



Building elements :		Insulation	U - value
Walls	Timber frame	100 mm	0.37
Roofs	Pitched, insulation between joists	200 mm	0.2
Floors	Solid concrete	40-80 mm	0.34
Windows	Double glazed, Low-E, wood/PVC frame, 16 mm gap	n.a.	2.0
Doors	Solid wooden	none	3.0

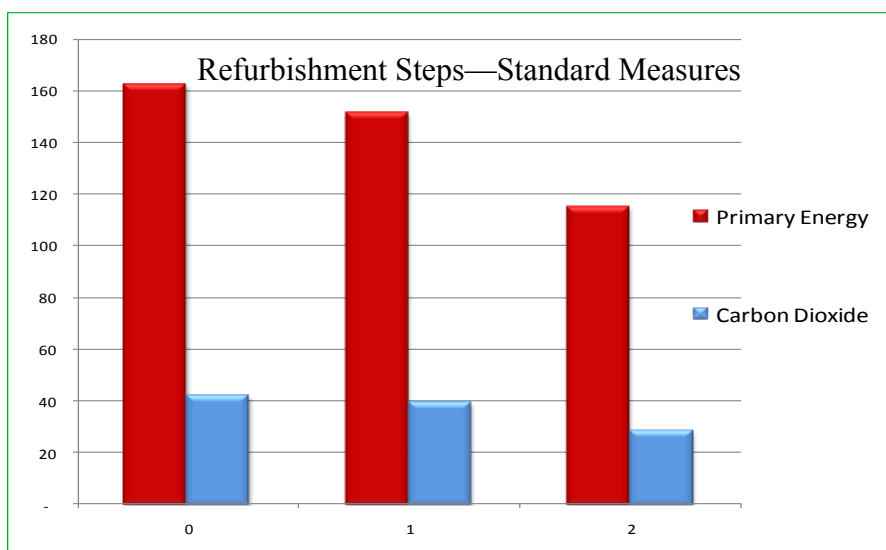
Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, primary pipework insulated.	Heating oil	80%
Secondary	Open fire in grate	Smokeless	30%
Hot water	From primary heating system. Separated time controls.		
Cylinder	Factory insulated, 35 mm spray foam, cylinder thermostat		
Controls	Separated controls for SH and DHW, room stat, TRV's, boiler interlock		

Description

Timber frame construction accounted for more than 10% of the new house market from 2000 onwards. The walls are well insulated with U values as low as 0.27 W/m²K and the floors are well insulated. 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	162 (actual state)	42 (actual state)	C1
1	Roof insulation and standard package*	Add	100 mm of mineral wool over the existing insulation	0.13	152	39	C1
Systems upgrade:							
2	Space and water heating system and controls	Add / Replace	Condensing boiler 90% efficient, additional heating zone, secondary heating removed.		115	28	B2

*also includes draughtstripping (if not present), 80mm lagging jacket for DHW cylinder (if insulation is not present) and low energy bulbs.



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


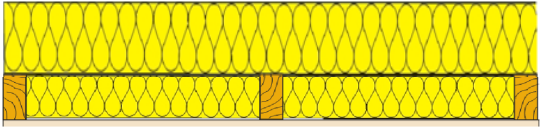
Estimated costs and payback time**

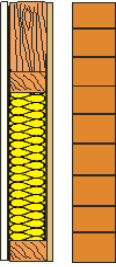
Measure	Estimated costs	Payback (y)
Step 1	€ 800	6.7
Step 2	€ 2,700	5.5
Total:	€ 3,500	5.8

Standard upgrade summary

Consumption of primary energy reduced by:	47 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.

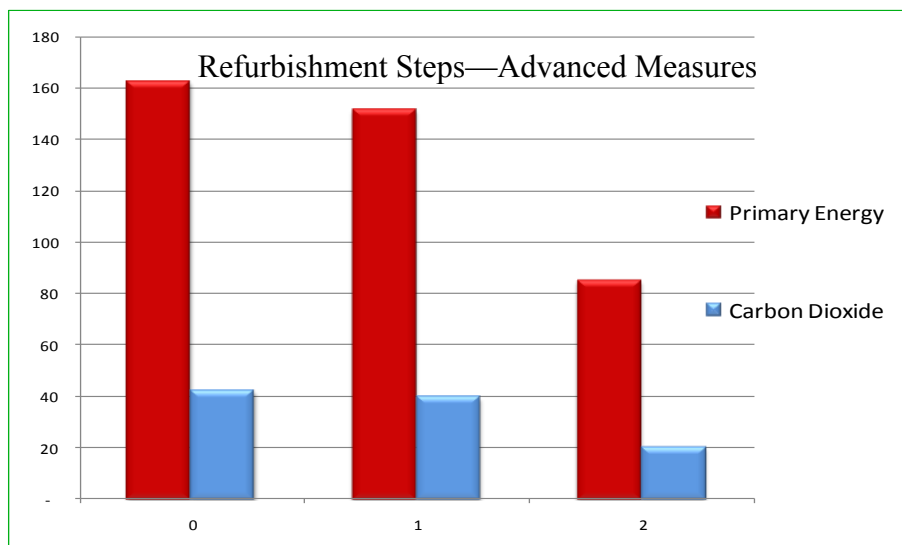
Typical roof upgrade (standard/advanced)	
200 mm of mineral wool between and above the ceiling joists	Before: 
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK	After: 

Typical wall construction	
Timber frame wall	
	Timber frame wall with the outer brickwork and ventilated drainage cavity. Insulation between the studs. U-value = 0.37 W/m ² K

Heating system upgrade		
Feature:	Standard	Advanced
Heat generator	Regular condensing boiler	Air source heat pump
Efficiency:	90%	380%
Fuel:	Heating oil	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	162 (actual state)	42 (actual state)	C1
1	Roof insulation and standard package*	Add	100 mm of mineral wool over the existing insulation.	0.13	152	39	C1
Systems upgrade:							
2	Space and water heating system and controls	Replace/add	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).		85	20	B1

* package also includes draughtstripping, 80mm lagging jacket for DHW cylinder (if not present) 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	€ 800	6.7
Step 2	€ 18,100	16.6
Total:	€ 18,900	15.6

Advanced upgrade summary

Consumption of primary energy reduced by:	77 kWh/m²/y
Emission of carbon dioxide reduced by:	22 kgCO₂/m²/y