cosy homes
oxfordshire

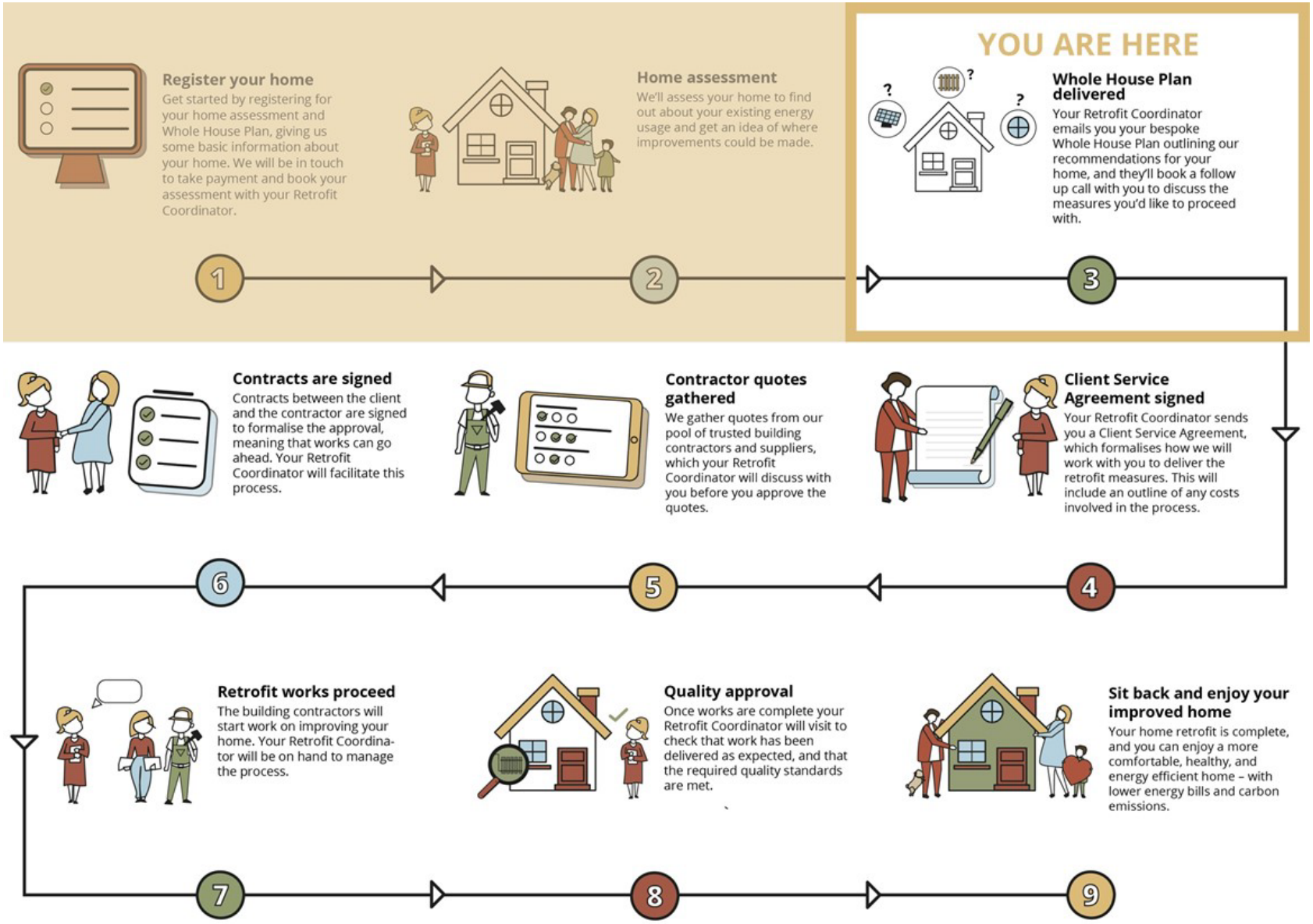
St. Clements, Oxford

Whole House Plan
Sample

happy . healthy . homely

Contents

1: Your Retrofit Journey



2: Introduction

This Whole House 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 clearly shown the estimated costs and benefits of each stage.

The Plan should be regarded as a 'live' document and can be adapted to suit changes in packages, or the implementation of other ideas should they arise. This may happen as discussions progress, and we are happy to continue to develop it further after signing the Client Service Agreement.

3: Methodology

We have evaluated your home by looking at your estimated

- fuel bills in £,
- environmental impact in Carbon Dioxide (CO_2) emissions, and
- energy use in kilowatt hours (kWh)

We use the nationally accepted methodology for calculations that underpins the Energy Performance Certificate (EPC) regime for all UK homes, but we don't rely on the automated EPC recommendations.

Using our expertise, the data we collect from your home is used to generate a range of appropriate and individual home improvements. You can then move forward easily with your preferred upgrades.

How we help you invest in your home

Strategy
First, we identify all possible measures that will impact on your energy bills, comfort, and environmental impact. This **Whole House Plan** is your strategy.

Specification
Each measure is designed to suit your home in a way that a contractor will be able to understand and install.

Groups of measures are selected and designed to complement each other as well as your home.

Futureproofing
We ensure that all future measures are not blocked by the initial work, thereby reducing work and costs in the long-term.

4: Your priorities

Here is a summary of the key items that you communicated to us.

- You are concerned about climate change and your main objective is to reduce your carbon emissions.
- You would also like to improve the internal comfort of the house which can often feel cold.
- You're particularly interested in recommendations to:
    - improve the warmth and efficiency of the unseparated conservatory; and
    - reduce heat loss from the traditional single glazed sash windows at the front.

5: Modelling assumptions

Listed are some of the assumptions we made when modelling your home.

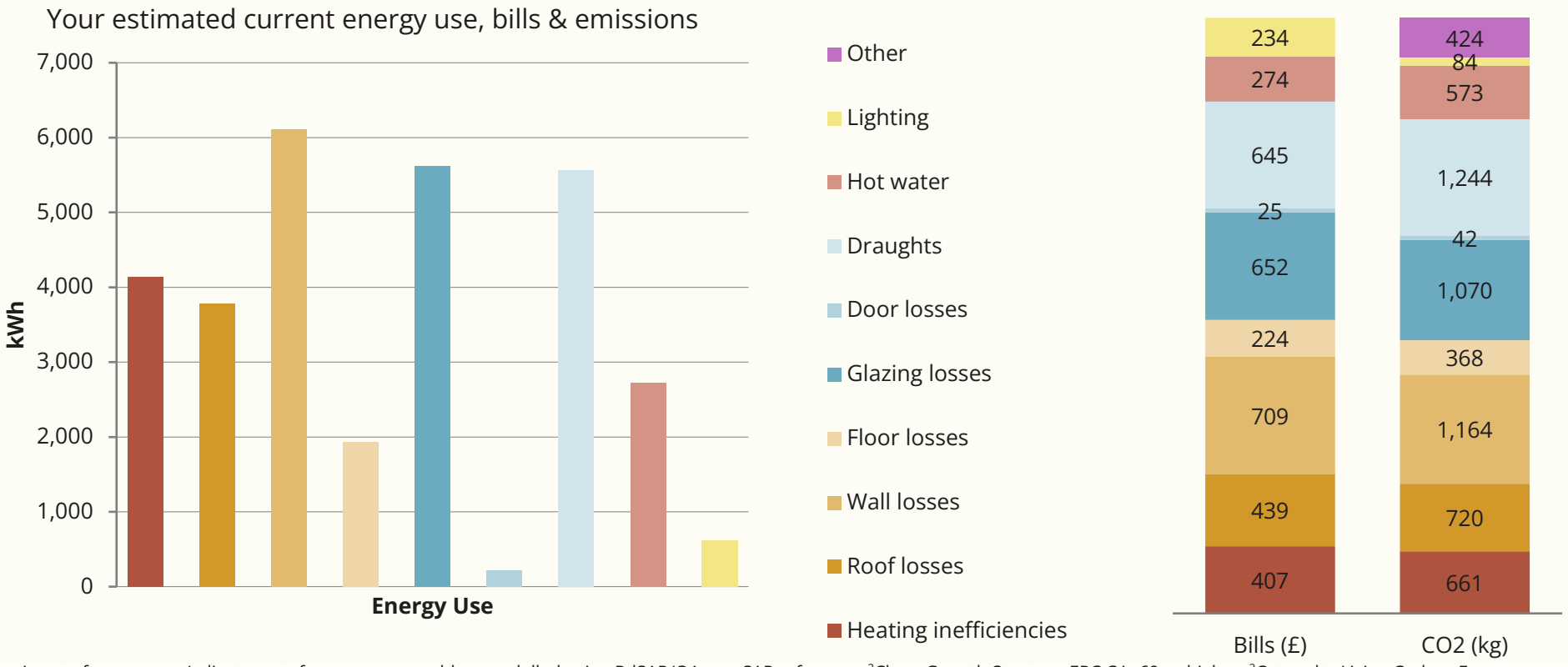
If your home has multiple methods of construction, these are modelled individually and are shown as 'extensions'.

- Your house is in the St Clements area of Oxford and it is not within a conservation area.
- It is semi-detached and was built between 1930-49. Various extensions have been added and the house has been modelled in the following way:
    - Main: 1930-49; 2 storeys with room-in-roof (RIR, 1996-2002); as built cavity walls (300mm); suspended timber floors; pitched roof, insulation levels unknown.
    - Extension 1: 1930-49; single storey (bay windows); as built cavity walls (300mm); suspended timber floors; pitched roof, insulation levels unknown.
    - Extension 2: 1983-90; 2 storeys (kitchen/bathrooms above); as built cavity walls (400mm); solid floor; pitched roof, insulation levels unknown.
    - Extension 3: 1996-02; single storey (rear utility/wc); as built cavity walls (300mm); solid floor; pitched roof with sloping ceiling insulation.
- 84% of the windows are timber double glazed (unknown age); 16% are timber, single glazed.
- There is an unseparated conservatory at the rear.
- There is one main heating system, an A rated condensing combi gas boiler which is 89% efficient. The house is heated by radiators.
- The occupancy is 2 adults.

6: Where you are now

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

Net Energy Use estimated annual kWh[1]	Energy Rating 1 to 100 – higher is better	Fuel Bills Annual[1]	Tonnes CO_2 Annual[1]
32,982	**67 D**	**£3,510**	**6.35**
A kilowatt hour (kWh) is a unit of energy use used by energy suppliers	The national target for all homes by 2035 is EPC **C**[2]	Calculated using our energy survey and the current price cap tariff: may differ from your actual bills	The UK average per home is **3.50**[3]

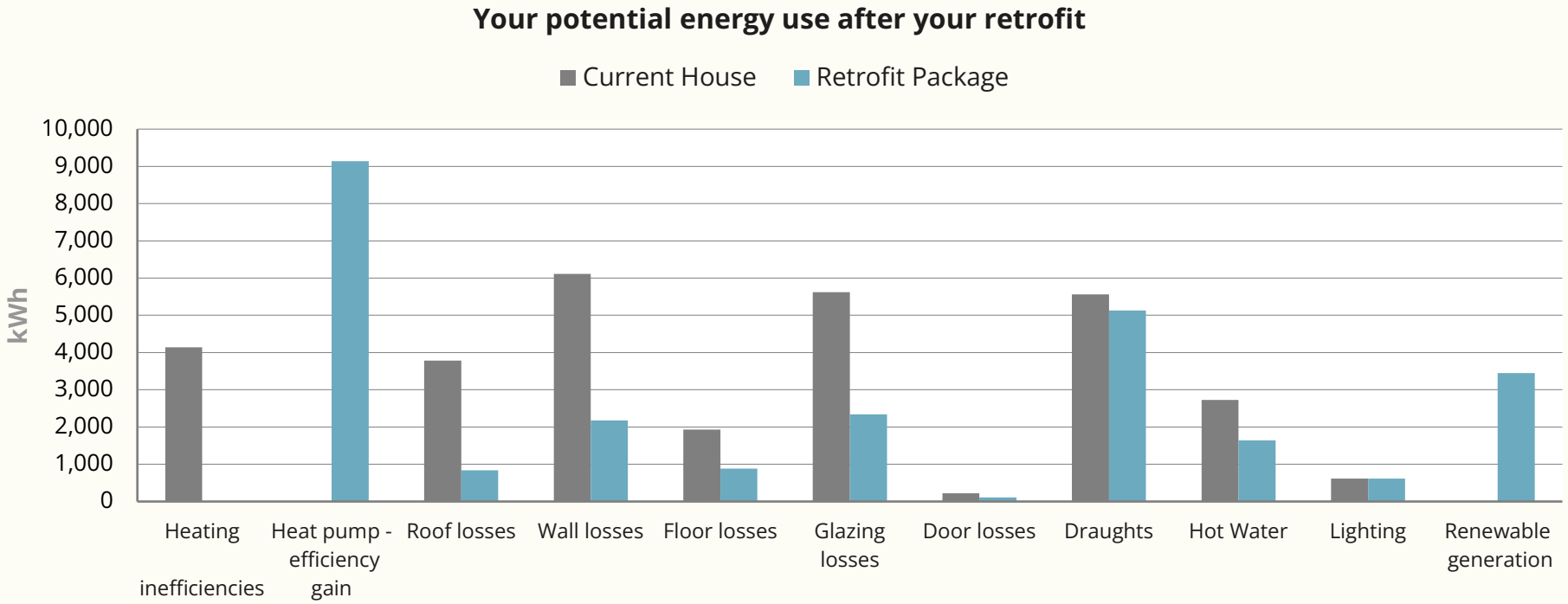


[1]Figure is net after revenue/adjustments from any renewables, modelled using RdSAP/OA, see SAP reference; [2]Clean Growth Strategy, EPC C is 69 or higher; [3]Catapult - Living Carbon Free
Where present, 'Other' includes values for pumps, fans and (occasionally) non-standard energy saving/generation technologies.

7: 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
Before	67 D	£3,510	6.35
After	93 A	£1,110	0.21



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8: How we help you

Our homes are responsible for 15% 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 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]Clean Growth Strategy

9: Caveats to this analysis

The costs in this plan are indicative. They are the current best estimate we have for your measures and are subject to change. The costs only include the works pertaining to the energy efficiency measures e.g. loft insulation is for the materials and labour of adding extra insulation over the existing insulation. It does not include any costs for eaves trays, boarding, widening the loft hatch etc.

They are not quotations. Savings are based on energy bill rates prevalent on the market at this time. Should you wish to take any of the measures forward, we will gather quotes from our pool of trusted contractors.

Estimated budget costs do not include:

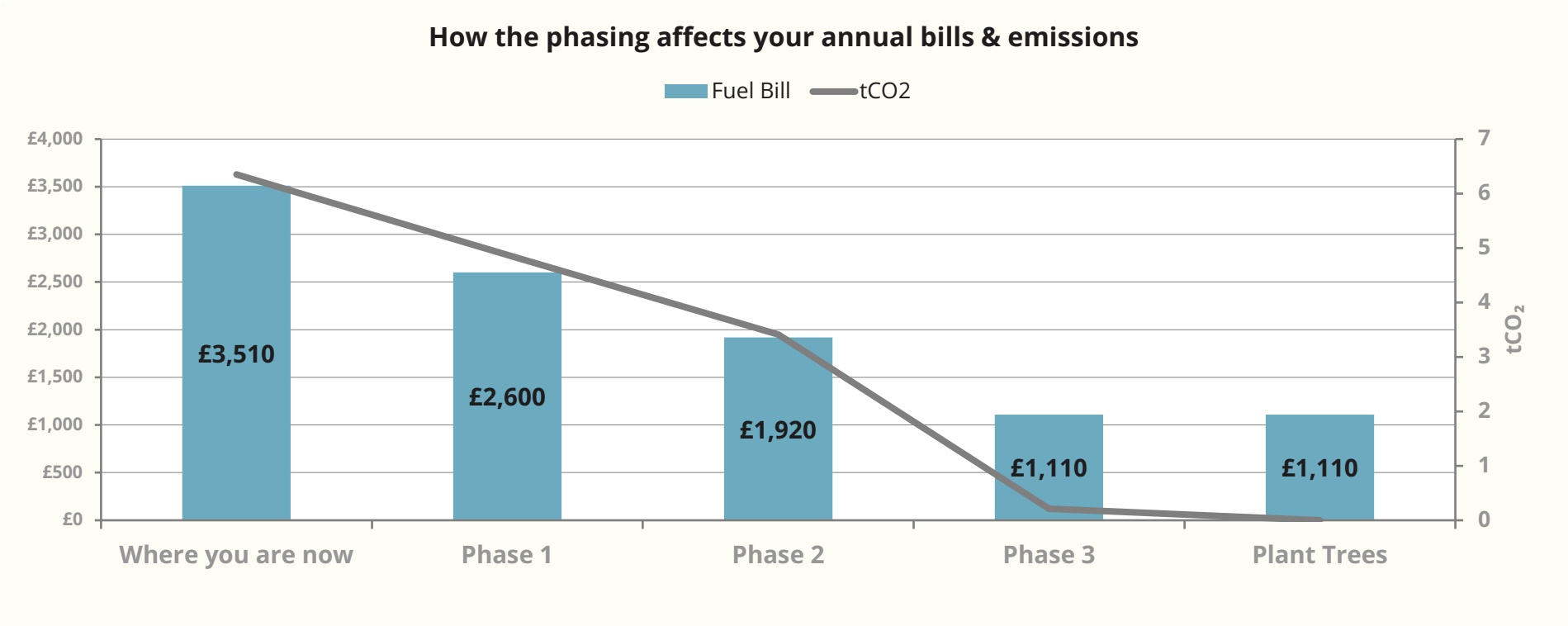
Preliminaries & Professional fees
Preliminaries such as scaffolding cannot be estimated at this stage, they can only be quoted for after a contractor has assessed your requirements. Furthermore, some additional professional fees may apply to your project, such as architectural services or additional surveys, and these costs are not included in your estimates.

Inflation
Budget costs as based on current information and market prices at the time of writing. The cost of your work may increase due to inflation. Inflation within the construction industry is difficult to predict as it is extremely sensitive to currency fluctuation, workforce, material costs and availability.

Redecoration costs
Due to the significant differences in personal requirements for each home, we are unable to estimate the costs of redecoration.

10: Phasing your improvements

Summary of Packages		Estimated Cost Per Phase	Energy Rating	Fuel Bill	tCO_2
Where you are now			**67 D**	**£3,510**	**6.35**
Phase 1:	Minor Retrofit Measures	£19,290	75 C	£2,600	4.87
Phase 2:	Major Retrofit Measures	£86,280	81 B	£1,920	3.41
Phase 3:	Renewables	£28,000	93 A	£1,110	0.21
Combined savings				**£2,400 saving**	**6.14 saving**
Combined reduction				**68%**	**97%**
Trees that you could plant to bring the remaining	**0.21**	**tCO_2 to zero**			**9**


How the phasing affects your annual bills & emissions
Fuel Bill
tCO2
£4,000
£3,500
£3,000
£2,500
£2,000
£1,500
£1,000
£500
£0
7
6
5
4
3
2
1
0
tCO2
£3,510
£2,600
£1,920
£1,110
£1,110
Where you are now
Phase 1
Phase 2
Phase 3
Plant Trees

The measures recommended below aim to significantly reduce your energy use, annual energy costs and CO_2 emissions. They demonstrate a good range of the possibilities available, although some of them may be beyond your current budget.

Minor Retrofit Measures	Estimated Costs	Energy Rating	Fuel Bill	tCO_2
Where you are now	**Per Measure**	**67 D**	**£3,510**	**6.35**
Remove secondary heaters - solid fuel	£330	69 C	£3,370	6.53
Separate off conservatory and stop heating it	£2,400	69 C	£3,240	6.25
300mm loft insulation from unknown insulation - no access to loft	£1,720	72 C	£2,940	5.61
Sloping ceiling insulation to rear, single storey extension	£3,300	72 C	£2,930	5.58
Cavity wall insulation to 1940s cavity walls	£1,510	74 C	£2,690	5.06
Cavity wall insulation to 1980s cavity walls	£840	74 C	£2,660	5.01
Secondary glazing to single glazed windows at front	£6,950	75 C	£2,610	4.90
New insulated front door	£2,500	75 C	£2,600	4.87
Humidity controlled kitchen and bathroom extractors and passive ventilation on other rooms	£2,100	75 C	£2,600	4.87
After Minor Measures		**75 C**	**£2,600**	**4.87**
Package Cost & % Improvements	**£21,650**		**26%**	**23%**

Major Retrofit Measures	Estimated Costs	Energy Rating	Fuel Bill	tCO_2
After Minor Measures	**Per Measure**	**75 C**	**£2,600**	**4.87**
Upgrade Room-in-Roof - insulate throughout	£7,580	75 C	£2,580	4.83
External wall insulation (100mm) to 1940s filled cavity walls	£16,460	76 C	£2,420	4.49
External wall insulation (100mm) to 1980s filled cavity walls	£7,490	76 C	£2,420	4.49
External wall insulation (100 mm) to 1990s filled cavity walls	£12,270	77 C	£2,390	4.43
Insulated floors (150mm) from 1940s suspended timber floor	£10,290	78 C	£2,250	4.11
Insulated floors (50mm) from 1980s solid floor	£3,010	78 C	£2,240	4.09
Insulated floors (50mm) from 1990s solid floor	£3,730	78 C	£2,220	4.06
New timber double glazed windows from older double glazing	£25,450	81 B	£1,920	3.41
After Major Measures		**81 B**	**£1,920**	**3.41**
Package Cost & % Improvements	**£86,280**		**26%**	**30%**
Cumulative Cost & % Improvements	**£107,930**		**45%**	**46%**

Renewables	Estimated Costs	Energy Rating	Fuel Bill	tCO_2
After Major Measures	**Per Measure**	**81 B**	**£1,920**	**3.41**
Air Source Heat Pump with enhanced existing radiators and new hot water tank	£20,500	84 B	£1,830	0.68
Install 4 kW PV system where potential has been identified	£7,400	93 A	£1,110	0.21
EPC	£100	93 A	£1,110	0.21
After Renewables		**93 A**	**£1,110**	**0.21**
Package Cost & % Improvements	**£28,000**		**42%**	**94%**
Cumulative Cost & % Improvements	**£135,930**		**68%**	**97%**

11: 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.

General

The measures above have been included because they are feasible for your house and demonstrate how you might lower your carbon emissions closer to zero over the longer term. Some of the measures will be too disruptive or expensive and it's expected that you will focus on the measures that are most likely to meet your shorter-term objectives.

Our software produces measures based on data collected during the survey and on build dates. If you want to understand more specifically how different elements of your house perform the following surveys are available on request:

- Thermal image surveys highlight heat loss pathways.
- Borescope surveys identify construction/insulation materials and methods in inaccessible places.
- Airtightness tests measure ventilation rates.

We have divided the fabric measures into minor and major depending on the cost and disruption associated with them. This does not mean that works need to be completed in this order and bespoke sequencing plans can be devised to meet personal circumstances. As explained below, some measures complement each other and should ideally be done together to achieve the best possible outcome in terms of performance.

Roof Insulation

Your house has many different roof spaces including a room-in-roof (RIR). It wasn't possible to determine the insulation levels in your loft/roof spaces because they're covered with plasterboard. In these instances our software assumes insulation levels which correlate to the building regulations at the time of construction. You could consider having a borescope survey done to confirm insulation levels/type in inaccessible places and inform the retrofit process.

Sloping ceilings (extension 3) and RIRs can be insulated in two separate ways. The most effective and least disruptive option is to remove the roof tiles and insulate between and over the rafters. This means that the internal decoration is not disturbed; and there is no reduction in the height of the room. Particular considerations for you are that you have solar panels on the roof which would need to be temporarily removed to carry out the works; and your property is semi-detached so (unless your neighbour does the same works) there will be an increase in the height of your roof relative to your neighbours. The other option

is to insulate from below. This means that the existing plasterboard is removed, and insulation is placed between and under the rafters. This method can result in the height of the room being reduced; and it requires re-plastering and redecoration. But it prevents the house from being re-roofed. With RIRs we always recommend using natural insulation materials (wood fibre) because they buffer summertime solar gain and prevent overheating.

The two bay windows on the front of the house have inaccessible roof spaces above them. It's likely that these have either no or very little insulation and will be a source of heat loss from the sitting room and study. You could create access to the roof spaces from the inside or outside and increase the insulation levels. Care should be taken not to block ventilation pathways to the roof timbers.

Conservatory

Your house has an unseparated conservatory which, as you explained, is poorly constructed and can make the dining area feel cold. Given the glazed roof, you will be losing radiant heat to the open sky at night. You have a number of options which vary in terms of price including upgrading the conservatory to triple glazing; replacing the glazed roof with a solid insulated roof with velux rooflights; installing external grade glazed bi-fold doors between the conservatory and dining area; or installing a thick insulated curtain which can be drawn at night to isolate the conservatory from the rest of the house and reduce heat loss.

Wall Insulation

All your walls are cavity, of varying age and thickness. The original walls are 300mm thick but there's no evidence that they've been insulated. We would recommend a borescope survey to determine whether the cavities are wide enough and free from damp and debris to enable them to be filled with insulation. Cavity wall insulation has been included in the Minor Measures phase because it's relatively cheap and of low disruption. It's also possible that the kitchen extension wall (built around 1997) may not be insulated so it would be worth checking this at the same time.

To demonstrate how to get your house closer to zero carbon I've included external wall insulation (EWI) in the major measures phase although this would have a big impact on the aesthetics of the house and may not be desirable for this reason. Mostly commonly, EWI has a rendered finish and would need planning permission. Your house has very deep eaves so it may not be necessary to extend the roof to cover the additional thickness of the insulation.

Another option is to apply internal wall insulation (IWI) to the external facing walls of the house. If you were going to do this then you would not fill the cavities with insulation. Although IWI carries slightly more moisture risk than EWI it has the benefit of being able to be done on a room by room basis (so you can tackle the coldest rooms first); and it doesn't affect the external appearance of the house. With IWI we only recommend natural insulation materials (wood fibre or lime plasters impregnated with cork) because they have low/no embodied carbon; and carry far less risk in terms of moisture compared to fossil-fuel based insulation materials.

Floor Insulation

You have a combination of suspended timber floors (original house) and solid floors (extensions 2 and 3). Insulation of both these types of floor have been included in the Major Measures phase although insulation of the suspended timber floor should come higher up the priority list than the solid floors.

Timber floors can be insulated in one of two ways - both require there to be sufficient cross-ventilation of the sub-floor area. One option is where a small robot enters the floor void and sprays foam insulation onto the underside of the timber boards and joists. The benefit of this is that the original floorboards do not need to be lifted and it's low disruption.

The second option is for the floorboards to be lifted and flexible insulation material (usually mineral wool) placed between the floor joists using tapes and membranes. This method is more disruptive than the robot method and may not be appealing because your two main ground floor rooms are carpeted which will already be offering insulation and draught-proofing benefits.

I've also included an option to insulate your solid floors to give you the full range of retrofit opportunities but heat loss to the ground is less than to the air and you would only consider this if you were undertaking a large scale retrofit of the house because it's very disruptive.

Windows and doors

Most of your windows are double glazed (unknown age) but the ones on the front elevation are timber, single glazed sash windows. Given that these windows are in good condition and contribute to the aesthetics of the house I've included an option to secondary glaze them in Minor Measures. There are lots of different types of secondary glazing which vary in terms of price, functionality and look and it's worth looking around to find the system which is best suited to your needs.

For the double glazed windows I've included an option to replace them in the Major Measures phase. Since 2002 there have been technological advances in double glazing and triple glazing is now readily available. Window replacement is ideally complemented with wall insulation because the thermal bridge between the window frame and the wall can be mitigated. The way windows are installed is crucial to their performance and there are airtightness tapes and insulation materials specifically designed to produce an airtight seal at the junction between window and wall.

I've included a new insulated front door in Minor Measures which is not essential but if your existing door feels draughty or you are thinking of changing it for security reasons then it would be sensible to consider an insulated and draught-proofed one.

Airtightness and Ventilation

Based on the build date of your house and the various extensions, the airtightness is likely to be poor and draughts could be contributing to your fuel bills. Insulation measures, if done well, will improve airtightness but other actions such as sealing gaps around service penetrations; placing thermal hoods over the back of LED downlights; and installing chimney sheep in open fireplace flues can make a difference. You currently have intermittent extractor fans in the kitchen and all bathrooms. There are no trickle vents on the windows but given the size of the house and the low occupancy this

is not presenting problems. If you were to carry out insulation works, building regulations will require a ventilation strategy to be in place to ensure that moisture and other pollutants are extracted from the house and replaced with fresh, clean air to ensure the health of occupants and the building. As a minimum I've included decentralised humidity-controlled ventilation and extraction in Minor Measures.

Heating and hot water

Your current boiler is a condensing combi gas boiler which is 89% efficient. The graph on page 5 is showing some heating inefficiencies which are attributable partly to your fireplaces and partly to your boiler. Your actual heating inefficiencies may well be lower depending on how much you use the fireplaces for heating the house.

It is not necessary for you to replace your gas boiler with a heat pump yet but in the future an air source heat pump (ASHP) is likely to be the most viable non-fossil fuel heating option for you. ASHPs are 250-300% efficient which means that for every unit of electricity used to power them they produce 2.5-3 units of heat. They are an effective way of reducing carbon emissions because the national grid is decarbonising at an increasing rate. Depending on the type and efficiency of the boiler they replace, ASHP can be cost neutral (and occasionally more expensive) in terms of running costs vis-à-vis mains gas, because electricity prices are 3 or 4 times more expensive than gas. Therefore we recommend making insulation improvements, to reduce the heat demand of the house, before installing a heat pump.

You have plenty of external space for the outdoor unit of the ASHP but you would need to find a suitable place internally for a hot water tank.

There is a government grant available, called the Boiler Upgrade Scheme, to help homeowners with the cost of heat pump installations: https://www.ofgem.gov.uk/environmental-and-social-schemes/boiler-upgrade-scheme-bus

Renewables

Solar PV has been included in the Renewables section of your plan but this could be installed at any time. I have modelled for a total of 4 kWp of panels across your rear and side roofs which are SE and SW facing. The amount and configuration of solar panels would need to be confirmed by a solar PV contractor.

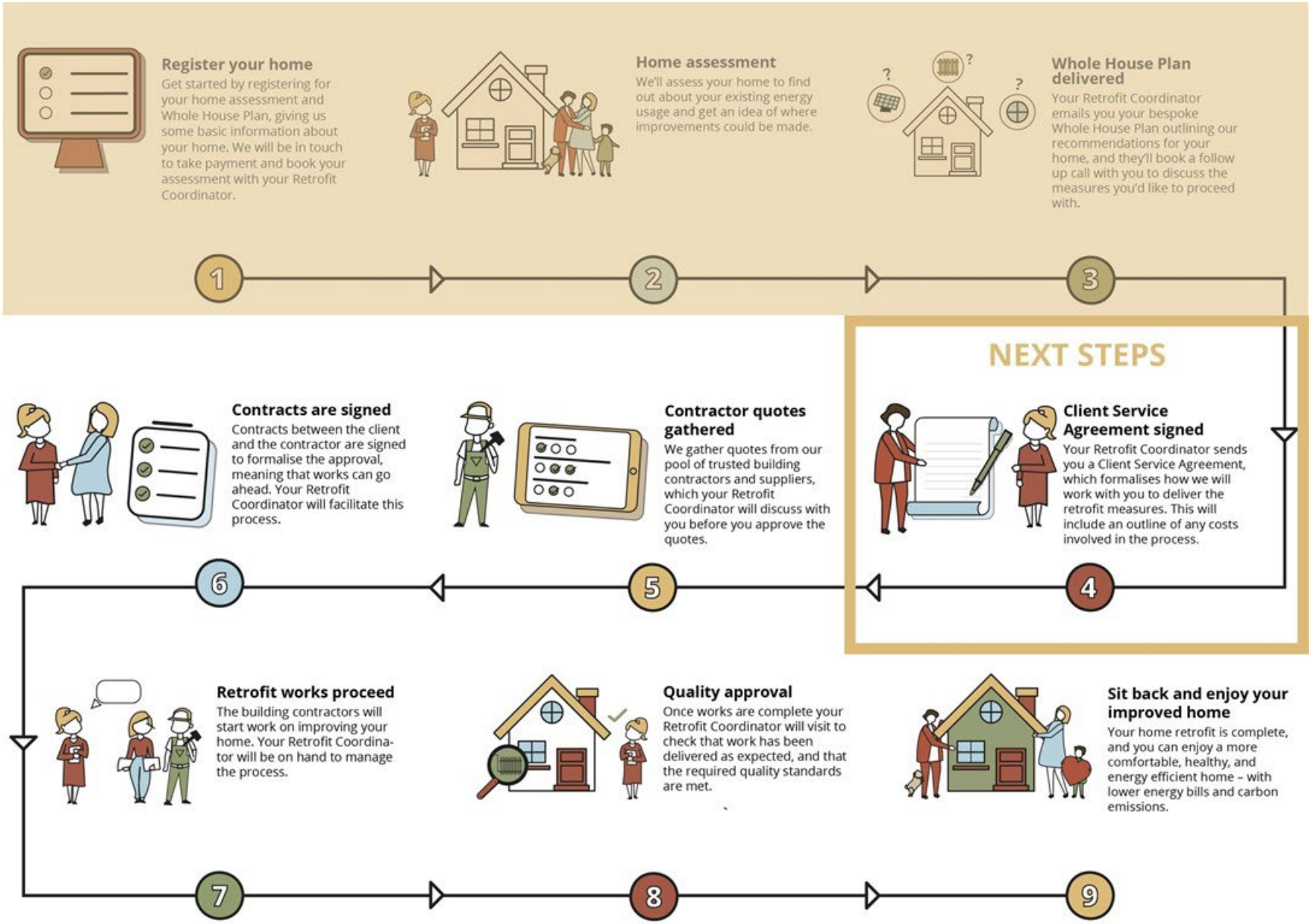
The government no longer pay feed-in tariffs for solar panel installations although some energy suppliers pay small amounts for electricity exported to the grid (the Smart Export Guarantee) which is likely to increase in the future. At the moment, electricity savings from solar PV and the length of payback, depend on how much of your self-generated electricity you can use on site. If you were to switch to a heat pump, then the solar PV could help with its running costs outside of the winter months. Other devices that help to maximise solar electricity use include:

- solar immersion devices that use your solar panels to heat hot water via immersion (only applicable where you have a hot water tank).
- Electric car chargers; and

- Solar batteries.

We tend to recommend solar PV ahead of solar thermal because the electricity has multiple uses within the house and can be exported to the grid. Solar thermal can be beneficial where there is a high and consistent demand for hot water and where there is a direct south facing roof but it requires more regular maintenance than solar PV.

12: Next steps



1: Review / Adapt

Let's set up a 30-minute phone call with your Retrofit Coordinator to discuss the report and its contents. If necessary, we can look at further upgrade scenarios and budgets for your property after signing the Client Service Agreement. **Please book your appointment by contacting support@cosyhomesoxfordshire.org.**

2: Additional Retrofit Coordinator Advice

If you require more than the 30-minute follow-up for discussion or research of questions you may have, you can agree to pay an hourly rate of £75 incl. VAT for additional time spent by your Retrofit Coordinator.

3: Client Service Agreement (CSA)

This agreement sets out how we will work together; what you need to do; and what we promise to do. It includes the price of the Building Performance Requirements and the administration of the quotation process.

4: Building Performance Requirements (BPR)

This document will include details about the measures that you have identified for inclusion in the works. It may include:

- Detailing of insulation at critical areas.
- Methods of installation to aid building contractors in price works and carry out construction.
- Consideration of how the heating and other systems must integrate with the whole building.

5: Get quotes

Once the strategy is settled, we will request quotes from trusted and pre-vetted contractors for your chosen package of works.

6: Review quotes

Your Retrofit Coordinator will run through the quotes including both the technical options and the prices.

7: Go ahead

If the quotes are agreeable to you, we will:

- Facilitate any contract documents that are required between yourself and the contractor.
- Coordinate the retrofit measures with the contractors to ensure they are appropriately sequenced.
- Oversee the works to ensure the contractor conducts what they have promised. We will be on hand to manage any issues or conflicts that may arise.
- Sign off the work and give you the all-clear to pay the contractor.

13: Appendix: All your options

Here is a list of everything that has been analysed.

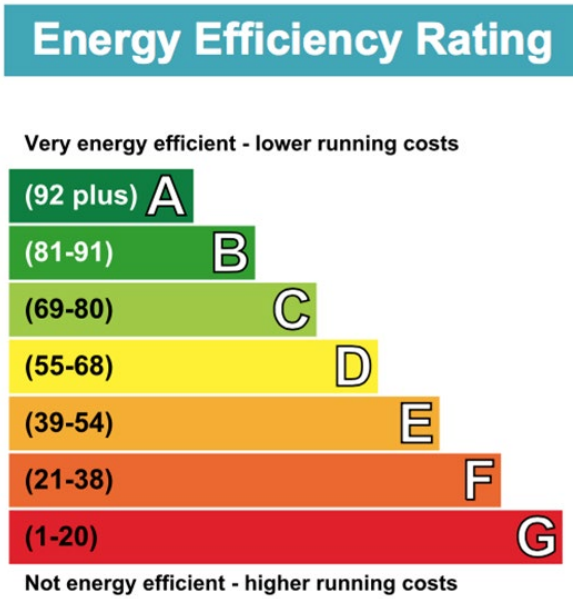
Please Note: Combined measures installed together usually achieve less savings than the sum of the individual measures set out below:

		Energy Rating			Estimated Fuel Bills			Kilograms CO_2		
Measures	Costs	Score	Saving	£/point	Bill	Saving	Payback years	Kg CO_2	Saving	£/kg CO_2
ASHP (45 degree emitters) with enhanced existing radiator central heating and hot water	£20,500	70 C	3.22	£6,366	£3,430	£80	148.5	1,265	5,084	£4.00
ASHP (55 degree emitters) with existing radiator central heating and hot water	£20,500	68 D	0.96	£21,354	£3,680	£-180	443.8	1,360	4,989	£4.10
Cavity wall insulation and external insulation (100 mm) to empty 1930-49 cavity walls	£17,081	70 C	3.29	£5,192	£3,130	£380	122.0	5,591	758	£22.50
Internal insulation to 1930-49 empty cavity walls	£16,806	70 C	3.19	£5,268	£3,140	£370	123.9	5,615	734	£22.90
External insulation (100 mm) to 1930-49 empty cavity walls	£16,460	70 C	2.96	£5,561	£3,170	£340	130.8	5,668	681	£24.20
300mm loft insulation from unknown - no access to loft	£1,725	70 C	2.63	£656	£3,200	£300	15.4	5,744	605	£2.90
Full multi zone controls from full normal control set	£898	70 C	2.76	£325	£3,210	£290	8.3	5,763	586	£1.50
A++ triple glazed windows from unknown age double glazed windows	£50,408	69 C	2.32	£21,728	£3,240	£260	519.9	5,824	525	£96.00
A+ double glazed windows from unknown age double glazed windows	£25,454	69 C	2.25	£11,313	£3,250	£260	266.9	5,833	516	£49.30
Install PV system where potential has been identified	£7,400	76 C	9.30	£796	£2,780	£730	16.3	5,880	469	£15.80
Cavity wall insulation to 1930-1949 cavity wall	£1,510	69 C	1.99	£759	£3,280	£230	17.8	5,890	459	£3.30
Separate off conservatory and stop heating it	£2,400	68 D	0.49	£4,898	£3,370	£140	47.9	6,083	266	£9.00
Insulated floors (150mm) from 1930-1949 suspended timber floor	£10,292	68 D	1.27	£8,104	£3,380	£130	210.9	6,085	264	£39.00
Underfloor heating and insulation from radiators and uninsulated solid floor	£5,193	68 D	1.06	£4,899	£3,390	£120	119.3	6,096	253	£20.50
A++ triple glazed windows from single glazed windows	£8,240	68 D	0.67	£12,299	£3,430	£80	290.6	6,195	154	£53.70

Measures	Costs	Energy Rating			Estimated Fuel Bills			Kilograms CO_2		
		Score	Saving	£/point	Bill	Saving	Payback years	Kg CO_2	Saving	£/kg CO_2
A+ double glazed windows from single glazed windows	£4,370	68 D	0.62	£7,048	£3,440	£70	164.5	6,205	144	£30.40
External insulation (100 mm) to post-1982 filled cavity walls	£12,266	68 D	0.56	£21,904	£3,440	£70	510.3	6,219	130	£94.30
Secondary glazing from single glazed windows	£6,950	67 D	0.40	£17,375	£3,460	£50	405.5	6,256	93	£74.90
Internal insulation to 1983-1995 empty cavity walls	£6,941	67 D	0.34	£20,415	£3,470	£40	472.6	6,269	80	£87.30
External insulation (100 mm) to 1983-1995 empty cavity walls	£7,492	67 D	0.29	£25,834	£3,470	£30	595.3	6,281	68	£110.00
Cavity wall insulation to 1983-1995 cavity wall	£837	67 D	0.20	£4,185	£3,480	£20	95.8	6,302	47	£17.70
Upgrade room-in-roof - insulate throughout	£7,585	67 D	0.15	£50,567	£3,490	£20	1,131.8	6,313	36	£209.00
Sloping ceiling insulation to rear extension	£941	67 D	0.11	£8,555	£3,500	£10	198.8	6,323	26	£36.70
Insulated floors (50mm) from 1991-2002 solid floor	£3,730	67 D	0.11	£33,909	£3,500	£10	796.0	6,324	25	£147.00
New insulated front door	£2,500	67 D	0.11	£22,727	£3,500	£10	543.3	6,324	25	£100.30
Insulated floors (50mm) from 1983-1990 solid floor	£3,011	67 D	0.06	£50,183	£3,500	£10	1,052.1	6,334	15	£194.30
EPC House or Bungalow	£96	67 D	0.00	£∞	£3,510	£0	∞	6,349	0	£∞
Humidity controlled kitchen extractor	£500	67 D	0.00	£∞	£3,510	£0	∞	6,349	0	£∞
Humidity controlled extractors per wetroom	£1,000	67 D	0.00	£∞	£3,510	£0	∞	6,349	0	£∞
Trickle vents on windows	£330	67 D	0.00	£∞	£3,510	£0	∞	6,349	0	£∞
Humidity controlled passive ventilation to non-wet rooms	£600	67 D	0.00	£∞	£3,510	£0	∞	6,349	0	£∞
Remove secondary heaters - solid fuel	£330	69 C	1.95	£169	£3,370	£140	4.3	6,531	-182	£-1.80
Mechanical Extract Ventilation (Centralised)	£4,250	62 D	-5.52	£-770	£4,180	£-670	n/a	6,876	-527	£-8.10
Mechanical Ventilation with Heat Recovery from Natural Ventilation	£5,250	56 D	-11.5	£-456	£4,940	£-1,430	n/a	7,180	-831	£-6.30

14: 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		



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). The fuel bill figures and CO_2 consider your actual geographic location using historical weather data.

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 quite 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://stbauk.org/whole-house-approach/
Trustmark - PAS 2035	https://www.trustmark.org.uk/ourservices/pas-2035
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	
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
SAP (Standard Assessment Procedure), RdSAP, Occupancy Assessment (OA)	https://www.gov.uk/guidance/standard-assessment-procedure
Clean Growth Strategy	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf
Catapult - Living Carbon Free	https://es.catapult.org.uk/report/net-zero-living-carbon-free/

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