Eco Refubrishment

A guide to preparing for your eco refurbishment project

2030 Architects

A Quick Guide to Eco–refurbishment

What are the fundamentals? This non-technical guide identifies the main issues to consider and suggests ways for you to plan the upgrading of your property.

The aim of eco-refurbishment is to make your existing building, whether it be a house or workplace, more healthy and comfortable whilst also reducing its energy consumption and overall environmental impact. By using appropriate materials, technology and construction methods, refurbishment can improve the internal environment whilst taking advantage of the qualities of the existing building for the future. Recycling at its best!

In addition existing buildings can be made more resilient to climate extremes of wind, rain and temperature. Perhaps more important in Cumbria than many other parts of the UK!
What does this mean in practice? We have put together a simple guide to help building owners understand the principles that should be adopted and to point out some of the pitfalls that can occur. First of all though, what are we dealing with?

- Homes and non-residential buildings (commercial and public) are responsible for 38% of total UK greenhouse gas emissions due to energy consumption, so we should make a serious effort to improve their energy efficiency!
- 8.6million (39% of all) homes were built before 1945, including 4.5million built before 1919. Most of these properties have solid walls and many will have very poor thermal performance so this is where the priority should lie. Building a new energy efficient/ zero carbon building or extension is relatively easy by comparison!

The thermal image illustrates the success in fitting external wall insulation on the central building in the terrace. Much less heat escaping, so more comfortable, cheaper to run, and healthier to live in.

Your Project: Moisture and Renovation

One crucial thing to be aware of in Traditional (Solid Wall) Construction compared with Modern (Cavity) Construction. MOISTURE!
There is a significant difference in dealing with traditional (i.e. solid wall construction whether stone, brick or mud) and more modern masonry cavity or frame constructions. One of the main issues to consider, is how to deal with moisture both external and internal. Traditional buildings did not have to cope with the same internal humidity environment that we now create in our homes and workplaces, by cooking, bathing, washing etc. Also a conversion of a traditional building may have a new use for which it was not originally designed and the issues of moisture control will become more critical.

Increased internal humidity raises the risk of condensation within the structure (interstitial condensation), which can cause mould or decay if left untreated. This problem can be caused by the inappropriate application of insulation, inappropriate ventilation strategies, inadequate heating or a lack of integration between different aspects of a refurbishment/ conversion.

The main source of water vapour in buildings is from people themselves through breathing and perspiration, and also their activities (e.g. washing and drying clothes). Most habitable traditional buildings originally used lime mortar and renders in their construction, which allow a certain amount of water vapour to safely pass through the structure without causing damage. This capacity for dealing with moisture is termed “breathability” and allows traditional buildings to deal with moisture in a way that most modern building materials do not, However most traditional buildings are very poorly insulated by modern building standards which means that walls and other fabric are much colder, encouraging condensation and potential mould growth. A good target to aim for is around 50-55% Relative Humidity.

High, unregulated ventilation rates are also associated with traditional buildings often causing draughts but also helping to maintain appropriate levels of indoor humidity and air quality. If the ‘holes’ in the building fabric are blocked without an alternative ventilation system being incorporated, the changes can have significant effects upon human health; think of mould growth, dust mites and bacteria for instance.

Your Project: Moisture and Renovation

Humidity levels can be drastically altered through the inappropriate application of draught proofing, insulation or the application of less vapour permeable materials such as cement renders to traditional building structures, and therefore careful consideration of the movement of air and moisture is required.

The issues of indoor humidity, interstitial condensation and ventilation also apply to more modern constructions but require a slightly different approach.

For all eco-refurbishment the most fundamental principle is that of looking at the whole building rather than one feature in particular. Don't concentrate on the heating system if the building is leaky and draughty! Don't put loads of insulation in a loft space if the walls are uninsulated and windows single-glazed and expect it to slash the energy bills Consider the entire fabric of the building in relation to the insulation, heating, ventilation, lighting, appliances and control strategies. You should also look for any opportunities to alter and/or repair the existing structure to improve functionality, comfort and reduce running costs in order to ultimately reduce the demand for fossil fuels. It is essential to assess the opportunities for a refurbishment at pre design stage so that priorities can be established to inform the subsequent design.

Issues to consider

1. INCREASE INSULATION
Increase the insulation for the external envelope of the building, i.e. walls, floors roofs, windows and doors. Insulation is relatively cheap and once fixed in the building to the correct specification will provide a long term solution, requiring less energy to maintain comfort levels within the building.

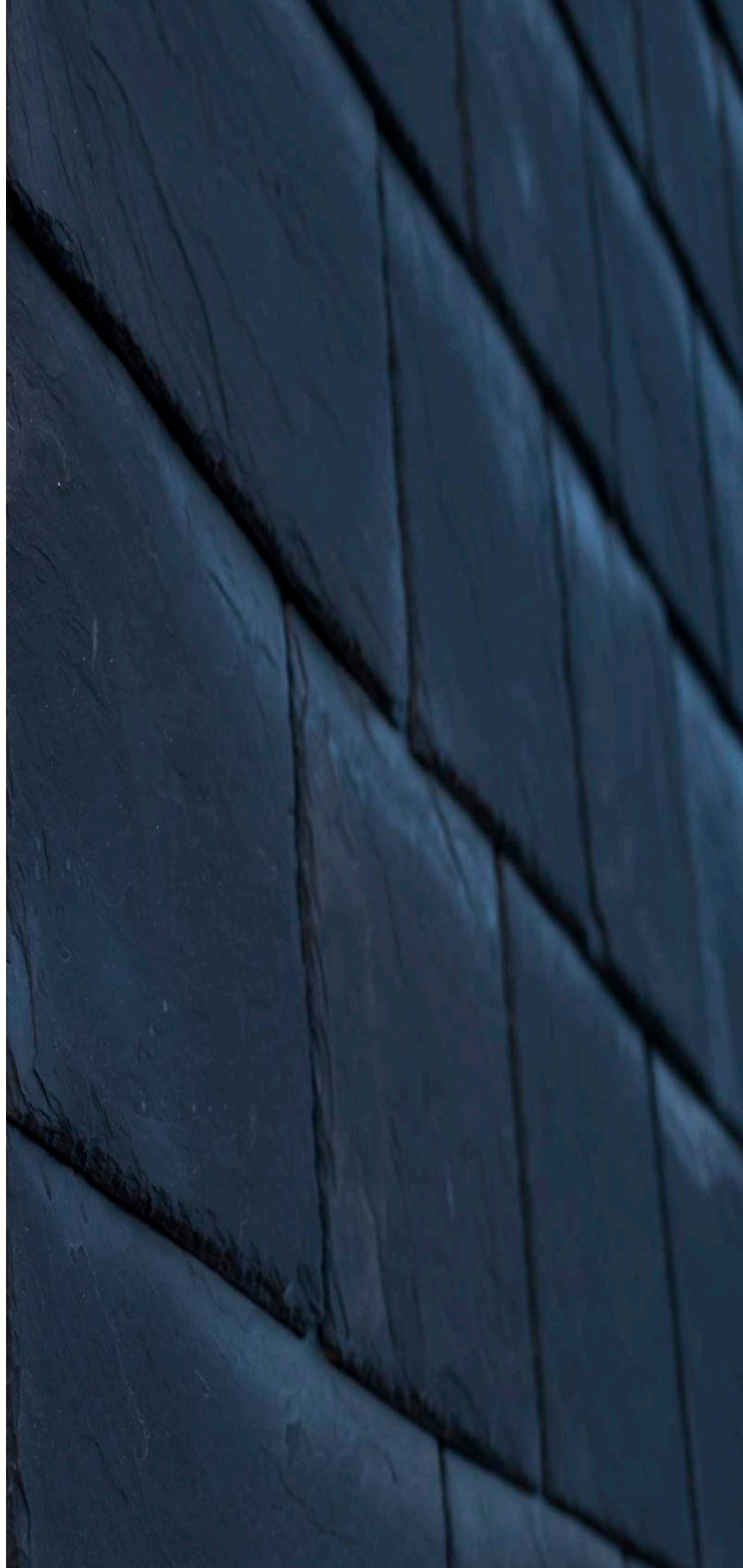
Issues to consider

There are many insulation materials available and it is important to understand the effect they may have upon the fabric of a building particularly in relation to moisture control.
TOP TIP Choose internal insulation to solid walls carefully, consider the vapour permeability of the structure to avoid future problems.

2. INCREASE AIRTIGHTNESS
There is not much point in adding insulation to a building if there are gaps under doors, around windows or through floor boards, so it is essential that the building is made as airtight as possible whilst at the same time providing adequate ventilation (see 3). Use of specialist airtight membranes and tapes are now a feature of effective refurbishment. Existing buildings are often more airtight than you might think. Simple draught-proofing measures to remedy small defects can have a dramatic effect upon comfort and reduce heating costs.
TOP TIP Have an airtightness test to understand how well your building performs before embarking on expensive design solutions.

3 VENTILATE RIGHT
Having made a building airtight, ventilating correctly is important and can be much more easily controlled. You can ensure that the ventilation is reaching the appropriate places at the right time. This can be achieved by simple mechanical extract combined with controlled sources of fresh air, more sophisticated whole building heat recovery ventilation, or natural passive ventilation installations which rely on wind pressure and the background movement of warm air without using power. Pressure testing your building during construction is an essential tool in achieving the correct performance.
TOP TIP If considering mechanical heat recovery ventilation ensure that airtightness is very good and insulation levels high.

4 APPROPRIATE HEATING and HOT WATER SYSTEMS
Having reduced the overall heat demand through measures 1, 2 and 3 it is now time to assess what the actual heat demand is for the building. This needs to take into account how the building is used. Is it a home occupied all day by a family or pensioners?



Issues to consider

Is it a workplace with regular hours during the week? Is it a community building that doesn't have a fixed pattern of use? The location of the building also has an effect upon the heating system. Is natural gas (mains) available? If not then electricity, oil, LPG and wood fuel (biomass) are the main options. Are there any renewable energy sources available on the site? This can make a contribution to the heating source or hot water production and needs to be considered when assessing the heating system (see 8).
TOP TIP Use building energy modelling to assess the options for heating systems

5 CONTROL SYSTEMS
When refurbishing or replacing energy sources for a building, consider how best to manage that energy. Intelligent controls are available for most heating systems that optimise the building's energy usage with the energy demand in relation to the weather. Zone controls can ensure that heat or light is only used where necessary. Monitoring of energy use is an essential tool in managing energy use. If you identify what consumes the most energy, you can upgrade, replace or alter the usage to save energy. Many modern control systems have interfaces with smart phones or computers to allow easy real time monitoring.
TOP TIP Use real time energy monitoring to help achieve the design performance of the building

6 LIGHTING
A revolution in lighting energy efficiency has occurred in the last 5 years with LED (light emitting diode) lights. LEDs are now far more available both as replacement bulbs to existing lights and as light fittings in their own right. LED lights are up to 10 times more efficient than old tungsten bulbs and 4-5 times more efficient than fluorescent tubes. Be aware however that like the more familiar low voltage lights, LED lights need transformers (called drivers) as they also operate at 12V. Often these transformers can be quite large and require ingenuity in concealing them!

Issues to consider

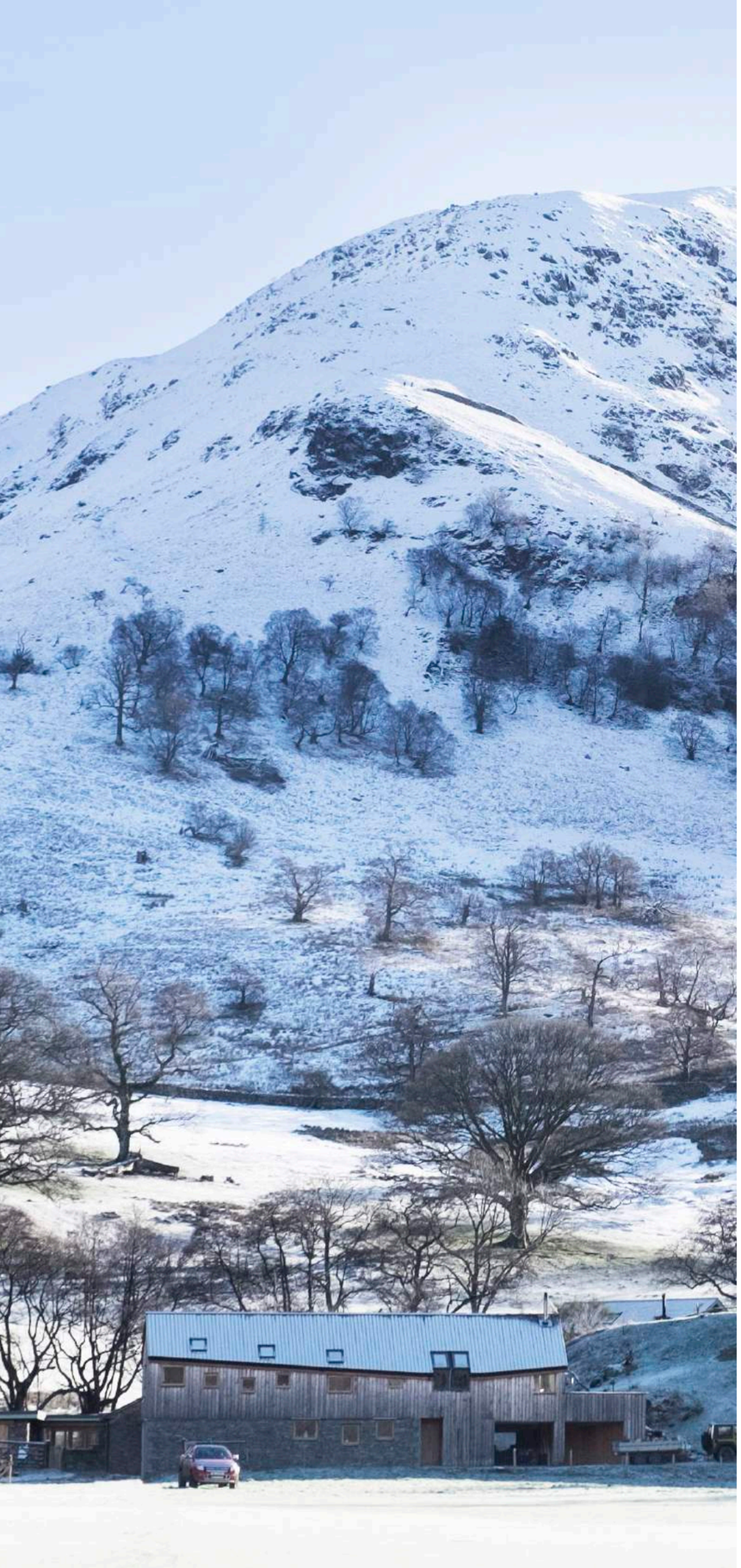
If you want free lighting then use daylight! This is a much-underused resource but it has a significant effect upon the health and wellbeing of building users. If rooflights can be added as part of a refurbishment light levels can be significantly improved as rooflights are up to 4 times more effective than the equivalent sized vertical window in a wall.
TOP TIP Don't forget to use daylight to best advantage.

7 APPLIANCES
Having done everything else its now time to make sure that electricity demand is as low as it can be by using A+ or A+++ rated appliances and ensuring products with standby modes are either switched off or have very low energy demand.
TOP TIP Research appliances carefully to match them with your requirements.

Once you have set targets for items 1-7, you can assess what renewable energy options may contribute. Depending upon your location Solar Photo Voltaic panels (PVs) are likely to be the easiest bolt-on, virtually maintenance-free solution. Wind turbines or small scale hydro-electric generation may also be possible but unless you are in a rural location it is usually not worth considering these options.

A heat pump can use electricity in conjunction with ambient heat from the environment. This can be a ground source heat pump with a long pipe buried in the ground or in deep boreholes, or it could be an air source heat pump extracting heat from the air. The benefit is that for every (kW) of electrical energy consumed by the heat pump up to 2 - 4 kW is provided as useful heat. When combined with a renewable source of electricity this can provide an effectively zero-carbon system.

Wood fuel or biomass may also be a solution or part solution depending upon the amount of space you have for storing fuel, and whether you want to the ease of using pellets, or chips or perhaps the labour of managing a log boiler.



Issues to consider

Biomass and heat pump solutions are currently supported by the Renewable Heat Incentive (RHI), which pays a tariff for every kW of heat created by the system meaning that most installations can be paid for in 5-7 years providing the installation has been installed according to certain government criteria. Government policy is changing fast so check current tariff payments before considering a system. Up to date information can be found on Yougen's website: www.yougen.co.uk

9 SPACE
At the end of the day if you are spending money refurbishing a building consider how the internal environment can be improved or made more flexible for the future. Small alterations can have big effects and if considered as part of the overall retrofit solution you will achieve the best value results. Repair and maintenance tasks should be incorporated into the refurbishment to protect the fabric of the building.
TOP TIP Always look at the whole building to get the best out of your project.

10 ENVIRONMENT
Finally, having concentrated on creating a more comfortable and healthy internal environment, consider the impact of the actual construction materials of your building.

As a rule of thumb, the energy used in the occupation of an average building over say 50 years will be 30-40 times that of the energy embodied in the fabric. As overall energy consumption is reduced, the relative environmental impact of the materials selected will increase. Also consider the potential harmful effects of synthetic products such as formaldehyde off gassing from glues and resins used in carpet/plywood/ or the use of paints with volatile compounds.

Choosing sustainable building products also contributes to a smaller carbon 'footprint'. This can be achieved by choosing materials that use less energy to manufacture (e.g. wood compared to steel or concrete), or sourcing materials and products that have been manufactured locally.

Issues to consider

Generally, natural materials have lower embodied energy than manufactured ones. Materials need to be evaluated carefully for their function and environmental impact and used appropriately for the particular project. For instance glass is an extremely energy intensive product to make and so should be used to maximum effect.
Where possible, it is also worth considering how materials, services and equipment can be re–used in the future or how they can allow for future changes in the building. For example, materials such as timber floors with a high inherent value could be fixed using screws rather than glued in place to allow for easy replacement, re-use or repair.
TOP TIP Don't compromise upon the performance of materials but choose carefully.

Your design project, going forward....

Now that you have been introduced to the fundamentals, you will be more aware of the interrelationship of the issues when discussing a design with an architect or contractor. Remember, every refurbishment project is different, and will have different priorities, but always try and integrate all of the aspects we have discussed to achieve the greatest benefit for yourselves and the planet.

Whatever project you have in mind, we hope this guide has helped you to imagine what's possible with an eco-refurbishment. If you would like help in developing a strategic brief and considering the options for your project we offer a low cost * Needs and Options Appraisal Meeting from which we develop a detailed strategic brief based upon a site visit and discussions with your selves. To book an appointment just give us a call or drop us an email:

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* N+O Appraisal rate 2019 £400 + VAT

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