



Building elements :		Insulation	U - value
Walls	300 mm cavity walls, partially filled	15-25 mm	1.1
Roofs	Pitched, insulation between joists	100 mm	0.4
Floors	Solid	10-15 mm	0.64
Windows	Double glazed, metal frame, 6mm gap	n.a.	3.7
Doors	Solid timber	none	3.0

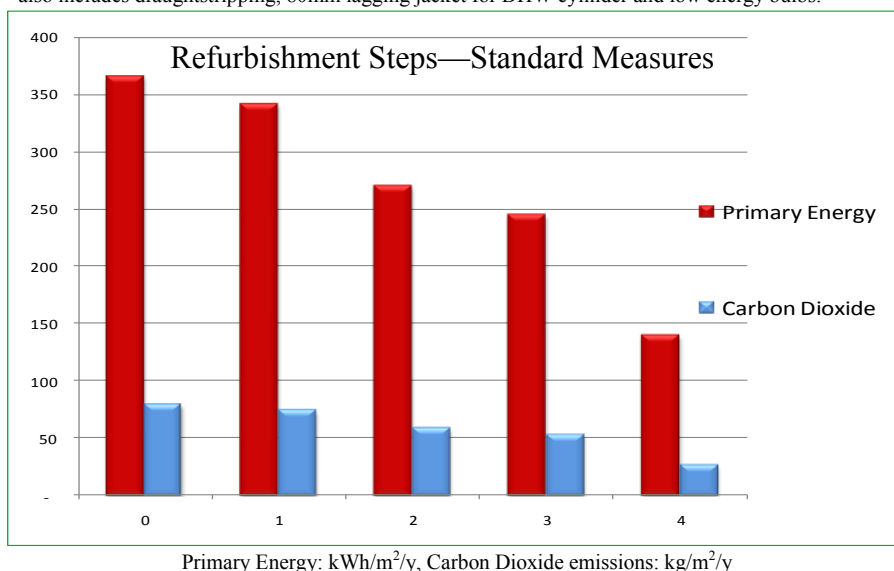
Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, pipework uninsulated.	Mains gas	70%
Secondary	Open fire in grate	Smokeless	30%
Hot water	From primary heating system. Electric immersion heater is used in summer.		
Cylinder	Insulated with loose jacket, 35 mm thick, no thermostat		
Controls	Time clock only		

Description

Red-brick fronted detached house with cavity wall construction, i.e. wall contains a 100mm cavity part-filled with a 50mm insulation board. More commonly found outside of Dublin and neighbouring counties.

Refurbishment steps — standard				Prim. energy kWh/m ² /y	Carbon Dioxide kgCO ₂ /m ² /y	Energy Rating	
0	Building fabric upgrade steps:			Expected U-values	366 (actual state)	79 (actual state)	E2
1	Roof insulation and standard package*	Add	200 mm mineral wool over the existing insulation.	0.13	341	73	E2
2	Wall insulation	Add	50-80 mm of remaining cavity filled with beads	0.41 (for 50mm)	270	58	D2
3	Windows and Doors	Replace	Double glazed low-e windows, air filled, 16mm gap. Insulated PVC/wooden doors.	2.0	245	52	D1
Systems upgrade:							
4	Space and water heating system and controls	Replace	Condensing boiler 90% efficient, two separated heating zones with time and thermostatic control, independent water heating. Hot water cylinder insulated with 50 mm spray foam.		140	27	B3

*also includes draughtstripping, 80mm lagging jacket for DHW cylinder and low energy bulbs.



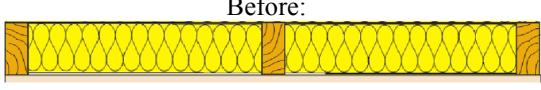
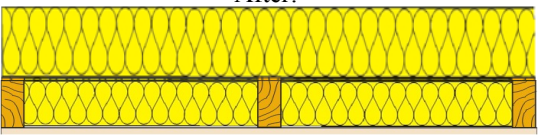
Estimated costs and payback time**

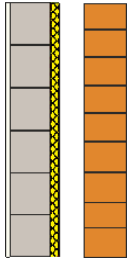
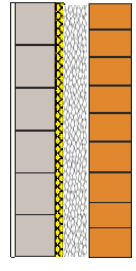
Measure	Estimated costs	Payback (y)
Step 1	€ 830	4.3
Step 2	€ 1,600	3.8
Step 3	€ 8,200	55.6
Step 4	€ 3,000	4.5
Total:	€ 13,630	9.5

Standard upgrade summary

Consumption of primary energy reduced by:	226 kWh/m²/y
Emission of carbon dioxide reduced by:	52 kgCO₂/m²/y

**Note: 1. Costs are indicative only, based on typical prices (2011). 2. Measures analysed are one of many options, especially for the renewable heating systems.

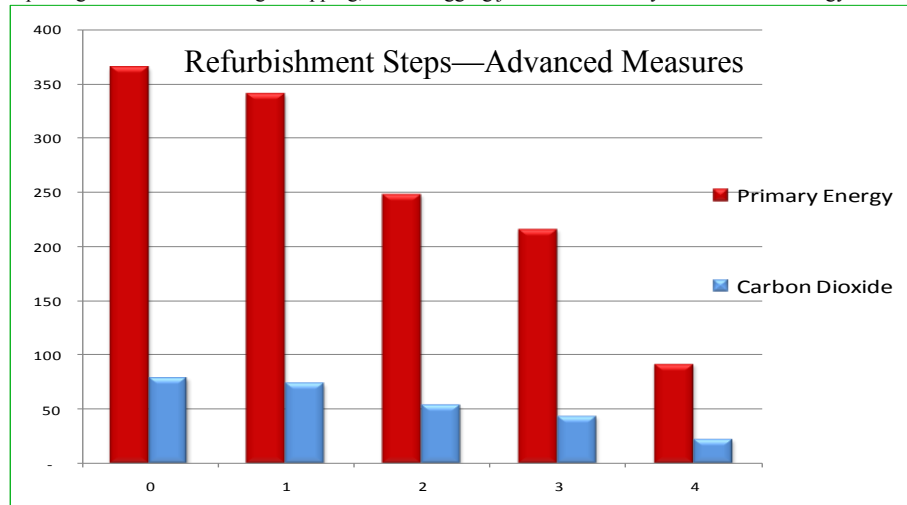
Typical roof upgrade (standard/advanced)	
100 mm of mineral wool between the ceiling joists	
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK	

Typical wall upgrade (standard)			
Before		After	
	Cavity walls, outer brick and inner block with plasterwork, partially insulated U-value = 1.1 W/m ² K		Remaining cavity filled with the beads through the number of holes drilled in the outer brickwork. Conductivity of beads up to 0.033 W/mK

Heating system upgrade		
Feature:	Standard	Advanced
Heat generator	Regular condensing boiler	Ground source heat pump
Efficiency:	90%	400%
Fuel:	Mains gas	Electricity
SH Controls type:	Full zone control	Full zone control, load compensation
Hot water source (HW):	Primary heating system	Primary heating system and solar thermal panels providing 50% of HW demand
HW Cylinder:	120 litre, factory insulated	200 litre combined cylinder, factory insulated
HW Controls type:	Time and thermostat	Time and thermostatic
Ventilation:	Natural	MVHR, 90% efficient

Refurbishment steps — advanced					Prim. energy kWh/m ² /y	Carbon Dioxide kgCO ₂ /m ² /y	Energy Rating	
0	Building fabric upgrade steps:				Expected U-values	366 (actual state)	79 (actual state)	E2
1	Roof insulation and standard package*	Add	200 mm mineral wool over the existing insulation.	0.13	341	73	E2	
2	Wall insulation	Add	50-80 mm of remaining cavity filled with beads, with combination of drylining (front) and external wall insulation (sides and rear). Thickness: 50-100 mm	0.21	248	53	D1	
3	Windows and Doors	Replace	Triple glazed low-e windows, argon filled, 16mm gap Insulated doors.	1.3 2.0	216	43	C3	
Systems upgrade:								
4	Space and water heating system and controls	Replace	Ground source heat pump 400%, two separated heating zones with time and thermostatic control, independent water heating, solar thermal panels providing 50% of hot water demand with combined HW cylinder. Mechanical ventilation with heat recovery (MVHR).		92	22	B1	

* package also includes draughtstripping, 80mm lagging jacket for DHW cylinder and low energy bulbs.



Primary Energy: kWh/m²/y, Carbon Dioxide emissions: kg/m²/y

**Note: 1. Costs are indicative only, based on typical prices (2011). 2. Measures analysed are one of many options, especially for the renewable heating systems.

Estimated costs and payback time**		
Measure	Estimated costs	Payback (y)
Step 1	€ 830	4.3
Step 2	€ 20,100	37.1
Step 3	€ 11,050	59.2
Step 4	€ 18,100	30.8
Total:	€ 50,080	33.2
Advanced upgrade summary		
Consumption of primary energy reduced by:	274 kWh/m²/y	
Emission of carbon dioxide reduced by:	57 kgCO₂/m²/y	