



Building elements :		Insulation	U - value
Walls	Timber frame	50 –100 mm	0.55
Roofs	Pitched, insulation between joists	150 mm	0.26
Floors	Solid	20-30mm	0.41
Windows	Double glazed, wood/PVC frame, 12 mm gap	n.a	2.8
Doors	Solid wooden	none	3.0

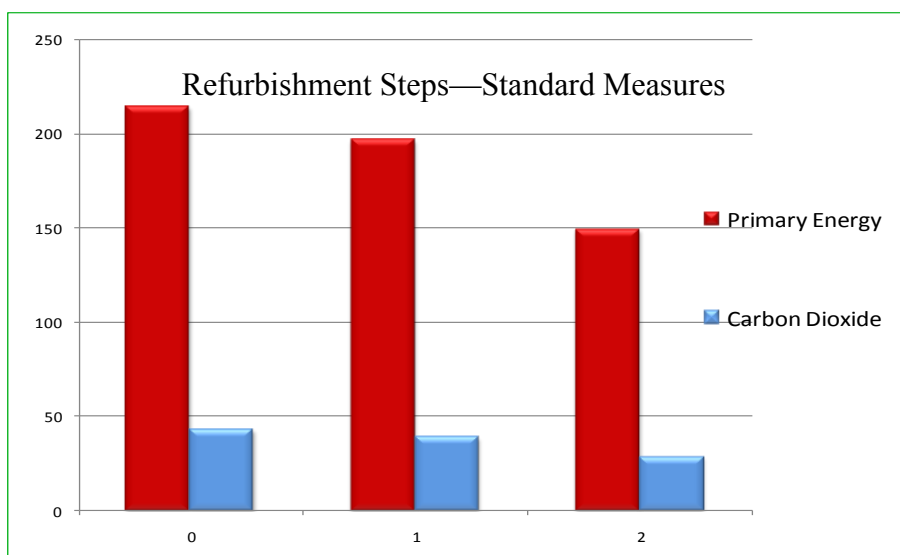
Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, primary pipework uninsulated.	Gas	80%
Secondary	Electric heaters	Electricity	100%
Hot water	From primary heating system. Separated time controls,.		
Cylinder	Insulated with 35mm spray foam, cylinder thermostat		
Controls	Separated timers for SH and DHW, room thermostat		

Description

Timber frame construction started to become increasingly popular in the late 1990s and has made up more than 10% of the market from 2000 onwards. Apart from adding additional roof insulation, the focus for retrofit would be on upgrading the space & water heating systems.

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	215 (actual state)	43 (actual state)	C3
1	Roof insulation and standard package*	Add	150 mm of mineral wool over the existing insulation	0.13	197	39	C2
Systems upgrade:							
3	Space and water heating system and controls	Replace	Condensing gas boiler 90% efficient, additional space heating zone		150	29	B3

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



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

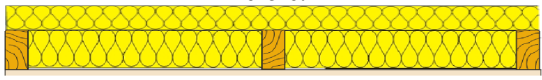
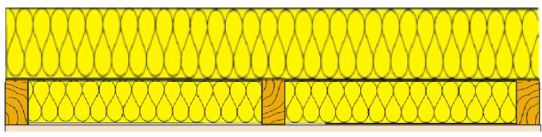
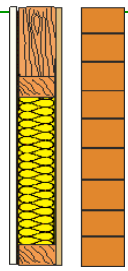
Estimated costs and payback time**

Measure	Estimated costs	Payback (y)
Step 1	€ 950	8.6
Step 2	€ 2,060	7.6
Total:	€ 3,010	7.9

Standard upgrade summary

Consumption of primary energy reduced by:	65 kWh/m²/y
Emission of carbon dioxide reduced by:	14 kgCO₂/m²/y

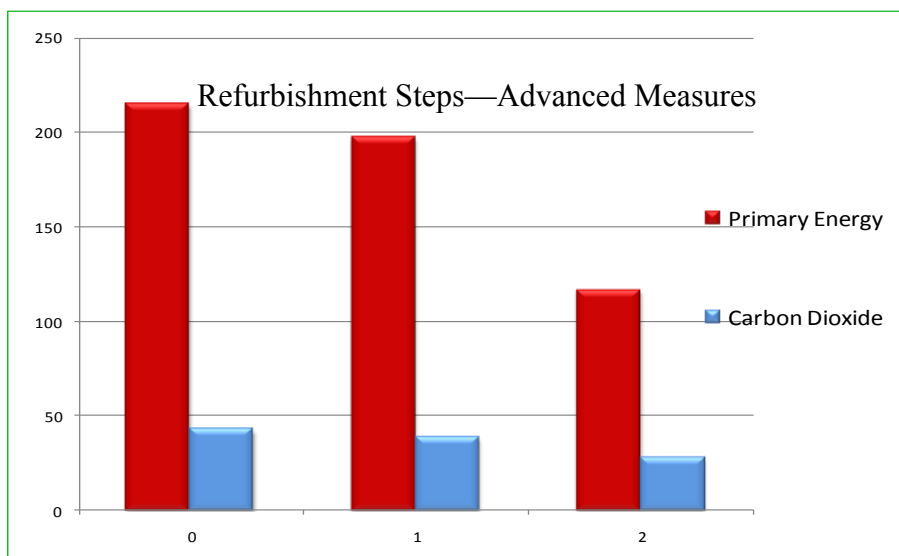
**Note: 1. Costs are indicative only, based on typical prices (2011). 2. Measures analysed are one of many options, especially for the renewable heating systems.

Typical roof upgrade (standard/advanced)	
150 mm of mineral wool between ceiling joists	Before: 
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK	After: 
Typical wall construction	
Timber frame	
	Timber frame wall with the outer brickwork and ventilated drainage cavity. Insulation between the studs. U-value = 0.55 W/m ² K

Heating system upgrade		
Feature:	Standard	Advanced
Heat generator	Regular condensing boiler	Air source heat pump
Efficiency:	90%	380%
Fuel:	Mains gas	Electricity
SH Controls type:	Full zone control	Full zone control
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	215 (actual state)	43 (actual state)	C3
1	Roof insulation and standard package*	Add	150 mm of mineral wool over the existing insulation.	0.13	197	39	C2
Systems upgrade:							
2	Space and water heating system and controls	Replace	Air source heat pump 380% efficient, 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).		117	28	B2

* 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

Estimated costs and payback time**

Measure	Estimated costs	Payback (y)
Step 1	€ 950	8.6
Step 2	€ 11,100	50.6
Total:	€ 12,050	36.5

Advanced upgrade summary

Consumption of primary energy reduced by:	98 kWh/m²/y
Emission of carbon dioxide reduced by:	15 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.

Analysis conducted in association with IHER Energy Services, www.iher.ie