Whole House Retrofit Plan

Our ref: W008

[redacted]

Survey date: 14/12/2021
Report date: 23/02/2022
Version: Final

Your Retrofit Coordinator

Ben Owen

[redacted]

Contents

1 Summary

Your home currently is rated at a level equivalent to an ‘D’ on an Energy Performance Certificate just below the national target of bringing up the average home to band ‘C’ level by 2035. The modelled heat loss demand for the home is below above the SuperHomes 1 Star Rating (90 kWh/m2/year) and can be improved with additional loft insulation, new windows and checking cavity wall insulation. The compact nature of your home and that you are mid-terrace means that your home is lower than the UK average for carbon emissions and bills related to heating the home.

A thermographic survey with an infra-red camera would provide some evidence of cavity wall insulation behind the cladding as well as highlight specific areas of heat loss and draughts that could be dealt with quickly and inexpensively.

The area to focus on when it comes to your home is reducing the carbon emissions of the heating system. An Air Source Heat Pump (ASHP) is the best method of removing fossil fuels from your heating system.

Additionally, we have included improvements the ventilation in your home by introducing humidity controlled decentralised continuous extract ventilation systems in the kitchen and bathroom upstairs. There were signs of damp in the home in the bathroom and large rear and during the survey, it is worth keeping an eye out for signs of damp and/or having a *hygrometer* in the home to monitor humidity levels. Ideal indoor air should have a Relative Humidity of between 40%-65%.

The pitch and orientation of your either side or even both sides of your roof should be suitable for Solar Photovoltaics (Solar PV) and a large solar array would reduce your reliance on the grid an reduce bills, particularly when switching to an electrical form of heating.

In some cases, grant funding or low-cost financing may be available to help pay for some measures. As information and criteria for grants and loans can change rapidly, we have put together a useful summary which you can find on the SuperHomes website.

2 Introduction

Your Retrofit Plan has been produced following a home assessment carried out to collect information about your home, and how you think you would like to improve it. We have set out your options, packaged up to suit your preferred upgrade process, and shown the estimated costs and benefits of each stage.

The first version of your Plan should be regarded as a ‘draft document for you to read and consider. After you have discussed the Plan with your Retrofit Coordinator it can be updated to suit any changes to packages or the implementation of other ideas. To understand what happens next after this report see Section 14, Next Steps.

Your Retrofit Plan can also be used to allow your home to be assessed under the SuperHomes Rating Scheme. This enables you to understand how your retrofit compares to benchmarks which have been set for five performance levels. You will find a summary of what your retrofit measures will achieve later in the report.

3 Methodology

We have evaluated your home by looking at your estimated

- environmental impact in Carbon Dioxide (CO_2) emissions, and
- energy use in kilowatt hours (kWh)
- fuel bills in £,
- space heating demand (kWh/m^2/yr)

We produce an energy model of your home based on the Government's national methodology for assessing the energy use of homes, as used to produce Energy Performance Certificates (EPCs) for homes. All the data collected in the home survey is put into this energy model so it is bespoke to your home.

We don't rely on the automated EPC recommendations: instead, using our expertise, the data we collect from your home is used to generate a range of appropriate and tailored home improvements. You can then move forward easily with your preferred upgrades.

You may find that the estimated fuel bill in the report is slightly lower or higher than your actual bill. This will be because of factors such as the number of people in your home, the pattern of your heating use, and the price of the tariff you use.

In section 9 we have recorded your current energy costs based on the information you have given us. You can then see how your costs compare to our estimate.

4 Your Priorities

Your Retrofit Plan has been specifically tailored to your home and what you would like to achieve from the retrofit

Here is a summary of the key items that were discussed with your Retrofit Coordinator.

- You would like to understand how and where energy is lost within your home.
- You would like any renovation work make your home as energy efficient as is possible within your budget.
- You have no plans for any extensions to the home.
- You have recently replaced the cladding at the front and rear of the property.
- There are currently 3 people living in the home.

5 Key findings from your retrofit assessment

- Your home was built in the early 1970s. It is not in a conservation area.
- The ground floors are solid and uninsulated.
- The walls are of cavity construction and have been insulated with Cavity Wall Insulation.
- The loft is insulated with 100mm of rockwool at the joists.
- The majority of the double glazed windows were installed before 2002, and do not have trickle vents.
- There is one main heating system, an A rated conventional condensing gas boiler which is 90% efficient.
- There is additionally a decorative gas fire in the living room.
- The front porch extension was added since you moved in. An insulated front door has been installed.
- The storage to the side of the porch is considered outside of the ‘thermal evelope’ with that wall an external wall to the property.

6 Making sure the measures are right for your home

Introduction

While some energy efficiency measures are simple to install, others are more complex and need specialist design. This is particularly important if your home is an older property or of a more unusual type of construction.

Installing energy efficiency measures can sometimes impact on areas of your home that you may not have considered, for example by increasing the moisture level in the air or increasing the load on you roof.

To make sure the measures recommended are right for your home and deliver the outcomes you would like to see, we classify your retrofit as low / medium or high risk.

We will use this risk grading to identify which surveys are required, to highlight any key areas to consider and any specialist surveys or investigations that you may want to consider.

Your Risk assessment

Based on the age of your home, its construction type, and the retrofit measures that are proposed your retrofit is classed as **high** risk.

This is due to the technical risk of the recommended Air Source Heat Pump. A specialist installer should install and commission this heating system.

A Cavity Wall Inspection is also recommended.

Risks Levels explained

A – low risk – simple energy efficiency measures

B – medium risk – a typical package of energy efficiency measures in homes of standard construction

C – high risk – a more complex package of measures needing detailed specification; high rise flats; homes that are Listed or in a Conservation area

7 The importance of ventilation

Retrofitting your home with additional insulation is important to reduce heat loss and therefore energy use. However, as your home becomes more airtight this can impact on both the supply of fresh air into the home, and the removal of moisture generated by everyday activities.

We have assessed the current ventilation of your home and made recommendations to upgrade this where appropriate.

We generate a lot of moisture in the home through cooking, washing and breathing. This moisture often escapes through gaps and cracks around the home (draughts). Reducing draughts is essential to reducing heat loss but it is also necessary to ensure there's sufficient circulation of fresh air to maintain good indoor air quality. Poor ventilation can cause damp in winter and overheating in summer. It can have serious health implications including fatigue, headaches, chest infections and exacerbation of allergies and asthma.

Draughts or *uncontrolled* ventilation are significantly reduced when insulating, meaning that *controlled* ventilation is needed. A well-designed ventilation system will monitor and remove excess moisture from the home to ensure good internal air quality and reduce the chances of condensation and mould.

Your home is currently ventilated by:

- uncontrolled ventilation;
- occupant controlled 'purge' ventilation (opening the windows)
- Intermittent Extract Ventilation (IEV) in the downstairs toilet that turns on with the light;

Additionally, there is:

- a fan above the cooker hood does not that exhaust to the outside.

There were signs of damp noticed during the survey, particularly in the bathroom upstairs and on the rear bedroom windows. It is worth keeping an eye out for signs of damp or having a Relative Humidity meter in the home to monitor levels. Ideal indoor air should have a relative humidity of between 40%-65%.

We would recommend that Relative Humidity controlled continuous extraction is installed in the bathroom upstairs and the kitchen downstairs.

8 How we help you

Our homes are responsible for 20% of UK emissions,[1] so there is no better place to start taking steps to reduce your carbon footprint and help address the Climate Emergency.

The Government's Clean Growth Strategy[2] sets a target to upgrade as many homes as possible to EPC Band C by 2035.

We have gone further by showing a range of measures that will get your home closer to zero energy bills and zero CO_2 emissions.

We have packaged these measures into phases in order to facilitate such a level of reduction, even if that work is carried out after you have moved to a different home.

[1] BEIS (See References)
[2] https://www.gov.uk/government/publications/clean-growth-strategy

Caveats to this analysis:

1. Costs of installation are estimated, based on the rates we experience from contractors for similar work.
2. **They are not quotations.** Savings are based on energy bill rates prevalent on the market at this time.

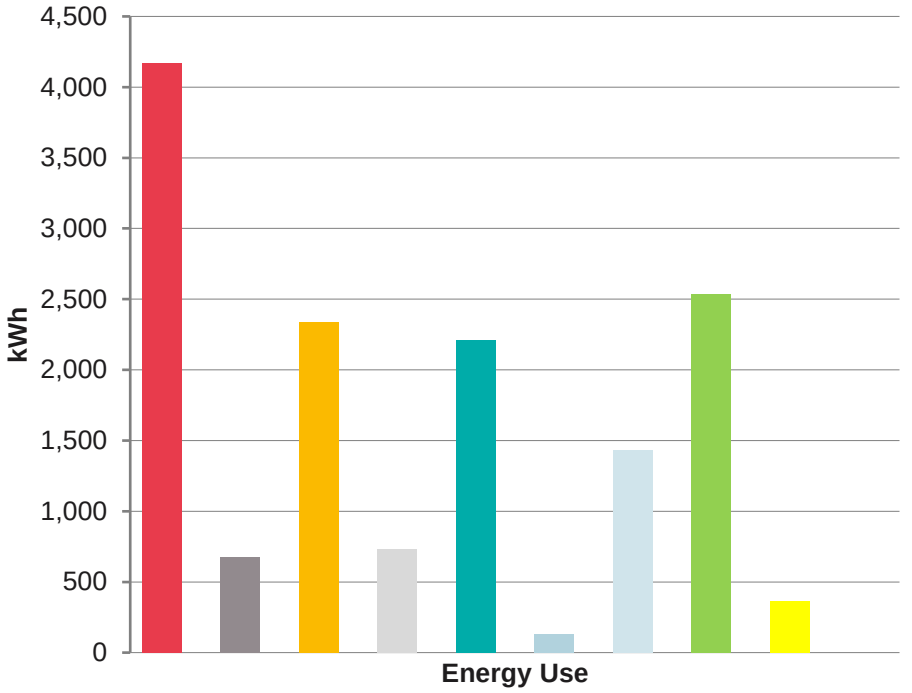
9 Where you are now

Below is the estimated baseline of your home's energy performance, from which we evaluate improvements:

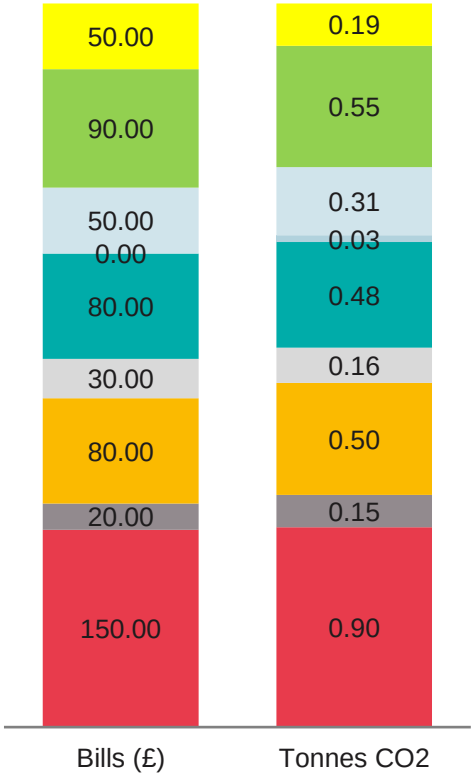
Energy Rating 1 to 100 – higher is better	Fuel Bills Annual[1]	Tonnes CO_2 Annual[1]	kWh/m² Heat Demand Annual
A rating of your home on a scale of 1 – 100. The rating is calculated based on your home's modelled running costs.	*Fuel bills – this estimated cost includes the energy used for heating your home, providing hot water, ventilation and lighting. It does not include energy costs for household appliances.*	*Carbon dioxide emissions from energy use are a significant contributor to climate change.* *Fossil fuel heating systems using gas, oil or coal will have high CO_2 emissions. Low carbon heating systems such as heat pumps will perform well here.*	*This is the amount of energy needed to heat your home.* *Because this figure is calculated before the type of heating system and its efficiency is considered, it's a really good way to look at how good the fabric of your home is before thinking about the type of heating and renewable energy system to use.*
67 D	**£690**	**3.06**	**86.1kWh/m²**
The national target for all homes by 2035 is **C**[2]	Modelled using SAP[3] The UK average is **£1,184**[4] *When making a comparison remember that your energy bills will include costs for household appliances.*	The UK average per home is **3.50**[5]	A measure of how much heat your house loses, above 150 is typical, below 60 is excellent

[1]Figure is net after revenue/adjustments from any renewables; [2]Clean Growth Strategy; [3]the government's standard home energy use calculation methodology 'Standard Assessment Procedure', see bregroup.com/sap; [4]OFGEM; [5]Catapult (See References)

Your estimated current energy use, bills & emissions



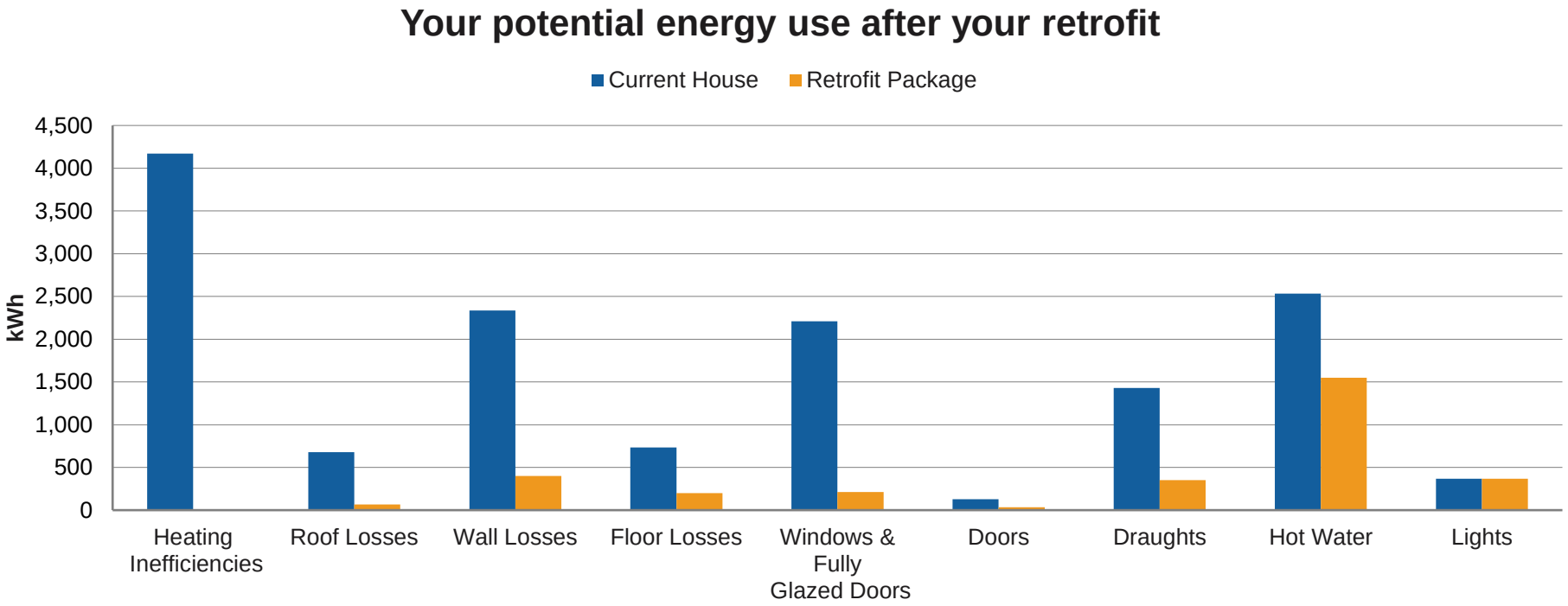
- Renewables
- Lights
- Hot Water
- Draughts
- Doors
- Windows & Fully Glazed Doors
- Floor Losses
- Walls Losses
- Roof Losses
- Heating Inefficiencies



10 What you can achieve

Below are the projected energy performance improvements for your home, based on our evaluation:

Comparison	Energy Rating	Fuel Bills	tCO_2	kWh/m^2
Before	67 D	£690	3.06	86.12
After	97 A	£-10	-0.03	53.13

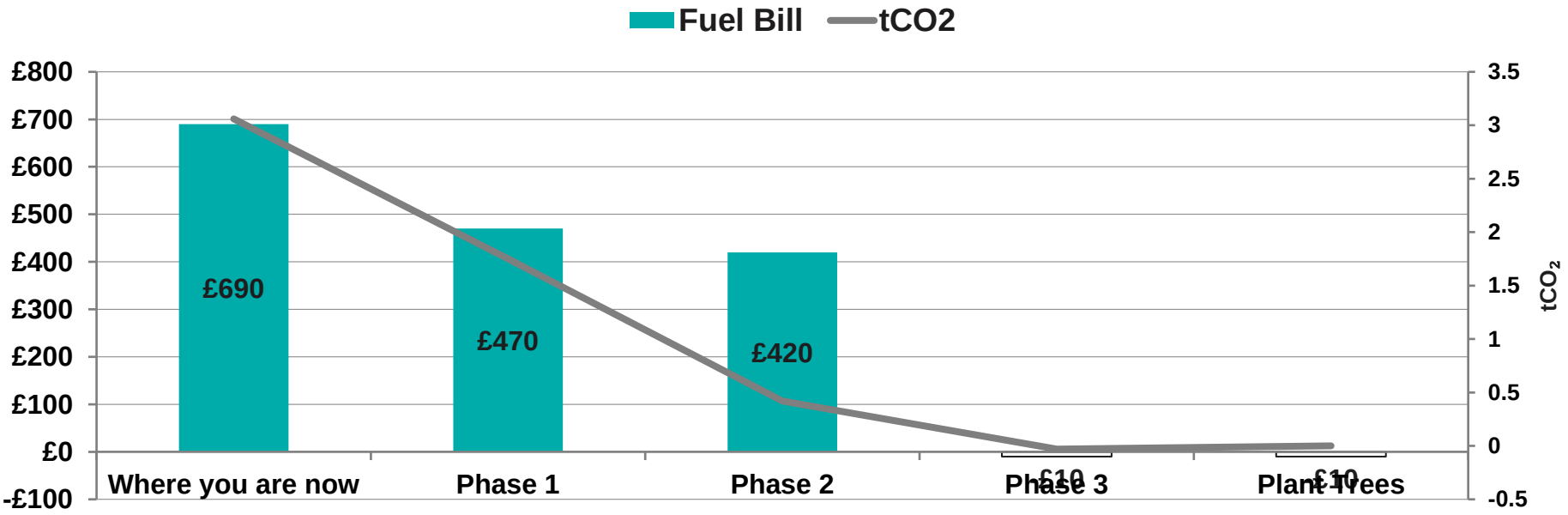


Note: The drop in energy demand for the home shown in the graph above is due to the the Air Source Heat Pump requiring roughly one third of the energy to heat the home (with two thirds coming from the latent outdoor heat, the sun). Meaning that the energy required to heat your home will be one third of existing energy requried with a gas boiler regardless of improvements to the fabric of your home.

11 Phasing your improvements

Summary of Packages		Estimated Costs Per Phase	Energy Rating	Fuel Bill	tCO_2	kWh/m2
Where you are now			**67 D**	**£690**	**3.06**	**86.12**
Phase 1:	Fabric First	£13,380	77 C	£470	1.75	53.13
Phase 2:	Low Carbon Heating	£12,000	80 C	£420	0.42	53.13
Phase 3:	Renewables	£6,300	97 A	£-10	-0.03	53.13
Combined savings				**£700 saving**	**3.09 saving**	
Combined reduction				**101%**	**101%**	
Trees you could plant[1] to bring the remaining -0.03 tCO_2 to zero: -1						

How the phasing affects your annual bills & emissions



[1]Based on 22kg per year per tree, www.eea.europa.eu/articles/forests-health-and-climate-change/key-facts/trees-help-tackle-climate-change

11 Phasing your improvements (continued)

The measures recommended below aim to significantly reduce your energy use, annual energy costs and CO_2 emissions. This demonstrates a good range of the possibilities available. We can of course limit recommendations to your more immediate needs to fit within your current budget.

Phase 1 Measures: Fabric First	Estimated Costs	Energy Rating	Fuel Bill	tCO_2	kWh/m^2
Where you are now	**Per Measure**	**67 D**	**£690**	**3.06**	**86.12**
Remove secondary heaters - gas	£360	72 C	£590	2.46	86.12
300mm loft insulation from 100mm	£640	73 C	£570	2.34	80.67
Humidity controlled kitchen extractor	£300	73 C	£570	2.34	80.67
Humidity controlled extractors per wetroom	£300	73 C	£570	2.34	80.67
A++ double glazed casement windows from older double glazing	£8,000	75 C	£510	2.00	64.89
Roof insulation (150mm) from unknown flat roof	£770	75 C	£510	2.00	64.89
Cavity wall insulation to unfilled party cavity wall	£1,050	77 C	£470	1.75	53.13
Extract failing cavity wall insulation and refill	£1,960	77 C	£470	1.75	53.13
After Phase 1 Measures		**77 C**	**£470**	**1.75**	**53.13**
Package Cost & % Improvements	**£13,380**		**32%**	**43%**	

Phase 2 Measures: Low Carbon Heating	Estimated Costs	Energy Rating	Fuel Bill	tCO_2	kWh/m^2
After Phase 1	**Per Measure**	**77 C**	**£470**	**1.75**	**53.13**
ASHP (45 degree emitters) with enhanced existing radiator central heating and hot water, from A rated gas boiler	£12,000	80 C	£420	0.42	53.13
After Phase 2 Measures		**80 C**	**£420**	**0.42**	**53.13**
Package Cost & % Improvements	**£12,000**		**11%**	**76%**	
Cumulative Cost & % Improvements	**£25,380**		**39%**	**86%**	

Phase 3 Measures: Renewables	Estimated Costs	Energy Rating	Fuel Bill	tCO_2	kWh/m^2
After Phase 2	**Per Measure**	**80 C**	**£420**	**0.42**	**53.13**
Install PV system where potential has been identified	£6,300	97 A	£-10	-0.03	**53.13**
After Phase 3 Measures		**97 A**	**£-10**	**-0.03**	**53.13**
Package Cost & % Improvements	**£6,300**		**102%**	**106%**	
Cumulative Cost & % Improvements	**£31,680**		**101%**	**101%**	

12 Retrofit Coordinator technical review

Each measure needs to be specified in a way that ensures it suits your home and lifestyle. The measures in this report must be detailed correctly so that the contractor is able to fully understand the implications of not designing and installing the work correctly.

No revisions have been made to this report from the Draft Version dated 14th January 2022.

Phasing

The above energy efficiency measures are the best-case scenario for your home. The measures can be installed all at once, however based on our conversations I have provided a phased approach to indicate measures that would be best completed concurrently.

Phase 1 follows the 'fabric first' principle – our aim to make the home as energy efficient as possible. These measures focus on making sure that your home can maintain the heat for as long as possible without major disruption.

With all the fabric-first measures taken care of, Phase 2 looks at installing a low carbon heating system; and the final phase (Phase 3) shows the impact of maximising the potential solar PV suitable for your roof.

Removing the Gas Fire

Decorative gas fires can be as low as 25% efficient with most of the heat lost through the chimney and is the main cause of the 'Heating Inefficiencies' shown in the graphs on pages 11 & 12. We appreciate that there are other benefits to this type of heating and that they are rarely used to heat the home, however, removing this fire would be the first step in reducing the reliance on gas for heating the home. Blocking this chimney (while ensuring adequate ventilation of chimney breasts) would also improve the heat lost through draughts.

Loft insulation at joist level

Insulating at ceiling level provides the most cost effective insulation solution in terms of the ratio of cost to energy saved.

The condition of your loft insulation should be checked. During the survey I noticed that insulation was stuffed at the eaves of the loft potentially blocking ventilation at this junction – this should be removed and re-laid.

Best practice is for joist level insulation to be 300mm with the first layer laid between the joists and subsequent layers laid over the joists and at right angles to them.

Care should be taken to maintain ventilation pathways at the eaves; to insulate and draught-proof the loft hatches; and to install draught and fire-resistant covers for light fittings.

If the loft is to be used for storage then we would advise you to install a proprietary raised board system that allows an air gap above the insulation to prevent condensation and safe storage without compressing the insulation and reducing its thermal performance.

Flat roof insulation

It has been assumed that insulation was installed on the flat roof at the time of the porch extension.

Cavity Wall Insulation

The walls of your house are of cavity construction and there is evidence from the survey that they been filled with insulation. However, due to the cladding on the first floor there is no evidence at the time of the survey that the cavity insulation continues up to the first floor of the front and rear walls.

Even if the CWI is completely installed across the walls and may still be performing well, over time some cavity wall insulation materials have a tendency to slump.

We recommend a borescope survey be carried on your house which involves drilling small investigative holes at various points in the walls and inserting a small camera. The results will show the existing insulation type and the depth of the unfilled cavity which will help us specify the correct partial-fill materials.

Additionally, it would be worth checking the coverage and effectiveness of your CWI by commissioning a thermal image survey when temperatures and weather conditions permit.

Depending on the results of these surveys, your options may include:

- doing nothing;
- topping up the existing CWI; or
- extracting the failing CWI and refilling the cavity (as shown in Phase 1).

Party Cavity Wall Insulation

Party Cavity walls are often vented and therefore heat can escape through these walls, helped by a constant supply of cool air rushing up the gap between the homes. Filling this cavity with a modern insulation material such as resin coated polystyrene beads.

If there is a cavity, before insulation work goes ahead, we recommend that a cavity wall inspection is completed to understand the width of cavity and to ensure that there are no obstructions to the insulation.

Additional wall insulation

Not included in the options from model is insulating the walls around the porch. Some insulation may have been installed when the porch was incorporated into the home. A thermographic survey would be able to show the surface temperatures and indicate areas of larger heat loss through the various elements of this space. An insulation strategy can then be formed based on this evidence.

Ventilation & Air-Tightness

As discussed on page 8, ventilation of the home is important for good indoor air quality. Mould, a sign of excess moisture in the home, was noted during the survey in the upstairs bathroom and around the window in the larger rear bedroom.

As a minimum we would recommend humidity-controlled extract fans in the bathroom and kitchen to expel stale, moist air trickle vents should be specified on any new windows not in rooms with extractors.

A good indicator for this is Relative Humidity (RH). It is worth keeping an eye out for signs of damp or having a *hygrometer* in the home to monitor levels of humidity. Ideal indoor air should have a relative humidity of between 40%-65%.

Thermal Imaging

A thermographic survey with an infra-red camera would show the surface temperatures of all elements of the home. This survey can help identify areas of concern regarding heat loss, whether CWI has been installed behind the cladding, highlight draughts and detect and show the importance of thermal bridges (usually found at junctions between elements of a building). With this information simple fixes could help improve the fabric of the building.

Air-source heat pump (ASHP)

The existing boiler is A rated and is 90% efficient at converting fuel to heat.

Switching to electrical forms of heating such as storage heaters or heat pumps can be an impactful way of reducing carbon emissions particularly as the national grid decarbonises at an increasing rate.

This Whole House Retrofit Plan includes replacing the gas boiler with an ASHP (200-350% efficient). Heat pumps work most efficiently in well insulated houses where a radiator flow temperature of between 35° to 45° is sufficient to keep the house warm. It is important to carry out insulation and draught-proofing changes prior to installation to ensure the heat pump is correctly sized for the heat demand of the house.

Depending on insulation levels, radiators sometimes need to be changed to accommodate the lower temperatures that heat pumps operate at, but this can't be known until detailed heat loss calculations are carried out.

The installation of heat pumps usually falls within permitted development rights providing certain criteria are met. The fabric upgrades mentioned above are intended to make the home ready for an ASHP. Noise should be considered when siting of the heat pump unit.

From the figures in the appendix, you can see that a heat pump significantly reduces your carbon emissions, but they don't tend to reduce heating costs compared to gas because the price of electricity is considerably higher than the price of gas. To assist

with this, heat pump installations are subject to a government grant – the Renewable Heat Incentive (RHI) - which is a financial incentive to encourage homeowners to switch from conventional fossil fuel heating to renewable heating. It currently pays in fixed quarterly instalments over 7 years based on the heating and hot water demand of your house. The RHI has been extended until March 2022 and they are considering making it a one-off upfront payment. Once the RHI grant scheme ends another scheme will take its place, the details of the scheme are currently unavailable, but this scheme is likely to provide owners a £5,000 grant upfront to pay for the initial cost of the heat pump.

Current feedback from installers in London is that they are fully booked for installations between now and the end of March. This may not be the case near you, but it might be worth getting in touch with a couple of installers to check their availability if you are thinking about applying for the RHI scheme.

The estimated cost in this report includes a compatible hot water cylinder and other associated works but excludes costs related changes in radiator sizes.

Photovoltaic (PV) panels

The orientation and pitch of your roof provides two large areas that lends themselves to a sizeable PV array if deemed suitable by a specialist.

The government no longer pay feed-in tariffs for solar panel installations, but electricity companies are starting to pay for solar electricity that is generated and fed into the national grid (the smart export tariff). The payment amount varies from 0.5 p/kWh to 5.5 p/kWh.

The electricity savings from solar PV and the length of payback, depend on how much of your self-generated electricity you are able to use on site. If, in future, you were to switch to a heat pump then the solar PV would help with its running costs during the spring, summer and autumn months.

There’s also a simple gadget which can be added to your hot water tank so that ‘free’ excess solar electricity can be diverted to heating the hot water via immersion and reduce the energy required for hot water (see pages 11 & 12).

13 Costs and funding

Costs

The costs shown in this plan are indicative. They are the current best estimate we have for those particular measures and are subject to change.

These costs only include the works pertaining to the energy efficiency measures e.g. extra loft insulation is for the materials and labour for rolling out extra insulation over the existing insulation; it does not include any costs for eaves trays, boarding out the loft, widening the loft hatch nor installing a loft ladder.

In planning for your home retrofit you should also consider potential additional costs which might include:

- Heat loss calculations for heat pump installations
- Thermographic survey or air tightness test
- Cavity Wall Inspection

Funding

In some cases, grant funding or low-cost financing may be available to help pay for some measures. As information and criteria for grants and loans can change rapidly, we have put together a useful summary which you can find on the superhomes.org.uk/winchester/ website.

In certain circumstances there is also funding available directly through the **Winchester Area SuperHomes** project. You can find out more about this by speaking to the Project Officer and you can find their contact details at the end of the report.

14 Next steps

1: Review / Adapt

Once you've had a chance to read the report, the next step is a 30-minute phone call with your Retrofit Coordinator to discuss the report and its findings. We can answer any questions you have and revise your report if needed. We can then send you a finalised copy of the report. Please book your appointment by contacting your Coordinator directly.

This is the final stage of the service provided by your Retrofit Coordinator as part of your Whole House Retrofit Plan.

2. SuperHomes Assessment

If you would like to undertake a SuperHomes Assessment of your planned retrofit you can speak to your Retrofit Coordinator to find out more.

3. Further surveys

This report may include recommendations for further surveys that you need to undertake to help inform your retrofit design:

- Heat loss calculations for heat pump installations
- Thermographic survey or air tightness test
- Cavity Wall Inspection

4. Funding

To find out more about options for funding your retrofit you can refer to the superhomes.org.uk/winchester/ website or speak to the Project Officer

5. Managing the retrofit

You may choose to manage the retrofit yourself, or you can use the services of a Retrofit Coordinator who will guide you through the entire process. This is an additional paid for service and you can obtain a quotation from your Retrofit Coordinator

5. Retrofit Design

The next stage to consider is the retrofit design. Depending on the measures you chose, you may need a more detailed specification along with design drawings. To minimise the environmental impact of your retrofit you may wish to think in more detail about type of insulation materials you specify and where products are sourced. You can find further sources of reference on this in the 'Next Steps for Retrofit' pack.

6: Obtain and review quotes

Once the strategy and design is confirmed you will need to seek quotations from contractors for your chosen package of works.

7: Installation of measures

When you have agreed a contract with your installer then work can go ahead. Make sure you ask your installer for copies of all operating instructions, guarantees and commissioning certificates.

8. Monitoring and evaluation

Once your retrofit is competed, we encourage you to monitor your energy use over the following year. If your home is being assessed for SuperHomes you will need to carry out monitoring for 12 months to achieve your final SuperHomes rating.

15 Appendix: All your options

Here is a list of every energy saving measure that has been analysed. The following is a full list of every energy saving measure that has been analysed. Many of these options may not fit your priorities but have been included for background information. Your Retrofit Coordinator has selected from this list the recommended measures above based on your priority which is reduced CO2 emissions. The measures here have been sorted in the order that pay back for themselves fastest over time.

Please Note: Combined measures installed together usually achieve less savings than the sum of the individual measures set out below:

		Energy Rating			Fuel Bill			Kilograms CO2			CO_2 Cost-effect
Measures	**Costs**	**Score**	**Saving**	**£/point**	**Bill**	**Saving**	**Payback years**	**$KgCO_2$**	**Saving**	**£/$kgCO_2$**	**£/lifetime CO_2**
Extract failing cavity wall insulation and refill and add external insulation	£7,134	68 D	1.51	£4,725	£660	£30	225.8	2,872	191	£37.40	£0.40
External insulation to filled pre 1976 cavity walls	£5,815	68 D	1.51	£3,851	£660	£30	184.0	2,872	191	£30.50	£0.50
Extract failing cavity wall insulation and refill and add internal insulation	£5,724	68 D	1.51	£3,791	£660	£30	181.1	2,872	191	£30.00	£0.50
Extract failing cavity wall insulation and externally insulate	£5,968	68 D	1.58	£3,777	£660	£30	180.7	2,864	199	£30.00	£0.50
Medium Solar Thermal on a south pitched roof with no shading (for use with heatpump measures)	£4,725	68 D	1.26	£3,750	£660	£30	160.2	2,852	211	£22.40	£0.70
Internal insulation to filled pre 1976 cavity walls	£5,570	68 D	1.51	£3,689	£660	£30	176.3	2,872	191	£29.20	£0.50
A++ triple glazed casement windows from old double glazing	£12,086	70 C	3.53	£3,424	£620	£70	166.5	2,625	438	£27.60	£0.50
ASHP (35 degree emitters) with new underfloor central heating and hot water, from A rated gas boiler	£18,000	74 C	6.94	£2,594	£550	£140	127.2	551	2,512	£7.20	£2.10
A+ double glazed casement windows from older double glazing	£8,004	70 C	3.16	£2,533	£620	£70	121.5	2,665	397	£20.10	£0.70
A++ double glazed casement windows from older double glazing	£8,004	70 C	3.53	£2,267	£620	£70	110.3	2,625	438	£18.30	£0.80
ASHP (55 degree emitters) with existing radiator central heating and hot water, from A rated gas boiler	£12,000	72 C	5.40	£2,222	£580	£110	106.1	579	2,484	£4.80	£3.10
Insulated floors (50mm) from 1967-1975 solid floor	£1,763	68 D	0.84	£2,099	£670	£20	100.9	2,957	105	£16.70	£0.90

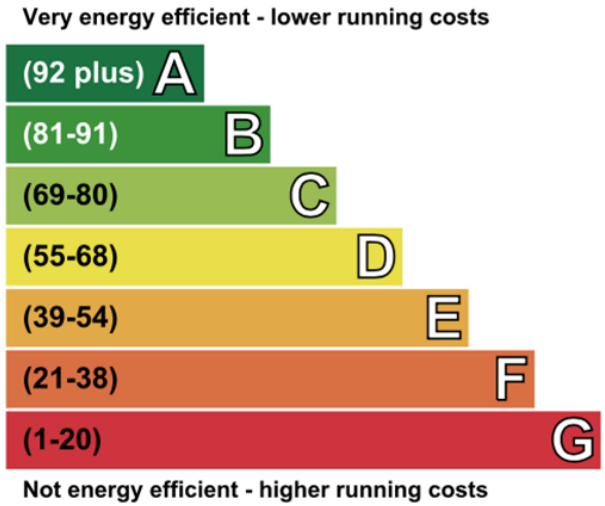
Measures	Costs	Energy Rating			Fuel Bill			Kilograms CO2			CO_2 Cost-effect
		Score	Saving	£/point	Bill	Saving	Payback years	$KgCO_2$	Saving	£/$kgCO_2$	£/lifetime CO_2
ASHP (45 degree emitters) with enhanced existing radiator central heating and hot water, from A rated gas boiler	£12,000	74 C	7.24	£1,657	£540	£150	80.6	542	2,520	£4.80	£3.20
WWHRS in suitable wet rooms - MixerWithBath	£780	67 D	0.77	£1,013	£670	£20	44.8	2,958	105	£7.40	£2.00
Compensating controller from mains gas boiler with none	£350	67 D	0.48	£729	£680	£10	37.3	3,006	57	£6.20	£2.40
300mm loft insulation from 100mm	£643	68 D	1.23	£523	£660	£30	25.1	2,908	155	£4.20	£3.60
Cavity wall insulation to unfilled party cavity wall	£1,050	69 C	2.44	£430	£640	£50	20.6	2,755	308	£3.40	£4.40
FGHRS to compatible boiler - Ideal Logic Boost 26	£1,080	69 C	2.68	£403	£630	£60	18.9	2,718	345	£3.10	£4.80
Install PV system where potential has been identified	£6,300	84 B	16.98	£371	£260	£430	14.7	2,621	442	£14.30	£1.10
Full multi zone controls (room thermostat) from programmer, TRVs and bypass	£634	69 C	2.56	£248	£640	£50	12.8	2,787	276	£2.30	£6.50
Condensing gas room fire from low efficiency secondary gas heater	£900	72 C	5.10	£176	£590	£100	9.0	2,460	603	£1.50	£10.10
Full controls (room thermostat) from programmer, TRVs and bypass	£95	68 D	0.99	£96	£670	£20	4.7	2,966	97	£1.00	£15.30
Remove secondary heaters - gas	£360	72 C	5.12	£70	£590	£100	3.6	2,458	605	£0.60	£25.20
Whole House Heat Recovery Ventilation from Natural Ventilation	£3,250	58 D	-9.08	£-358	£880	£-190	-16.8	3,351	-288	£-11.30	£-1.30
Mechanical Ventilation and Heat Recovery	£4,250	58 D	-9.08	£-468	£880	£-190	-22.0	3,351	-288	£-14.70	£-1.00
Demand Controlled Ventilation	£3,250	62 D	-4.26	£-763	£770	£-80	-38.2	3,224	-161	£-20.20	£-0.70
Community heat pump and full controls from individual gas boilers	£11,000	62 D	-4.69	£-2,345	£800	£-110	-103.4	1,395	1,668	£6.60	£2.30
Underfloor heating and insulation from radiators and uninsulated solid floor	£3,708	66 D	-1.06	£-3,498	£710	£-20	-235.6	3,158	-95	£-39.00	£-0.40
High heat retention storage heaters and dual immersion cylinder from A rated gas boiler	£4,000	67 D	-0.08	£-50,000	£680	£10	488.5	1,293	1,770	£2.30	£6.60

		Energy Rating			Fuel Bill			Kilograms CO2			CO_2 Cost-effect
Measures	**Costs**	**Score**	**Saving**	**£/point**	**Bill**	**Saving**	**Payback years**	**$KgCO_2$**	**Saving**	**£/$kgCO_2$**	**£/lifetime CO_2**
PAS2035 fee	£0	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£NaN
Install a loft hatch	£0	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£NaN
Loft boarding	£0	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£NaN
Roof vent trays	£0	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£NaN
Roof insulation (150mm) from unknown post-2002 flat roof	£770	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
EPC House or Bungalow	£96	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Scaffolding	£1,540	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Humidity controlled kitchen extractor	£300	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Humidity controlled extractors per wetroom	£300	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Trickle vents on windows	£210	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Humidity controlled passive ventilation to non-wet rooms	£360	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00
Extract failing cavity wall insulation and refill	£1,958	67 D	0.00	£∞	£690	£0	∞	3,063	0	£∞	£0.00

16 Glossary, References & Useful links

Glossary			
ASHP	Air Source Heat Pump	PV	Solar photovoltaic panels
EPC	Energy Performance Certificate	RHI	Renewable Heat Initiative
EWI	External Wall Insulation	SAP	Standard Assessment Procedure
FGHRS	Flue Gas Heat Recovery System	tCO_2	Tonnes of Carbon Dioxide
GSHP	Ground Source Heat Pump	TRV	Thermostatic Radiator Valve
IWI	Internal Wall Insulation	WWHRS	Wastewater Heat Recovery System
kWh	Kilowatt hours		

Energy Efficiency Rating



Fuel Bill Modelling

SAP models energy use based on ‘typical’ occupancy (assumed number of people living in your home, based on the floor area) and behaviour (e.g. heating the property to 21C in living areas and 18C elsewhere), in a property located in the middle of England.

You may have a lower or higher occupancy than ‘typical’ in your home and you may prefer heating your home to a higher or lower temperature than used in the model, which means your baseline energy use can be very different to that which SAP models.

Furthermore, insulation levels are modelled on the age of the house if other evidence is not available, this will also impact on predicted energy use.

Useful Links

Retrofit Coordinator	https://www.youtube.com/watch?v=k4nJlJXpo9A&feature=emb_logo
UKCMB - Ventilation	https://www.youtube.com/watch?v=aBWlXLMnqBk
STBA - Solid Wall Insulation	https://www.youtube.com/watch?v=6KFC0vbxii8
Trustmark - PAS 2035	https://www.trustmark.org.uk/ourservices/pas-2035
OFGEM - RHI	https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi
RHI calculator	https://renewable-heat-calculator.service.gov.uk/StartCalculation.aspx
CCC - Homes for the Future	https://www.theccc.org.uk/wp-content/uploads/2019/02/Homes-of-the-future-are-needed-today-Infographic-A4.pdf
SAP – Standard Assessment Procedure	https://www.gov.uk/guidance/standard-assessment-procedure

References

[2]Clean Growth Strategy	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf (page 13, point 12)
[3]Standard Assessment Procedure	https://www.gov.uk/guidance/standard-assessment-procedure
[4]OFGEM - Energy average UK bills	https://www.ofgem.gov.uk/publications-and-updates/infographic-bills-prices-and-profits
[5]Catapult - Living Carbon Free	https://es.catapult.org.uk/wp-content/uploads/2019/06/ESC-Living-Carbon-Free-report-for-CCC.pdf
[6]BEIS - 2018 UK GHG emissions	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863325/2018-final-emissions-statistics-summary.pdf

17 Contact details

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Winchester Area SuperHomes

WinACC Winchester Action on the Climate Crisis

NATIONAL ENERGY FOUNDATION

South Downs National Park Authority