

## 1 FEASIBILITY STUDY

The key issue is – what is the cost benefit? e.g. a pareto chart that shows highest costs savings in descending order ? How do you do a cost benefit analysis? Unfortunately this has been difficult to quantify and I suspect that this would be needed as part of the “Whole House” package that the government envisage in the [Heat and Energy Saving Strategy](#)

A number of assumptions have been made based on the priorities outlined [in Eco Refurbishment by Peter Smith:-](#)

- Loft Insulation – Some in place but will need top / replacement
- Draft proofing (and are the existing doors good enough?)
- Cavity Wall insulation (already done)
- Thermostatic valves – in most rooms but looking to remove radiators and install under floor heating.
- Appliances – already addressed and will continue to only by A+ rated items.
- Double Glazing – already in place but at least 15 years old. Some windows will need replacing.
- Under floor insulation.
- External cladding
- Solar Panel
- PV

The investigations so far indicate that significant amounts of insulation will help achieve the project goals of “no heating required during the winter period”. However, there is a risk that this may not hold true, and if there are very low temperatures during the winter, then some heating is required. Hence the risk mitigation is to keep the existing gas central heating but reposition most of it as under floor heating, and have a wood burning stove which would be used in preference to the gas central heating. See appendix for gas & electric readings.

What follows is my high level “whole house” assessment based on the requirements in the tender document – a [youtube video](#) provides a tour of the house picking out most of the items below.

### 1.1 EXTERNAL WALL INSULATION

In order to achieve a passivhaus u-value of .14, external wall insulation is required. Since this alters the external appearance of the house, planning permission is required.

Several systems have already been investigated and quotes provided:-

- CarbonEco using 200mm of EPS and external render based on 173 m<sup>2</sup>. Quote £16,492.
- Platinum Finishes Ltd using Weber MFS 190mm. Quote £26,550 - £27,486

I have investigated Diffutherm from NBT. Price per board (100x1300x790mm = 0.948 m<sup>2</sup>) £52.78. So assuming 173 m<sup>2</sup> this raw material cost would be £9631. U-value calculation has not been done but lamda is less than other materials.

Celotex has also been investigated. U-value calculation has been provided by the Celotex technical support team who have recommended a thickness of 110 x 1200 x 2400mm of XR3000 product, and rain screen cladding (25mm gap and breathable membrane). Raw insulation material costs £2156. (I have yet to investigate the use of cedar for cladding.)

This is the preferred solution since this is within the technical capability of the owner to implement.

## 1.2 LOFT EXTENSION REFERBISHMENT

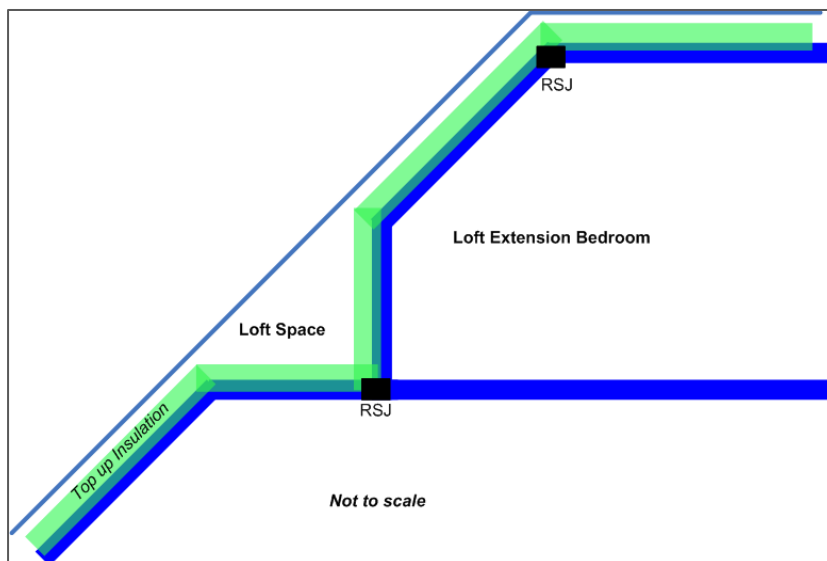
The flat roof is reaching the end of its lifetime, and the windows need replacing. This provides the opportunity to significantly upgrade the insulation using a combination of insulation between the joist such as Celotex GX3000, and Celotex TD3000 insulation bonded to 5.5mm WBP ply. The existing cladding would be replaced with Cedar, and the 2 existing window frames and glazing replaced, ideally with low maintenance frames, triple glazing.

Roof tiles would need to be removed and additional insulation placed into the rafter space (using Celotex FR4000). The installation of the external wall insulation (3.1) would require the width to be increased to accommodate the rain screen cladding.

An additional requirement for consideration is the installation of a roof light to give extra light to the 2<sup>nd</sup> floor hall and access to the roof.

## 1.3 ROOF INSULATION TOPUP

This is not as easy as it sounds – access to the roof is limited due to the design of the loft extension. This is



likely to require the removal of roof tiles to access the rafter space to lay down top up insulation.

However, the brackets and wiring where appropriate for the PV can be put in place whilst the roof tiles have been removed, and the width of the roof will need to be extended to allow for the external wall insulation.

## 1.4 GARAGE

- Two walls will need insulation in order to stop heat loss from the sitting room and hall.
- Repositioning of down pipe (see below)
- Remove garage ceiling and install under floor heating.
- Whilst ceiling is off, install small bore pipe from hot water tank, and cold water supply to reduce the amount of runoff :-
  - Mixer tap into washing machine (to reduce costs of heating water)

- Bathroom sink and bath
- Bedroom sink (access from living room)
- To the kitchen via hall.
- To downstairs toilet.
- Put piping in place for 1<sup>st</sup> floor toilet to be connected (eventually) for rainwater harvesting.
- Ditto for ground and 2<sup>nd</sup> floor toilets.
- Reposition electric sockets – add more for workbench.
- Add additional lighting.

## 1.5 SITTING ROOM

A major refurbishment of the sitting room is proposed:-

- Replacement of radiator with under floor heating. This removes the radiator from under the existing window which is to be replaced with a sliding door into the conservatory.
- Replacement the floor with a marble type tiling, and insulation.
- Reposition of down pipe in the corner to the garage to enable a wood burning stove to be installed.
- Install wood burning stove and a DIY heat recover system to warm incoming fresh air.
- Replace ceiling to substitute the bedroom radiators for under floor heating and insulation.
- Replace sitting room door with thermally insulated version and draft proofing.
- Replace ceiling lighting with LED lighting.
- Redecoration.
- Re-plaster room.
- Make the room air tight.

Another requirement at a later date is the conversion of the garage to a bedroom, and splitting the property into 2 halves so that the 1<sup>st</sup> and 2<sup>nd</sup> floor can be remodelled into separate accommodation. This would require ceilings on the ground floor to be replaced to meet fireproof regulations.

## 1.6 HALL, STAIRS AND LANDING

This too requires major refurbishment:-

- Replacement of radiator with under floor heating.
- Replacement of the floor with marble tiling and insulation.
- Replacement of the front door with thermally insulated version and draft proofing.
- Replace door to garage with thermally insulated version and highly efficient draft proofing.
- Replace ceiling to install insulation and LED lighting.
- Repeat for 1<sup>st</sup> floor ceiling.
- Decide on décor for stairs and flooring for 1<sup>st</sup> floor.
- Re-plaster hall and 1<sup>st</sup> floor ceiling.
- Redecorate hall, stairs and landing.
- Make the area air tight.

## 1.7 STUDY

- Removal of sloping ceiling and install insulation between joist.
- Replace ceiling with Celotex insulated plasterboard.

- Fix drop in roofline – reinforcing existing joist.
- Velux window double glazing is blown and needs replacing.
- Remove floor and radiator and replace with under floor heating with insulation.
- Make the area airtight.
- Redecorate.

### 1.8 FLAT ROOF - SOLAR PANEL

The existing hot water tank already has a secondary coil ready for solar panel. The requirement is to install a solar panel on the flat roof. This will require **planning permission** since it will extend beyond the roof line.

### 1.9 GARAGE

When the solar panel is installed, additional pipe work is required to supply the washing machine:-

- Small bore pipe from the hot water tank to a mixer tap which has a temperature control. This is input to the washing machine – the intent being to reduce the amount of electricity required to heat the water for a wash.
- The small bore pipe needs to be extended to the kitchen.
- Wall insulation is required on the end and right hand side walls.

### 1.10 KITCHEN

Refurbishment of the kitchen is not intended, but some changes are required as follows:-

- Re-plumbing of the hot water supply. Currently there is a long run from the hot water tank in the roof, which follows old pipe routes resulting in a long time for hot water to arrive at the tap. This wastes a considerable amount of water. Work for (3.9) needs to be extended through to the kitchen. This needs to be done whilst (3.6) is being renovated. This will be difficult to achieve since it will involve crawling under the kitchen floor.
- Replace lighting with LED lighting.

### 1.11 PV

Installation of PV will mainly depend on budget. However, a minimal system could be install with the intention of adding to over time. Assuming roof Insulation top up requires the removal of roof tiles (3.3), then the support brackets could be fixed in place and the wiring position appropriately.

### 1.12 VENTILATION

This has yet to be investigated, but needs defining before work commences since ducting will need to be placed under the floor and in the ceiling as appropriate. Should it be a heat recovery system? (This uses energy) or rely on air pressure and air flow (no energy required but wont function if there is no wind).

### 1.13 RAIN WATER HARVESTING

The pipe work of flush toilets is mainly in place but needs to be repositioned so that is can be more easily accessed

The rain water cladding for the external wall insulation could also include guttering at the base to catch the run off and redirect the water to the rain water tank / water butt.

## 2 CONSERVATORY

The picture below shows an example of the conservatory we require, the key features being:-

- Good insulation (passiv ?)
- Day light from above, but not all glass.
- Width sufficient for a long dining table for family events.
- Sliding door system to open out to the garden.
- Floor to ceiling sliding door into the sitting room
  - Existing sliding door to be replaced with a window.
  - Existing window to be replaced with one sliding door extending the existing sitting room into the conservatory.
- Sitting room – conservatory appear as one room. Floors at the same level. Flooring to be the same material.



We envision walls at each end since they do not look out to the garden but the fence.

Unfortunately the back of the house faces east and will not catch a lot of sun in the winter months. Again, the walls, and floor will require high levels of insulation and the glass to have a low u value.

From a technical perspective we need to know if additional RSJ are required for the “floor to ceiling” sliding door between the sitting room and conservatory. Additionally, we need to know the finish point for the external wall insulation, and ensure there is no thermal bridging from the conservatory. We would then expect to continue to the insulation inside the conservatory with a recess for the sliding door (i.e the sliding door is hidden when fully open.)

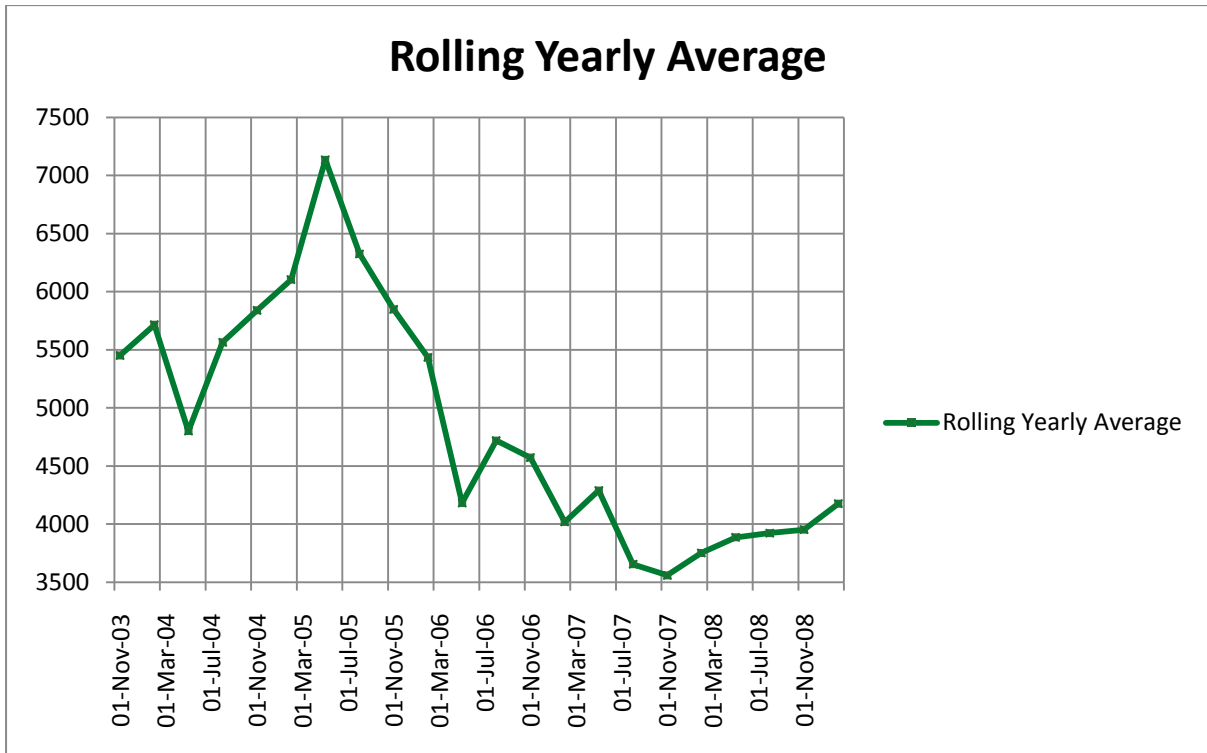


**Above: Adding Light**  
A roof lantern allows natural light to flood into the newly extended kitchen. Sliding folding doors pull right back to open the dining space onto the garden.

### 3 APPENDIX

#### 3.1 ELECTRICITY CONSUMPTION

	Kwh Reading	yearly Average	kw/day
01-Feb-00	1556		
01-May-00	1188		
01-Aug-00	926		
01-Nov-00	1787	5457	
01-Feb-01	1123		
01-May-01	1116		
01-Aug-01	1040		
01-Nov-01	897	4176	
01-Feb-02	1564		
01-May-02	1055		
01-Aug-02	2543		
01-Nov-02	1791	6953	
01-Feb-03	1551		
01-May-03	1943		
01-Aug-03	729		
01-Nov-03	1229	5452	14.9
01-Feb-04	1814	5715	15.7
01-May-04	1028	4800	13.1
01-Aug-04	1494	5565	15.2
01-Nov-04	1503	5839	16.0
01-Feb-05	2078	6103	16.7
01-May-05	2060	7135	19.5
01-Aug-05	684	6325	17.3
01-Nov-05	1027	5849	16.0
01-Feb-06	1665	5436	14.9
26-May-06	806	4182	10.7
26-Aug-06	1221	4719	12.1
23-Nov-06	880	4572	11.8
07-Feb-07	1111	4018	10.8
25-May-07	1077	4289	11.8
07-Aug-07	587	3655	10.6
23-Nov-07	785	3560	9.8
06-Feb-08	1303	3752	10.3
23-May-08	1211	3886	10.7
06-Aug-08	624	3923	10.7
03-Nov-08	814	3952	11.4
05-Feb-09	1526	4175	11.4



## 3.2 GAS CONSUMPTION

From	To	Kwh	Kw per day based on Quarter	Rolling Yearly Total	Kw per day based on Yearly Total
14-Feb-02	15-May-02	6778	57.8	21051	57.8
15-May-02	07-Aug-02	2026	59.4	21139	59.4
07-Aug-02	14-Nov-02	3619	57.9	21552	57.9
14-Nov-02	10-Feb-03	8782	58.7	21205	58.7
10-Feb-03	13-May-03	7473	60.3	21900	60.3
13-May-03	15-Aug-03	2412	59.7	22286	59.7
15-Aug-03	10-Sep-03	763	64.8	19430	64.8
08-Sep-03	14-Nov-03	3813	51.8	14461	52.2
15-Nov-03	16-Feb-04	10967	64.1	17955	64.4
17-Feb-04	17-May-04	8088	85.6	23631	85.6
18-May-04	31-May-04	284	88.0	23152	87.0
01-Jun-04	03-Oct-04	1169	64.1	20508	63.5
04-Oct-04	10-Oct-04	158	41.6	9699	41.1
11-Oct-04	01-Feb-05	10572	47.6	12183	47.0
02-Feb-05	31-Mar-05	4387	54.3	16286	53.7
01-Apr-05	12-May-05	2356	80.5	17473	79.4
13-May-05	07-Jul-05	1440	70.5	18755	69.7
08-Jul-05	02-Oct-05	1150	39.1	20063	82.9
03-Oct-05	05-Jan-06	7142	43.8	12088	43.3
06-Jan-06	30-Mar-06	7988	55.7	17720	55.2
14-Apr-06	11-Jul-06	3250	36.9	19530	53.1
11-Jul-06	06-Oct-06	67	0.8	18447	50.1
06-Oct-06	06-Jan-07	5132	55.8	16437	45.0
06-Jan-07	31-Mar-07	4497	53.5	12946	36.9
31-Mar-07	25-Jun-07	4201	48.8	13897	39.8
25-Jun-07	26-Sep-07	1257	13.5	15087	42.5
04-Oct-07	26/12/2007	3989	48.1	13944	39.4
26-Dec-07	04-Apr-08	9882	98.8	19329	52.2
04-Apr-08	25-Jun-08	3216	39.2	18344	50.1
25-Jun-08	10-Oct-08	545	5.1	17632	47.4
10-Oct-08	24-Dec-08	3452	46.0	17095	47.0
24-Dec-08	02-Feb-09	2389	59.7	9602	31.6

