

housewarming

Guides



Preparing a
Whole House Plan

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WELCOME TO OUR SIXTH HOUSEWARMING GUIDE

This is the sixth guide in the series of Housewarming guides created by Low Carbon Oxford North. The series focusses on each of the core retrofit areas that may be required to improve the fabric of our buildings - fundamental to cutting energy use and the associated carbon emissions. Stopping heat loss from our homes is also an essential step in moving away from fossil fuels and becoming heat pump ready, particularly for older homes. Our homes will become warmer, healthier, and more comfortable to live in too.

At the heart of all the guides is a focus on reducing gas and other fossil fuel use for heating and hot water as this is where the greatest long-term carbon and financial savings can be made.

This guide helps you to understand how to prepare a complete retrofit plan. It describes how to bring everything in the other guides together so you can make decisions about how to progress. There will still be unknowns – you may not have tendered prices for the insulation work, for example. There will also still be other questions you don't have answers to but we believe this will allow you to plot the path from where you are now to the heat pump ready house you are aiming for.

You will almost certainly need professional help to take the next steps and fill in some of the gaps.

This will very likely require a detailed energy survey which results in energy modelling of your house so you can see the benefits of insulating different parts to particular levels. This will allow you to investigate the trade-offs of differing approaches.

There are different levels of investment you can make: they all give returns, some over the long term. All generate an environmental benefit and will improve comfort. Somewhere there is a balance which suits you between a lower short-term investment with larger energy bills in the longer term versus the most costly and beneficial project and very low bills forever.



This guide focusses on improving the whole house as part of a retrofit.

The choice depends on your ambition, budget and long-term plans. For example, if your energy bill is £4,000 per year, would you be willing to invest £20,000 to save £1,000 per year every year into the future? That gives an equivalent return of 5% per year (plus inflation, but less any interest/dividend you might have earned on that £20,000 investment).

You don't need to be a homeowner to start moving towards a heat pump ready home. Landlords and tenants have a role to play too. Already landlords must meet minimum EPC E and we expect that by 2030 that will rise to EPC C. So it makes sense to get heat pump ready sooner rather than later. As a tenant you can start to ask what your landlord plans to do and talk to the council.

Structure of the guide:

- This guide begins by helping you to establish the baseline of where your house and its energy are now and what other constraints you feel will influence your plan.
- Then we discuss how you can approach putting a draft plan together. We don't think many people will be able to do this on their own but by reading the range of **Housewarming Guides** you will be better prepared to talk to professionals.
- We present some information on those professionals, indicating who they are and what they can do.
- The next steps section is where we hand over to you. This is where you need to get specific advice and costs for your particular draft plan. We suggest how this might be done.

- We have included template worksheets at the end of this guide to help you record your thoughts and decisions as you build your plan. When it is completed with information about your house, the energy you use and the constraints and aims you have it will form an excellent basis for discussing what you want to achieve with friends, neighbours and ultimately the professionals you will employ to take it forward.



We will discuss how to put together a draft plan and have also produced a template for you to use.

BASELINE: YOUR HOUSE AND THE ENERGY YOU USE

You should now be ready to start making your plan. You can begin to plot the direction of travel and see how far you need to go.

Start by describing your house and the amount of energy you use at the moment. This is the basis for all the next decisions:

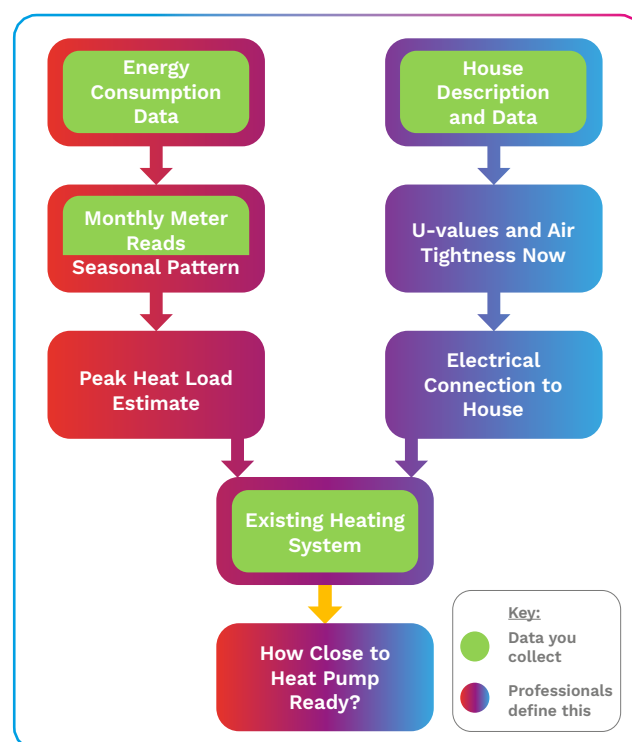
- How much energy you use now determines how far you need to improve your house to be heat pump ready.
- The construction and architecture of your home allows you to choose specific options for insulation, new windows and draught proofing. Ultimately issues such as owning a listed building or living in a conservation area may limit what you can do and you might not be able to have a heat pump.
- The layout of your house and how you use it now and what you plan for the future will also influence what you choose to do. If you are already thinking about remodelling and an extension, then now is exactly the right time to integrate an insulation upgrade to the existing parts of the house and to specify very high performance for the new parts.

Knowing where you are now enables you to decide how fast you can reduce emissions and how much money you may need – or how far a fixed budget

will allow you to go. Either way, you can prioritise what you invest in.

In our first guide, **Housewarming Guide H1: Taking Stock**, we suggested you start with known data, and that guide has a short survey form to help you collect this. So, gather information and have a look at your EPC if there is one for your house.

EPCs are not perfect and often contain subjective judgements but they are a start. How they were done has changed over time so an old one is not as useful as a new one.



The information and results you will need.

The previous diagram shows the information you need and the results obtained. You need to find the information in green boxes: professionals do the rest.

PINCH POINTS

Some aspects of your house and the overall plan may create pinch points. These are places where you need to make major upgrade decisions or have significant restrictions on what you can do.

Electrical Connection

The electrical connection to your house and the electrical fuse board are potential pinch points when it comes to installing a heat pump, solar PV and an electric vehicle (EV) charger. Think about all the electrical things you need to do to your house to get to heat pump ready plus the PV and EV charger and have one upgrade done to make the electrical system ready for them all. Housewarming Guide H7: Electricity, Appliances and Home Renewables will provide more detailed information.

An electrical upgrade is best done at the beginning of work so you don't have to drill through insulation and seal it up again afterwards. Constraints on your electrical connection are key reasons for starting by making your home more energy efficient, requiring a smaller, cheaper heat pump and no need for an upgrade to your electricity supply.

You should talk to an electrician and may need to talk to your DNO (Distribution Network Operator, which in Oxford is SSE).

Hot Water

The hot water provision in your house will almost certainly have to change when you move to a heat pump. You

won't be able to use the same tank if your current tank is heated by your boiler (or solar heating) as you will need a different internal heat exchanger to match a heat pump. You will also need a bigger tank as the water within it will not be as hot, so a shower will use more of it. If you have a combi-boiler and no tank think about where you will be able to put a tank. This should be located as centrally as possible to avoid long pipe runs which simply waste heat and water.



You will probably need a larger hot water tank.

Controls and Zoning

Energy efficient design and insulation of a home go hand in hand with a well-designed and operated heating system. A poorly designed and badly run heating system in the most efficient home will cost more money than it should to heat your home and will produce more carbon emissions. This means you need to think about the controls and how well your existing heating system is laid out. Where are the radiators? Can you fit underfloor heating? Can you zone the system to provide more localised control? This may be quite disruptive

as many floorboards will need to be lifted and new pipes and valves fitted throughout the house regardless of which rooms you are improving with insulation.

Start thinking about how you would zone your heating system for best control of rooms when they are being used.

OVERALL AIMS

Start considering what you are aiming to do. Upgrade the whole house, or just make some small interventions? Maybe you aren't sure yet.

Start writing down the things that will help to determine your plan:

- What sort of timescales are you thinking of?
- Do you have any idea of budget to spend?
- Can you cope with half the inside of the house being a building site for a few weeks?
- What is your future vision for the house and family?
- Set a target, for example; "I want to halve my energy consumption" or "I aim to reduce my carbon emissions to only 20% of those now".

The box (right) shows some illustrative examples.

CONSTRAINTS

If you are time poor, have sufficient finance available and want everything done in one go, think of getting a project team involved, examples include Eco Design Consultants, Enhabit (part of Green Building Store), CL-PM Ltd. Or you



A Bold Plan:

We have lived here for 7 years and in the next 5 we want to extend the back of the house to make a master bedroom with ensuite bathroom. We are told we will need £35,000 and so could add another £10,000 for improving other parts of the house. We are planning to move out for the summer and stay with friends in Spain while the most disruptive work is being done. We would like energy consumption to be half what it is now. We would be happy to do a few more small things the year after and be sure we could fit a heat pump when the boiler is 10 years old (it is three years old now).

Lower Key for Older Person:

I will be retiring in about 7 years and I expect to eventually downsize and move to an apartment somewhere in Oxford. My main concern is that I may have to meet an EPC C before I sell. I don't have the capital to do a complete 'Heat Pump Ready' plan but I do want to reduce my bills for the next 7 to 10 years and get to EPC C. The external render on the front of the house needs attention which I will have to pay for so I wonder if I can afford external wall insulation and new double glazing there as well?

may already know of a recommended architect who can help.

CAN YOU DO SEVERAL THINGS AT ONCE?

If you want to minimise disruption, plan ahead and make many improvements in one go, such as the floor and walls in one front room and all the windows at the front of your house. Some costs, like scaffolding, can be spread across several projects if you plan this way. For example, if you are thinking of solar PV, can the same scaffolding be used for new window installations and getting to the roof?

INITIAL CONVERSATIONS

If you own a semi-detached or terraced house or a flat, talk to your neighbours about collective action and cost sharing, such as external wall insulation or a bulk deal on windows.

If you are in a flat and want to take individual action, for example, to install better windows, talk to the building owner (the freeholder), the leaseholder and the residents' association. Encourage them to consider the whole building and work with you.

Is your house in a conservation area? Talk to the planners about options. You will probably have to focus on internal actions but there are some precedents for external works. Talk to your neighbours and find an architect who has worked in the area recently.

Is your house a listed building? There are some efficiency measures which you might already have but are not using. For example, internal shutters in good condition are almost as effective as double glazing. For other works, talk to planners and find out what is allowed. You can find your house and

the details of what is listed at:

www.historicengland.org.uk

You may need to agree the principles before you start any detailed planning, such as 'nothing that affects the fireplace in the first floor main bedroom'.

www.oxford.gov.uk/info/20064/conservation/1505/conservation_and_heritage_frequently_asked_questions

CONCLUSION OF BASELINE

You and any professionals you employ now have the starting point clearly stated. You have your initial aims written down and some idea of the sort of budget you think you can afford. You have considered the pinch points and talked to the council, friends, neighbours and perhaps had a few opening conversations with professionals. Now you can have a go at starting a draft plan.



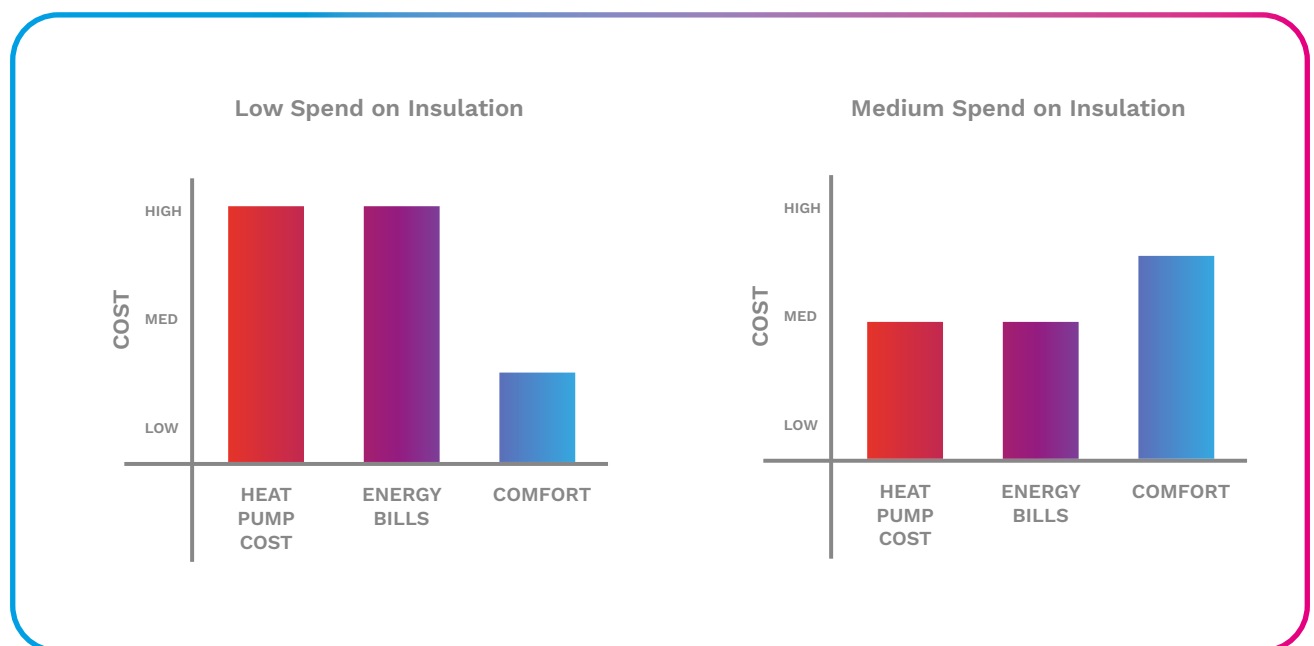
DRAFT PLAN

Have a stab at a first draft of a plan. It need not be exactly right, but by going through it you can find out what questions you don't feel you can answer, what concerns you most and what you really want to do soon. Once you have a draft you can start to iterate around it to improve it.

To work through each iteration, think about the trade-offs between various choices and constraints, for example, how investing more now on insulation will save energy later and allow you to have a smaller, cheaper heat pump.

Could you get the house to Passivhaus level? (You'd never have another heating bill.) Does the thought of external wall insulation changing how your house looks and/or the total upfront cost of installing this mean that it is off the agenda? Or could you just externally insulate the back of the house?

The charts below sketch out three typical levels of performance, cost and impact.

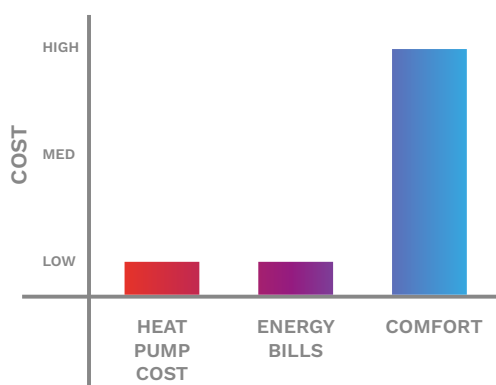


The three charts show relative gains according to investment.



These charts illustrate that by investing little in insulation now, you will have higher energy bills in future, a heat pump will cost more and comfort will be average. If you invest more now, you get lower bills, a cheaper heat pump and better comfort.

High Investment on Improvements:
Passivhaus or Enerphit Standards



What are 'passive' houses or 'passivhaus'?

Passive houses are extremely energy efficient homes with very low energy bills. Some designs require no dedicated heating system at all. They have been a design option for new builds for several decades and there are now international standards for them. In the UK the term 'passivhaus' is generally used; see The Passivhaus Designers Manual, edited by Christina J. Hopfe and Robert S. McLeod or www.passivhaustrust.org.uk

Passive houses have five key characteristics:

- Very high levels of insulation to reduce heat loss to tiny amounts
- Very airtight so there are no draughts
- Active ventilation with heat recovery from the extracted air
- Good thermal mass to moderate short periods of intense cold in winter or heatwaves in summer
- Optimised windows to gain sun in winter and avoid overheating in summer.

There are emerging passive house retrofit standards for upgrading existing houses e.g. EnerPHit:

<https://passipedia.org/certification/enerphit>



Most people will need professional help to produce proper numerical charts like these, but the principles are important. The actual cost trade-offs need to be calculated with a detailed energy model and by a professional with experience of insulation, glazing and draught proofing work in the building industry. You could invest for the maximum performance possible (Passivhaus) and have very low bills, a small low-cost heat pump solely for hot water and a very comfortable house.

RANK THE OPTIONS

To help see your way through the options, rank the improvement measures you could carry out. Do two versions: the perfect and the practical. This will help you understand the trade-offs. The perfect will bring your bills down very low but you will need to invest more now; the practical will be more affordable now, but your bills will be bigger in future.



Summary of Our Housewarming Guides

Here we distil the key points from our other guides. If you haven't read them, please do.

h1

Housewarming Guide H1: Taking Stock. The starting point for gathering information on your house, its construction and your energy consumption. Consider what you

h2

Housewarming Guide H2:

Insulation. The loft is easiest and makes a difference quickly – put in at least 300mm of mineral wool but ideally 400mm. Solid walls will benefit greatly from internal or external insulation. Internal reduces room sizes slightly but can be done room-by-room. External may change the look of your house if it is brickwork, but if rendered it will look very similar afterwards. As a wraparound blanket, external insulation also helps keep you cooler in short summer heatwaves. If you are planning to extend, can you get the external insulation to wrap around the old and new at the same time?

h3

Housewarming Guide H3:

Windows and Doors. Triple glazing is what we should all be aiming for, but good double glazing which is less than 10 years old is still pretty good. Old double glazing, especially if other parts of the frame and hinges are suffering, should be replaced. If you have old single glazing and a listed building or live in a conservation area, then secondary glazing or well-fitting internal shutters are almost as good as double glazing. Don't forget to think about how to match new windows to other efficiency improvements such as wall insulation

as windowsills will need to be the right depth. When enquiring about the performance of new windows and doors, ask for the whole window U-value which should be $1.8 \text{ Wm}^2 \text{ C}$ or lower for double glazing, or ideally $0.8 \text{ Wm}^2 \text{ C}$ for triple glazing if budgets allow.

h4 Housewarming Guide H4: Draughts and Ventilation. You need good ventilation to keep indoor air quality good for physical and mental health. Too much ventilation and you may sit in an uncomfortable draught and have big energy bills. Find the balance for your home and use controllable ventilation – trickle vents, opening a window, and good quality heat recovery extractor fans. If your house, budgets and overall plans allow, then making your house really airtight and using a whole house Mechanical Ventilation with Heat Recovery system is a great idea, but relatively few houses are suitable unless fully refurbished.

h5 Housewarming Guide H5: Heating and Controls. Even the best gas boiler is a huge emitter of CO_2 which is why LCON is recommending we all aim for heat pumps. Even with a super energy efficient house and a heat pump, good controls are essential to keep it running smoothly and get the right balance between the lowest bills and comfort.



PHASING THE WORK

Try to think about the stages of work that might need to be done. Consider how you will need to move things around the house – both the furniture should you need to clear a space while work is being completed and more permanent changes, like the space for a hot water tank. Talk to someone who has had similar work done to their house before, for example, you undertake a large extension.

You will only ever put in insulation once, so add as much of the best performing type as you can when you do. Get the new U-values down as low as possible. The cost of work will not double if you double the thickness of the insulation because some costs, such as, scaffolding, preparation, finishing, and disposing of waste material will be the same.

There are things that go together naturally. External wall insulation and new windows work together because it is best if you make windowsill depths match the insulation and you will use scaffolding at the same time. Perhaps you could also put solar PV on the roof to use the same scaffolding?

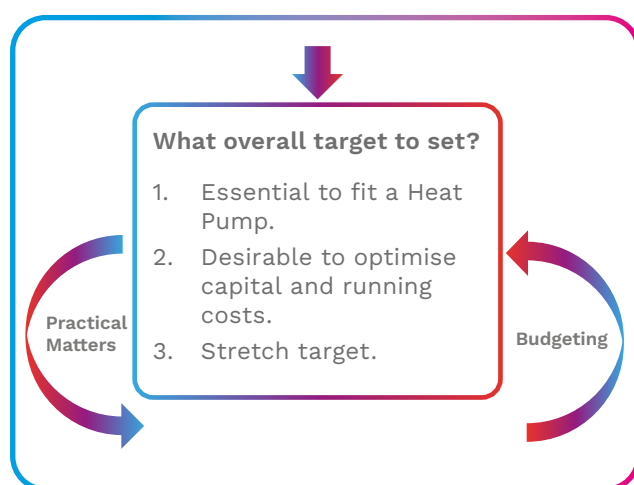
Could you do practical short-term measures now and add the other measures which get you to 'perfect' later?

EXISTING CYCLES OF REPLACEMENT, MAINTENANCE AND SEASONS

There are seasonal, annual and longer cycles that are relevant here too. It is better to do work on the outside of the house in summer when it is dry and there is lots of daylight, but internal work could be done at any time of year. Summer is a good time to sort out the loft as you can put things in the garden while you add the loft insulation.

How old is your boiler? They tend to last between 10 and 15 years before major repair or replacement is needed. Could you be ready to install a heat pump by the time the boiler is ready to be replaced?

Are you planning to renovate the bathroom, redecorate the lounge or refit the kitchen? Now is the time to think if you want to use internal wall insulation, fit new windows and heat recovery ventilation. You will only have to do the decoration and cope with the disruption once.



The factors that should be considered in planning

PRIORITIES AND SHORT-TERM WINS

Think about your priorities. This could be the biggest room or the most often occupied or the one no-one uses in winter because it is always cold or the one you are about to decorate and modernise because you are working from home much more now. Is that going to be your short-term focus? If so, consider if there are any benefits of packaging other work together to save cost and disruption in the long run.

Do you live in an older bungalow? If so, focus on your loft and suspended timber floor first, as these are almost certainly the biggest sources of heat loss (see **Housewarming Guide H2: Insulation**). If the floors are concrete, then the walls are probably next on the list, but if you have large 'picture' windows these will be your next priority so aim for triple glazing (see **Housewarming Guides H2: Insulation and H3: Windows and Doors**).

Are you in a Victorian terraced property? First find out how much of your heat is lost through the windows versus walls. If the windows are still single glazed these will probably be the most important change to make. Do make sure you think about wall insulation at the same time so windowsills can be right first time and decorating afterwards need only be done once.

DETAILED ENERGY SURVEY FOR A BETTER PLAN

Now is the time to start going into more detail on your house. You need to

find out what is losing most heat from your house: the walls, floor, glazing or roof. Is it 'the big single glazed window in the old part' or the 'draughty patio doors fitted to the extension in 1997'? An energy survey will help to establish this and put numbers to the heat loss.



Discrete packages of work

What can be done in separate packages of individual tasks?

Loft insulation is the single most separate type of insulation that can be fitted. This can be done at any time and is also a good DIY task. Do it this summer and you will make immediate savings during the following autumn and winter.

Lifting floorboards and insulating below is also a task largely independent of other work – though if you are going to have internal wall insulation in the same room that is the time to do it because both will make a mess so do them together. You can normally lift floorboards without removing skirting boards, but you will need to ensure you seal around the whole edge of the room to stop draughts.

One room could be a single focus project. You might add

floor insulation, draught proofing and internal wall insulation and replace the windows. This would not impact on the rest of the house.

You could have all your windows upgraded as a package. This is especially a good idea if you cannot (or don't need to) make any changes to the walls, inside or out.

Combinations where there are cost savings.

Replacing windows on the same wall as external wall insulation means only one scaffolding hire and only one set of decorating inside.

Fit solar PV when there is scaffolding on site.

Fit underfloor heating and add heating control zones when you have the floorboards lifted to insulate under a suspended timber floor.

INDICATION OF APPROACHES

Once you have the results of an energy survey you can move to more detailed consideration of the options for your house, your aims, timescales and constraints. The two diagrams below and overleaf show how the route to 'heat pump ready' can be different for different houses: the sizes of bars are approximate. The routes have different opportunities and constraints, but both houses can get to 'heat pump ready' using alternative approaches. They also show an interim solution which falls slightly short of the aim, but the plan is adjusted to reach the goal.

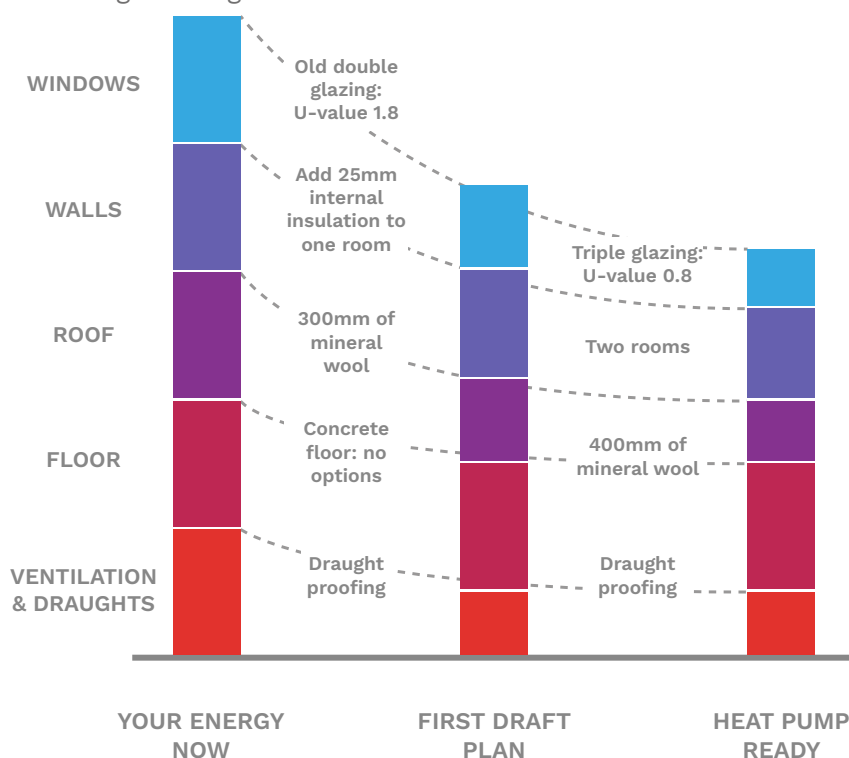
The diagrams also illustrate how improving each part of the fabric could be done stage by stage, so partial gains are made along the way. An energy surveyor should be able to produce these plans for you.

Semi-detached Victorian: this shows how the floor cannot reasonably be improved so reductions in heat loss have to be made elsewhere, for example, the roof and glazing.

Detached 1950s or 1960s house: this shows an alternative approach which is appropriate to this house. The floor is a huge opportunity but the roof has already been improved so little gain can be had.

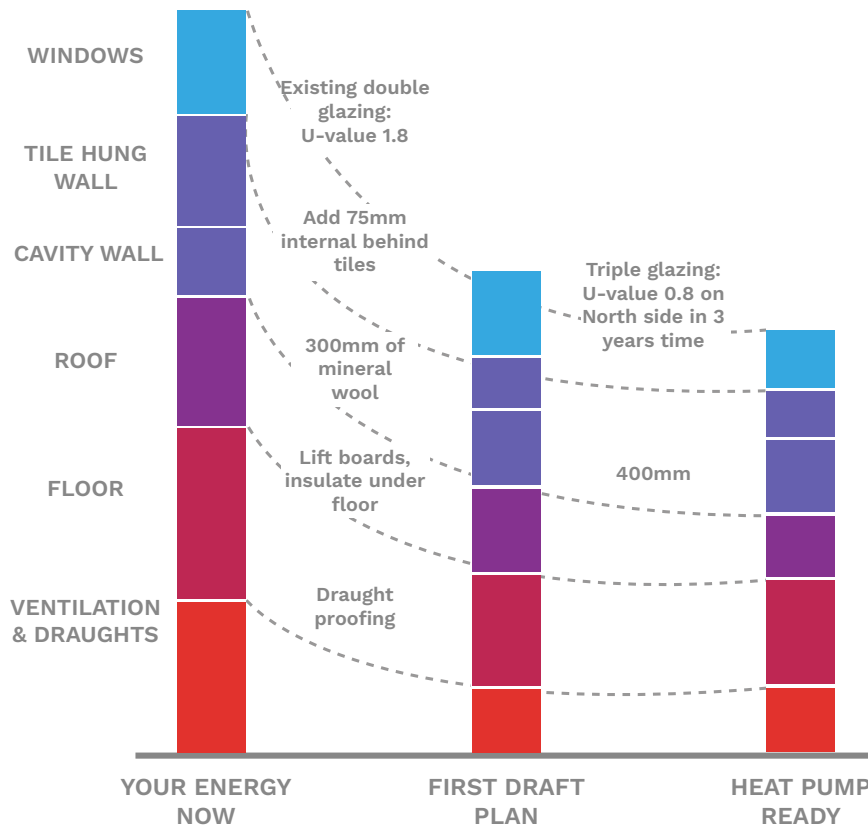
STARTING POINT: SEMI-DETACHED VICTORIAN HOUSE

Semi-detached, Victorian with narrow cavity wall, large old draughty double glazed windows, hardly any loft insulation, solid concrete floors, many holes where old pipes & cables used to go through walls



STARTING POINT: DETACHED 1950s OR 1960s HOUSE

Detached, 1950's or 1960's, with filled ground floor cavity wall, first floor wall is tile-hung over 100mm blockwork, large picture windows 2009 double glazed, 200mm loft insulation, suspended timber floors, 2005 rear extension.



HOW BOLD SHOULD YOU BE?

If you are going to be really bold, would you be happy to invest all your budget in insulation so you don't need a heat pump at all, that is, get to Passivhaus or Enerphitt standard? There is often a perceived risk in aiming for Passivhaus in that people feel it cannot be possible to manage without a central heating system, but there are many houses like this in the UK. Take a look at www.passivhaustrust.org.uk/competitions_and_campaigns/passivhaus-retrofit/

Maybe you could at least invest more in insulation now so the heat pump can be really small and your bills stay relatively low for ever.

You will need to think about the choices you have for your home and will almost certainly go through several iterations to reach a plan. As you get closer to the final retrofit plan, you will need to bring in professionals more and more. In particular, you will need to get tenders for the improvement works you are considering.



Energy Bills, Insulation and Heat Pumps

When you make your house more energy efficient by insulating it and adding draught proofing, you will need less energy to keep it warm. As long as you adjust the controls so you don't accidentally have a warmer house, you will immediately save on your bills. People often ask, 'When gas is cheaper than electricity, why doesn't a heat pump powered by electricity cost a lot more to run than a gas boiler?' There are three things you need to understand about the boiler and the heat pump.

Firstly, a really good boiler is still only about 90% efficient so 10% of the gas you pay for goes straight up the flue. 10,000 kWh of gas at 10.3 p/kWh (Government Cap to March 2023) gives you 9,000 kWh of heat and the energy bill is £1030.

Secondly, a heat pump is like a 'heat multiplier': you put in one unit of electricity and you get about 3 units of heated hot water from an air source heat pump and about 4 from a ground source heat pump. To get 9,000 kWh of heat from an air source heat pump needs 3000 kWh of electricity which at 34p/kWh (Government Cap to March 2023) means the energy bill is £1020. With a ground source heat pump, it would cost £765.

With night-rate electricity and/or if you have solar PV then it gets more complicated but if set up correctly it will probably be cheaper to use the heat pump than a gas boiler.

Thirdly, we are also emphasising that we need to insulate our homes to use less energy whatever means we use to heat it. So if you halve your heat needs you also halve your bill: the bill would be only £510 with a heat pump.

Of course, we are also aiming to help you reduce CO₂e emissions and a heat pump produces much less than a gas boiler.

The cost of energy is likely to keep increasing so the sooner you improve the insulation of your house the better, and the sooner it will pay back. Also, while we cannot predict the relative future cost of gas and electricity, it is likely that the electricity bill you pay if using a heat pump will be about the same for the foreseeable future as using gas through a boiler. However, as natural gas becomes even more scarce its price will probably rise and as the UK installs more low-cost renewable energy the electricity price should stabilise or reduce. Therefore, the cost of running a heat pump should also be under control.

ROLES OF THE PROFESSIONALS

These are some of the types of professionals working in this field. This is an expanded version from our Housewarming Guide H2: Insulation.

We suggest checking for local recommendations.

- **Energy Assessors**

A 'Domestic Energy Assessor' or DEA is specifically qualified to provide an EPC (Energy Performance Certificate), legally required at the time of sale or when a building is to be rented out. They usually spend little time in your property and are unlikely to provide any more advice than the EPC. The cost can be as low as £50. You will need a new EPC once your upgrade work is completed.

You will need to build and keep a portfolio of information about the work you have done as you go along, including photographs. This is so that the DEA has evidence of what has been done when it is finished and it can be counted. Talk to building control and a DEA before you start to know what you need.

- **Surveyors**

A surveyor should be a chartered professional, typically a member of RICS, ICE or CIOB, and should

have wide experience of all building matters from roofs to drains. If they have specific energy experience that would be helpful. Their role can be to provide a survey of the starting point of your building including any maintenance needs. They should be able to correctly identify the type of walls you have and comment on specific risks of improving your home. A full survey can cost in the region of £500 to a few thousand, depending on how much detail is investigated. For example, do you include woodworm, rot, damp, drainage? This would be the sort of survey you should commission before buying a house.

Some surveyors may have access to and be qualified to carry out energy modelling of your house to help select the mix of insulation that meets your aims.

- **Architects / Draughtsmen**

When you are required to provide drawings as part of the specification of work you want done, architects or draughtsmen can do this. They will probably be able to apply for planning permission or building regulations approval on your behalf. An architect may not be the right person for a simple set of drawings and specification for a simple wall insulation, but if you are planning

other refurbishment and/or reorganising the building then they may be more appropriate.

You will need to specify that you are aiming for more than just a better EPC rating. Specify that you want a house that achieves the low energy bills you set out in your aims. Otherwise, you may get an 'industry-standard' set of suggestions.

- **Project Manager**

If the work is part of a larger overall plan including, for example, new windows and wall insulation, the work needing to be managed is interconnected. You may wish to employ an independent project manager to ensure all runs smoothly.

If you employed an architect, they may be willing and able to take on this role. If you are instructing a builder to undertake all the work, then it should be part of their responsibility.

- **Builders and other contractors**

Builders will install what you have specified. A building firm may have all the above professionals 'under one roof' and so may be able to take on the whole set of tasks from survey to handover. Alternatively, you may wish to consult independent professionals at the survey and specification stage and ask for quotes for the work from a few builders.

There are some specialist contractors who provide specific energy efficiency works. These may be highly relevant if, for example, you are interested in just external wall insulation. It is recommended

that the earlier survey work is carried out independently but then quotes should be obtained from a few specialists.

- **Retrofit Coordinators**

There is a new group of people termed Retrofit Coordinators coming to this field; they are essentially project managers. They are the result of the development of a standard 'PAS 2035' intended to ensure a consistent high level of quality is achieved in energy retrofits. PAS 2035 also defines roles for: Retrofit Advisor; Retrofit Assessor; Retrofit Designer; Retrofit Evaluator and Retrofit Installer. Some or all of these people may be qualified to carry out energy modelling.

- **Complete Retrofit Service Organisations**

There are private organisations that can bring all of this together and provide a 'one-stop-shop' for survey, design, tendering and installation. Many are companies that provide sustainable building support services alongside other construction related services.

Examples include: Eco Design Consultants, Enhabit (part of Green Building Store), CL-PM and Ltd.

QUALITY ASSURANCE

There is currently no overall scheme in the UK to check the design, the quality of the materials you choose, or the installers you select. An outline of a scheme is being developed under a draft document referred to as PAS 2035/2030 but this has not yet gone through the full rigour of an international or European standard.

Tendering and getting into contract with installers is going to be a pinch point.

Always make sure that you have a copy of the insurance certificates from your

chosen suppliers at the time of getting quotes and this is essential before work starts. Ask for warranties from them and on the materials and make sure you receive the certification before final payments.

Make sure you obtain references and see recent work that your chosen installers have completed where possible. Have a signed contract in place before you start and make sure that there is a clause that covers remedial work, should you later find a problem. Never pay the whole, or a significant proportion, of the bill up front.



There are private organisations that provide a 'one-stop-shop' for survey, design, tendering and installation

NEXT STEPS

Now is the time to get some professional advice. You need to have an energy survey carried out to:

- Confirm what you have noted above about the building.
- Refine your ideas about what specifically could be done to improve it.
- Calculate U-values for all the fabric elements and build up a total to estimate a peak heat load.
- Compare this to your heating system performance, annual and monthly energy consumption.
- Help you define a full specification of the works required.

You could consider getting an air test if you believe your house is draughty. This would help find draughts as well as get a test result.

REVIEW OF RESULTS

If you have had a full energy survey (not just an EPC), or a good architect or M&E consultant has been involved, then you should now have a clear idea of how the building's heat loss can be reduced to be heat pump ready.

These professionals should also be able to give an indication from their recent experience of how much the suggested improvements might cost.

Now you can go back to your budget and list of probable work, constraints and plans and make adjustments. Then you can think about getting quotes for the work that fits your plans and budget.

GETTING QUOTES

You should have professional help if you are at all uncertain about how to get and manage quotes from suppliers and installers. You need to be clear about what exactly you are asking them to do and who is responsible for side issues such as bringing general materials in and removing waste, who hires scaffolding, what happens if they make unexpected discoveries, and so on.

A professional such as a construction project manager, architect or M&E consultant should have the right experience to advise you on this.

You will also need to find a suitable 'long list' of companies to ask so that you get at least 3 quotes back to compare.

Once you have quotes you need to decide which is best. Professional advice is also extremely valuable at this stage, so you don't fall into any 'elephant traps'.

MANAGING THE WORK

Depending on the scale of the retrofit project and whether you have experience in these matters, you should probably employ a project manager to ensure the works are carried out professionally, to time and cost.

BASIC CONTRACTS

There are two standard forms of contract that are commonly used for small amounts of building work.

These are:

JCT: www.jctltd.co.uk/category/contract-families

RIBA: www.architecture.com/digital-practice-tools/riba-contracts

It is in your interest to have a contract in place and these examples have been developed to suit the scale of works you are likely to require.



We suggest checking for local professionals who come recommended.

SUMMARY

CRITICAL QUESTIONS TO ASK

What is your baseline? How much energy do you use, and how was your house constructed? The answers to these questions help define your starting point in terms of total energy use and why your house uses it. They are the basis for the improvements you can make.

An energy professional can use this information to see where the energy is going and then suggest specific improvements to reduce it.

What level of energy and carbon emissions do you want to aim for when all the work is completed? Now you have set an end point aim.

What is the capacity of the electrical connection to your house and the fuse board (consumer unit) within it? An electrician with experience of heat pumps could answer this question. Think about any other electrical work you might eventually need done, for example, solar PV or an electric vehicle charge point, before you upgrade your connection. This is to make sure you future-proof your connection capacity.

What is your total budget? Would it help if it were split into sums that can be invested in phases of work over several years?

Where might you put a heat pump and appropriate hot water tank?

MOST IMPORTANT DECISIONS TO MAKE

Develop a draft plan for what you want done with timescales, approximate budgets and questions you do not have answers to yet.

Consider the trade-offs in investment now versus energy bills later.

See if you can match the improvement work with other cycles of maintenance and repair, for example, when will your boiler reach 10 years old? If it needs replacing at that time is this the obvious moment to replace it with a heat pump?

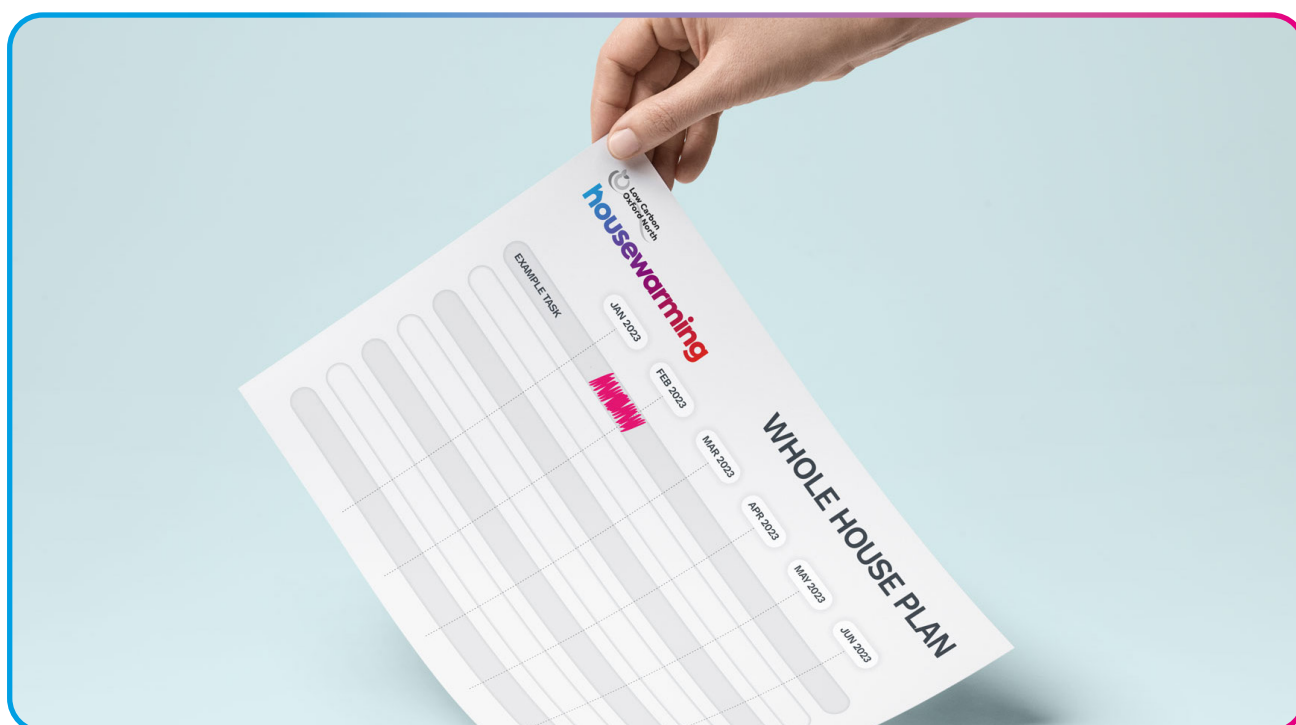
Talk to a few professionals with experience of energy upgrades and, ideally, of work in your local area.

Rank the options you are considering and establish your priorities. Have another look at the other Housewarming Guides to help you.

How much of the management of the process do you feel confident you can do yourself? How much would you rather delegate to a professional?

Start to discuss the works with a number of alternative professionals and refine your plan.

You are now at the point where it is most beneficial to finalise your specification of works and get quotes for the work. Finding potential contractors is not simple and is probably best done with the help of professionals with recent experience of this type of work.



Develop a whole house draft plan with timescales.

A TEMPLATE FOR ACTIONS

We have prepared this template for you to use for working through some of the above questions and choices. You may not reach a completed plan by the end but you will have a much better idea of what to discuss with the professionals.

INITIAL DATA

The first **Housewarming Guide H1: Taking Stock** contained a short survey form for you to complete. Fill in all of this as the starting point.

Next, make sure you either have a valid EPC or, better still, a new energy survey. This will tell you what the building is made of and thus the typical U-values of the fabric.

From the above find out your monthly energy consumption profile and have someone calculate the likely peak heat load for the building.

Look at the floor plan of your house. Mark the rooms big enough to have, say, 100mm of internal wall insulation without feeling too small afterwards. What about 75mm?

Are you in a conservation area or is the building listed? If so, then you need talk to the planning department soon and discuss what might be allowed. Take

some photos of your house so you can discuss what it looks like now compared to what might change.

This defines the energy situation now and it is important to have all of this in one place.

YOUR CIRCUMSTANCES, PLANS AND CONSTRAINTS

Write down your overall plans for your house for the next 3 to 5 years. It might simply be 'to stay here'. Consider whether you will be extending or are planning a major refurbishment of the kitchen or bathroom or any decoration. Note important family events such as children's GCSEs, or a retirement date. Sketch a quarterly calendar with this on it.

Now put together an indicative budget. Also consider other household income and expenditure plans: will you be replacing a car with a full electric one in the next few years? Might you draw down a lump sum from a pension when you retire?

From your initial data, what is your heating bill now? What would half of that be, plus inflation, and how much are you willing to invest to save that amount

each year? For example, if your bill is £2,000 per year, would you be willing to invest £20,000 to save £1,000 per year every year into the future? That gives an equivalent return of 5% per year (plus inflation, but less any interest or dividend you might otherwise have gained).

IMMEDIATE OPPORTUNITIES

What is the condition of your windows? How old is the boiler and the rest of the central heating system? What might you need to spend in the next few years on maintenance of the house?

Before you ask for quotes for any of this, start to put any replacement or repair items into your overall plan and consider how the maintenance costs could be part of the energy improvement budget.

What is the state of insulation in your loft? Could you empty it and lay 400mm of mineral wool plus loft legs and a floor this summer (see **Housewarming Guide H2: Insulation**)?

DISCLAIMER

This guidance document is written with the intention of providing a better basis for home owners to decide how to reduce the energy consumption and carbon emissions of their homes.

We have not surveyed your home and so the suggestions and discussions in this document can only be a general guide and LCON and its consultants cannot be held responsible for or accept any liability for damage, failures or disputes which result from the use of this document.

We recommend that specific decisions are made only after a suitable survey by an appropriately qualified specialist.

We recommend gaining several quotes for work from a number of suppliers and suitably qualified and experienced companies with appropriate insurance.

It is essential to follow material manufacturer's instructions and specification sheets to avoid risks of damage to structure and property and to ensure the intended performance is achieved. We recommend the use of only those products with appropriate independent certification for the intended use e.g a BBA (British Board of Agreement) certificate.

We recommend appropriate contracts are used and signed by all parties before work is undertaken and suitable legal advice should be sought.

CREDITS

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The Housewarming series has been created for Low Carbon Oxford North by Jane Grindey, written by Tony Duffin of Corrie Energy and supported by Dr. Brenda Boardman.

A LIST OF PROBABLE WORK



You should now have an idea of the sort of things you might do to reduce your energy consumption to move towards heat pump readiness. You should now be able to answer the following questions which are the main ones to get your plan underway.

- Do I own my house or am I a tenant? If tenant, speak to council and landlord
- How old are my windows? Single / double glazed? Age: SG / DG
- Do my windows need replacing? Yes / No
- Do I need permission to do this? Yes / No
- Which might I replace soon? List them here and mark them on the floorplan

- What are my walls made of? Solid 9 inch brick / narrow cavity brick /
cavity wall / filled cavity wall / other
- Can I have external wall insulation fitted? Yes / No
- Can I fit 100mm internal wall insulation? Yes / No
- In which rooms do I want to do this? List them here and mark them on the floorplan

- Does the house have a loft? Yes / No / Partial
- How much loft insulation do I have? mm of mineral wool
- Or mm of foam insulation.
- Has the house been extended and do I have drawings? Yes / No
 (If no, can you get hold of them via the council planning portal or from the original architect?)

- What type of floor do I have? Solid concrete /
suspended timber with ventilation
- If suspended timber, has it been insulated and draught proofed? Yes / No / Don't know
- What is my view of draughts in the house?
(refer to the **Housewarming Guide H4: Draughts and Ventilation**)



- Do I have a hot water ('immersion') tank? Yes / No
- If no, where could I put one? Note here:

Any other notes:

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