. They plan to stay there at least 10 to 15 years. He had been worried by his father's poor experience of solar contractors but was reassured when he found a contractor endorsed by a major home improvement retailer, who he felt would act as a kind of guarantor. He was conscious of the look of his panels and was keen to make sure they were the type that are integrated into the roof for 'curb appeal'. At the time of installation he went with the suggestion of the installer and incorporated a SOLiC 200 to allow the solar panels to heat his hot water for 'a few hundred extra quid'. If he had had an extra 'few thousand' he would also have had a battery installed but with his wife at home she was able to make use of the hours of sunshine to put on the washing machine and dishwasher, something they actively avoid doing at night. He knows he can have a battery retrofitted in future and was thinking about doing this when his wife was returning to work, but with Covid he is now working from home and able to make use of his solar-generated electricity. He didn't check about grants assuming funding was only there for people on lower incomes. They had a new kitchen put in and Ricky wanted to get an induction hob to make use of the solar-generated electricity but his wife wanted to stick with gas. Ricky is waiting for the second-hand EV market to mature and then he plans to get an EV so he can enjoy 'free' motoring by home charging. This could be another reason to invest in a battery so he can charge the car at night

on his own electricity. He's very happy with the outcomes and reckons he has cut his energy bills in half. He has had doors and windows replaced but is not interested in a heat pump as he wanted the speed and instant heat of a combi boiler and had heard heat pumps are more expensive and 'you have to have your lawn dug up'. He likes making use of the latest technology in his home and one of the reasons he went for a new boiler was to be able to control his heating from a Nest controller; he also has Philips Hue lighting so he can turn off lights from his phone when they leave the house. He would '100%' have paid £175 for a whole-house planning service as he felt it would have centralised all the advice he has had to go to multiple sources to get and given him ideas like the SOLiC 200 he might not have heard about.



Environmental commitment

While not necessarily a primary motivation for undertaking 'Free-for-life energy' measures, the environmental benefits are more salient than for 'Enhanced living, lower bills' measures. This may be to do with the immediate visibility of electricity coming from roof-mounted solar panels. Given the potential for financial and synchronicity/self-sufficiency benefits householders can also act on their commitment to the environment. The environmental commitment of some may even lead them to deprioritise financial benefits, with one reporting that they wouldn't feel it was essential to recoup their costs given solar's environmentally-friendly nature.

Implications for messaging: These measures have the appeal of offering more sustainable living which might be enhanced by communicating that through synchronicity, householders can maximise benefits to the environment by using their home-generated electricity to drive an EV and wash or dry clothes and dishes.

Synchronicity and self-sufficiency

The motivation of being at least partially self-sufficient in energy generation, and of making the most of that free energy, is closely connected with undertaking Free-for-life energy measures. The householder with solar was hoping to buy an EV once the second-hand market had become more established to make the most of their 'free' energy and another who already had an EV was considering getting solar so they could enjoy 'free' driving, essentially similar motivations but reversed. Being able to make best use of 'free' solar energy during sunshine hours was a key factor and working from home during Covid made this more feasible and therefore the attraction more salient. The householder with solar reported trying to avoid using their washing machine and dishwasher at night so that they could benefit from 'free' energy when the sun was shining. In a sense this can be seen as smart use of dumb appliances. When they purchase an EV they indicated that they may buy a battery in order to charge their car at night. A battery offers the benefit of linking home energy usage with non-contemporaneous home-energy generation but householders were put off by the current high cost of batteries. Although the householder with solar emphasised that saving money had been their primary motivation for installing solar, they seemed to derive satisfaction from their experience of synchronicity and self-sufficiency, getting the most out of their 'free' energy.

Implications for messaging: The appeal of synchronicity and self-sufficiency appear compelling as benefits to communicate to householders who might install solar or micro-wind where it is suitable. The findings also suggest an opportunity for initiatives to incentivise acquisition of solar or micro-wind together with an EV.

Awareness and knowledge

Awareness and knowledge of solar voltaic panels is high but there is less awareness of solar tiles, solar thermal, battery and wind.

Implications for messaging: This is also an area where a whole-house plan and advisory service could be particularly effective in raising awareness and knowledge of possible measures, while avoiding forward-compatibility issues.

Financial wherewithal

Resources available

Similar to other measures limited resources can inhibit investment in Free-for-life energy measures. A householder committed to sustainable living and prepared to sacrifice financial payback to get solar cited initial cost as the only real barrier. Battery storage may be key to benefitting fully from synchronicity but the cost can be perceived as prohibitive.

Access and willingness to tap grants and finance

Those potentially considering solar had the impression that grants and deals for solar were no longer as attractive as they used to be. On the one hand they worried they might get locked into a long-term contract with the grid that could put off future buyers, and on the other hand that more attractive deals supported by government initiatives might come along in future that they would miss out on if they moved forward now.

The householder with solar had not expected to qualify for a grant and recalled doing only minimal research into grant availability and eligibility.

Implications for messaging: Messaging should aim to address confusion over availability of grants and deals. A whole-house planning service could support householders in identifying grants for which they would be eligible. A commitment to future grants being retrospective might overcome householders' concerns about missing out by acting early.

Barriers to undertaking measures

Beyond financial, contractual and aesthetic concerns, the most significant reported barrier to installing solar was whether the roof was facing in the right direction. Gaining planning permission may also be a barrier, with one householder reporting concern because their neighbour had been forced to remove their panels by the local authority. One householder also reported being reluctant to move forward with a Solar Together offer, partly because they thought the local authority would not grant planning permission. Covid-related concerns about having contractors inside the home were less significant for work like this as it was seen as being mainly external.

Implications for messaging: A whole-house survey would presumably be able to advise on suitability of roof direction for solar and should also be able to check any planning permission constraints. Such a 'joined-up' service may also be expected by householders if the local authority is associated with or backing the whole-house planning service.

Forward-compatibility, whole-house considerations

The concept of synchronicity is closely tied in with forward-compatibility and whole-house considerations. The householder with solar indicated they would have happily paid the £175 upfront fee charged by the example service they were shown.

Implications for messaging: Promotion of whole-house planning should seek to connect its holistic approach with the motivations of synchronicity and self sufficiency.

Anticipated length of tenure

Anticipated length of tenure likely plays a big role in a householder's willingness to invest in Free-for-life energy measures given the size of investment and time required for payback. It was the first measure taken by the householder with solar in order to recoup as much as possible over time.

3.3 PAYING FOR LITTLE PERCEIVED GAIN

Measures such as heat pumps and waste-water-heat-recovery promise reductions in future energy bills but upfront costs are high relative to any savings, especially as significant fabric measures may be required for heat pumps to be most effective. Neither offers salient experiential benefits, and heat pumps may be perceived to offer potentially less effective heating than gas boilers.

Motivations

Experiential benefits

These do not apply to Paying for little perceived gain, as the measures are not seen to enhance comfort or offer other experiential benefits like health, security, protection from noise or improved aesthetics.

Financial benefits

With the high upfront costs of such measures, the financial benefits are tilted towards lowering future bills and away from payback over a realistic timescale. Without salient experiential benefits householders can be put off considering such measures. Those with more environmental commitment were most enthusiastic but were prevented from acting by the high upfront cost.

Environmental commitment

Without experiential benefits, environmental commitment assumes greater relative importance when some financial sacrifice is required. The amount of required environmental commitment increases with the amount of work needed to ready the home for a heat pump. This research reflects the findings from other research that householders are not generally aware of the high contribution boilers make to carbon emissions. This awareness is a necessary prerequisite to appreciating the environmental benefits of heat pumps and measures like waste-water heat recovery. The findings suggest that more environmentally-committed householders may become more motivated to consider installing a heat pump if they understood the extent of the impact they would have on reducing carbon emissions. They would also need to know more about the performance, cost and reliability of such unfamiliar technology.

Implications for messaging: Messaging needs to communicate the extent of the impact on carbon emissions that taking such measures can have which in turn is dependent on householders becoming aware of the contribution central heating boilers make to carbon emissions. It also needs to educate about such technologies and their potential experiential benefits, including a more consistent level of heating in the home.

CASE STUDY

Rosie and her partner live in a detached 1980s house they moved into a few months ago. Since moving in they have had the loft boarded and insulated, with the help of a grant, while also getting electricity up there, and changed some radiators downstairs partly for aesthetics and because they had a wall removed. They don't heat the upstairs but feel it is much more comfortable now, and should they have children an upstairs nursery will need to be warm. Rosie recalls the loft insulation being highlighted on the 'sort-of-middle-grade' EPC report as a measure that would make a big difference. Rosie knows that the windows need replacing but has put that on hold partly because of finances but also because of Covid. She knows she can get recommendations for contractors from parents at her school. Rosie is a teacher who has been responsible for creating the curriculum module on the environment. The living room had a gas fire which they had removed. 'We do try to be as green as we can within reason, but I suppose we are not perfect'. Rosie is aware of the net zero targets and is considering solar panels for that reason. She says she is happy to pay more to be as green as possible within reason but worries that if they don't stay in the house more than 10 years installing solar may not pay off. She is torn between getting solar soon to make the most of the savings and waiting for possible better government grants. She quite likes the look of solar panels on roofs, having lived some years in Australia, but worries that they might put off a future buyer. This and the upfront cost are holding her back. The boiler is quite old and Rosie says that when it comes to replacing it she will look for the greenest option she can find. She hadn't

been aware of the significant contribution that gas boilers make to carbon emissions. She didn't know much about heat pumps and on learning about their cost indicated that she'd try to keep the boiler running a few more years in the hope that heat pump costs will come down or there will be alternatives. She would also like to be clear, if she switched to a heat pump, how much carbon she would be saving and what the impact on her energy bills would be. Rosie found the idea of combining solar with a heat pump to become self sufficient very appealing 'if it would definitely work in practice'. Rosie also said 'I mean, we've always said we would love to be self sufficient. You feel like you're doing your bit. We certainly catch more planes than we perhaps should. And I feel like we're very aware of that. And that is our sort of, emissions vice as it were, so we want to be as careful as we can with everything else.' Rosie would happily have paid £175 for a whole-house plan as she felt she would learn a lot from an expert, in the way she was learning during the research interview, and would really value learning about ordering and forward compatibility, as they would otherwise just be going with their 'priorities list'.



Synchronicity and self-sufficiency

The synchronicity and self-sufficiency benefits of such measures are not immediately salient but once the possibility of using home-generated electricity to power the extraction of heat for warming the house was brought into the discussion, some appeal was evident.

Implications for messaging: The benefits of synchronicity and self-sufficiency appear potentially compelling as a way to encourage householders who are already taking extensive measures including solar, to install heat pumps.

Awareness and knowledge

Awareness and knowledge of this type of measure is low; it was somewhat higher for heat pumps than waste-water heat recovery which no one had heard of.

Implications for messaging: Again this is an area where a whole-house plan and advisory service could be particularly effective in raising awareness and knowledge of possible measures, and ideally at a time when it is not too late to avoid forward-compatibility issues.

Financial wherewithal

Resources available

The high upfront cost and lack of immediate experiential and financial benefits mean that householders are currently unlikely to prioritise. Paying for little perceived gain measures over other areas of home spending that compete for their limited financial resources, even when they have quite a strong commitment to the environment. For many the upfront cost will be increased by the need to take other measures necessary to ready the house for heating by heat pump. The devices are seen as relatively new technology and as such there is also a concern that prices will come down in future, acting as a barrier to early action.

Access and willingness to tap grants and finance

Given the high upfront costs and absence of other benefits, grants are likely to be key in motivating householders. One, who was off-grid for gas, was interested in heat pumps as a sustainable source of heating, but was expecting to install an oil-fired boiler unless they found a grant that would help them.

Implications for messaging: The high cost of heat pumps and the other measures that may be required to ready a home for a heat pump suggest an opportunity for bundled deals such as 'Heat as a service' where the upfront costs are bundled into an ongoing contract to deliver heat, but this might be dependent on a long anticipated tenure.

4. Areas for follow-up research

Barriers to undertaking measures

As a fairly unknown and new technology, householders can feel that it would be best to wait for improvements to performance and reliability as is normal with new technologies, along with reductions in price. Among the few with any knowledge of heat pumps, there was some concern over a possible need to dig up their garden for installation of pipes, and whether it could work with a small, narrow garden.

More generally, and with lack of understanding around the contribution of gas boilers to carbon emissions, householders can feel that there is currently no existing problem for heat pumps to solve.

Forward compatibility, whole-house considerations

Forward-compatibility and whole-house considerations are perhaps most relevant to installation of a heat pump given the wide range of measures, including insulation and solar, that may need to be in place to make heating by heat pump both practical and appealing.

Implications for messaging: While there are currently significant barriers to many householders installing a heat pump or waste-water heat recovery system in the near term, they are motivated to ensure that measures they take in the short term are compatible with measures they may want to take in the longer term such as installation of a heat pump. This was the most appealing aspect of whole-house planning and should be clearly communicated.

Anticipated length of tenure

Given the limited financial benefits and the high upfront cost and work involved in heat pump installation only those with a long anticipated tenure would be likely to install a heat pump as things currently stand.

Implications for messaging: Policies need to overcome the financial barrier of installing. Paying for little perceived gain measures, most especially when householders do not expect to live in their house for long.

As mentioned in the introduction this was small-scale, qualitative, exploratory research that covered a broad area relating to whole-house retrofit.

In the course of the research a number of areas were identified that would benefit from more-detailed follow-up research:

1. A number of key motivational and other householder factors were highlighted that influence adoption of measures. Further qualitative research and analysis could be undertaken to create a typology of householders with respect to engaging in whole-house retrofit. Such a typology would help support targeting of policies and messaging to different types.
2. Synchronicity and self-sufficiency were highlighted as motivators for getting solar but only one householder had already installed solar. Further qualitative research involving interviews or mini focus groups with householders who have installed solar could validate and explore this tentative finding in more depth, including the relationship with EV ownership.
3. Synchronicity self-sufficiency of using heat pumps in conjunction with solar was highlighted as one way to encourage take up of heat pumps; this could also be explored in the context of two above.
4. Grants and finance, along with more-assured increase in property value were highlighted as potential ways to overcome barriers involving high-upfront costs and shorter or uncertain tenures. Participatory-design workshops could be used to explore and gain householder input into different ideas for structuring grants, finance and possible tax reductions that would have attraction for householders.
5. Packages of measures and 'Heat as a service' were also highlighted as ways to overcome barriers to action, especially in relation to installing high-cost measures like heat pumps and waste-water heat recovery. Participatory-design workshops could be used to explore and gain householder input into different ideas for delivering such offers, considering especially shorter or uncertain tenures.
6. A number of suggestions were made in the report for shaping a whole-house planning service. Participatory-design workshops could be used to explore and gain householder input into different ideas for both shaping and promoting the service to maximise uptake and usefulness.



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