

Clonskeagh Retrofit E1 to B2 Transformation

From cold and costly to warm, efficient and future-ready



Picture 1: The original uninsulated house with a cold front porch

The Challenge

This existing house in Clonskeagh was cold, poorly insulated and expensive to heat.

The owners needed a practical low-energy solution that would not disrupt their lifestyle.

On close inspection, we found serious problems to overcome:

- The external walls are a classic, attractive red brick cavity wall with a small (50mm) cavity, which ruled out the use of external insulation.
- The existing roof rafters were fixed into a concrete ring beam which had no eaves ventilation to the timbers.
- The front of the house was facing south but left little room for fixing a sizeable array of solar PV.
- The windows were old wooden windows which were warped and at the end of their design life.
- The gas boiler was also at the end of its design life and needed to be replaced along with the heating controls system.
- The client wanted the house and its energy system to “float” in their absence, relying solely on solar ventilation. In achieving this, the thermal design needed to keep the house above the condensation limit.
- The client also expressed the need for a fast-acting heating system that could be controlled remotely via a phone app, to allow for their lifestyle and give control of the temperature when they are abroad.

The GreenRefits Solution

External Wall Insulation

As the outer walls were predominantly a classic red brick, they could not be externally insulated.

The solution was to fill the cavity with blown platinum bonded bead insulation to improve the U-Value but also to stop air circulation which is vitally important. Internally, the walls were drylined with 70mm of foil backed insulation, tightly bonded to the existing hard plastered wall.

This was then battened out with 25mm timber studs which was used to fix an airtight breather membrane to the insulation. Plasterboard was then fitted to the battens, leaving a service cavity behind the plasterboard. This important step negated the affect of any air gaps causing thermal looping within the wall insulation system.



Picture 2: Internal insulation fitted tightly to the external wall including the window jambs, to prevent thermal looping occurring behind the insulation

Roof Insulation

The original attic was insulated at ceiling tie level. As the client wished to use the attic for storage, it was decided to insulate at the rafter level to create a 'Warm Roof' solution. Due to the original construction method used, eaves ventilation was not possible, making a spray foam solution unfeasible.

Following consultation with Saint Gobain, a technically satisfactory solution was developed; fully filling the gap between rafters and adding a further layer of horizontal insulation to achieve a better U-Value.

We then applied a sealed breather membrane on the warm side preventing external air infiltration to the warm room in the roof.

This also meant that no slate vents were required in the slating procedure, as the attic was now part of the house's thermal envelope and could be ventilated by the ventilation system being installed

Air Tightening of the Envelope

Air infiltration levels in the house were significantly reduced by the insulation systems used and their integrated air-tightening membranes.

These membranes were also tightly sealed to the new triple glazed windows.

This resulted in the elimination of draughts. It was therefore necessary to have a ventilation system to reduce risk of mould growth and dampness within the house. GreenRefit's solar enhanced mechanical ventilation system is designed to deliver the required ventilation at a zero energy penalty.

High Performance Glazing

The existing windows were at the end of their design life. They were replaced with modern triple glazed windows, giving a U-Value of approximately 0.73 W/m².K. These windows were also virtually airtight.



Picture 3: The modern triple glazed windows mimic the original windows from an architectural viewpoint while achieving the GreenFits Design Team requirements of airtightness and a U-Value of 0.73 W/m².K

Solar PV Array

The GreenRefits Design Team calculated that an array of 12 panels with a peak output of 5.1 kW was required.

The front south facing roof could not remotely support this size of array. It was decided to do a freestanding array against the back wall of the garden.

Another issue arose due to the height restrictions of the array, which needed to be under 2 metres. This was addressed by designing a special blockwork support arrangement as no simple proprietary structural arrangement could be found to accommodate 3 rows of panels.



Picture 4: Blockwork supports for the solar panel array



Picture 5: Finished 12-panel solar array with a 5.1 kWpeak output



Picture 6: View of solar panel array from the patio

Solar Enhanced Hot Water and Heated Ventilation Air

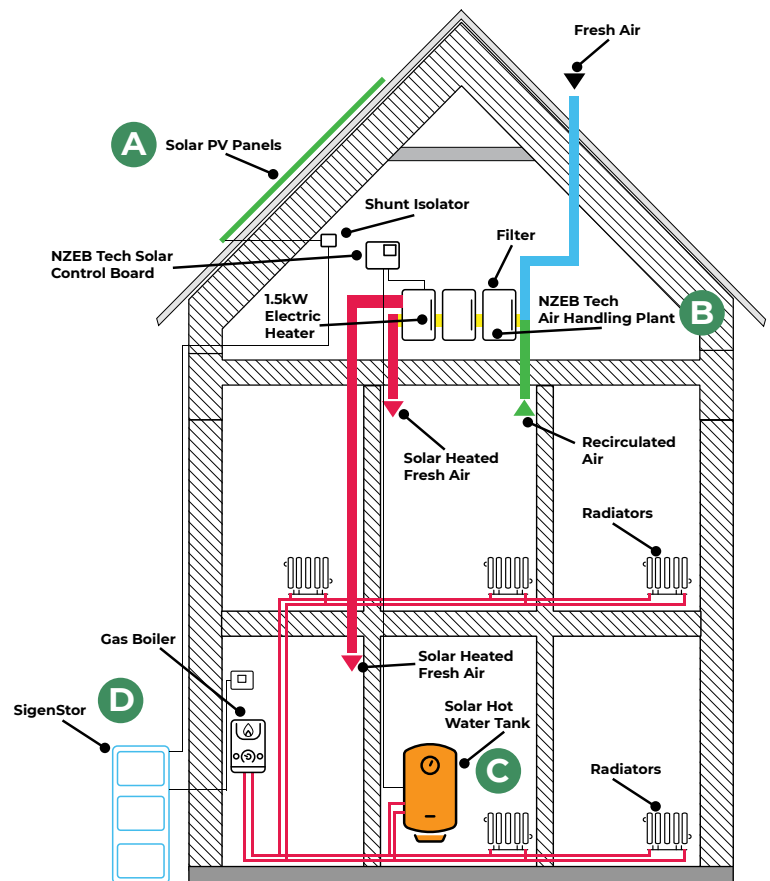
The sketch opposite shows the basic components of the GreenRefits solar enhanced space heating, ventilation and hot water system.

Firstly, we have a fully integrated PV Array which goes on the roof of the house **(A)**. This PV Array can feed electricity to the electrical distribution board, satisfying the electrical requirements of the house. The PV electricity can then go to the hot water cylinder or the ventilation unit **(B)**.

This PV Array can deliver solar heat to the ventilation system to provide warmed fresh air to the house. This means that copious amounts of fresh ventilation air can be supplied at a zero energy penalty.

The domestic hot water cylinder is sized to allow storage of solar energy which can be used for all of the household hot water requirements **(C)**.

The SigenStor battery unit is used to store electricity for later use **(D)**.



The main purpose of this fully integrated GreenRefits Design is to make the best use of the solar PV system. The system is designed to satisfy the electrical requirements of the house, followed by the warm air ventilation and hot water demand of the house. Any excess is stored in the SigenStor battery system or exported to the grid, where a feed-in tariff is in place to reduce the homeowner's electricity bill.

Condensing Gas Boiler and Heating System Controls

The existing gas boiler was at the end of its design life and needed replacement. The GreenRefits Design Team considered the practicality of using an air-to-water heat pump instead of a gas boiler. The heat pump was rejected for the following reasons:

- Because of their modern lifestyle, the clients wanted a system that would react to their intermittent heating demand as quickly as possible. In short, they needed a heating system that could deliver power on demand. **Heat pumps do not meet this requirement this as they favour a constant 24-hour house temperature.**
- Most importantly, **the energy used in a house with a particular heat loss characteristic is directly proportional to its average house temperature.** As a heat pump keeps a house at a high average temperature on a 24-hour basis, this will require more energy than a house designed for intermittent occupation.
- The ventilation system is also designed to deliver warm air by way of the PV array during the day if and when required. **This will hold the house at the highest possible temperature but it does so at a zero-energy penalty, making the house more energy efficient and reducing gas consumption.**

For these reasons, a condensing gas boiler was chosen as the best, most economic and energy efficient system, mainly due to the GreenRefits integrated solar heating, ventilation and hot water system. The heating system controls were designed by the GreenRefits Design Team to give full time, temperature and zone control. A mobile phone app can also be used to interact with the control system from abroad as desired.

The Results

The following are the results achieved in this project:

- Warm, healthy indoor environment – consistent comfort with filtered fresh air.
- Substantially lower energy bills – reduced heating and electricity costs.
- Lifestyle-fit heating – intermittent, high-output system ideally suited to the clients' requirements.
- Minimal disruption – no need to rip up the ground floor slab.
- Lowest cost options to achieve clients' requirements.
- Future-ready – B2 BER rating with solar integration.



Picture 7: Finished house - Clonskeagh Oct 25

And the message from the clients:

“We now have a warm, properly ventilated home with much lower running costs. The new system suits our lifestyle perfectly.”



Call: 01 663 6372

Email: info@greenrefits.ie

www.greenrefits.ie

 [GreenRefits.ie](https://www.facebook.com/GreenRefits.ie)