












Retrofit of 19th century house with eco-redevelopment of outbuildings & new-build extension



Overview

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| Age/Period: | circa 1850 (house dates back to various periods including Georgian and pre-Georgian but was finally 'reworked' in the Victorian era) |
| Type: | 19th century detached with eco-redevelopments & extension |
| Years in residence: | 13 |
| No. Bedrooms: | 4+2+4 |
| Wall type: | Solid wall to original house, insulated cavity walls to redeveloped outbuilding and green oak frame with insulated cavity walls to new extension |
| Area: | Larkhall |

Key Features

-  Internal solid wall insulation
-  Working shutters
-  Draught-proofing
-  Behavioural change
-  4 wood burners
-  Passive solar design
-  Solar PV and thermal
-  Energy efficient appliances and lighting
-  Reuse of materials onsite
-  Multigenerational living
-  Rainwater harvesting

Introduction

The house is owned jointly by Bernardo Mori, his wife and her parents.

The two families wanted to find a property that they could renovate / extend to ensure it was as eco-friendly as they could afford and create two independent but interlinked living units. This would allow the three generations of the family (grandparents, parents, and children) to live together for mutual support, while maintaining their privacy and independence. The design of the house has been carefully thought out to allow flexibility of living arrangements to accommodate many current and future possible scenarios. This 'social sustainability' aspect of the project was a key driver for the families.

By joining Bernardo Mori's knowledge of eco construction as an architect (he runs his own Bath based architectural practice Mori Architects) and his father-in-law Digger Harris's expertise as an engineer and project manager, they carried out the works as a self-build project. Environmental performance was central to the design. One of the challenges with making the property energy efficient was ensuring that the old side of the house could be upgraded without destroying its aesthetics.

"We wanted to bring our home into the 21st century without losing its charm and character. To make it as sustainable as possible and financially viable, the aim was to use first and foremost low-tech solutions (like insulation and passive solar design), with the eco technologies as additional features."



Features

Insulation

The existing 400mm Bath stone walls have been insulated using 4 different technologies:

- 75mm modern polyurethane insulation
- 80mm hemp and lime
- 80mm cork and lime
- 80mm wood fibre

Bernardo was keen to experiment with different types of internal wall insulation to understand the advantages and disadvantages of each of the materials, out of professional interest, and to be able to better advise others. The polyurethane provides the best insulation but is difficult to install correctly and it's non-breathable unlike the other 3 products tried. Bernardo currently prefers wood fibre faced with lime plaster as it requires relatively little expertise to install and has led to a 75% reduction in heat loss on these traditionally built solid walls. Careful design of internal wall insulation is important to reduce the risk of damage to walls from interstitial condensation.

All the floors have been insulated, both external and internal using a variety of insulation:

- Mineral wool
- Recycled jeans
- Jute

Draughtproofing

The property is extensively draughtproofed by Bernardo using a variety of materials. It also has working shutters which help retain heat on cold evenings.

Energy efficient boiler, under-floor heating and wood stoves

Energy efficient gas condensing boilers, with insulated thermal store tanks which allow heat input from other sources of heating (e.g., solar water heating), supplies the radiators in the old house, and under-floor heating in the new areas. Four wood burning stoves are fed by wood harvested locally (including from the garden of the property), but the family have cut back their use in recent years because of concerns over air pollution.

Solar PV and solar thermal water heating

A set of 20 evacuated solar thermal tubes provide free hot water and halves hot water energy consumption. The south facing roof of the new oak frame extension was fitted with a 2.2 kWp black photovoltaic array with an estimated annual production of 1900 kWh. As these were going to be in a more prominent position than the solar thermal tubes, the owners opted for black rather than blue/silver panels, in order to reduce their visual

impact on the low slate roof.

New-build green oak frame extension

The new extension has a traditional green oak frame, with the wood sourced from France. Local tradesmen and artisans were used in the construction to ensure economic sustainability. From the demolition of the derelict outbuildings, the owners carefully set aside stone and many other construction materials which were reused in the new-build, in order to minimise the requirement to import new materials.

The glazing in the extension was designed to maximise passive solar gain in the winter and provide cross-ventilation to reduce overheating in the summer.

Traditional eco design

The house has various 'traditional eco design' features. The main entrances all have insulated draught lobbies which minimise heat loss when entering the house. On the north side of the extension, there is a thermally separated cold store (a proper traditional larder). This space, together with the large naturally cool cellar, provide storage for food at perfect temperatures, minimising the use of refrigeration.

"Actually, many of the ways people used to design buildings were intrinsically 'eco' – like cold food stores – which we've tried to replicate."

Other measures

- Water for the vegetable garden is provided by a well, fed by rainwater harvested from the roofs of the house
- The house has carefully designed utility rooms with hanging drying racks to allow natural clothes drying
- Electric ducting has been laid across the drive for EV charging in anticipation of the eventual purchase of an EV
- Heating times have been reduced and jumpers worn more often during the energy crisis
- 3 cars are shared between the 2 families reducing the need for cars

Impact

The measures, particularly the internal wall insulation has led to the north side of the house consuming (14,000kWh/year for 250m²) under half the gas of historic home in Bath of equivalent similar design and size.

Contacts

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