Carbon Co-op
My Home Energy Planner

Name
Louise

Address
243 Hulme Street Manchester

Post Code

Date (Survey)
24-01-2019

Date (Report)
5-03-2019

Local Authority Area

Welcome to My Home Energy Assessment

This report is based on what you told us, and the survey we carried out of your home, fed through My Home Energy Planner by one of our assessors.

Our advice is specific to your home. We have taken your household, lifestyle and priorities into consideration. We create a detailed model of energy use in your home, based on an adapted version of the full Standard Assessment Procedure. This considers all energy uses in your home, including heating, hot water, lighting, cooking and appliances like washing machines and televisions.

We consider various attributes of your home as it stands now including: areas of greatest heat loss and heat gain; space heating demand; total energy demand and the fuels used; primary energy use; carbon dioxide emissions; approximate energy costs; comfort and health.

We then use the energy model to develop three scenarios for making improvements to your home, based on its physical attributes and what you told us about your plans and priorities. We take a whole house approach, considering how improvements work together or don't, and which measures need to be done together. For example, we always consider the need for proper planned ventilation alongside insulation and air-tightness works.

We test how these scenarios affect the attributes described above, and set out a pathway to significant energy and carbon emissions reductions.

The impact of each of the scenarios suggested is set out in Section 1.0 of this report - and compared with your home as it stands now as well as with UK averages and Carbon Co-op targets. The work required to achieve them is set out in Section 2.0, and described in further detail in Appendix A.

Many measures suggested will require further detailed design work or specialist advice before being carried out. The intention of this report is to provide you with an overview of what might be involved, which measures it might be sensible to do together, and their relative likely impact. It is the first step on your retrofit journey.

You told us that the following things are most important to you in considering energy efficiency retrofit options for your home, and we have considered these in developing the scenarios set out in this report:

Figure 1: Retrofit Priorities

1. Save money
1. Improve comfort
3. General modernisation

Your report is made up of three sections.

In Section 1.0 we measure the current performance of your home and model this against the UK average, the potential impact of the scenarios suggested in this report and Carbon Co-op's targets for energy and carbon emissions reductions.

The scenarios we developed in this report are:

Scenario 1: First Steps

Scenario 2: Windows and Internal Walls

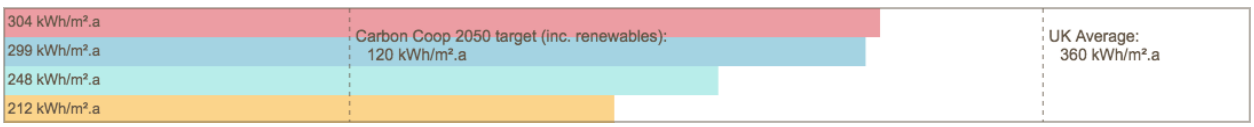
Scenario 3: Windows and Internal Walls

Your headline results are:

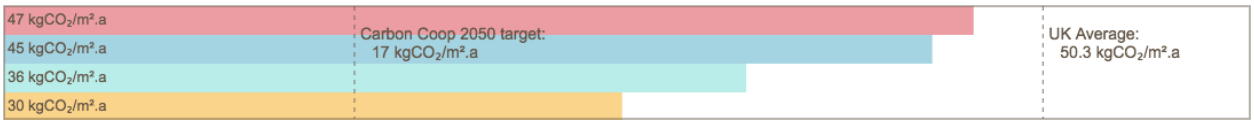
Figure 2. Performance Summary

Space heating demand

Primary energy demand



CO_2 Emission rate



Key

Your home now Scenario 1: First Steps Scenario 2: Windows and Internal Walls

Scenario 3: Windows and Internal Walls

In Section 2.0 we set out how the retrofit scenarios shown in section 1.0 could be achieved, with further details on each of the measures contained in Appendix A. We show you a full range of possibilities for your home, from simple DIY measures through to Your 2050 Home – an exemplar model of significant energy saving and carbon reduction.

In suggesting measures we consider comfort, ventilation and indoor air quality alongside energy use. We also consider the level of disruption involved in carrying out various building works in accordance with what you told us would be acceptable.

These recommendations show a pathway for you to achieve a 2050 emissions reduction and energy use target by using technologies and techniques that are currently available.

In Section 3.0 of the report we provide details of how Carbon Co-op might be able to help you take the next steps in your retrofit journey.

We also included five appendices:

Appendix A: Scenario Measures Complete Table - Further details on each of the retrofit measures suggested for each scenario.

Appendix B: Scenario comparison - Based on the survey we completed of your home, and results generated using My Home Energy Planner, we provide comparisons across fabric condition; heating and hot water systems; ventilation; lighting; appliances and cooking; and renewables.

Appendix C: Glossary - There may be words and phrases in this report that you are unfamiliar with. This short glossary provides definitions and explanations.

Appendix D: About our methodology - A bit more information about the model we used to produce this report.

This report was prepared by one of our experienced and expert assessors.

Your assessor is: Marianne

If you've got any questions about this report, please contact: info@carbon.coop or 0161 448 6492

How does your home perform?
Section 1.0

The charts in this section are designed to help you understand how your home's current energy use compares with UK averages and targets. We also show the extent to which your home could be improved to meet the UK's 2050 80% carbon reduction target, reduce your fuel bills and improve comfort.

We've modelled your home as it is now in SAP (Standard Assessment Procedure). We've modelled it again to show the effect of the measures proposed in Section 2.0 of this report.

Where provided, we've also compared this with information from your utility bills. The SAP model makes a set of assumptions, based on averages, about climate, heating patterns, hot water and appliance use. If your energy bill data is from a particularly mild or cold year, of if your household habits are very different from the UK average, the model may produce a predicted energy use that is different from your actual energy use.

Through the way you live in your home, or changes you've already made, you may already be some way towards the 2050 target. However, if you are significantly under-heating your home, you may have noticed other problems such as excessive condensation or poor indoor air quality. This may affect your comfort and health - and is something you might want to tackle through energy efficiency retrofit work, though it may mean you don't make big savings in energy use with more 'light touch' measures, it should mean you are warmer. Alternatively, you may find that you are using far more energy than predicted in the SAP model, and that a few simple steps could help reduce this significantly.

1.1 Heat losses and gains

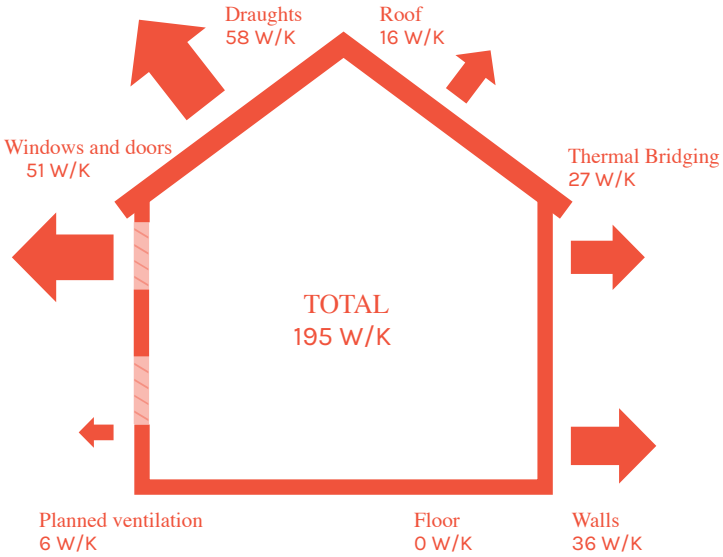
In the UK, most homes use the majority of energy to keep warm during the cooler months of winter, spring and autumn. When it is colder outside, your home continuously loses heat from the warmer inside through the building fabric. The building fabric is made up of walls, floor, roof and windows. The better insulated your home the slower this heat loss happens, so the less energy is needed to keep your home warm.

Your home also loses heat through draughts and ventilation. Warm leaves your home through gaps in the building fabric – or intentionally through windows or fans. This rate of heat loss depends on how draughty your home is and the ways you choose to ventilate your home.

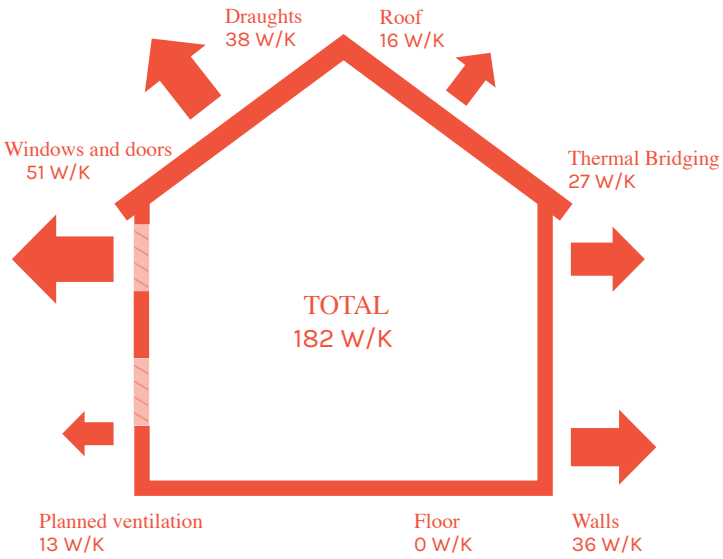
Figure 3 shows how your home loses heat, modelled against the various scenarios created in this report.

Figure 3. Heat Loss Summary

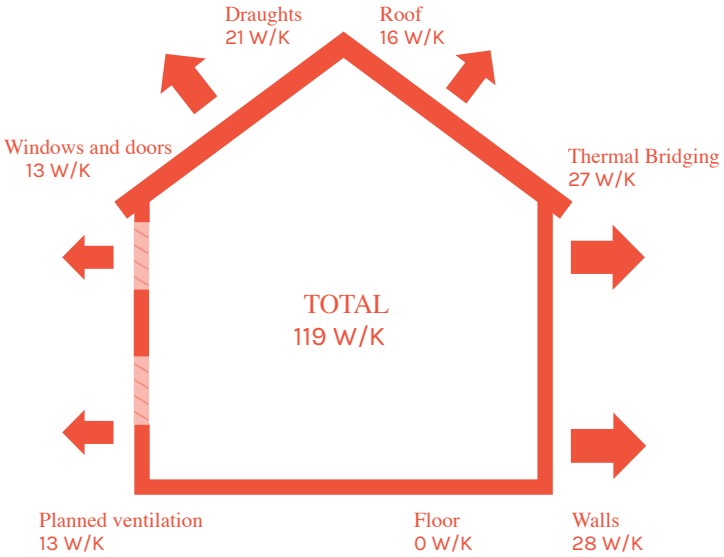
Your home now



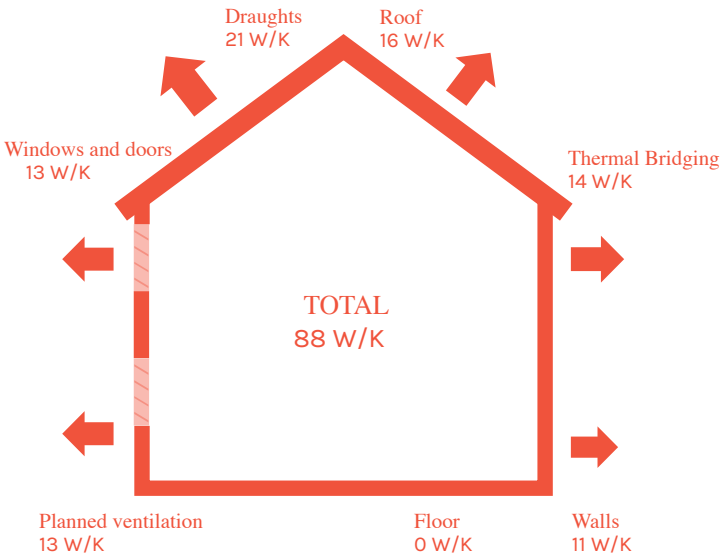
Scenario 1



Scenario 2



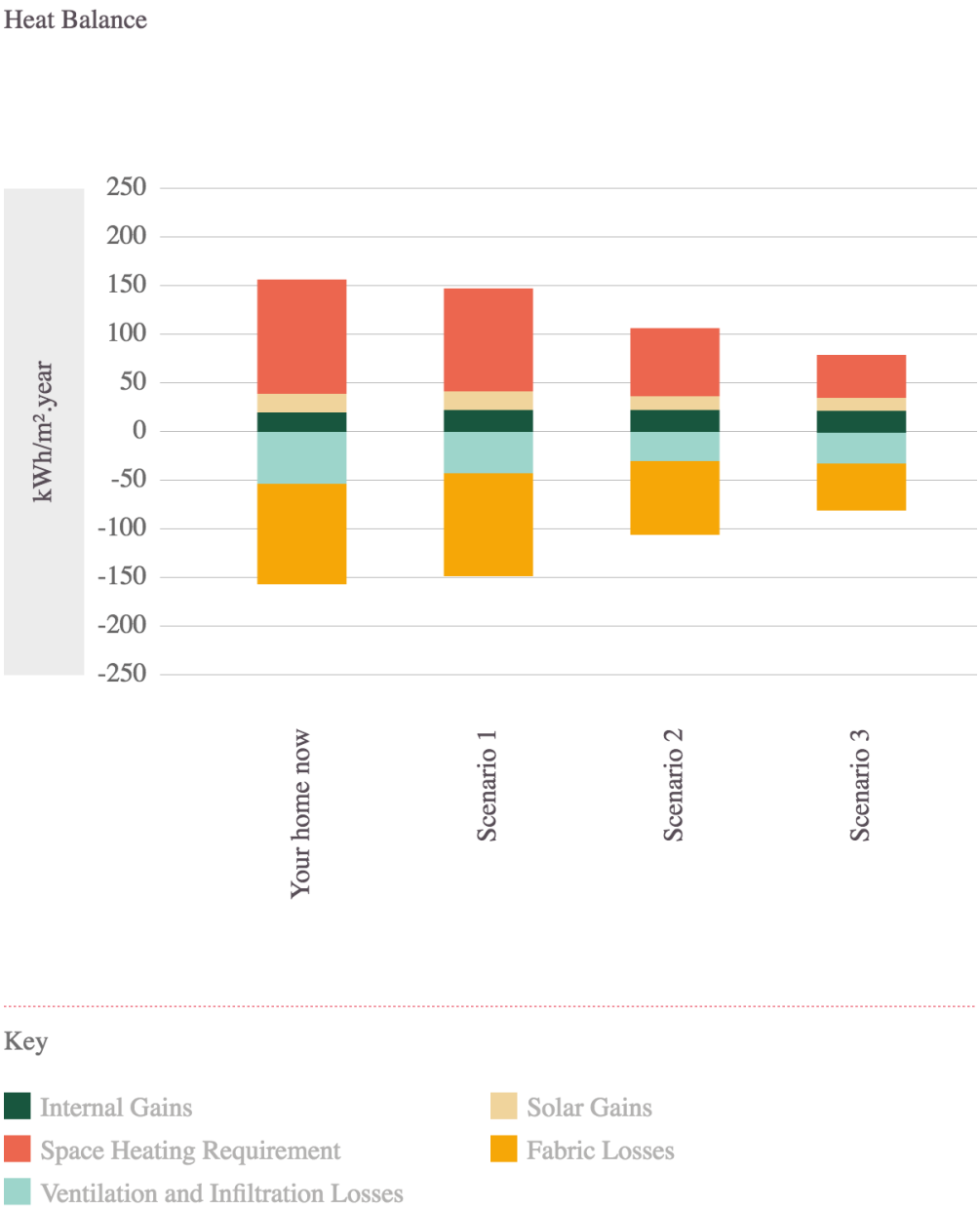
Scenario 3



It’s not all bad news though. These heat losses are balanced by the heat generated by you and activities in your home, such as cooking (these are shown as 'internal' gains on the graph below). Heat is also provided by sunlight entering your home – this is known as passive solar gain (this is shown as 'solar' on the graph below). The absolute contribution that both solar and internal gains make to heating your home might go down as you make improvements - as more efficient appliances, lighting and hot water systems will reduce the amount of heat they create, and better glazing in windows reduces the amount of solar gain. However, as you improve the rest of the fabric, the proportion both of these contribute to your space heating needs will go up, reducing the energy used by your home's heating system.

Figure 4 shows this balance for your home in each of the scenarios mapped out in this report.

Figure 4. Your home's heat balance



1.2 Space heating demand

To keep your home warm, the gap between heat losses and heat gains in your home needs to be bridged by your heating system. The amount of energy needed to do this is known as space heating demand.

Space Heating Demand is measured in kilowatt-hours per square metre per year, so that different sizes of building can be compared. Space heating demand takes into account all the heat loss and heat gain factors described in 1.1 above. It also takes into account the efficiency of your building fabric, and any internal and solar gains, but also the type of controls on your heating system, the number of hours you choose to heat your home for, and your thermostat setting. It does not cover any other energy uses, such as lighting, hot water or electricity use for fans, pumps and appliances.

Space Heating Demand is affected by the shape and volume of your home. The more complicated the shape of your home, and the greater the proportion of exposed surface area to floor area, the higher your Space Heating Demand is likely to be. A complicated detached house will usually have a higher space heating demand than an apartment with only one or two external walls, even if their construction is similar.

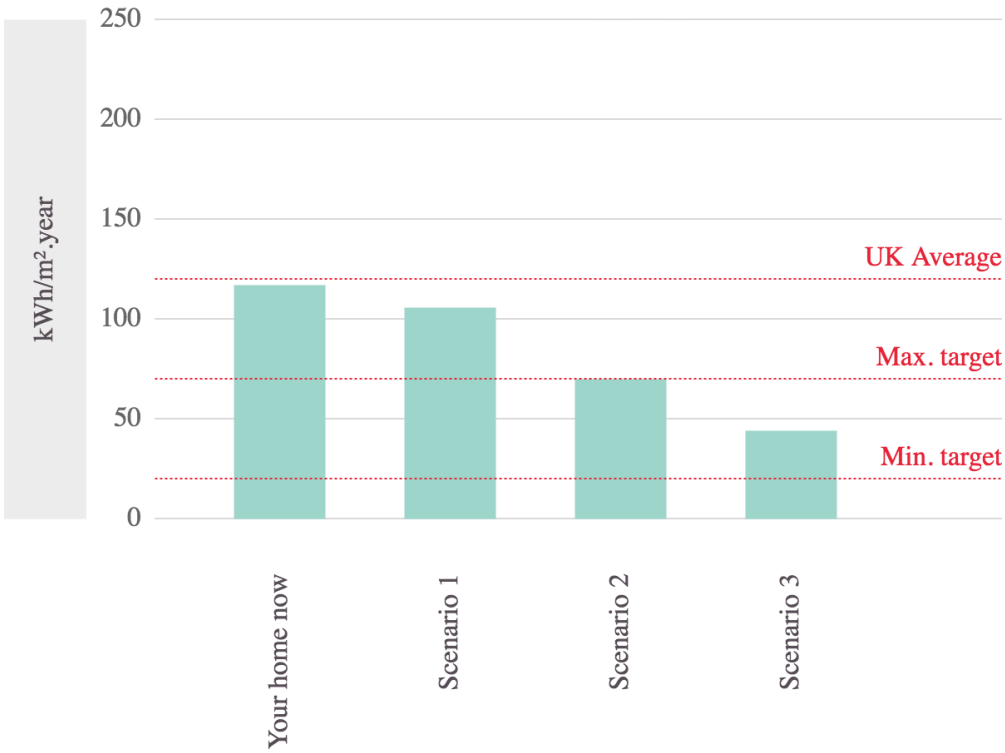
If your home is uncomfortably cold or you have problems with condensation and damp, the most important thing you can do is improve the efficiency of its fabric, so that it stays warmer for longer – whilst also being mindful of the need for adequate planned ventilation to ensure good indoor air quality and remove excess moisture.

All other things being equal, improving the levels of insulation and draught-proofing of your home will reduce the Space Heating Demand. The lower the number given for 'Space Heating Demand', the more efficient your home is, and the easier it will be to keep it warm, making you more comfortable and reducing the risk of condensation and damp.

In creating the scenarios for this report, we have used the information you gave us during the survey about how often and for how long you heat your home, and your thermostat setting. If the current thermostat setting is below 18oC, we have increased it in each of the retrofit scenarios to 18oC as a minimum. Retrofit is about health and comfort as well as saving energy, and this is generally recommended as a healthy minimum temperature setting. In this way the modelled scenarios show you what you can save whilst taking a sensible approach to ‘comfort take back’ that is likely to happen once you’ve improved you home. You could of course choose to carry out retrofit work and keep your thermostat setting very low. This might produce greater savings; however, you should be mindful that there may be consequences for health and comfort, and the risk of surface condensation within your home may be increased.

Figure 5 shows the space heating demand for your home. The graph shows each of your home now as modelled, and each of the scenarios we have created, against the current UK average and the Carbon Co-op suggested target range for space heating demand.

Figure 5. Space heating demand – how your home compares



1.3 Energy Usage

Figure 6. Total amount of energy used in your home in kilowatt-hours per year and by fuel type

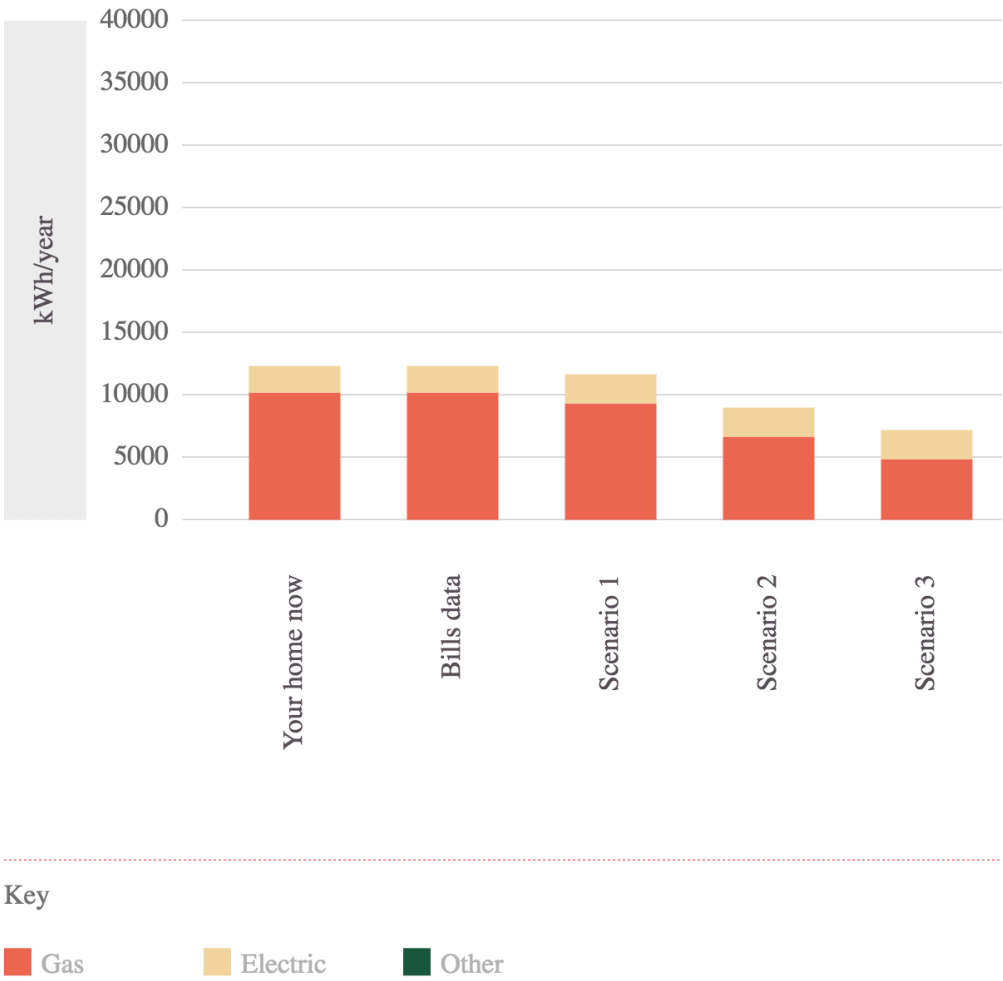


Figure 6 shows the total amount of energy used in your home, in kilowatt-hours per year and by fuel type. This is a total figure specific to your home, and is not benchmarked against any other buildings or targets. It is intended to help you understand how much energy you use in total and how much this could be reduced if you carry out retrofit works.

If you have existing on site electricity generation equipment, such as solar panels, any electricity you generate and then use yourself will not be shown on your electricity bill. This is because you have not paid to import this electricity from the national grid. As such, your bill data can suggest that your electricity usage is lower than reality. Where import, export and generation of electricity is not metered separately, we have to make some assumptions to give a more accurate representation of electricity use in your home now. In the graph below, we assume that you use a certain proportion of the electricity you generate yourself (usually around 50%, though we adjust this depending on how you occupy your home). We then add this to the figure given in your bills for electricity usage to give a more accurate picture of your total electricity use.

Your actual energy use is affected by factors such as the external climate and the way you use energy in your home – so it will change over time. Please remember that this graph is based on a model - so is more useful for making comparisons between different scenarios than making absolute predictions.

1.4 Primary energy use

Primary energy is the total amount of energy used by your home, from the power station to your lightbulb. Primary energy is measured in kilowatt-hours per square metre per year.

The level of insulation in your home, the efficiency of services such as heating and lighting, and the type of fuel used all affect your primary energy use.

The same task, such as boiling a kettle, will take different amounts of primary energy depending on the fuel used. This is because of efficiency differences in the way various fuels are generated and distributed. Primary energy includes an allowance for the efficiency of the national electricity grid and fuel transport.

Figure 7 shows the primary energy use for your home now, both as modelled in SAP and using any utility bill data you gave us. It also shows Your 2050 Home as modelled in SAP and against the Carbon Co-op target of 120kWh/m^2.year (which it may not be feasible for all homes to meet), and the different scenarios modelled to reach the 2050 target.

If you have existing on site electricity generation equipment, such as solar panels, any electricity you generate and then use yourself will not be shown on your electricity bill. This is because you have not paid to import this electricity from the national grid. As such, your bill data can suggest that your electricity usage is lower than reality, and this in turn affects your total Primary Energy Use figure. Where import, export and generation of electricity is not metered separately, we have to make some assumptions to give a more accurate representation of electricity use in your home now. In the graph below, we assume that you use a certain proportion of the electricity you generate yourself (usually around 50%, though we adjust this depending on how you occupy your home). We then add this to the figure given in your bills for electricity usage to give a more accurate picture of your total electricity use.

Figure 7: Primary energy use in kilowatt-hours per square metre per year

1.5 Carbon dioxide emissions

The carbon dioxide emissions from your home are measured in kilograms per square metre per year. Carbon dioxide emissions are affected by the level of insulation, the efficiency of services such as heating and lighting, and by the type of fuel used for each of the services in your home.

For example, with the current make up of the national grid, 1 kilowatt hour of mains electricity produces more carbon dioxide than 1 kilowatt hour of mains gas.

Figure 8 shows your home now, and the scenarios we've looked at including Your 2050 Home, modelled in SAP against your current bill data (if provided). We've also benchmarked this against the current UK average and the Carbon Co-op 2050 target.

Figure 9 demonstrates your personal carbon footprint, showing carbon dioxide emissions in kilograms per person per year, based on the actual number of people living in your home rather than the average number that SAP assumes.

If you have existing on site electricity generation equipment, such as solar panels, any electricity you generate and then use yourself will not be shown on your electricity bill. Where import, export and generation of electricity is not metered separately, we have to make some assumptions about your electricity use to give a more accurate representation of carbon emissions from your home now. In the graph below, we assume that you use a certain proportion of the electricity you generate yourself (usually around 50%, though we adjust this depending on how you occupy your home). We then add this to the figure given in your bills for electricity usage to give a more accurate picture of the carbon emissions from your home.

Figure 8: Carbon dioxide emissions in kilograms per square metres per year

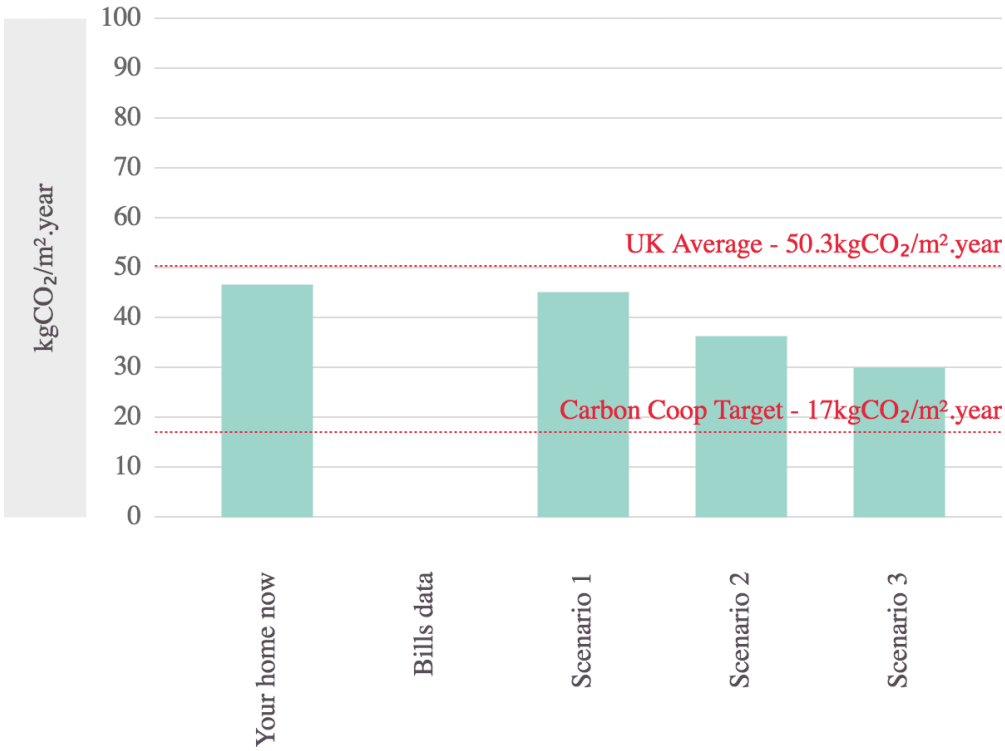
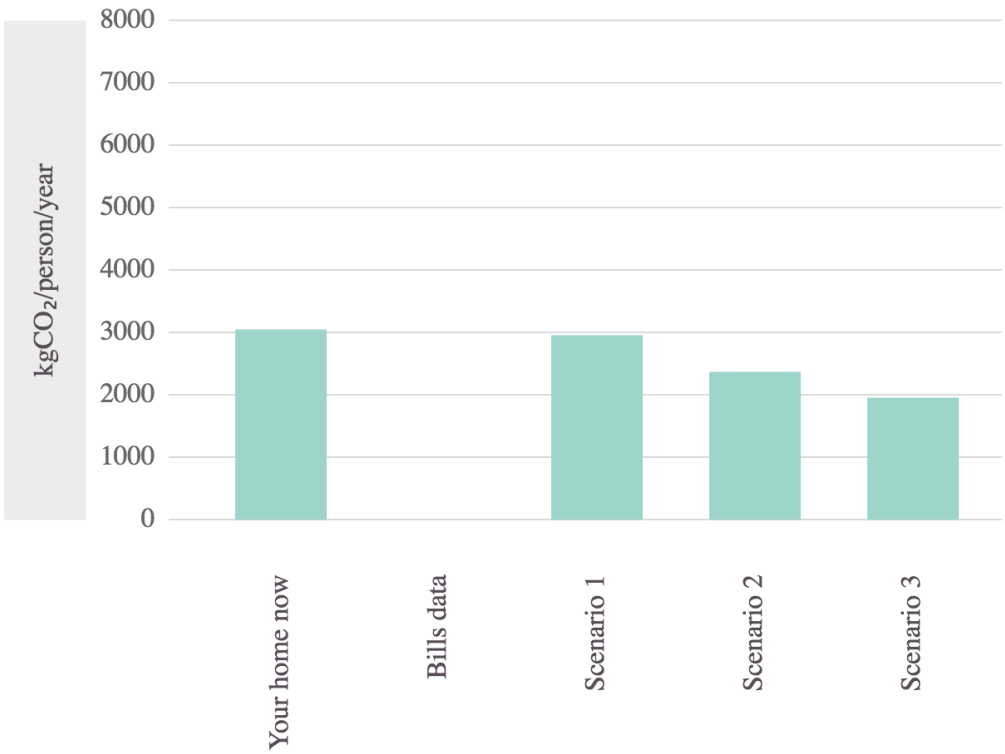


Figure 9: Carbon dioxide emissions in kilograms per person per year (your personal carbon footprint)



1.6 Energy costs

Figure 10 shows the estimated annual cost of fuel for your home now and your retrofitted home as modelled. For comparison, it also shows your current annual energy costs from bill data, if you provided this.

The fuel costs for your home will be affected by the level of insulation, the efficiency of services and lighting, the type of fuel used and the fuel tariff you have with your supplier. If you provided bills, Figure 10 uses your actual fuel unit costs per kWh. If you didn't, Figure 10 uses standard fuel unit costs per kWh, which are based on national averages. This allows clearer comparison across scenarios but as it doesn't take into account energy deals the total costs have to be taken as an orientation.

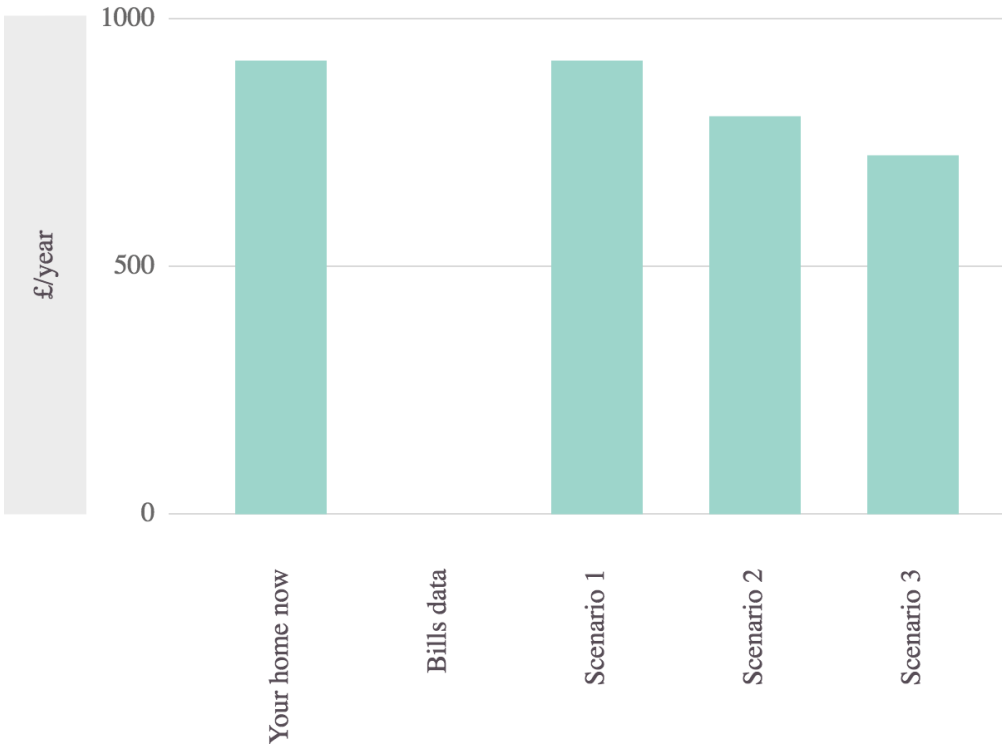
In most retrofits, it is possible to significantly reduce the cost of heating, hot water, lighting and ventilation through improvements in building fabric and services – or at least to improve comfort, whilst not increasing costs. However, the cost of energy uses such as cooking and using appliances, are much more dependent on individual behaviour. So, alongside physical retrofit measures, you can maximise savings by being more aware of how you use energy in your home.

We have shown the benefits of the estimated amount of energy you generate if it is used directly in your home – for example by running appliances whilst solar panels are generating electricity. We generally assume that you will use around 50% of the energy you generate on site, though can adjust this depending on how you use your home. This

is an estimate, whether you are able to make use of this energy. You can maximise your savings from on-site generation like solar panels by using more of it directly yourself, but this may require a change in your household's habits. Figure 10 shows as negative values the estimated savings due to the onsite use of renewables.

We have not included any payments you might receive such as Feed-in-Tariffs (FITS) for renewable electricity generation from things like solar panels, or payments from schemes like the renewable heat incentive (RHI). This is because these payments and the rules around them change on a regular basis, so what you may be entitled to will vary significantly over time. This is the case for both existing and proposed renewable energy installations.

Figure 10: Estimated energy costs net comparison



Please note: models work on assumptions and there are several reasons why your actual current and future energy use may be different.

The model makes assumptions about average regional climate that may not hold true in a given year. Maybe we get a mild winter and you don't put the heating on as much. Or, the summer is cold and wet and you use your heating system a lot more than usual.

1.7 Comfort and Health

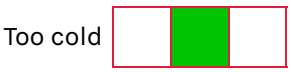
The link between the built environment, our comfort and health is well established. Living in a home that is too cold, hot, damp, dry or draughty can affect your physical and mental wellbeing. This may trigger or worsen respiratory and cardiovascular problems, skin conditions, trips and falls, anxiety and depression.

When calculating heating demand, SAP assumes a temperature of 21°C in your living area for a set number of hours. In reality, your living area may be warmer or cooler than this (for longer or shorter periods) because we all have different perceptions of what is comfortable as well as different occupancy patterns. This will also be affected by the efficiency of the building fabric and your heating system.

This is why we collect information about you as householders. Understanding your perceptions of comfort, as well as how you use the spaces within your home, allows us to tailor the recommendations with your comfort and health in mind.

Figure 11: Comfort tables

Temperature in winter:

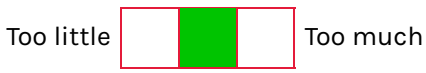


Temperature in summer:

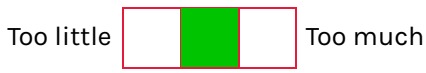
Air in winter:

Air in summer:

Amount of daylight:



Amount of artificial light:



Draughts in winter:

Draughts in summer:

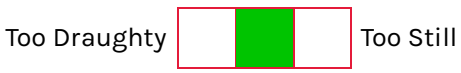


Figure 12: Health

RH data

When we visited, the relative humidity was 0%. (The ideal range is 40-60%).

Temperature data

When we visited, the temperature was 0°C.
(It is recommended that living spaces are at 16°C as a minium (World Health Organisation).

You also told us

Do you have any problems with noise from neighbours, between rooms, or from outside?
Traffic noise. No much neighbour noise. Concerned about floor noise transfer to neighbour downstairs.

Any problem locations for lighting?
Kitchen a bit dark.

Are there any particular problem locations for thermal comfort?
Whole flat fine when heating on. Little bedroom next to bathroom is coldest. In summer can get too hot - west facing windows.But can't easily open windows cause of traffic noise.

Your favourite room?
Balcony.

Any rooms in your home you don't love?
The red bedroom needs Mari Kondoed

How do you dry your laundry?
outdoor clothes line, radiators

How could your home perform better?
Section 2.0

In this section we give recommendations for planning retrofit works in your home. We show you a full range of possibilities for your home, from simple DIY measures through to Your 2050 Home – an exemplar model in line with 2050 80% carbon reduction targets.

2.1 Scenarios

Figures 13, 14 and 15 on the following pages summarise our recommendations for planning retrofit works in your home. More detailed information on the nature of the works, and other things you may need to think about, are contained within the tables in Appendix A. We have mapped out three scenarios:

Scenario 1: First Steps

Scenario 2: Windows and Internal Walls

Scenario 3: Windows and Internal Walls

Following these scenarios, we have also included a commentary that gives more specific guidance based on the assessment we've carried out on your home.

We focus first on quick wins and the things you told us are most important to you. We take a whole house approach, rather than considering single measures in isolation.

We consider factors other than energy use and finances that may be important to you. For example, comfort, ventilation and indoor air quality. We also consider the level of disruption involved in carrying out various building works.

We consider the embodied environmental impact of the materials and systems we recommend, choosing lower impact materials where possible.

We do not necessarily expect you to do all these works at once! These recommendations simply show a pathway for you to achieve a 2050 emissions reduction and energy use target by using technologies and techniques that are currently available.

2.2 Table headings

In addition to listing and describing proposed measures, we use the following table headings to guide you through our recommendations:

Performance target:

This is the standard a measure needs to achieve to match the assumptions made in the model. For a wall, floor, window or roof this is usually a measure of its thermal performance and insulation value (known as a U-value and measured in watts per square meter per degree Kelvin - $W/m^2.K$), for a boiler it will be its efficiency, usually measure as a percentage. It is important to reference this when looking at detailed specifications – if this report assumes 200mm high quality insulation, the same effect won't be achieved with 100mm of lower quality insulation.

Benefits:

We understand that you may wish to carry out retrofit works for reasons other than simple energy and cost savings – such as comfort improvements, improved indoor air quality or carbon emissions reductions. It's important that in planning the work you understand and communicate your priorities to any professionals or builders you're working with. Carbon Co-op can help you understand and explore these issues – please see Section 3.0 of this report for more details of how we can help.

The relative impact of each measure will vary depending on the order you do them in. For example, if you change your boiler before installing insulation, the absolute savings from the insulation work will be less than if you had done the insulation work first.

How much?

We have based the costs given on generic cost information to provide an overall idea of what you will need to complete the recommended measures. This is just an approximation so that you can plan a budget.

Before you begin most work on your home, you will need to undertake a detailed cost plan, in most cases based on information provided by suitably experienced professionals, and obtain quotes from a range of suppliers.

Please note: costs do not include any contingency, VAT, fees, costs for relocation (if you want to move out while works are undertaken) or redecoration costs. In a building contract, approximately 10% of the construction cost is a standard amount to allow for contingency and may be higher depending on how complex the work is

and the nature of the contractor*. Other costs will vary over time and be dependent on your detailed specification and how they are being procured. These should be investigated and itemised on a project by project basis.

*The VAT rate may vary depending on government policy and the way that you procure the works. Discount VAT rates may be available for some works – both self-build and energy efficiency. When you are preparing your works budget, you should consult HMRC to take account of this.

For more significant building works you will also need to allow for preliminary costs. These are the management and other costs associated with carrying out building work – for example, paying for scaffolding and the services of a site manager.

You may also need to account for professional fees required for gaining permissions and preparing detailed construction information. Again, 10% is a sensible budget cost, but this will vary significantly dependent on the scale and complexity of the works. You may also need to pay for statutory fees, such as for Planning and Building Control.

Who by?

We've provided a guide to who might carry out each measure. This is subjective and dependent on context.

Disruption:

We've given a guide as to the level of disruption. Again, this is subjective and dependent on context.

Summary of measures

Figure 13a - Scenario 1: First Steps

Total cost of the scenario £1550

Name	Label/location	Performance target	Benefits (in order)	Cost	Completed By	Disruption
Block or remove uncontrolled wall vent	Wall Vent at Window	n/a	Comfort, carbon	£50.00	DIY or general contractor	
Block or remove uncontrolled wall vent	Wall Vent at Window	n/a	Comfort, carbon	£50.00	DIY or general contractor	
Advanced Draughtproofing measures	Whole house	Air permeability - Dependent on existing 3-7.5 $m^3/m^2.hr50pa$	Comfort, fuel bills, carbon.	£600.00	DIY/ General Contractor	
Decentralised continous mechanical extract ventilation DEV	Whole house	See building regulations	Indoor air quality, reducing risk of condensation and mould	£750.00	Qualified Electrician	
Clothes Drying Rack	Whole house	n/a	Indoor air quality, reducing risk of condensation and mould, reduced energy use for drying	£100.00	DIY/ General Contractor	

Figure 13b - Scenario 2: Windows and Internal Walls

This scenario assumes the measures in Scenario 1 have already been carried out and adds to them

Total cost of the scenario £9600

Name	Label/location	Performance target	Benefits (in order)	Cost	Completed By	Disruption
Internal Wall Insulation	Wall Two - To Stair	0.4 W/m2.K	Comfort Carbon Emissions Fuel Bills	£992.98	Specialist Installer Only	
Insulated Timber Door - triple glazing assumes glazing 30-60	D02 - Balcony Door	1.1 W/m2.K	Comfort Carbon Emissions Fuel Bills	£1200.00	General Contractor/ Joiner	
Triple glazed window timber	Various	0.85 W/m2.K	Comfort Carbon Emissions Fuel Bills	£5905.29	General Contractor/ Window Fitter	
Very advanced Draughtproofing and air-tightness works.	Whole house	Air-permeability - 2.5m^3/m^2.hr50pa	Comfort, fuel bills, carbon.	£1500.00	General Contractor	

Figure 13c - Scenario 3: Windows and Internal Walls

This scenario assumes the measures in Scenario 2 have already been carried out and adds to them

Total cost of the scenario £10290

Name	Label/location	Performance target	Benefits (in order)	Cost	Completed By	Disruption
Fill Cavity Masonry Wall	Party Wall	0.2 W/m2.K	Comfort Carbon Emissions Fuel Bills	£319.62	Specialist Installer	
100-140mm External Wall Insulation EWI on filled cavity wall.	Various	0.15 W/m2.K	Comfort Carbon Emissions Fuel Bills	£9970.36	Specialist Installer Only	

2.3 Commentary

The scenarios suggested in your home area structured from basic 'first steps' which you shouldn't need permission from the freeholder to carry out in Scenario 1, to works that you may be able to do individually with the permission of the freeholder, to significant works that could only really be undertaken by the whole estate.

In scenario 1 we have suggested that you simply carry out an in-depth draught-proofing exercise, and couple this with improved ventilation to ensure that you maintain good indoor air-quality in your home. It is sensible to tackle draughts first as the energy model suggests these are the largest cause of heat loss in your home - slightly more than the heat loss from your windows. For more detail on existing draughts see the thermal imaging pictures supplied alongside this report. By improving the ventilation system, you can safey remove some of the uncontrolled air bricks that cause draughts and discomfort without risking poor air quality.

This should be coupled with a consideration of how you dry your clothes in your home. We understand that you dry your clothes either on the balcony or on radiators. We suggest that creating a dedicated drying rack close to a ventilation extract point rather than drying clothes on or near radiators should mean that clothes still dry quickly, but also that your home is warmer as your radiators are able to work more efficiently. It should mean also that the air in your home will be healthier. Monitoring the temperature and humidity in your home may help you keep a track of this - ideally relatively humidity should be between 40% and 60%.

In scenario 2 we have suggested you tackle the second greatest area of heat loss in your home - the windows. This is quite costly but will be very worthwhile - cutting heat loss here by more than half, whilst also enabling draught-proofing to be further improved. We recognise that this will be expensive and will require the support of the freeholder, so will not be an easy job - so when you do carry out this work, we suggest that you make sure you get the best windows you can. We've shared with you the Carbon Coop info sheet on windows to help with this. Also in this scenario we have suggested that you internally insulate the walls that divide your flat from the unheated entrance hallway. This will make some difference overall - because we suspect that this is an uninsulated cavity wall, and so the cavity here is acting like a chimney, removing heat from your flat. It should make the rooms affected much more comfortable. It means you will lose a small amount of space, but because these walls are sheltered on the other side i.e. they don't get rained on this is a relatively low-risk measure that could help make these two bedrooms warmer. The two measures suggested in this scenario are unrelated so you could do the walls without the windows and vice-versa.

Scenario 3 shows the final steps you would need to take to make your home as comfortable and low-carbon as possible. However, this would require the outside appearance of the building to change, with the application of external wall insulation. We understand that this is unlikely to happen anytime soon, or even at all, given the effect on the appearance of the building and the requirement that the whole building be

done at once - but thought it was worth demonstrating what would be technically possible. If this work was done it would cut heat loss through the walls of the building by more than half - provided care was taken to tackle all of the possible 'thermal bridges' when doing the work.

A big area of thermal bridging is the floor of the balcony and if this work was carried out - or even without the external wall insulation - making this into a 'winter garden' may help cut down on heat loss and this effect - though this would mean that ventilation routes from the bathroom and kitchen would need to be extended to the outside. We'd suggest that this is something that could be looked at in more detail as a project of it's own - either on a flat-by-flat basis, or across the whole block. However it is complicated - so needs further thought, investigation and modelling than is possible here.

A final measure in this scenario is to fill the party walls, which we suspect are currently unfilled cavities. This may help with noise issues if done well - blocking air-paths for noise transmission - but should also stop these cavities acting like chimneys and removing heat from your home. This would require specialist surveys, and the permission of your neighbours, but is becoming more common as a retrofit measure.

All of this would get you a large part of the way towards the carbon target. In future the remainder could be achieved through switching your heating system to a non-fossil fuel based one using electricity. Your existing boiler is relatively new, so we have not suggested that here - but in the long term this would be a possibility. Adding solar panels on the roof would also be a possibility - but again this would require the consent of the fr

How can Carbon Co-op help?
Section 3.0

Carbon Co-op is a community benefit society made up of like-minded members, individuals taking practical action to reduce their use of home energy. We can assist you by providing information or by facilitating the sharing of knowledge and expertise between householders. Some services are accessible to all; others are exclusive to members – as described below.

In taking things forward it is important to realise there are no one-size-fits-all solutions. Some people employ professionals to oversee their improvements; others carry out the work on a DIY basis. Some achieve everything at once in a 'big bang'; others work in stages, incrementally over years.

However you decide to tackle things, there are a number of ways you can access information and advice from Carbon Co-op.

3.1 Available to all

Seminars: We host retrofit seminars and events, ranging from introductory sessions to more advanced workshops. Led by industry professionals, our seminars provide specialist information and enable householders to access trusted, independent expertise.

Green Open Homes weekends: Householders who have carried out improvements regularly open their homes to the general public over a weekend – and we co-ordinate visits and bus tours. Open homes are a great way to understand just what is involved in a whole house retrofit, exchange contacts and to become aware of some of the common pitfalls to avoid.

Keep an eye on the Carbon Co-op website for details of upcoming events.

3.2 Carbon Co-op member services

Membership of Carbon Co-op is open to anyone for an annual subscription. As a member you become a co-owner of the organisation, you can attend general meetings and stand for the governing committee. Members also get access to a range of exclusive services including:

Factsheets and case studies: available through our website, factsheets and case studies give key information about a particular area of expertise within retrofit.

Webinars: We host regular webinars through our website and members can access additional back up video resources from workshops and seminars. These cover a range of topics, from open source energy monitors to interviews with retrofit experts.

Members' forum: The members' area on our website includes a forum for householders to exchange advice on suppliers, installers and contractors - and ask for advice on particular questions.

Socials: We host socials, opportunities for members to meet, network and swap experiences. These events, often held in a cafe or pub, feature short presentations or skill-share sessions from members, followed by informal networking with food and drink laid on.

Bulk discount offers: Our members benefit from collective purchasing power. Where a common need can be identified, Carbon Co-op can negotiate a bulk discount scheme with suppliers or installers. Past deals include energy monitors, triple glazed windows, car share schemes and LED lightbulbs.

3.3 Recommendations?

We are often asked to recommend specific, trusted contractors that householders can use to carry out retrofit works. At present, for a number of reasons, we do not make recommendations.

Firstly, the retrofit sector is new and developing – there isn't currently a large range of experienced contractors available to carry out works and very few have a track record.

Secondly, a recommendation from Carbon Co-op on such high value works confers a high level of trust. To offer this we would need to monitor and evaluate ongoing contractor performance - an intensive process.

Instead of recommendations, we offer training and advice to householders, providing them with the tools to procure high quality, appropriate contractors, installers and consultants. Through events, socials and our forum we also offer a platform for householders to exchange contacts and provide feedback on their experiences.

3.4 Keep in touch

In addition to these specific services we're always happy to answer questions and signpost help where we can. Drop us a line at info@carbon.coop or give us a call on 0161 448 6492.

Appendices

Appendix A: Scenario Measures Complete Tables

Figure 14a - Scenario 1: First Steps

Total cost of the scenario £1550

Measure: Block or remove uncontrolled wall vent

Label/location: Wall Vent at Window

Description: Blocking or removing uncontrolled wall vents will help with draught-proofing and reduce heat-loss.

Associated work: Ventilation and Draughtproofing

Maintenance: --

Special and other considerations: Make sure you have adequate planned and controlled ventilation to ensure that indoor air quality is not adversely affected by removing draughty old vents.

Who by:	DIY or general contractor	**Key risks:**	Indoor air quality		
Benefits:	Comfort, carbon	**Dirt and disruption:**	MINIMAL		
Performance target:	undefined	**Cost (£/unit):**	50	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	50.00

Measure: Block or remove uncontrolled wall vent

Label/location: Wall Vent at Window

Description: Blocking or removing uncontrolled wall vents will help with draught-proofing and reduce heat-loss.

Associated work: Ventilation and Draughtproofing

Maintenance: --

Special and other considerations: Make sure you have adequate planned and controlled ventilation to ensure that indoor air quality is not adversely affected by removing draughty old vents.

Who by:	DIY or general contractor	**Key risks:**	Indoor air quality		
Benefits:	Comfort, carbon	**Dirt and disruption:**	MINIMAL		
Performance target:	undefined	**Cost (£/unit):**	50	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	50.00

Measure: Advanced Draughtproofing measures

Label/location: Whole house

Description: This will include draught-proofing measures to doors and windows including doors to unheated spaces such as garages and cellars, skirting boards/ junctions, ceilings, letter boxes, loft hatches and cat flaps etc. It may also include fully sealing any floor constructions or ceilings, for example by installing an air-tightness membrane as part of floor or loft insulation works. It may also include sealing all service penetrations - vents, flues, waste water pipes, gas inlets etc - at the air-tight layer with appropriate tape, sealant or grommet. These may not all be accessible, so may be done as part of other related works e.g. plumbing works.

Associated work: Ventilation works and insulation, including internal and external wall insulation.

Maintenance: Minimal. Ensure any draught-proofing strips are replaced as they wear out over time.

Special and other considerations: This takes a good deal of attention to detail, and may require some specialist air-tightness products and materials. Walking round your home on a windy day, with a smoke pencil or similar if required, should enable you to find the biggest draughts and seal them. A thermal imaging survey could provide a more detailed analysis. As you are making your home more air-tight, its important to also ensure there is adequate ventilation so indoor air quality doesnt suffer. Make sure as a minimum you have extract ventilation from kitchens and bathrooms. Follow the rule seal tight, ventilate right.

Who by:	DIY/ General Contractor	**Key risks:**	Indoor Air Quality, Condensation, Mould.		
Benefits:	Comfort, fuel bills, carbon.	**Dirt and disruption:**	MEDIUM		
Performance target:	undefined	**Cost (£/unit):**	600	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	600.00

Measure: Decentralised continous mechanical extract ventilation DEV

Label/location: Whole house

Description: Decentralised continously running extract fans. This system involves the provision of continuously running low-energy fans in all wet rooms - kitchens and bathrooms. This helps ensure better air-qualitty in better draught-proofed homes. Extract fans rely on air being supplied from elsewhere - via trickle vents to windows or wall vents in living and bedrooms. The budget cost quoted here includes provision of inlet vents.

Associated work: Draught-proofing works

Maintenance: MINIMAL - Regular cleaning of fans and replacement required when parts wear out.

Special and other considerations: The ventilation strategy for your house should be carefully considered from the start of your retrofit. The most appropriate system will depend on a number of factors including the size and location of your house and its level of air-tightness. This system is suggested as a possible way forward, but further specialist design may be required to confirm whether this or another system is most suitable for your home. Noise should be a criteria when specifying the make model and control method especially for fans close to bedrooms - it is now possible to obtain fans with a rating below 30dB the level of a whisper. How the boost for the fans is controlled should also be carefully considered to match your needs - whether by simple attachment to a light-switch, or more sophisticatedly via a humidistat. Aesthetics and the level of disruption and disturbance may be a consideration for you, as well as functioning and cost.

Who by:	Qualified Electrician	**Key risks:**	Insufficient fan power, noise		
Benefits:	Indoor air quality, reducing risk of condensation and mould	**Dirt and disruption:**	MINIMAL		
Performance target:	undefined	**Cost (£/unit):**	750	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	750.00

Measure:	Clothes Drying Rack
Label/location:	Whole house
Description:	Fit ceiling mounted wooden clothes drying rack in appropriate location e.g. above stairs, near rooflight or next to extract in bathroom/ utility room. Reduces need for use of tumble dryer and improves indoor air quality.
Associated work:	Ventilation system, draught-proofing works
Maintenance:	MINIMAL
Special and other considerations:	Creating a ventilated space for clothes drying will help to improve indoor air quality and dry your clothes more quickly, whilst reducing or avoiding the need to use a tumble-dryer.

Who by:	DIY/ General Contractor	**Key risks:**	---		
Benefits:	Indoor air quality, reducing risk of condensation and mould, reduced energy use for drying	**Dirt and disruption:**	MINIMAL		
Performance target:	undefined	**Cost (£/unit):**	100	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	100.00

Figure 14b - Scenario 2: Windows and Internal Walls

This scenario assumes the measures in Scenario 1 have already been carried out and adds to them

Total cost of the scenario £9600

Measure: Internal Wall Insulation

Label/location: Wall Two - To Stair

Description: Vapour open internal wall insulation system with vapour control membrane and plasterboard finish. Condition of external existing wall is important, to ensure water cannot penetrate to back of new insulation. Repointing and other repairs of brickwork may be required, and it may be beneficial to apply a water-proof but vapour permeable sealant, especially in exposed locations. Proper allowance should be made for making the structure air-tight - with suitable tapes etc - both to reduce energy loss through unintended draughts, but also to prevent warm, damp air entering the structure from the inside, potentially leading to condensation within the wall.

Associated work: Windows and doors, suspended and solid floor insulation, loft/roof insulation.

Maintenance: MINIMAL: Ensure outer face of wall retains integrity so no water can enter structure, and air-tightness is maintained on inner face.

Special and other considerations: May require the removal of impermeable finishes on internal face of wall. All timber skirting boards, mouldings, picture rails, radiators, curtain rails, electrical and telephone/broadband sockets, wallpaper etc will need to be removed and refixed/replaced. A service void can be included on the inner face of the wall - to protect the vapour control layer from damage by battening out between that and the internal wall finish. Internal redecoration will be required. All internal plaster features within the depth of the insulation will be lost. Insulation of window reveals is VERY important to ensure effectiveness of insulation - not insulating the reveals can negate the effect of the insulation. Thickness of insulation should be limited so that external wall face does not become affected by freeze/thaw cycle, potentially damaging it. Particular care to be taken to any timber structure - e.g. floor joists - which passes through the insulation layer into the now cold wall. In some instances may be better to reconfigure floor joists or fit them onto hangers so this situation is avoided - though results in increased costs and disruption. An intelligent membrane may be suggested, esp in walls facing east/south/west which allows wall to dry out to ithe nside in certain conditions, to reduce risk of summer condensation water vapour driven into wall from outside face by warmth of sun. Ask installers for condensation risk calculations.

Who by:	Specialist Installer Only	**Key risks:**	Condensation within wall build up or penetrating damp damaging insulation and any timber structure		
Benefits:	Comfort Carbon Emissions Fuel Bills	**Dirt and disruption:**	VERY HIGH		
Performance target:	undefined	**Minimum cost**	100		
		Cost (£/unit):	100	**Units:**	sqm
		Quantity (units):	8.93	**Total cost (£):**	992.98

Measure: Insulated Timber Door - triple glazing assumes glazing 30-60

Label/location: D02 - Balcony Door

Description: Replacement insulated doorset. Fitted to minimise thermal bridges and maintain air-tightness.

Associated work: Ventilation, external wall insulation, internal wall insulation, draught-proofing.

Maintenance: Cleaning on a regular basis. Oiling hinges annually. Re-painting or re-varnishing externally to maintain weather protection of the timber frame in accordance with manufacturers recommendations - usually every 5-10 years.

Special and other considerations: Ensure reveals and threshold where possible are insulated where fitted within external or internal wall insulation - and a good seal is made against any cavity wall insulation. If wall insulation might be fitted later, ensure the door frame is deep enough to allow for this easily. Check the light transmittance values the glazing used - this can make a big difference to the amount of light in your home. If the door is part of a fire escape, ensure it can be opened from inside without a key. You may also wish to specify enhanced security standards, such as multiple locking mechanisms.

Who by:	General Contractor/ Joiner	**Key risks:**	Air-tightness failure at junction with wall. Fire escape.		
Benefits:	Comfort Carbon Emissions Fuel Bills	**Dirt and disruption:**	MEDIUM		
Performance target:	undefined	**Minimum cost**	100		
		Cost (£/unit):	1100	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	1200.00

Measure: Triple glazed window timber

Label/location: Various

Description: Replace existing windows and/ or glazed doors with triple-glazed low-e argon filled windows with warm edge spacers. Fitted in order to be air-tight and with minimal thermal bridging. Factory finished painted or varnished.

Associated work: Ventilation, external wall insulation, internal wall insulation, draught-proofing.

Maintenance: Cleaning on a regular basis. Oiling hinges annually. Re-painting or re-varnishing externally to maintain weather protection of the timber frame in accordance with manufacturers recommendations - usually every 5-10 years.

Special and other considerations: Ensure reveals and cill are insulated where fitted within external or internal wall insulation - and a good seal is made against any cavity wall insulation. If wall insulation might be fitted later, ensure the window frames are deep enough to allow for this easily. Check the light transmittance values the glazing used - this can make a big difference to the amount of light in your home. Think as well about the arrangement of openings in the window - as a general rule the simpler the framing, the better it will perform thermally, the more light it will provide, and the cheaper it will be. Ensure opening lights meet fire escape regulations.

Who by:	General Contractor/ Window Fitter	**Key risks:**	Air-tightness failure at junction with wall. Fire escape.		
Benefits:	Comfort Carbon Emissions Fuel Bills	**Dirt and disruption:**	HIGH		
Performance target:	undefined	**Minimum cost**	100		
		Cost (£/unit):	500	**Units:**	sqm
		Quantity (units):	10.61	**Total cost (£):**	5905.29

Measure: Very advanced Draughtproofing and air-tightness works.

Label/location: Whole house

Description: This will include draught-proofing measures to doors and windows including doors to unheated spaces such as garages and cellars, skirting boards/ junctions, ceilings,letter boxes, loft hatches and cat flaps etc. It may also include fully sealing any floor constructions or ceilings, for example by installing an air-tightness membrane as part of floor or loft insulation works. It may also include sealing all service penetrations - vents, flues, waste water pipes, gas inlets etc - at the air-tight layer with appropriate tape, sealant or grommet. These may not all be accessible, so may be done as part of other related works e.g. internal wall insulation. It should also include fully sealing the junction with the external wall at windows and doors using high-quality air-seal tape.

Associated work: Ventilation works, new windows and doors and insulation, including internal and external wall insulation.

Maintenance: Minimal. Ensure any draught-proofing strips are replaced as they wear out over time.

Special and other considerations: This takes a good deal of attention to detail, and may require some specialist air-tightness products and materials. Walking round your home on a windy day, with a smoke pencil or similar if required, should enable you to find the biggest draughts and seal them. A thermal imaging survey could provide a more detailed analysis. As you are making your home more air-tight, its important to also ensure there is adequate ventilation so indoor air quality doesnt suffer. Make sure as a minimum you have extract ventilation from kitchens and bathrooms. Follow the rule seal tight, vemtilate right.

Who by:	General Contractor	**Key risks:**	Indoor Air Quality, Condensation, Mould.		
Benefits:	Comfort, fuel bills, carbon.	**Dirt and disruption:**	HIGH		
Performance target:	undefined	**Cost (£/unit):**	1500	**Units:**	unit
		Quantity (units):	1.00	**Total cost (£):**	1500.00

Figure 14c - Scenario 3: Windows and Internal Walls

This scenario assumes the measures in Scenario 2 have already been carried out and adds to them

Total cost of the scenario £10290

Measure: Fill Cavity Masonry Wall

Label/location: Party Wall

Description: Cavity fill insulation injected into party wall to reduce chimney effect of thermal bypass in unfilled cavity. The U-value here assumes that it is not possible to effectively seal the edges and especially the top of the cavity. If this is possible - for example when re-roofing - the performance my be further improved.

Associated work: Ventilation, acoustic upgrades to party wall

Maintenance: MINIMAL

Special and other considerations: Need to be careful in assessing condition of existing cavity - if bridged may cause issues with damp and/or acoustics. Causes more disruption than cavity fill to external walls, as applied through holes drilled in internal walls - causing damage to decor. Some disruption may be caused even to establish whether wall in question has a cavity, as hard to do without drilling some exploratory holes.

Who by:	Specialist Installer	**Key risks:**	Reduced sound insulation between houses		
Benefits:	Comfort Carbon Emissions Fuel Bills	**Dirt and disruption:**	HIGH		
Performance target:	undefined	**Minimum cost**	100		
		Cost (£/unit):	25	**Units:**	sqm
		Quantity (units):	8.78	**Total cost (£):**	319.62

Measure: 100-140mm External Wall Insulation EWI on filled cavity wall.

Label/location: Various

Description: 100-140mm thick vapour permeable external wall insulation EWI with render finish on filled cavity wall.To include insulation to all window and door reveals and thresholds, treatment of roof eaves and verges junctions, taking insulation to at least 300mm below the level of the internal floor so thermal bridge is reduced. It will require adjustments of external drainage, and removal/refixing of sundry items satellite dishes, telephone connections, alarm boxes, boiler flues, bird boxes, gates and fences etc.

Associated work: Windows and doors, roofline works and drainage etc and loft/roof insulation, floor perimeter insulation.

Maintenance: MEDIUM: Render may need painting and repair after 10-30 years. All sealed junctions may need to be renewed periodically to prevent water ingress.

Special and other considerations: It is VERY important to pay attention to all junctions in External Wall Insulation - so that water cannot get behind the insulation, causing damage and reducing its effectiveness, and so that thermal bridges in the wall are minimised. Junctions with the roof, windows and doors and the floor need careful attention. Gaps in the insulation reduce its effectiveness and create risks to the building structure. You should consider carrying out works to these areas at the same time, for example by re-roofing ideally extending the roof over the insulation, or replacing windows and doors so they can be moved into the insulation layer. There will be a requirement for scaffolding, which may need permission from neighbours. The current condition of the wall may affect the specification, and repairs may be required before external wall insualtion can be applied. Alternative finishes - tile hanging, timber cladding, rainscreen etc - may be possible, but will probably increase costs. The cavity within the wall should be filled if not already and quality of this should be checked to avoid risk of thermal bypass - where cavity acts as chimney, increasing heatloss through convection.

Who by:	Specialist Installer Only	**Key risks:**	Water ingress, cold briding, thermal bypass.		
Benefits:	Comfort Carbon Emissions Fuel Bills	**Dirt and disruption:**	HIGH		
Performance target:	undefined	**Minimum cost**	200		
		Cost (£/unit):	130	**Units:**	sqm
		Quantity (units):	72.08	**Total cost (£):**	9970.36

Appendix B: Scenario comparison

Based on the survey we completed of your home, and the results generated using My Home Energy Planner, here we provide comparisons across fabric condition; heating and hot water systems; ventilation; lighting; appliances and cooking; and renewables.

Figure 15a Master/Scenario 1Comparison Table

Ventilation

Ventilation system type changed from *IE* to *DEV*

Air change rate: *0.5 ACH* - Specific fan power: *0.6 W/(litre.sec)*

Loses due to ventilation (WK) changed from *6.38* to *13.08*

Infiltration

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

Structural infiltration changed from *1.07* to *0.70*

Loses due to infiltration (WK) changed from *58.45* to *38.08*

Clothes drying facilities

A new *Clothes Drying Rack* has been added

Energy requirements

The demand for *fans and pumps* has changed from *176.00* kWh/year to *410.21* kWh/year

The demand for *space heating* has changed from *7684.87* kWh/year to *6940.33* kWh/year

Fuel requirements

	Before	After	Energy savings	Cost saving
Standard Tariff	*Quantity: 2103.35 kWh, CO_2: 801.38 kg, Primary energy: 6898.99 kWh, Annual cost: £382.76*	*Quantity: 2337.56 kWh, CO_2: 890.61 kg, Primary energy: 7667.18 kWh, Annual cost: £418.04*	-11.13%	-9.21%
Mains Gas	*Quantity: 10168.74 kWh, CO_2: 2257.46 kg, Primary energy: 13015.98 kWh, Annual cost: £533.17*	*Quantity: 9339.03 kWh, CO_2: 2073.26 kg, Primary energy: 11953.96 kWh, Annual cost: £497.91*	8.16%	6.61%

Totals

	Before	After
Annual cost	*£916*	*£916*
Total income	*£0*	*£0*
SAP rating	*65*	*65*

Figure 15b Master/Scenario 2Comparison Table

Ventilation

Ventilation system type changed from *IE* to *DEV*

Air change rate: *0.5 ACH* - Specific fan power: *0.6 W/(litre.sec)*

Loses due to ventilation (WK) changed from *6.38* to *13.08*

Infiltration

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

Structural infiltration changed from *1.07* to *0.39*

Loses due to infiltration (WK) changed from *58.45* to *21.21*

Fabric

Changes to Floor's, Wall's, Windows and Roof elements

Before	W/K	After	W/K	Change
Wall Two - To Stair - Uninsulated brick wall to unheated space *Net area: 8.93m^2, U-value 1.29:, k-value: 135*	11.52 W/K	Wall Two - To Stair - Internal Wall Insulation *Net area: 8.93m^2, U-value 0.4:, k-value: 17*	3.57 W/K	-7.95 W/K
W01 - Living Room - Single glazed window timber frame *Net area: 2.99m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	14.34 W/K	W01 - Living Room - Triple glazed window timber *Net area: 2.99m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	2.54 W/K	-11.80 W/K
W02 - Red Bedroom - Single glazed window timber frame *Net area: 2.12m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	10.15 W/K	W02 - Red Bedroom - Triple glazed window timber *Net area: 2.12m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.80 W/K	-8.35 W/K
W03 - Big Bedroom - Single glazed window timber frame *Net area: 2.15m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	10.33 W/K	W03 - Big Bedroom - Triple glazed window timber *Net area: 2.15m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.83 W/K	-8.50 W/K
W04 - Small Bedroom - Single glazed window timber frame *Net area: 1.45m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	6.97 W/K	W04 - Small Bedroom - Triple glazed window timber *Net area: 1.45m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.23 W/K	-5.73 W/K
W05 - Bathroom - Single glazed window timber frame *Net area: 0.81m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	3.86 W/K	W05 - Bathroom - Triple glazed window timber *Net area: 0.81m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	0.68 W/K	-3.18 W/K
W06 - Kitchen - Single glazed window timber frame *Net area: 1.10m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	5.27 W/K	W06 - Kitchen - Triple glazed window timber *Net area: 1.10m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	0.93 W/K	-4.34 W/K
D02 - Balcony Door - Solid Timber/uPVC Door with Single Glazing 20 *Net area: 1.80m^2, U-value 3.2:, k-value: 0, g: 0.85, gL: 0.9, ff:0.2*	5.76 W/K	D02 - Balcony Door - Insulated Timber Door - triple glazing assumes glazing 30-60 *Net area: 1.80m^2, U-value 1.1:, k-value: , g: 0.58, gL: 0.74, ff:0.4*	1.98 W/K	-3.78 W/K

Energy requirements

The demand for *fans and pumps* has changed from *176.00* kWh/year to *410.21* kWh/year

The demand for *lighting* has changed from *209.98* kWh/year to *216.61* kWh/year

The demand for *space heating* has changed from *7684.87* kWh/year to *4561.67* kWh/year

Fuel requirements

	Before	After	Energy savings	Cost saving
Standard Tariff	*Quantity: 2103.35 kWh, CO_2: 801.38 kg, Primary energy: 6898.99 kWh, Annual cost: £382.76*	*Quantity: 2344.18 kWh, CO_2: 893.13 kg, Primary energy: 7688.92 kWh, Annual cost: £419.03*	-11.45%	-9.48%
Mains Gas	*Quantity: 10168.74 kWh, CO_2: 2257.46 kg, Primary energy: 13015.98 kWh, Annual cost: £533.17*	*Quantity: 6684.15 kWh, CO_2: 1483.88 kg, Primary energy: 8555.71 kWh, Annual cost: £385.08*	34.27%	27.78%

Totals

	Before	After
Annual cost	*£916*	*£804*
Total income	*£0*	*£0*

SAP rating	*65*	*71*

Figure 15c Master/Scenario 3Comparison Table

Ventilation

Ventilation system type changed from *IE* to *DEV*

Air change rate: *0.5 ACH* - Specific fan power: *0.6 W/(litre.sec)*

Loses due to ventilation (WK) changed from *6.38* to *13.08*

Infiltration

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

The *Uncontrolled Wall Vent (20 m^3/h)* in *Wall Vent at Window* has been replaced with *Block or remove uncontrolled wall vent (0 m^3/h)*

Structural infiltration changed from *1.07* to *0.39*

Loses due to infiltration (WK) changed from *58.45* to *21.21*

Fabric

Changes to Floor's, Wall's, Windows and Roof elements

Before	W/K	After	W/K	Change
Wall One - Main External - Filled Cavity Masonry Wall - 50mm Cavity *Net area: 26.84m^2, U-value 0.5:, k-value: 110*	13.42 W/K	Wall One - Main External - 100-140mm External Wall Insulation EWI on filled cavity wall. *Net area: 26.84m^2, U-value 0.15:, k-value: 110*	4.03 W/K	-9.40 W/K
Wall Two - To Stair - Uninsulated brick wall to unheated space *Net area: 8.93m^2, U-value 1.29:, k-value: 135*	11.52 W/K	Wall Two - To Stair - Internal Wall Insulation *Net area: 8.93m^2, U-value 0.4:, k-value: 17*	3.57 W/K	-7.95 W/K
Wall Three - Small External - Filled Cavity Masonry Wall - 50mm Cavity *Net area: 13.55m^2, U-value 0.5:, k-value: 110*	6.78 W/K	Wall Three - Small External - 100-140mm External Wall Insulation EWI on filled cavity wall. *Net area: 13.55m^2, U-value 0.15:, k-value: 110*	2.03 W/K	-4.74 W/K
Wall Four - To Balcony - Filled Cavity Masonry Wall - 50mm Cavity *Net area: 8.09m^2, U-value 0.5:, k-value: 110*	4.05 W/K	Wall Four - To Balcony - 100-140mm External Wall Insulation EWI on filled cavity wall. *Net area: 8.09m^2, U-value 0.15:, k-value: 110*	1.21 W/K	-2.83 W/K
Party Wall - Cavity masonry wall, uncapped, unfilled. *Net area: 8.78m^2, U-value 0.5:, k-value: 110*	4.39 W/K	Party Wall - Fill Cavity Masonry Wall *Net area: 8.78m^2, U-value 0:, k-value: 110*	0.00 W/K	-4.39 W/K
W01 - Living Room - Single glazed window timber frame *Net area: 2.99m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	14.34 W/K	W01 - Living Room - Triple glazed window timber *Net area: 2.99m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	2.54 W/K	-11.80 W/K
W02 - Red Bedroom - Single glazed window timber frame *Net area: 2.12m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	10.15 W/K	W02 - Red Bedroom - Triple glazed window timber *Net area: 2.12m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.80 W/K	-8.35 W/K
W03 - Big Bedroom - Single glazed window timber frame *Net area: 2.15m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	10.33 W/K	W03 - Big Bedroom - Triple glazed window timber *Net area: 2.15m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.83 W/K	-8.50 W/K
W04 - Small Bedroom - Single glazed window timber frame *Net area: 1.45m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	6.97 W/K	W04 - Small Bedroom - Triple glazed window timber *Net area: 1.45m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	1.23 W/K	-5.73 W/K
W05 - Bathroom - Single glazed window timber frame *Net area: 0.81m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	3.86 W/K	W05 - Bathroom - Triple glazed window timber *Net area: 0.81m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	0.68 W/K	-3.18 W/K

W06 - Kitchen - Single glazed window timber frame *Net area: 1.10m^2, U-value 4.8:, k-value: 0, g: 0.85, gL: 0.9, ff:0.7*	5.27 W/K	W06 - Kitchen - Triple glazed window timber *Net area: 1.10m^2, U-value 0.85:, k-value: , g: 0.58, gL: 0.74, ff:0.7*	0.93 W/K	-4.34 W/K
D02 - Balcony Door - Solid Timber/uPVC Door with Single Glazing 20 *Net area: 1.80m^2, U-value 3.2:, k-value: 0, g: 0.85, gL: 0.9, ff:0.2*	5.76 W/K	D02 - Balcony Door - Insulated Timber Door - triple glazing assumes glazing 30-60 *Net area: 1.80m^2, U-value 1.1:, k-value: , g: 0.58, gL: 0.74, ff:0.4*	1.98 W/K	-3.78 W/K

Energy requirements

The demand for *fans and pumps* has changed from *176.00* kWh/year to *410.21* kWh/year
The demand for *lighting* has changed from *209.98* kWh/year to *216.61* kWh/year
The demand for *space heating* has changed from *7684.87* kWh/year to *2910.87* kWh/year

Fuel requirements

	Before	After	Energy savings	Cost saving
Standard Tariff	*Quantity: 2103.35 kWh, CO_2: 801.38 kg, Primary energy: 6898.99 kWh, Annual cost: £382.76*	*Quantity: 2344.18 kWh, CO_2: 893.13 kg, Primary energy: 7688.92 kWh, Annual cost: £419.03*	-11.45%	-9.48%
Mains Gas	*Quantity: 10168.74 kWh, CO_2: 2257.46 kg, Primary energy: 13015.98 kWh, Annual cost: £533.17*	*Quantity: 4833.77 kWh, CO_2: 1073.10 kg, Primary energy: 6187.23 kWh, Annual cost: £306.44*	52.46%	42.53%

Totals

	Before	After
Annual cost	*£916*	*£725*
Total income	*£0*	*£0*
SAP rating	*65*	*75*

Appendix C: Glossary

Retrofit and building efficiency have a language all of their own. In this report there may be words and concepts that are unfamiliar to you. If there is anything you don't understand, please ask us – either in person, through one of the regular Carbon Co-op webinars, or on the member forum.

We believe in using the correct terminology wherever possible, so that when you speak to professionals and tradespeople involved in retrofit you are familiar with the terms. To help your understanding we have provided this short glossary of common words and phrases:

Air changes per hour (ACH):

is usually used as a measure of ventilation but when natural ventilation is deployed the air-tightness contributes to the total.

Air tightness:

A draughty house allows heat to be lost around the insulation you have installed. Air tightness is usually measured as the volume of air that moves through a square metre of outside surface in an hour at a given difference in pressure between inside and outside – metres^3/hour/metre^2 at 50 Pascals, shorthand – q50.

Breathable (Vapour Permeable/ Vapour Open):

This can be confusing - if a material is described as 'breathable' it actually refers to the behaviour of materials in relation to water vapour and moisture rather than air - i.e. its level of vapour permeability. So it's not about draughts or air being able to move through a wall, but about whether water vapour can move through a wall or other construction. It is an important consideration in retrofit, because older building materials are generally more 'breathable' than modern materials, and this needs to be considered when suggesting changes to older buildings. The existing way in which the construction handles moisture needs to be understood, so that this isn't altered in a damaging way, and the risks of damp, mould and condensation associated with getting it wrong are mitigated. This is also talked about in terms of a material's 'hygroscopic' qualities.

Kilowatt-hour (kWh):

This is a unit of energy – a measure of the total amount of work done over a period of time. 1 kilowatt-hour would be used by a 1kW rated electric fire left on for one hour. A 100W bulb left on for one hour would use 0.1kWh.

Regulated emissions:

These are the energy uses and resulting carbon dioxide emissions that are covered by Building Regulations in the SAP rating (see below). These include the energy used to heat, light and ventilate your home and provide hot water.

Retrofit:

New houses can be built to a very high level of energy efficiency. Older houses, built when our expectations of comfort were much lower and when energy was cheaper, tend to perform very poorly in terms of energy efficiency, carbon emissions and comfort. These homes therefore need to be augmented with energy saving measures – both in fabric and services - or renewable energy generating measures, to bring them up to a more acceptable standard. This process is known as retrofit, i.e. ‘retrospectively fitting’ measures to an existing property.

SAP:

SAP is the Standard Assessment Procedure used to assess energy use in UK homes. The UK government devised SAP as a way to compare homes and test them against Building Regulations. SAP forms the basis of the energy model used in this report.

SAP makes assumptions about the number of people living in a home and how it is heated and used, based on averages for the UK. You may not be ‘average’ and may use your home in different ways. So, SAP is not an exact predictive tool.

SAP model:

The SAP model is the tool used to calculate the energy and carbon performance of a home and produce its SAP rating. It uses a standard set of calculations, set out in publicly available documents.

SAP rating:

Domestic buildings are given a SAP rating in the Building Regulations approval process for new-build homes. Energy Performance Certificates (EPCs) for sales and lettings of existing homes also include a SAP rating. The higher the SAP rating, the better the building is in terms of energy efficiency, carbon dioxide emissions and fuel costs.

The SAP rating is influenced by predicted energy use, carbon emissions and fuel costs. This means that the SAP rating is influenced by levels of insulation, how efficient your heating system and other services are, the type of fuel you use to heat and light your home, and whether you have any renewables. However, the SAP rating only covers regulated emissions. SAP does not cover appliances or cooking.

Unregulated emissions:

These are the energy uses and resulting carbon dioxide emissions that are not covered by Building Regulations. They are less directly related to the building fabric and include cooking and electrical appliance use. Appliance use covers laundry washing and drying, fridges and freezers, and consumer electricals such as TVs and computers.

U-value:

This is a measure of the thermal performance of a building element. U-value is measured in watts per square metre per degree of temperature difference (measured in Kelvin). So, if a wall has a U-value of 1 W/m^2. K, it loses 1 watt per square metre of wall area per degree of difference between inside and outside. So, if it is 0oC outside and 20 ^oC inside and the wall is 10 square metres, it would lose 200 watts of heat – equivalent to the power used by a set of hair-straighteners.

Watt:

This is a unit of power – that is the rate at which work is done or energy is used. 1 watt is equivalent to 1 joule per second. A 100-watt lightbulb uses 100 joules per second. 1 kilowatt (kW) = 1000W.

Appendix D. About our methodology

This report is based on a survey of the condition of your home at a fixed point in time (or as noted otherwise if you have planned works).

The information we gathered from this survey was entered into an energy model based an adapted version of on the UK's National Calculation Methodology – SAP version 9.92.

However, this model is only a representation that allows different approaches to be compared – it does not produce guaranteed absolute predictions. Whilst changing the physical properties of your home as suggested in this report should make a positive contribution towards energy saving, the actual amount of energy saved depends on how you use and interact with your home and the order in which the works are done.

Carbon Co-op has evidence from completed and monitored retrofits that these measures work – but they will produce different outcomes for different households. Different types of construction will also not always perform in accordance with the models. For example solid walls may actually perform better than predicted in standard heat loss calculations - though one of the adjustments made by Carbon Co-op is to improve their performance in accordance with the available evidence and our own calculations, so that our model more closely reflects reality.

We are confident that the levels of insulation we propose will have a significant impact on energy use and comfort. However, services measures are more difficult to predict, and the use of electrical appliances, hot water and cooking varies significantly between households. In addition, the savings available from renewable technologies will depend greatly on whether your household is able to maximise the amount of energy generated by them that is used directly in your home, and also the quality of their installation and maintenance.

Before making a final decision about retrofit works, you should carefully consider what your aims are and how they can best be achieved. Carbon Co-op can also help with advice on simple changes to how you use your home to save energy without altering the fabric.

Disclaimer:

We take reasonable care to ensure that the information contained within this report is of a level of accuracy and completeness sufficient for the purposes of an outline energy model of your home, and suggesting potential improvements. However, the measurements and information taken during our short survey are not suitable for use as construction information, and should be verified by others on site before carrying out any detailed design and construction work.

It should also be noted that we do not carry out invasive surveys as part of this report, and we will not access areas where to do so would cause undue risk to the assessor. We will therefore have made a number of assumptions about the construction of your home that may need to be verified by further investigation and detailed condition surveys of your home before detailed design and construction work is undertaken.

Whilst we will notify you if we see something in your home that concerns us as to its safety or condition, this is not a full building inspection and condition survey, and should not be used as such. We strongly recommend that before undertaking any major works – particularly where the structural condition of your home may be affected – you seek advice from surveyor or structural engineer to carry out a full structural and condition survey.

Thank you for using My Home Energy Planner.