# Warm Homes Fund
## Programme Evaluation

### Abridged third interim report

2021-2022

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# 1. INTRODUCTION

This report presents a summary of the key findings from the third interim report of the programme wide evaluation of Affordable Warmth Solutions' (AWS) industry funded Warm Homes Fund (WHF). The WHF is one of the largest fuel poverty programmes in Great Britain, administered by Affordable Warmth Solutions CIC and representing private sector investment of £150mn from National Grid.[1] The evaluation is being conducted by a consortium comprising Newcastle University, National Energy Action (NEA), and Energy Audit Company, and was designed to involve three consecutive waves of research activity at different points in the WHF programme. At the time of writing, the third and final wave of research is concluding, and the evaluation is consequently beginning the integration and synthesis of data from various strands of activity, including energy modelling, economic modelling, indoor environmental monitoring, and quantitative and qualitative fieldwork with WHF projects and beneficiary households.

This report contains two main sections. The first section reports on the design and development of a blueprint model to inform policymakers, industry actors, and other stakeholders on options for delivering large-scale energy efficiency programmes in the future. The blueprint model is a core output of the evaluation that will be refined as data analysis and synthesis takes place in the summer and autumn of 2022. The first section therefore reviews existing work in this area and sets out the way the evaluation will approach and develop the blueprint.

The second section examines the key emerging findings on the social and economic impacts of the WHF. It integrates findings from the energy modelling, economic modelling, and questionnaire research with beneficiary households to analyse the impact of the programme on fuel poverty, energy affordability, and health, as well as examining the broader impact of the WHF investment on household spending and the economy. In doing so it also discusses the extent to which WHF investment has supported the households most in need, primarily by analysing and comparing different fuel poverty indicators from the energy modelling and household questionnaire research. This work is ongoing, and a complete analysis will be presented in the final evaluation report, due at the end of December 2022.

## EVALUATION OBJECTIVES

- Determine the social and economic impacts from the WHF investment
- Develop a framework of appropriate input, output and impact measures which will provide a basis on which delivery performance can be assessed
- Determine the extent to which the support has reached the households most in need and any regional differences
- Produce a blueprint model to inform policy makers on options for delivering future large-scale energy efficiency programmes

In setting out the emerging findings from all strands of the evaluation and discussing the pathway to the production of the blueprint model, the report will be of interest to policymakers, especially those working on fuel poverty and energy efficiency programmes in the Department of Business, Energy and Industrial Strategy (BEIS), Ofgem, the energy industry (including energy suppliers and networks), and stakeholders across local and regional government, the social rented sector, and the health and social care sector.

# 2. DEVELOPING A BLUEPRINT MODEL FOR THE DELIVERY OF FUTURE LARGE-SCALE ENERGY EFFICIENCY PROGRAMMES

A core output of the evaluation is the production of a blueprint model that can be used to inform policy makers, industry actors, and other stakeholders about options for the delivery of future large-scale energy efficiency programmes. The blueprint is intended to be a *practical* resource that can help different actors to understand the most effective fuel poverty interventions in a range of contexts and assist them in identifying and addressing potential issues, challenges, and risks at different points of programme delivery.

## 2.1. Existing evaluations and analyses of energy efficiency programmes

In the broadest sense, programme blueprints are intended to define the actions that are required to transition between a 'present state' and a 'future state'. The starting point for this conceptualisation is the well-established 'Managing Successful Programmes (MSP™)', which was developed by the Office of Government Commerce (OGC).[1] MSP is widely considered to be a best practice framework for programme management that disaggregates programmes into smaller constituent parts to understand, plan, and manage their delivery.

In a review of previous evaluations and analyses of fuel poverty and energy efficiency programmes, the evaluation has not identified any works that have used MSP to construct programme blueprints. For example, the National Audit Office (NAO) has conducted several analyses of fuel poverty and energy efficiency programmes, such as Warm Front and, more recently, the Green Homes Grant.[2] The NAO's analysis typically proposes recommendations for the design of future programmes, but does not offer a blueprint or framework for the holistic design and development of programmes in the future (doing so would of course fall outside its remit).[3] Similarly, a number of independent evaluations of fuel poverty programmes follow comparable rationales in terms of their proposals and recommendations for programme change.[4]

Two studies have been identified that seek to develop conceptual criteria for the successful design of energy efficiency programmes, the most prominent of which is an analysis of the Energy Company Obligation (ECO) by the Institute for Public Policy Research (IPPR).[5] In their analysis, the IPPR advance five key questions or criteria for designing an energy efficiency scheme, which relate to 1) creating an accessible supply chain, 2) stimulating participation from government, consumers, landlords, and industry, 3) enabling more accurate targeting, 4) developing funding mechanisms and more equitable distribution of funds, and 5) future-proofing the scheme, its solutions, and its intended outcomes. They use this framework to propose a revamped ECO scheme centred on enabling Local Authorities to deliver area-based energy efficiency solutions to fuel poverty.[6]

## 2.2 The POTI blueprint model

Beyond work specifically on fuel poverty and energy efficiency, two other potential approaches have been identified. The first is the PESTEL approach to analysis, which seeks to identify the Political, Economic, Social/Sociological, Technological, Environmental, and Legal contexts within which an organisation must operate and to which they must respond.[7] However, the PESTEL approach is intended to be used primarily as a tool of analysis and not for the development of programme blueprints. The second approach, developed directly out of MSP, is the POTI model, which provides

a useful framework for identifying key components that might be considered when designing a large-scale energy efficiency programme.[8] The POTI framework has four components that together represent the scope of a programme:

**PROCESS**

Processes relate to operational delivery and business models.

**ORGANISATION**

Organisation covers personnel and organisational cultures, as well as skills, resources, partnerships and networks.

**TECHNOLOGIES**

Technologies relate to systems and tools utilised by a programme to deliver its objectives, but also can relate to interventions delivered by the programme.

**INFORMATION**

Information largely encompasses the production and use of data required by a programme to operate successfully, or the data that may be required in the future. It also covers aspects of reporting, performance monitoring and evaluation.

The POTI model and the wider MSP approach it stems from has been robustly developed, and is widely applied across national and local government, industry, and academia.[9] It is the only suitable pre-existing framework on which a blueprint model for the design of future large-scale energy efficiency programmes could be based. While it will not be used directly, it informs the ongoing development of a bespoke framework.

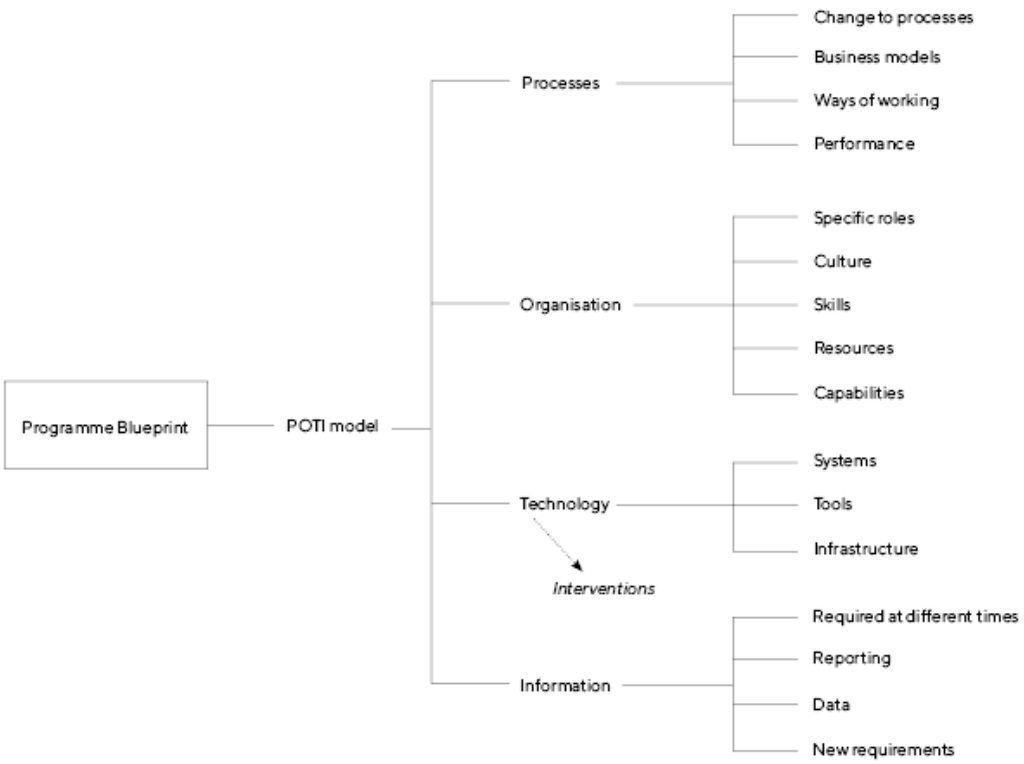



Figure 2.1. Components of the POTI model

Consequently, the evaluation will be informed by the POTI model as a starting point, and will begin a process of mapping the delivery, impacts, and outcomes of the WHF to the four constituent parts of the model (as described above). This will enable the evaluation to define the scope of what an energy efficiency programme like the WHF might look like in the future, and how each constituent part of the model might be different or need to be adapted to address any challenges, maintain or build on successes, or reflect new or emerging policy priorities (e.g. net zero transition). This acknowledges that the policy landscape today and in the near future will be substantially different to that when the WHF was first designed, and will draw on insights from WHF delivery to illustrate how a future programme may need to adapt over its life course.

# 3. THE ECONOMIC AND SOCIAL IMPACTS OF THE WARM HOMES FUND

This section turns to a preliminary and updated analysis of the economic and social impacts of the WHF on beneficiary households and the wider economy. Through its analysis of the technical and subjective fuel poverty status of households, it also begins to analyse the extent to which WHF interventions have reached the households in most need of support

The analysis is based on the following sources:

- **Energy modelling analysis** of **15,677 beneficiary homes**
- **Economic impact modelling** based on the pre- and post-intervention running cost changes of 15,677 beneficiary homes
- **Analysis of 582 household questionnaire responses**, which are disaggregated throughout into 286 Category 1 questionnaire responses; 108 Category 2 questionnaire responses; 144 Category 3 questionnaire responses; and 44 Category 3 (Park Homes) questionnaire responses.

The section is structured thematically, integrating and discussing findings from these different strands of the evaluation on:

- Fuel poverty and thermal comfort
- Running costs and energy affordability
- The economy and household spending
- Health and wellbeing

Before proceeding, it is necessary to reflect on the changing context of the period across which the fieldwork has been undertaken. The Covid-19 pandemic and the more recent energy crisis have resulted in significant changes to fuel prices. It is important to acknowledge this because fuel prices are a factor in calculating the results of the energy modelling analysis. In what follows, household running costs are modelled by taking fuel prices composed of averages of the previous six months national prices. These figures were taken from the Building Research Establishment's bi-annual update to the Product Characteristics Definitions File, which is the data source used to calculate the running costs displayed on EPCs.

In the final analysis, it was originally intended to model how fuel prices would change over three, five, and ten years, and examine how these changes would affect the fuel poverty status of beneficiary homes after intervention. This is now unfeasible for two reasons. Firstly, the price of gas, oil, and electricity has become very volatile, with significant increases from 2021 and large uncertainty over when, if ever, they will return to historical levels. Secondly, the definition of fuel poverty in England has changed, and in this new definition (LILEE) the fuel poverty status of a home does not depend on

the running costs in the majority of cases, although the fuel poverty gap still does. For these reasons, the final analysis will proceed to set a fuel price baseline, yet to be chosen but likely taken from a point before the energy market became volatile, and then analyse the changes to running costs and fuel poverty gaps under different scenarios where prices change by 20%, 50%, and 100%. Taking this approach will ensure that the results of the analysis can account for changes in fuel prices across the lifespan of the WHF, and be relevant to whatever level fuel prices are at in the coming years.

Similarly, changes in household incomes and fuel prices throughout the energy crisis and the Covid-19 pandemic have consequences for how the household questionnaire responses are treated. The questionnaire research has been undertaken in three waves: wave one took place at the end of winter 2020, wave two took place at the end of winter 2021, and wave three took place at the end of winter 2022. Waves two and three of questionnaire fieldwork therefore took place at key transitional moments in the Covid-19 pandemic and the energy crisis respectively, and it is likely that this shaped and potentially counteracted the impact of WHF interventions for respondents. In what follows, responses to the questionnaire are disaggregated by WHF funding category only. However, the final analysis will disaggregate by wave and perform statistical tests to discern if there are noticeable differences in impact across each wave. Further, data from qualitative interviews with beneficiaries will enable an analysis of how the pandemic and the energy crisis shaped the impact of WHF interventions for beneficiaries.

## 3.1 Fuel poverty and thermal comfort

This subsection analyses the impacts of Category 1 and Category 2 WHF interventions on fuel poverty. It does this by presenting the results of the energy modelling analysis alongside a subjective fuel poverty indicator collected through the household questionnaire.[10] The energy modelling analysis uses the recently introduced Low Income Low Energy Efficiency (LILEE) fuel poverty indicator, whereby a household is considered fuel poor if:

- It is living in a property with a Fuel Poor Energy Efficiency Rating (FPEER) of band D, E, F or G, and;
- Its disposable income after housing costs and energy needs is below the poverty line (60% of the national median income)[11]

In addition, the energy modelling analysis includes an assessment of the change in the fuel poverty gap for households defined as in fuel poverty before and after their interventions. The fuel poverty gap is defined as "*the reduction in fuel costs needed for a household to not be in fuel poverty*", and is a measure of the depth and severity of fuel poverty experienced by a given household.[12]

On the other hand, the household questionnaire attempts to capture a broader subjective indicator of fuel poverty that reflects the definition set out in the Warm Homes and Energy Conservation Act of 2000, which states "*a person is to be regarded as living 'in fuel poverty' if [they are] a member of a household living on a lower income in a home which cannot be kept warm at a reasonable cost.*"[13] Consequently, the questionnaire asks whether respondents could/can keep their whole homes warm in winter or when it was/is cold outside before and after they received their intervention from their WHF project.

The energy modelling analysis shows that the number of homes in fuel poverty (measured using LILEE) and the fuel poverty gap have both reduced after improvements were made. Table 3.1. shows that, because of the corresponding drop in running costs (demonstrated in Section 3.2. below), households primarily move from the low energy efficiency categories to the high energy efficiency

categories. In addition, a small number of homes move from low income categories to high income categories, which is caused by running cost reductions pushing their disposable incomes *after energy needs*, as defined by the LILEE definition, above the poverty line. Figure 3.1. below shows the changes between fuel poverty categories before and after the interventions took place.


Figure 3.1. Sankey diagram showing the flow of households from each quadrant of the LILEE fuel poverty indicator after their installation.

| | Before Improvements | | After Improvements | |
|---|---|---|---|---|
| Low Income High Energy Efficiency | 969 (6.2%) | NA | 3783 (24.1%) | NA |
| Low Income Low Energy Efficiency | 9900 (63.1%) | 699 | 5663 (36.1%) | 121 |
| High Income High Energy Efficiency | 876 (5.6%) | NA | 3780 (24.1%) | NA |
| High Income Low Energy Efficiency | 3932 (25.1%) | NA | 2451 (15.7%) | NA |

Table 3.1. The fuel poverty status of beneficiary homes before and after improvements were made.

5,660 homes (approximately 36%) were left in the LILEE bracket after their interventions, and were thus technically still defined as fuel poor. However, the large decrease in the fuel poverty gap from £699 to £121 demonstrates that, on average, where a household is still fuel poor their annual required running cost fell by almost £600, greatly reducing the severity of fuel poverty.

- **Fuel poverty levels prevalence reduced from 63.1% to 36.1% of modelled homes.**
- **The average fuel poverty gap decreased by 80%, from £699 to £121, greatly reducing the severity of fuel poverty.**

Interestingly, the household questionnaire suggests that a much larger proportion of respondents were able to keep their homes warm after their interventions than the energy modelling suggests. Figure 3.1. below shows whether surveyed households could keep their whole homes warm in cold temperatures both *before* and *after* they received their interventions, both in total and disaggregated by WHF funding category. It also shows the percentage point change between before and after they received their interventions. Category 1 interventions have resulted in the most substantial improvements, with an increase of 80 percentage points, from 9% before intervention to 89% after intervention. Category 2 interventions have also resulted in significant improvements, with an increase of 66 percentage points, from 16% before intervention to 82% after intervention. There were lesser, but nonetheless significant improvements reported by Category 3 and Category 3 (Park Homes) beneficiaries, with increases of 20 percentage points and 26 percentage points respectively. Approximately half of Category 3 respondents could keep their whole homes warm after their interventions (30% could do so pre-intervention), whereas 88% of Category 3 (Park Homes) beneficiaries reported being able to do so, albeit from a higher baseline of 63%.

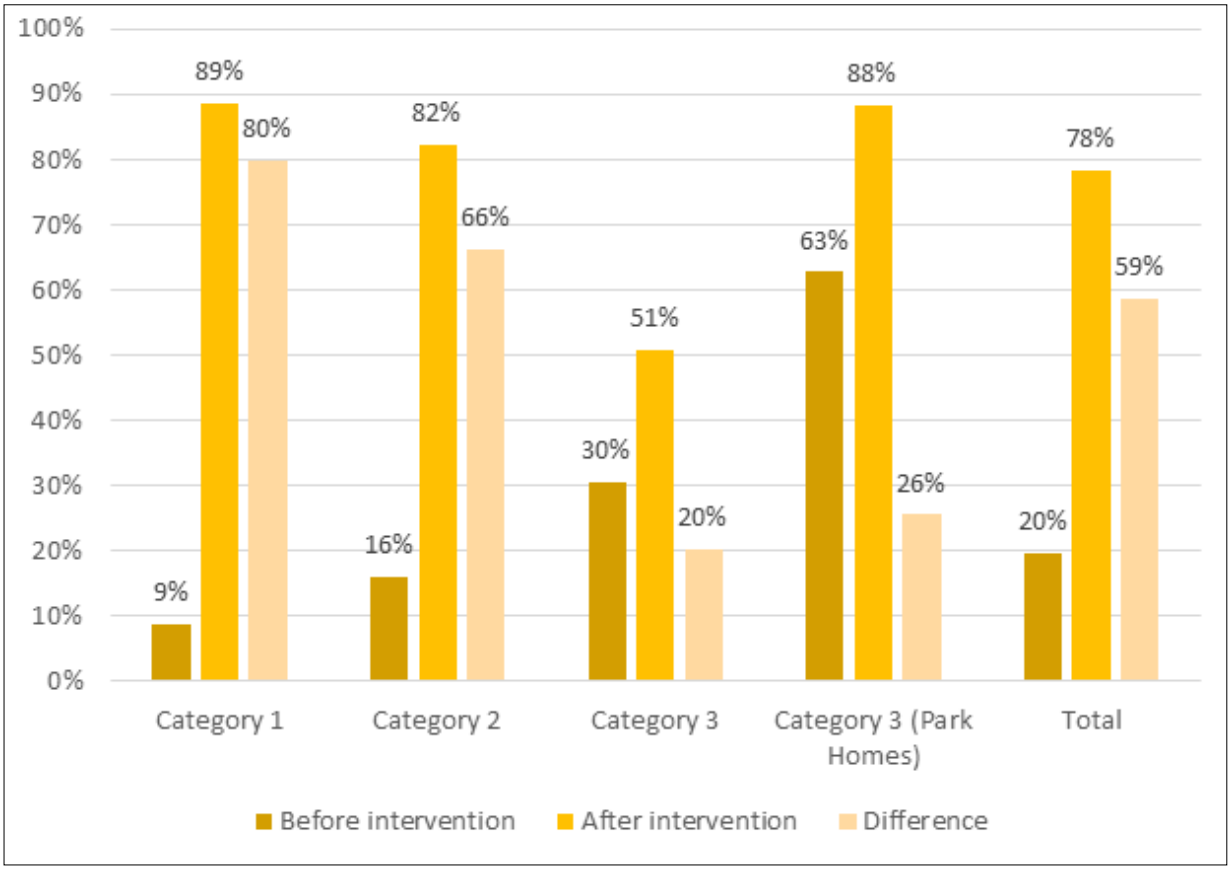



Figure 3.2. The proportion of questionnaire respondents who reported being able to keep their whole homes warm when it was/is cold outside before and after their interventions.

While the two indicators cannot be directly compared, one being based on energy modelling of a large dataset and the other being based on the viewpoint of a self-selecting sample of beneficiaries, it is instructive to juxtapose the findings. Considering only Category 1 and Category 2 interventions, Table 3.2. below illustrates that before interventions were made, the energy modelling analysis shows that approximately 63% of homes were defined as fuel poor under LILEE. In contrast, the self-reported indicator from Category 1 and Category 2 beneficiaries suggests that close to 9 in 10 could not keep their homes warm in cold temperatures prior to their intervention. Similarly, while 36.1% of homes were technically still defined as fuel poor under LILEE after improvements were made, Table 3.2. shows that only 13.1% of Category 1 and Category 2 respondents reported not being able to keep their homes warm in cold temperatures after their interventions.

| | Pre-intervention | Post-intervention |
|---|---|---|
| LILEE indicator (energy modelling data) | 63.1% | 36.1% |
| Subjective indicator (household questionnaire) | 89.2% | 13.1% |

Table 3.2. Comparison of the proportion of households in each dataset that can be defined as in fuel poverty by each indicator

These findings point to a potentially interesting question of how well a technical fuel poverty indicator (LILEE) reflects the subjective lived experiences of fuel poverty before and after an energy efficiency intervention is made, and suggest divergent answers to the question of how tightly interventions have been targeted at households most in need. It may also suggest the need to develop multi-indicator approaches to measuring fuel poverty and assessing the delivery performance of energy efficiency programmes.[14] These issues will be explored further in future integration and synthesis analysis.

## 3.2. Running costs and energy affordability

This subsection analyses the impacts of WHF interventions on the running costs of beneficiary homes, as calculated in the energy modelling analysis, and the parallel ability of beneficiary households to afford their energy. It follows a similar approach to the previous section, considering the energy modelling and household questionnaire data in tandem and exploring their similarities and differences.

The energy modelling analysis shows that the improvements made to beneficiary homes has had a substantial effect on the required running costs. Specifically, before making improvements, 6428 homes had annual running costs above £2000, while after improvements were made the number of homes left in this category was 460 – a reduction of 92.8%. With regards to averages, the mean annual running costs shifted from £2011 to £1089. Put differently, the installation of a new heating system saved beneficiaries £922 per year.

- **The number of homes with running costs above £2000 reduced by 92.8%.**
- **The average annual running costs reduced from £2,011 to £1,089, saving beneficiaries an average of £922 per year.**

To illustrate this change, Figure 3.3. below shows the running costs profile for beneficiary homes both before and after improvements were made. As shown, before improvements were made the running costs profile resembled a bell curve, with a substantial number of homes with running costs above £1500 per year. After improvements were made, the running costs profile changes to a sharp left-skewed peak, with the majority of homes with running costs of around £1000 per year.

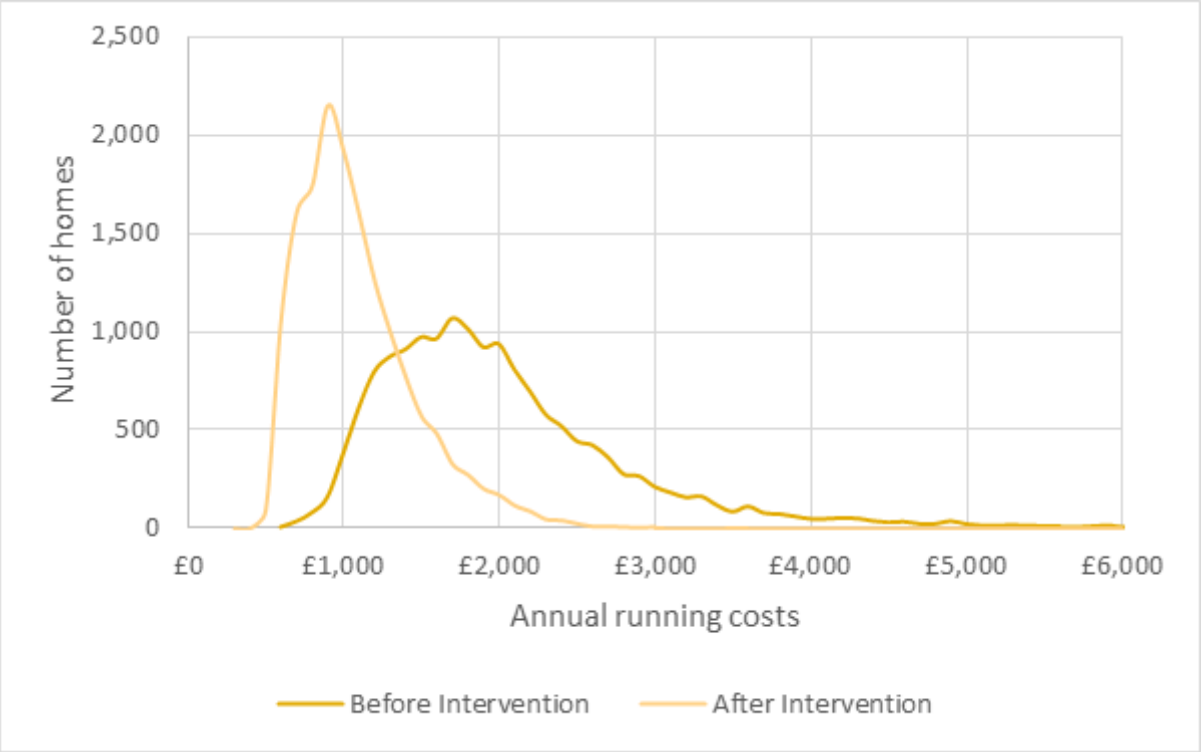



Figure 3.3. The running costs profile of beneficiary homes before and after improvements were made.

Findings from the household questionnaire, illustrated in Figure 3.4. below, allows changes in running costs to be considered from the perspective of the beneficiary. Figure 3.4. shows that changes in running costs have translated into self-reported improvements in energy affordability, especially for beneficiaries of Category 1 interventions. It shows that 61% of Category 1 questionnaire respondents reported that they find their energy bills a lot easier or a little easier to afford now, compared to before their intervention. 19% felt that there had been no change, 7% reported that their energy bills were more difficult to afford now, and a further 12% felt it was too early to make a definitive judgement.

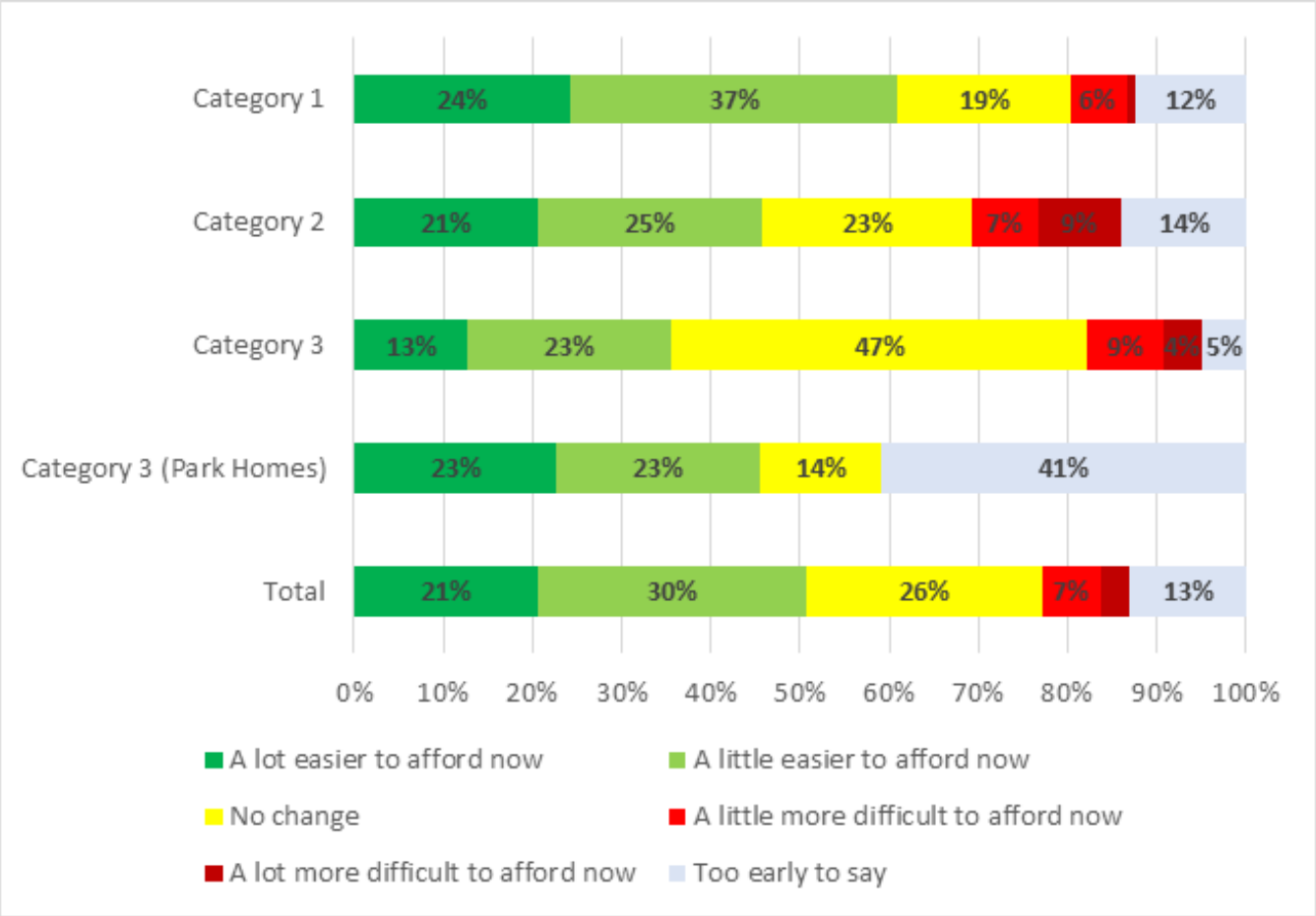



Figure 3.4. How easy or difficult do you find it to afford your energy bills (gas, electricity, oil etc.) now compared to before you received your new energy-related measures/health and/or energy related advice and support?

The findings also suggest that Category 2 and Category 3 (Park Homes) beneficiaries have experienced improvements to energy affordability; 46% of respondents in both categories said their energy bills were easier to afford now, and 23% and 14% of Category 2 and Category 3 (Park Homes) respondents respectively said that there had been no change. Notably, 41% of Category 3 (Park Homes) respondents said that it was too early to make a definitive judgement of the impact of their interventions on energy affordability, which may reflect the time taken to confidently compare LPG heating prices with the prices of mains gas, given that some respondents reported paying for their LPG in bulk, in clubs with their neighbours, or directly from the park site owner. Finally, Category 3 interventions were reported as having a lesser impact on energy affordability, with 36% reporting improvements and the most common response being 'no change'.

## 3.3. The economy and household spending

One of the main objectives of the evaluation is to determine the economic impact of the WHF programme. This subsection provides an updated analysis of the impacts of the programme's eventual £150mn investment on household spending patterns and the wider economy.[15] It does so by using a twofold approach:

- Economic impact analysis was undertaken using ONS multiple coefficients, which enable a consideration of how money is spent, re-spent, and circulated in the economy.

- As part of this, a Social Accounting Matrix (SAM) was used to model the likely re-spending of household income by low-income households, as well as the effects of the reductions in spending by energy firms.[16]

In addition, this subsection considers how selected findings from the household questionnaire, specifically with regards to self-reported changes in household spending on energy, food, and other essentials before and after intervention, can inform and reinforce the economic modelling.

### 3.3.1. The effect of reduced running costs in the wider economy

As demonstrated in Section 3.2. above, required running costs have decreased on average for WHF Category 1 and Category 2 households, reducing energy bills and improving the ability of beneficiaries to keep their homes warm. Academic literature shows that in such instances a 'rebound effect' occurs, where financial savings driven by the installation of energy efficiency measures are re-spent by households in different ways. A review of this literature suggests a rebound coefficient of 0.75, whereby 25% of achieved savings are spent on energy to keep the home warmer, meaning the real reduction in spending on energy bills is 75%.[17] In other words, the assumption is made that 75% of the modelled reduction in running costs for any given household is spent elsewhere in the economy, and the wider economic impacts of this re-spending can be modelled.

It is interesting to examine this coefficient in the context of the household questionnaire. Figure 3.5. below shows the responses to a specific item on the household questionnaire which asks the extent to which beneficiaries cut back on food, heating, and other essential items before and after their intervention. Figure 3.5. shows that, for Category 1 and Category 2 interventions, the proportion of survey respondents cutting back on heating all or most of the time reduced by 25 and 24 percentage points respectively. In other words, taken as an aggregate across the sample, this suggests that these households are using their heating systems more frequently (i.e., rationing their heating less). The figures are not equivalents, and it should be noted that one is a percentage *point* decrease, and one is a percentage decrease, and a direct comparison is therefore inappropriate. However, what it does suggest is that the 0.75 rebound coefficient is not unsuitable.

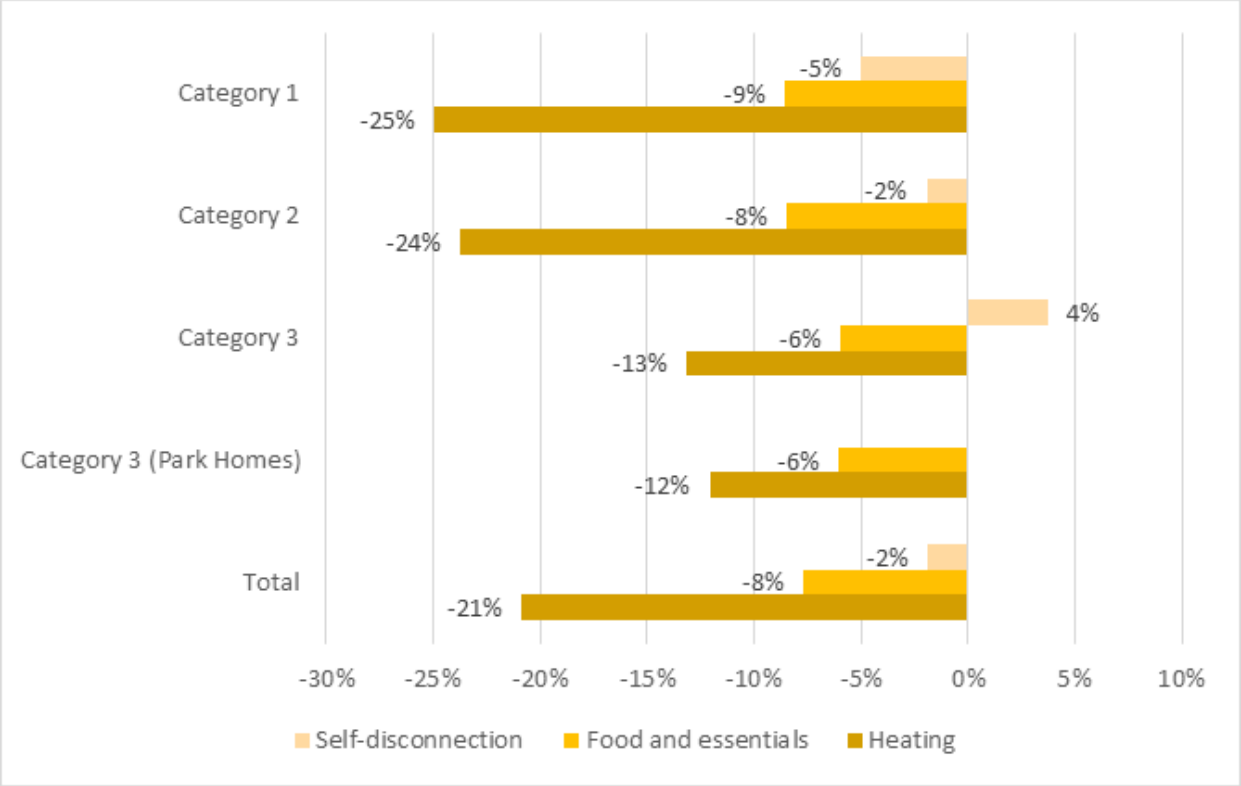



Figure 3.5. Percentage point changes in the frequency with which respondents felt they had to cut back on heating, cut back on food/other essentials, or self-disconnect from prepaid supply 'all or most of the time' after their interventions.

As a next step in the analysis, the modelled running cost reductions in the energy modelling were reduced again by 25% (to account for the proportion of savings that are spent on heating, as per the rebound effect) to arrive at the aggregate disposable income gains for each of the 15,677 beneficiary homes. These gains are simultaneously re-spent in other parts of the economy by households, and are also experienced as reduced income for energy suppliers. Table 3.3. summarises the updated interim findings of this analysis process, showing that reduced running costs are stimulating an annual boost of £8.4mn in demand to the UK economy, which is a result of the net effect of re-spending. More specifically, the analysis shows that of the total bill savings, £8.2m was re-spent in the economy in the first round of re-spending. This re-spent disposable income then had multiplier effects throughout the economy, in a second round of economic impacts of £5.9m. These are estimated by using the ONS demand multipliers for each sector of the economy. Taken together, these two rounds of positive economic impacts represent the positive economic impact of the bill reductions.

| Negative multiplier effects | | Positive multiplier effects | |
|---|---|---|---|
| Initial reduced annual demand | £-10.8m | Initial increased annual disposable income | £10.8m |
| 1st Round: Reduced annual spending as a result | -£3m | 1st Round: Annual re-spending | £8.2m |
| 2nd Round: Multiplied reduced annual re-spending | -£2.6m | 2nd Round: Multiplied annual re-spending | £5.9m |
| Total reduction in re-spending | -£5.7 | Total re-spending | £14m |
| Net Annual economic effect of energy intervention | **£8.4m increased demand in the economy annually** | | |

Table 3.3. Provisional economic impact analysis of the effects of the changes to household running costs

Similarly, the reduced income to energy companies is estimated to have led to reduced spending on their part in a first round of negative economic impacts of £3m. In line with the approach taken to the positive multiplier effects, these reductions in energy firm spending also have negative multiplier effects throughout the economy which would lead to further demand reduction of £2.6m. Accordingly, although the initial change of boosted disposable income for households and the reduced income for energy firms is exactly equal (± £10.8mn), the effects of additional or reduced spending are different because of different multiplier effects (see Table 3.3.). Put differently, this means that households' re-spending profiles and the subsequent multiplier effects are differently (and, in terms of economic impact, advantageously) distributed in the economy compared to the reductions in spending by energy companies. These differences create different eventual economic impacts for different sectors of the economy as well as explaining the difference in the total net economic impact.

### 3.3.2. The economic impacts of targeting low-income households

The WHF and the majority of government funded energy efficiency programmes are targeted at fuel poor homes, which are by definition households with a low income. The economic modelling analysis allows a comparison between the actual modelled impacts of the WHF Category 1 and Category 2 interventions and what the likely impacts would have been if they were not so tightly targeted at low income households. These impacts can be estimated using the SAM, which provides spending patterns of households in five income quintiles. In other words, the SAM divides households into five equally sized groups based on income (i.e. Group One is the 20% of all households with the lowest incomes and Group Five is the 20% of all households with the highest incomes). This is vital because different households have observably different spending patterns, rates of saving, and taxation liabilities depending on which of the five groups or income quintiles they fall into. As a result, boosting the disposable incomes of households with different incomes leads to different economic impacts.

Table 3.4. summarises the differences between targeting low-income households with interventions, as the WHF was designed, and a scenario where the interventions were distributed across all households and income bands, which is how a non-targeted WHF may have operated. It shows that targeting low income households has created a greater boost in demand across the economy than the average income targeting scenario. This is because the modelling suggests that targeting low income households results in more spending in parts of the economy such as services and groceries, whereas the average income household are more likely to save or pay tax. The significance of this is that it illustrates and explains what the multiplier calculations show; that low-income households have a higher 'marginal propensity to consume' (MPC) because as a proportion of their income they pay less tax, save less and spend more. **Because of this, interventions targeted at this group don't just help the beneficiaries themselves, they have stronger economic benefits for the wider economy compared to untargeted interventions.**

| | Low-income targeting scenario | Average income targeting scenario |
|---|---|---|
| 1st Round Re-spending | £8.2m | £7m |
| 2nd Round Re-spending | £5.9m | £4.9m |
| Total Positive Indirect Effect in the economy | **£14.1m** | **£12m** |
| Direct to in-direct effects coefficient | 1.29 | 1.2 |

Table 3.4. Comparison of targeting scenarios

Finally, it is instructive to again compare these findings with Figure 3.5., which shows the extent to which beneficiaries cut back on food, heating, and other essential items before and after their intervention. Figure 3.5. suggests that as well as the reduced propensity to severely cut back on heating, there has also been an aggregate reduction in the proportion of households cutting back on food, clothing, and other essential items, which supports economic modelling analysis that suggests that re-spending took place on services and groceries. Although analysis of household interviews is not yet complete, if it was established in an interview that an interviewee had experienced running costs savings (i.e., paying less for their energy bills), they were subsequently asked what this money was being spent on. Food and other essentials (e.g., for children, such as childcare or sanitary items, or transport costs) were commonly discussed,[18] and as the household interviews conclude and the integration and synthesis analysis continue, the evaluation will work between each data stream to triangulate the findings of the economic modelling on household spending with the actual spending reported in questionnaires and interviews.

## 3.4. Health and wellbeing

Finally, this subsection discusses the impacts of WHF interventions on health and wellbeing. It is well-established that living in a cold home is connected to range of respiratory, cardiovascular, and musculoskeletal conditions, as well as mental ill-health.[19] For example, a recent review of global evidence concluded that fuel poverty is associated with "*poorer general health, poorer mental health, poorer respiratory health, more and worse controlled chronic conditions, higher mortality, higher use of health services and higher exposure to health risks, with worse results for vulnerable groups across dimensions of inequality*."[20] In addition, previous research has also consistently demonstrated that the installation of energy efficiency measures (e.g. new heating systems, insulation upgrades) can result in positive health outcomes.[21] Understanding the health impacts of the programme is therefore key to the broader objective of understanding the social impact of WHF investment, and it is also a pivotal impact measure on which to assess delivery performance.

Figure 3.6. below shows the proportion of respondents who reported better physical and mental health after their interventions, compared to before. **It suggests that the most substantial improvements in physical health have taken place for households that received Category 1 and Category 2 interventions, with approximately three in five respondents in each funding category reporting better physical health**. Category 1 and Category 2 interventions were also more likely to be associated with improvements in mental health, with just under half of respondents reporting better mental health after their intervention. 36% of Category 3 respondents reported better physical and mental health after their intervention, with a much smaller number of Category 3 (Park Homes) respondents doing so (18% and 10% respectively).

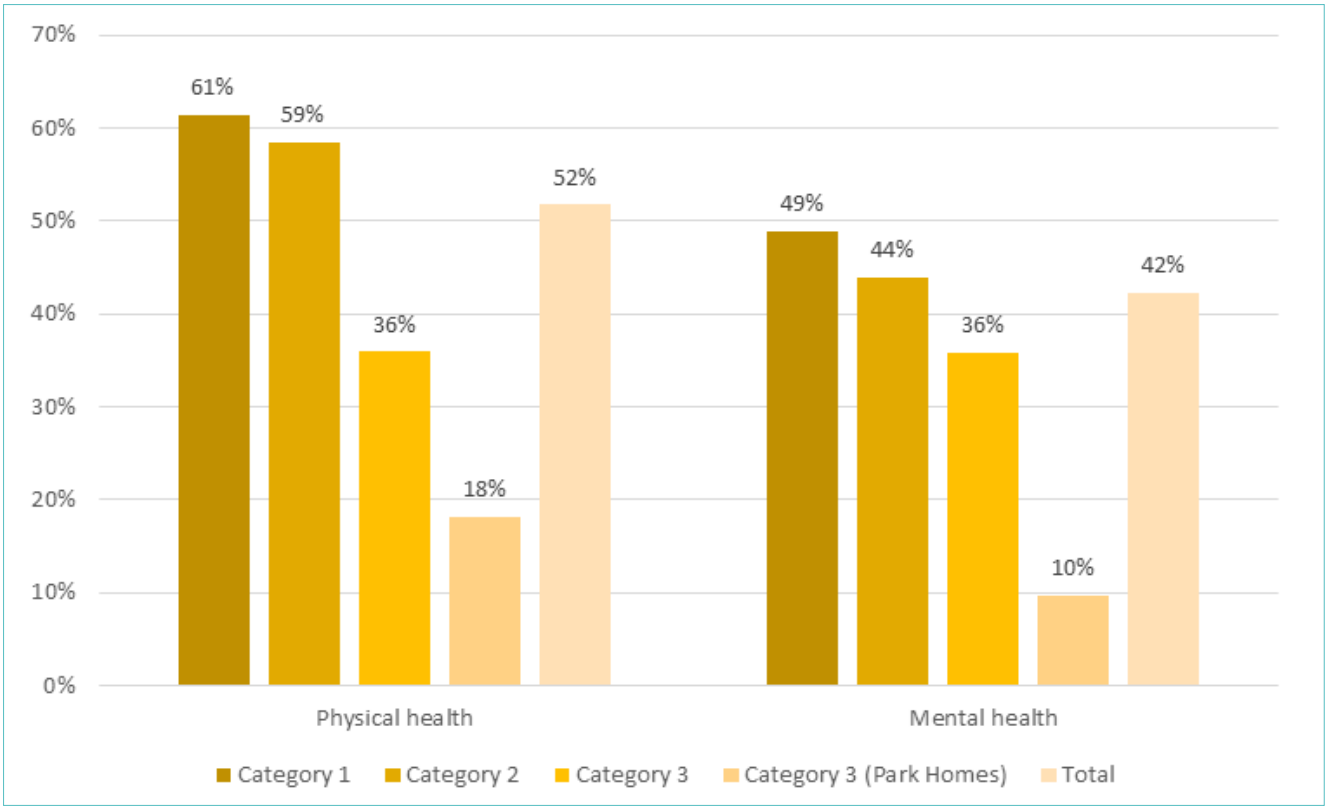



Figure 3.6. The proportion of respondents who said they physical or mental health is 'much better now than before' or 'a little better now than before', disaggregated by funding category.

Self-reported changes in health conditions are sometimes not directly attributed to the impact of a fuel poverty intervention such as those delivered by WHF projects. Instead, changes (especially when negative) are sometimes more likely to be perceived as due to deteriorations in chronic or longstanding conditions, or due to other factors that are perceived by households as beyond the reach of what a fuel poverty intervention can achieve. Tables 3.5. and 3.6. show the extent to which respondents who experienced positive changes in their physical or mental health related these changes to the support they received from their respective WHF projects.[22] Table 3.5. shows that approximately three in five respondents across all three categories thought it was probable or very probable that their physical health improvements were attributable to their WHF intervention. Similarly, Table 3.6. shows that approximately three in five Category 1 and Category 2 respondents thought it was probable or very probable that their mental health improvements were attributable to their WHF intervention, with one in two Category 3 respondents responding the same. **This suggests that all three core categories of WHF funding are having positive physical and mental health impacts for beneficiaries**.

| | Very probably | Probably | Total |
|---|---|---|---|
| Category 1 | 31% | 29% | 60% |
| Category 2 | 20% | 39% | 59% |
| Category 3 | 20% | 41% | 61% |

Table 3.5. Do you think any change in your or someone else's physical health condition is related to the energy-related measures you received? The table shows only those respondents who reported positive physical health changes, as shown in Figure 3.6.

| | Very probably | Probably | Total |
|---|---|---|---|
| Category 1 | 33% | 29% | 62% |
| Category 2 | 18% | 45% | 63% |
| Category 3 | 19% | 32% | 51% |

Table 3.6. Do you think any change in your or someone else's mental health condition is related to the energy-related measures you received? The table shows only those respondents who reported positive mental health changes, as shown in Figure 3.6.

# 4. CONCLUSIONS AND NEXT STEPS

At the time of writing, fieldwork and analysis from Wave 3 of the research activity is concluding, and the evaluation is currently engaged in a process of integrating and synthesising the different strands of work discussed throughout this report. This concluding section therefore widens the focus to consider the interim findings in the context of the evaluation objectives, as stated in the introduction, and sets out how the evaluation will work towards the final report and blueprint model, which will be completed in December 2022 and published in early 2023.

Although analysis is continuing, a picture is emerging from the different strands of activity on the core economic and social impacts of the WHF. The economic impact of the eventual £150mn investment by National Grid in the WHF has been provisionally modelled in previous work as creating approximately £100mn of increased additional demand across the economy, and the analysis presented in this report suggests that there is an annual boost of £8.4mn in demand as a result of reductions in household running costs, which allows beneficiary households to have more disposable income to spend in other parts of the economy. The analysis has also suggested that targeting energy efficiency schemes at low-income households produces a greater boost to the economy than if schemes were untargeted, with approximately £2.1mn more economic stimulus in the low income targeting scenario than the untargeted scenario. At present, this modelling does not consider the impact of Category 3 interventions, which through services such as income maximisation and grant applications aim to increase the disposable income of beneficiary households, but this will be considered in the final report. Summarily, the provisional results show that the economic impact of the WHF will be considerable, and the overall economic impact of the programme as a whole will be summarised in the final report.

In addition, the report has developed an interim assessment of the social impact of the WHF by focusing on fuel poverty, thermal comfort, energy affordability, and health improvements as key indicators of delivery performance. The findings thus far show that:

**Fuel poverty among Category 1 and Category 2 households, defined by LiLEE idicator has reduced from 63.1% to 36.1% and the fuel poverty gap has reduced by over 80% from £699 to £121**

**The ability of beneficiary households to keep their homes warm in winter or when it is cold outside has, in total, increased from 20% (1 in 5) to 78% (almost 4 in 5). The most substantial improvements have been seen in Category 1 and Category 2 interventions.**

**In total, around half of beneficiary households surveyed have experienced improvements in energy affordability, and the number of Category 1 and Category 2 households with modelled running costs above £2,000 reduced by 92.8%.**

**Approximately 3 in 5 beneficiary households who experienced positive changes to their physical and/or mental health attributed this to the support they received through their WHF intervention.**

Moving forwards, the evaluation will be undertaking in-depth analysis of qualitative interviews with WHF projects and beneficiary households to expand and define any additional social and economic impacts of the WHF. Furthermore, drawing on the energy modelling analysis of carbon savings, the evaluation will define the environmental impacts of the WHF programme as a whole. This work will feed into a holistic assessment of delivery performance and inform the design and development of the blueprint model, as discussed below.

With regards to reaching the households most in need, the interim findings point to the necessity of considering multiple fuel poverty, affordability, and health indicators to define need and the relative success of targeting methods. This report has considered and compared the official fuel poverty definition used in England, the LILEE indicator, with a subjective indicator of fuel poverty derived from the household questionnaire, and it has also emphasised that households that remained technically fuel poor (under LILEE) have experienced a reduction in their fuel poverty gap of over 80%, from £699 to £121, greatly reducing the severity of fuel poverty. The interesting contrasts between these measurements require further analysis to unravel, and the evaluation intends to examine a number of specific cases in more detail to understand and qualify the differences thoroughly. This will involve examining the self-reported and subjective lived experiences of between five and ten individual households that are technically defined as fuel poor, as well as integrating findings from the indoor environmental modelling and economic modelling where appropriate. Any regional or national differences in the extent to which the households most in need have been reached is not considered in this report, but geographical variances will be analysed in the final evaluation report.

Lastly, the evaluation will build on the work undertaken thus far on defining the scope and nature of the blueprint model. Informed by the POTI model and other approaches discussed in Section 2, the findings from each strand of the evaluation will be brought together to finalise and deliver a holistic blueprint that will inform policymakers, industry actors, and other stakeholders on options for delivering large-scale energy efficiency programmes in the future.

# Endnotes

[1] Category 1 is focused on urban homes and communities, primarily through first time gas central heating systems; Category 2 is focused on rural homes and off gas communities, primarily through 'non-gas' solutions such as LPG or heat pumps. The WHF includes two further categories: Category 3, which is focused on advice, health, and energy efficiency related solutions to fuel poverty, and Category 3 (Park Homes), which is focused on the extension of mains gas to park home sites.

[2] Department for Business, Innovation and Skills (2010) Understanding programmes and Programme Management.
National Audit Office (2003) Warm Front: Helping to Combat Fuel Poverty; National Audit Office (2016) Green Deal and Energy Company Obligation; National Audit Office (2021) Green Homes Grant Voucher Scheme.
[3] See for example National Audit Office (2021) Green Homes Grant Voucher Scheme, p.13.
[4] See for example CAG Consultants, Ipsos MORI and the Building Research Establishment (2011) Evaluation of the Community Energy Saving Programme; BEIS (2021) Energy Company Obligation (ECO) Evaluation.
[5] IPPR (2018) Beyond ECO: The future of fuel poverty support; Carbon Trust (2017) Available, attractive, too slow? How to accelerate energy efficiency by getting the financing for it right.
[6] IPPR (2018) Beyond ECO: The future of fuel poverty support, p.30-45.
[7] For an overview of PESTEL and an example of its application to energy efficiency, see Shilei, L. and Yong, W. (2009) Target-oriented obstacle analysis by PESTEL modeling of energy efficiency retrofit for existing residential buildings in China's northern heating region, Energy Policy 37 (6): 2098-2101.
[8] Department for Business, Innovation and Skills (2010) Understanding programmes and Programme Management.
[9] For example, see: South Lakeland Council (2016) Customer Connect Programme; UK Government (2018) Nuclear Waste Programme Blueprint; Leeds University (no date) Understanding the Future.
[10] For a fuller explanation of the energy modelling methodology utilised, see Powells, G; Scott, M; Stockton, H; Jobson, K. and Robinson, C. (2021) Warm Homes Fund Programme Evaluation: Abridged second interim report, p.4. Note that in previous analysis, homes in Scotland were not included because Scottish EPC data was not publicly available. This data has however now been released, and as a result the energy modelling analysis presented in this report includes WHF Category 1 and Category 2 interventions that took place in Scotland.
[11] BEIS (2022) Annual fuel poverty statistics report 2022 (2020 data), p.4.
[12] BEIS (2022) Annual fuel poverty statistics report 2022 (2020 data), p.7.
[13] Warm Homes and Energy Conservation Act (2000).
[14] Such approaches are being developed in Europe, such as in the Netherlands, and discussed in academic literature. For example, see Middlemiss, L; Mulder, P; Hesselman, M; Feenstra, M; Tirado Herrero, S. and Straver, K. (2020) Energy poverty and the energy transition: Towards improved energy poverty monitoring, measuring and policy action; Therna, J. and Vondung, F. (2020) EPOV Indicator Dashboard: Methodology Guidebook; Castaño-Rosa, R; Solís-Guzmán, J; Rubio-Bellido, C. and Marrero, M. (2019) Towards a multiple-indicator approach to energy poverty in the European Union: A review, Energy and Buildings 193: 36-48.
[15] The modelled economic impact of the eventual £150mn investment in the housing, construction, and installer sectors by National Grid was provisionally analysed in a previous evaluation interim report. See Powells, G; Scott, M; Stockton, H; Jobson, K. and Robinson, C. (2021) Warm Homes Fund Programme Evaluation: Abridged second interim report, p.7-9. This analysis will be refined ahead of the production of the final evaluation report.
[16] A SAM provides summary data on the flows of money between different actors (e.g., firms, households, government) in an economy. The SAM used in this analysis was developed and published by researchers at Strathclyde University, and was chosen primarily because it is the only British SAM which disaggregates households into income groups. The approach taken here is informed by SAM-based modelling of the wider economic impacts of energy efficiency policy undertaken by colleagues at Strathclyde University and well-established approaches to estimating economic multiplier effects. See Katris, A; Figus, G. and Greig, A. (2019) The 2013 Social Accounting Matrix for Scotland disaggregated by household income quintiles. For the analysis we matched the demand multipliers published by the ONS for each sector of the economy to the disaggregated sectors in the SAM to be able to estimate the final value of re-spending. See ONS (2021) UK input-output analytical tables.

[17] See Barker, T; Ekins, P. and Foxon, T. (2007) The macro-economic rebound effect and the UK economy, Energy Policy 35 (10): 4935-4946; Sorrell, S; Dimitropoulos, J. and Sommerville, M. (2009) Empirical estimates of the direct rebound effect: A review, Energy Policy 37 (4): 1356-1371; Gillingham, K; Kotchen, M.J; Rapson, D.S. and Wagner, G. (2013) The rebound effect is overplayed, Nature 493 (7433): 475-476.

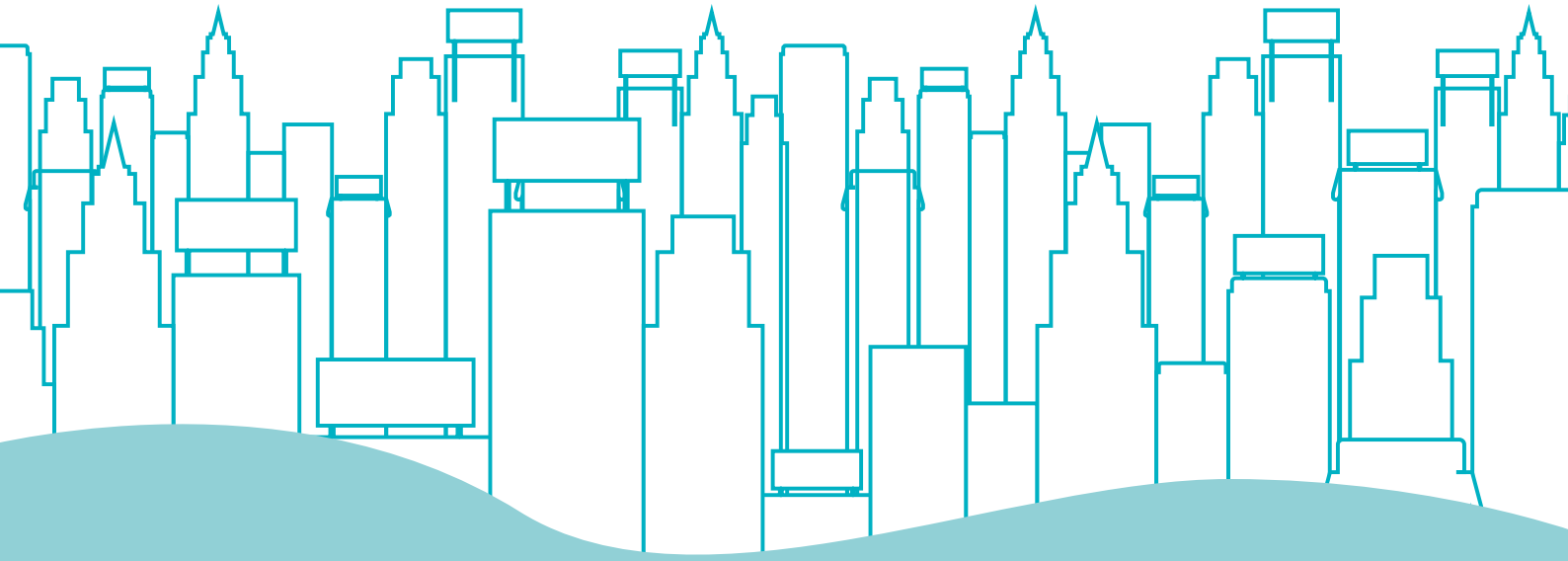
[18] See the preliminary findings presented in Scott, M; Stockton, H; Powells, G; Rosenburgh, J. and Jobson, K. (2020) Warm Homes Fund Programme Evaluation: Abridged interim report, p.5-7.

[19] NEA (2018) Under One Roof; NEA (2017) Connecting Homes for Health: Phase 1 Review; NICE (2015) NICE Guideline NG6: Excess winter deaths and illness and the health risks associated with cold homes.

[20] Ballesteros-Arjona, V. et al. (2022) What are the effects of energy poverty and interventions to ameliorate it on people's health and well-being?: A scoping review with an equity lens, Energy Research and Social Science 87: 102456, p.1.

[21] NEA (2018) Under One Roof, p.20; NEA (2020) Connecting Homes for Health: Executive Summary, p.9.

[22] Note that due to the relatively small number of Park Homes questionnaires received, it is not possible to reliably disaggregate health attribution from Park Homes questionnaires in this way.





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