CONFERENCE 2010
CASE STUDY
HOUSE B – RICHMOND

CONCERTO INITIATIVE
SERVE

Sustainable Energy for the Rural Village Environment

CONCERTO is co-funded by the European Commission

1 Semidetached Bungalow in SERVE region

1.1 Description

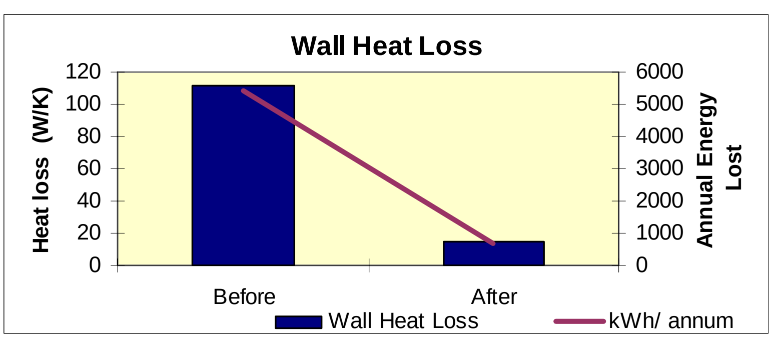
The House in Richmond was originally constructed of mass concrete walls, and had a cavity wall extension constructed to the rear of the dwelling. As with many houses, Internal insulation or drylining to any effective depth would reduce the internal floor area significantly. In addition to this, Mass concrete walls transmit heat well, and therefore the risk of interstitial condensation behind any drylining would be significant. In addition to this, as the house is semi-detached of modestly size, the external insulation grants would cover a large percentage of the cost of the retro-fit. In addition the external wall insulation the homeowner upgraded almost all other areas from an energy point of view:

- Replacing an inefficient oil fired range with a high efficiency condensing oil boiler
- Installation of a low loss cylinder and controls
- Roof insulation
- Space heating controls
- Windows

1.2 Wall insulation Upgrade

Description	Construction	Original U Value W/m^2 K	Final U Value W/m^2 K	Area m^2
Main Dwelling wall	Mass Concrete	2.2	0.23	45
Extension	Partially filled cavity	0.55	0.18	23

External Wall Insulation(EWI):
The EWI applied externally is a composite of 100mm Ecotherm PIR board, a fibreglass re-inforcing mesh and a multipart render system. At the base of the wall, either standing on the plinth or below in some cases Extruded polystyrene is used, as it is more resistant to moisture. The render system used in this application is **Powerwall** render system. It has full Irish agrément certification (09/0341) for use with a variety of insulation products.



Cavity Wall:
The rear extension had a partially filled (50mm LDPS) cavity wall of 24m^2 approx net wall area. This was pump filled (with HDPS Bonded bead, 0.033 W/m K) prior to the application of the external wall insulation (EWI), this was to prevent any thermal looping or ventilation in the cavity from undermining the effect of the EWI, it also resulted in the final wall U value being lower. The wall

if cavity filled alone would have had a final u value of approximately 0.3 – 0.35, also there would have been thermal bridges where the cavity wall interacts with the mass concrete wall, and due to such a low area of wall remaining it was appropriate to externally insulate the remaining wall. In addition there was a minimum % (75%)of wall insulation to draw down the SERVE external wall grant that would not have been applicable had the extension being insulated.

Above: Photograph of the house with the reveals around the doors and windows removed, prior to any insulation being applied.

Left: Photo of the EWI installed, prior to render being applied. Note the Expanded polystyrene at the lower level, note also the complete removal of thermal bridging save for the fixings.

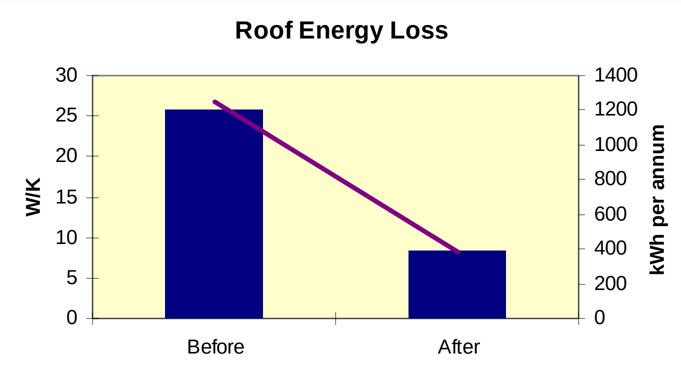
Below: Difficult detailing around chimney and fascia/ sofit areas.

(Photos courtesy of Paul Cahalan plastering Ltd.)

1.3 Attic insulation

Description	Construction	Original U Value W/m² K	Final U Value W/m² K	Area m²
Main roof area	100mm fiber-glass in rafter	0.4	0.13	64.6

Similar to a significant percentage of Irish homes, the original attic would have had 100mm of fibre-glass insulation present in the 100m joists at ceiling level. This has been topped up with a further 250mm (100mm and 150mm roll, cross laid to achieve a final u value of 0.13 W/m² K.



1.4 Heating System

Any heating system is made up of the following main components

- Heating appliance e.g. oil boiler
- Distribution system e.g. pipe work for space and water heating distribution within the building
- Domestic Hot Water (DHW) system e.g. hot water cylinder and associated controls
- Space heating system e.g radiators or under floor heating and associated controls

Any heating upgrade needs to consider each of these components and develop an integrated solution to address energy efficiency at each stage. In this house the boiler and the DHW and space heating controls were addressed.

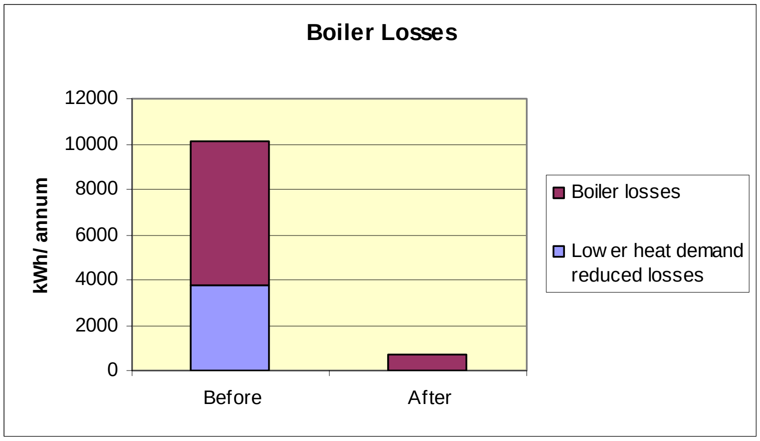
1.4.1 Boiler Upgrade

The boiler in the house was a oil fired range cooker, pictured below. Typically these systems, pre 1993 boiler directive boiler, would yield a typical efficiency in the range of 65% to 75%. Any figures displayed are based on the DEAP assumed default efficiency of 65%.

The boiler was replaced by a Grants Vortex condensing oil boiler with balanced flue. It has a certified energy efficiency of 95% on the National Heating Appliance Register of Performance or HARP database.

The net effect of replacing the boiler has decreased the energy required to heat the dwelling by over 9000 kWh per annum. Some of this is due to the heating load reduction, other remaining due to the boiler efficiency. The boiler cost, installed was approximately €2000.

The annual savings from the boiler replacement (on it's own) equate to €650 (Savings estimated from DEAP, and would likely be less, but not significantly so) giving a 3 year payback or 2 years with the grant aid available.



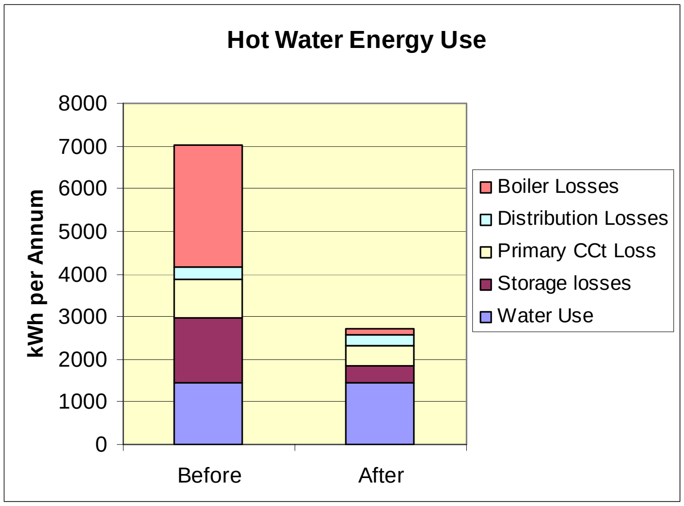
1.4.2 Domestic Hot Water and Space Heating Controls

The original heating system in this house was single circuit system, or was controlled and run as a single circuit system with the only control being provided by one combined timer and the water circuit thermostat on the cooker. The additional works required to bring this house up to standard required fitting of three motorised valves, three thermostats (two space and one hot water) and a programmer to ensure the space heating is on at the correct time to the required temperature.

1.4.2.1 Domestic Hot Water upgrades were as follows:

- New high efficiency cylinder to the 2008 building regulations (0.8W/l loss)
- Installation of motorised valve and relevant pipework.
- Cylinder temperature thermostat
- Inclusion on a multifunction programmer

In this house, DEAP assumes a small water consumption (in line with average occupancy per m^2), therefore the losses can be proportionally higher from a standard storage tank The aim therefore is do decrease these loss from the distribution, storage and heating of the hot water. As can be seen in the below graph, all the losses decrease, improving the "water at the tap" energy use to 55% from a very poor 18% before.



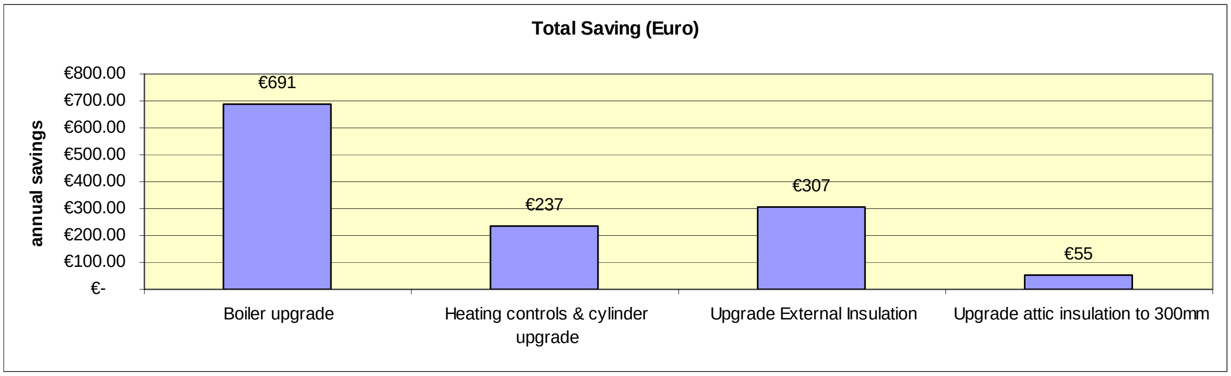
Space Heating Controls:

The space heating controls in the house were based on a single timer or switch on the range cooker, effectively eliminating all useful control. The current system should allow complete control of the building space and hot water demand.

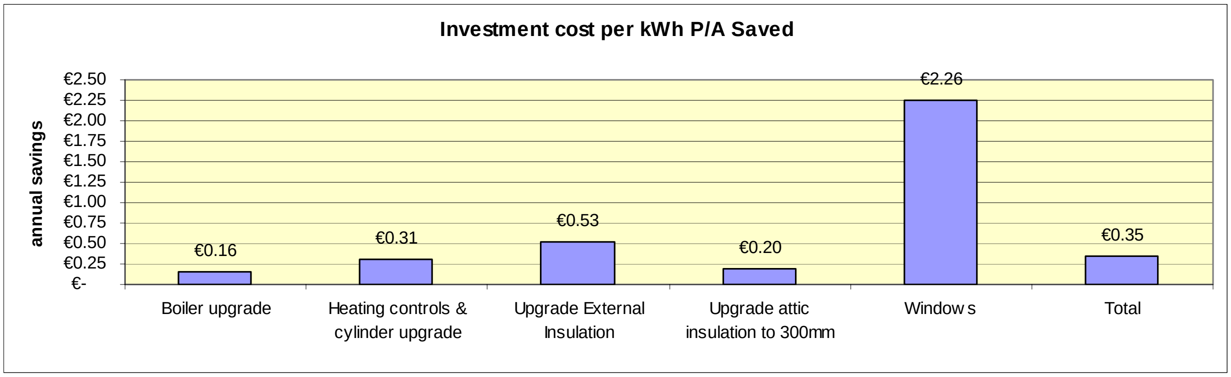
The direct reduction in energy consumed from this upgrade will be 3200 kWh per annum. The total cost of the upgrades to the space heating system and domestic hot water controls was €2000. The annual savings from controls would be estimated to be€230, giving a payback of 8.5 years. Again grant aid would have reduced this to under 5 years.

2 Summary of Upgrades

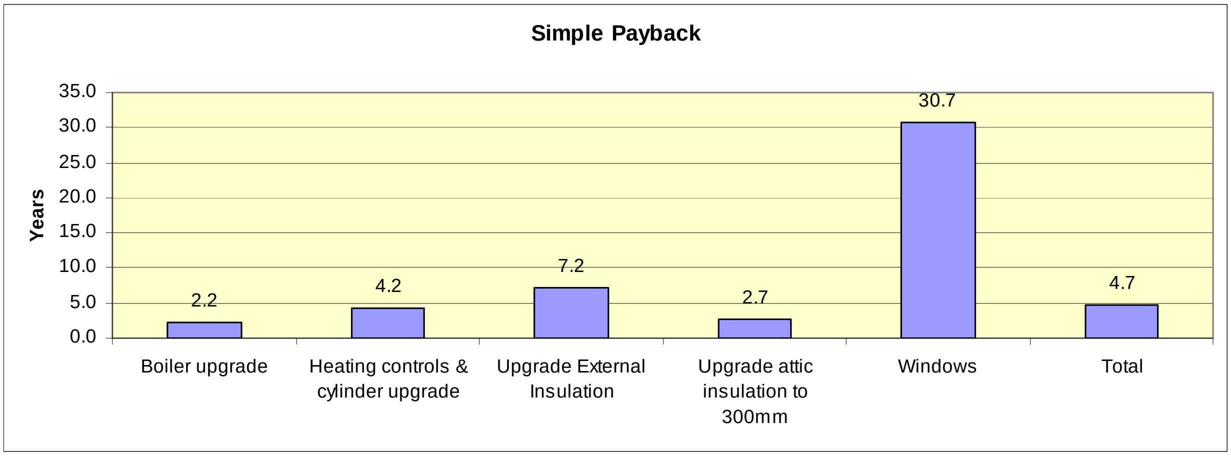
All the cost analysis is based on an energy price of 7.35c/kWh for oil delivered. Oil prices vary significantly being 9.6c and 4.1c during the life of the SERVE project to date. All the case studies are completed on a three year average energy priced based on prices for the three years ending Dec. 2008. While this can be argued, the current oil price (20/04/10) (60c/l ex Vat), including VAT and the forthcoming carbon tax on the 1st of may 2010 is 7.23c/kWh



Total annual savings in energy use.

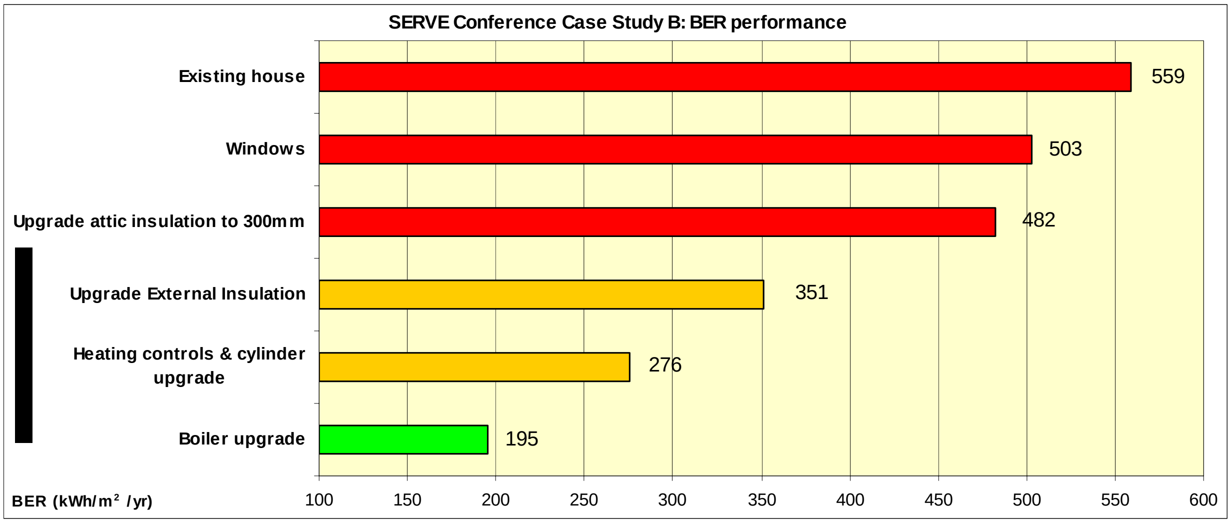


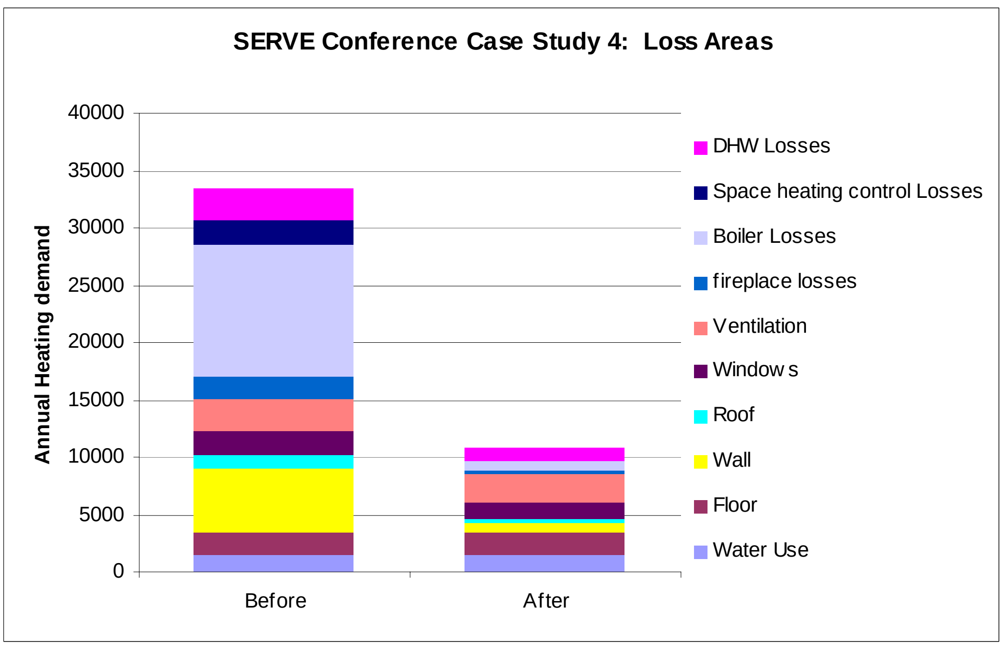
Investment cost to save one kWh of thermal energy per annum, after grant –aid is included.



After grant aid is applied, the simple payback to the home-owner.

2.1 Energy Performance





2.2 Further Potential Upgrades

Clearly from the above graph, the retrofit could be classified as a “deep” retrofit.

- Solar panel would be hard to justify, as would and ventilation upgrades.

2.3 Key Performance indicators

No.	Item	Indicator
1	Total kWh saved	18219
2	Total CO2 saved	4919
3	Before BER	559
4	After BER	195
5	Total investment	€ 18,600.00
6	Total investment per CO2 saved (€/kg)	€ 3.78
7	Total investment per kWh saved (€/kWh)	€ 1.02
8	Simple payback	13.9
9	Total 10 yr internal rate of return (3% inflation)	-4%
10	Homeowner investment	€ 6,350
11	Homeowner investment per kWh saved	€ 0.35
12	Homeowner simple payback	4.74
13	Homeowner rate of return	26%

2.4 Installers

External Wall Insulation	Paul Cahalan Plastering Ltd (Nenagh)
Plumbing and Heating	FPI Solar (Moneygall)
Boiler	Grant Engineering (Birr)
Windows	Munster Joinery (Mallow)
Attic & Cavity Wall Insulation	FPI Solar (Moneygall)