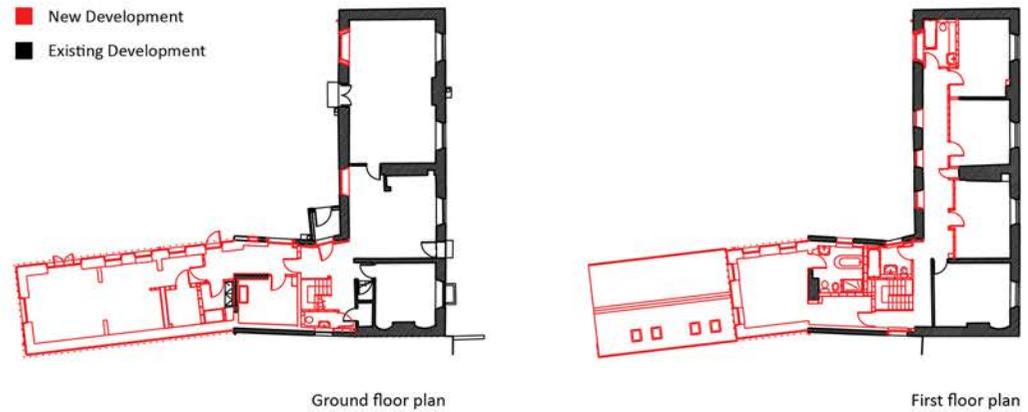
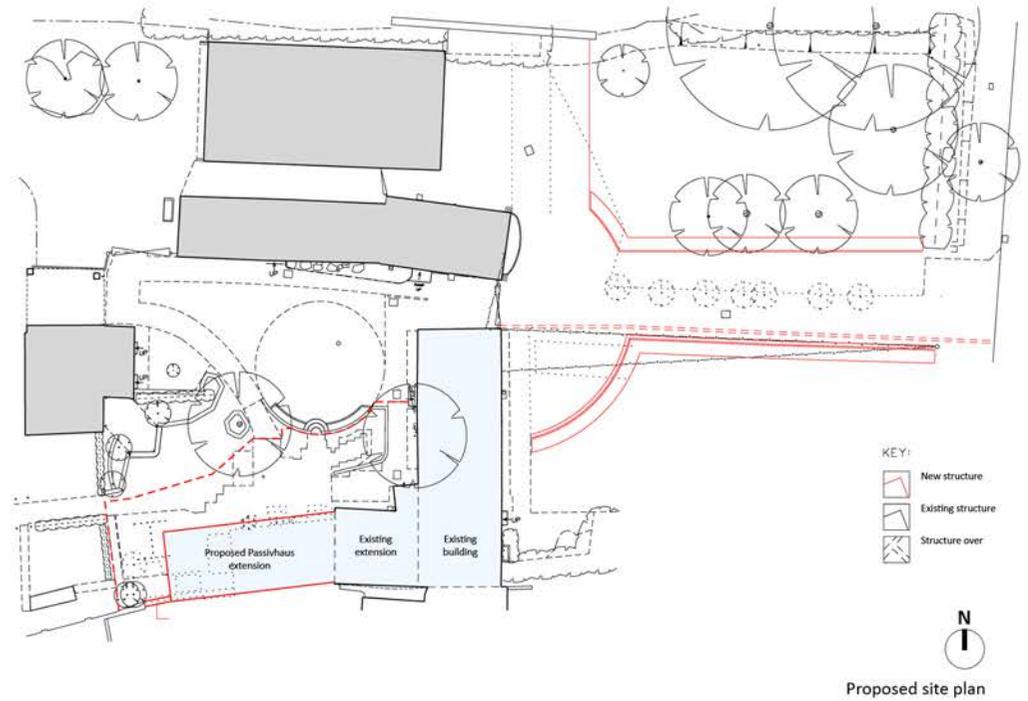


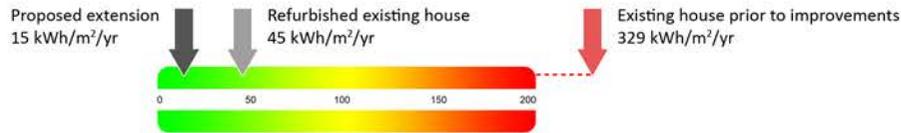
## Eco-Refurbishment with Passivhaus extension - Rugby, UK

This project comprises the eco-refurbishment of an existing old farm house with the addition of a proposed new extension. The refurbishment will vastly improve the thermal performance of the current building, while the new extension will be designed to the Passivhaus standard; a very high standard of thermal performance that utilises passive strategies, and minimises heat loss and uncontrolled air movement, to greatly reduce primary energy use.



The building sits to the left of the site with an annex and various barns and shelters grouped around a closed courtyard. The main and original building (date stone 1775) is a grade II listed 2-storey building constructed from coursed square ironstone and slate, with a brick and slate extension added much later. The original windows are timber frame single glazing with internally integrated shutters.

The proposed extension has been designed to replicate and reflect the traditional style of the existing surrounding buildings. It creates a welcome addition to the courtyard and transforms the existing house into a much larger and more family-orientated home. An extended kitchen and dining area, and additional facilities, offer improved versatility in the use of space.



**Building form & passive solar design**

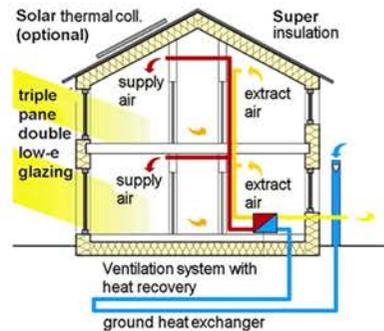
The proposed extension is simple in form to reduce surface area, with windows orientated towards the south where possible to utilise solar energy, to provide some of the space heating and lighting required in buildings and to assist natural ventilation. It differs from renewable energy producing technologies in that it aims from the outset to avoid the need for some of the conventional energy used in buildings.

**Ventilation**

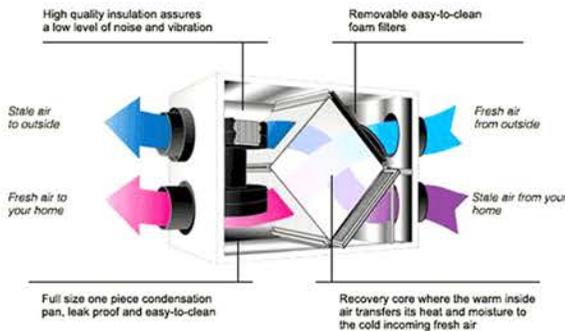
A mechanical ventilation system with heat recovery with an efficiency rate of over 80% will be installed in the new extension to maintain high air quality at a change rate of 0.4/hr.

**Space heating**

The new extension makes use of passive solar gain, body heat, and other internal sources such as lighting and appliance waste-heat. This means that a conventional heating system is not necessary.



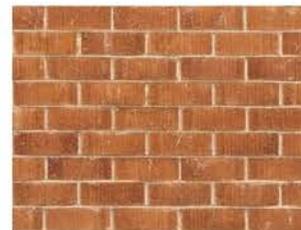
Mechanical ventilation system



Heat recovery unit



Welsh slate



Red brick - New and reclaimed



Sheepswool insulation

**Reclaimed Welsh slate & brickwork**

The slate and brickwork reclaimed from the demolished part of the existing building will be re-used for the roof and walls of the new extension. Re-using existing on-site materials is the most sustainable form of construction, as it prevents the production of new materials and its inevitable embodied energy.

**Air tightness**

Reducing the amount of uncontrolled air passing through the structure of the new extension (<0.4 1/h) via air tight construction will help to minimise heat loss through the building fabric. Sealing fireplaces and replacing existing, poor thermally-performing windows will help to reduce uncontrolled air passing through the existing structure.

**Super insulation**

Both the new extension and parts of the existing building will employ high levels of sheepswool insulation to reduce heat loss through walls, roof and floor (U-value of new extension 0.1 - 0.15 W/m²K).

**Advanced windows**

Triple-pane insulated glazing with air seals and thermally broken timber window frames (U-value 0.85 - 0.70 W/m²K for entire window including frame) will be installed in the new extension and will replace some of the existing windows.

**Thermal mass**

Internal thermal mass is incorporated to reduce summer peak temperatures, maintain stable winter temperatures, and prevent possible over-heating in spring or autumn before normal solar shading becomes effective.

**Lighting and electrical appliances**

To minimise the total energy consumption and reduce the amount of waste energy produced, low-energy lighting (such as LED or compact fluorescent lamps) and high-efficiency electrical appliances (A++ rating) will be used.

**Sustainable materials**

Use of environmentally friendly materials such as timber, natural stone and sheepswool minimises the impact on the environment and helps to reduce the CO<sub>2</sub> emissions resulting from construction as much as possible.



Timber-frame windows



A-rated appliances