



Description: Stone walls were common up to the 1930s in rural towns. Walls can be 300-400mm thick. These thicker walls have good thermal mass properties and help retain heat. The type of stone will influence the insulation options.

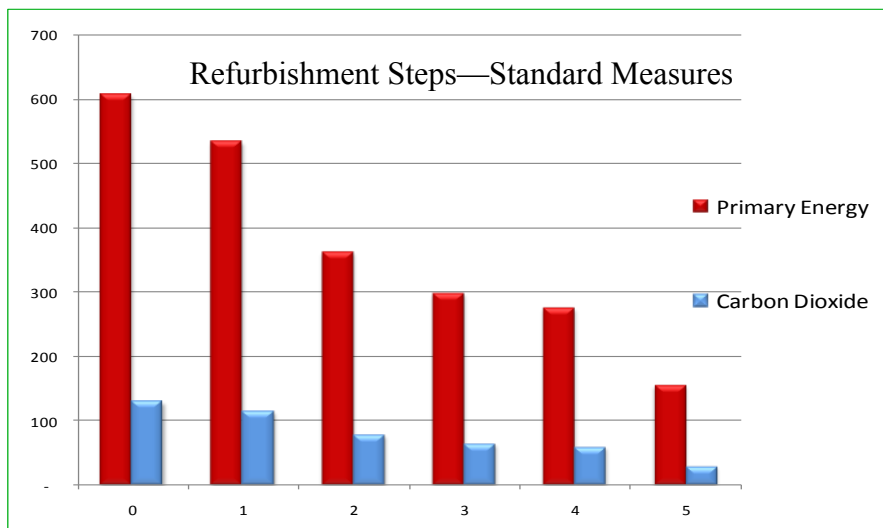
Building elements :		Insulation	U - value
Walls	Solid stone	None	2.1
Roofs	Pitched, insulation between joists	50 mm	0.68
Floors	Solid floor Suspended floor	None None	0.73 0.8
Windows	Single glazed, wooden frame	n.a.	4.8
Doors	Solid timber	none	3.0

Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, pipework uninsulated	Mains gas	65%
Secondary	Open fire in grate	Coal	30%
Hot water	From primary heating system. Electric immersion used in Summer.		
Cylinder	Uninsulated, no cylinder thermostat.		
Controls	Programmer only		

Refurbishment steps — standard

				Prim. energy kWh/m ² /y	Carbon Dioxide kgCO ₂ /m ² /y	Energy Rating
0	Building fabric upgrade steps:			607 (actual state)	129 (actual state)	G
1	Roof insulation and standard package*	Add	250 mm of mineral wool between and over the ceiling joists	534	114	G
2	Wall insulation	Add	External insulation or internal drylining. Thickness of the insulation: 70-100 mm	363	77	E2
3	Flat roof insulation	Add	Insulation boards, rigid urethane/phenolic (100-110mm)	298	64	D2
4	Windows and Doors	Replace	Double glazed, low-e windows, air filled, 16mm gap PVC/Timber doors, insulated	275	59	D2
Systems upgrade:						
5	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.	155	30	C1

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



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


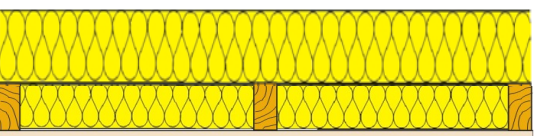
Estimated costs and payback time**

Measure	Estimated costs	Payback (y)
Step 1	€ 665	1.7
Step 2	€ 13,700	18.9
Step 3	€ 3,400	12.5
Step 4	€ 3,600	37.5
Step 5	€ 3,000	5.1
Total:	€ 24,500	11.8



Standard upgrade summary

Consumption of primary energy reduced by:	452 kWh/m²/y
Emission of carbon dioxide reduced by:	99 kg CO₂/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.

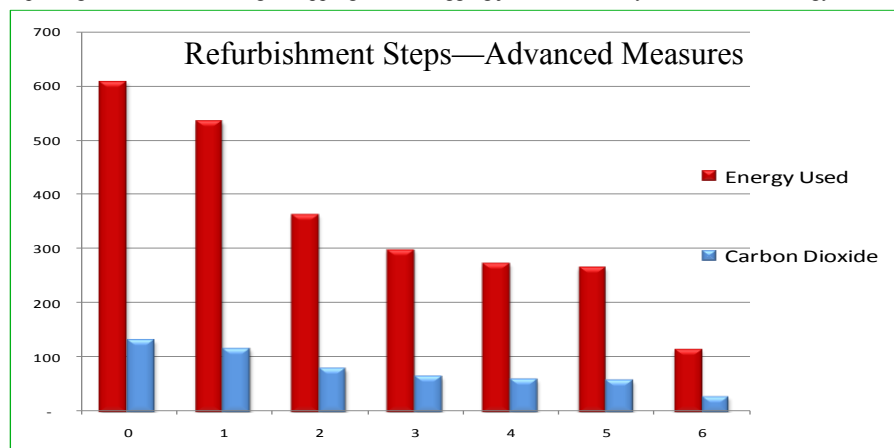
Typical roof upgrade (standard/advanced)	
50mm of mineral wool between ceiling joists	 <p>Before:</p>
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK	 <p>After:</p>

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

Typical wall upgrade (standard/advanced)			
Before		After	
	Solid stone wall, uninsulated U-value = 2.1 W/m ² K		External insulation added, EPS, urethane or phenolic boards, conductivity = 0.021 - 0.031 W/mK

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	607 (actual state)	129 (actual state)	G
1	Roof insulation and standard package*	Add	250 mm of mineral wool between and over the ceiling joist	0.13	534	114	G	
2	Wall insulation	Add	External wall insulation. Thickness : 90-150 mm	0.21	363	77	E2	
3	Flat roof	Add	Insulation boards, rigid urethane/phenolic (100-110mm)	0.22	298	64	D2	
4	Windows and Doors	Replace	Insulated PVC/wooden doors, Triple glazed, argon filled, low-e windows	2.0 1.3	273	58	D2	
5	Suspended floor	Replace	Suspended floor replaced, insulation boards added between the floor joists, 70-100mm	0.25	266	57	D2	
Systems upgrade:								
6	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).		115	27	B2	

* package also includes draughtstripping, 80mm lagging jacket for HW 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	€ 665	1.7
Step 2	€ 15,100	20.8
Step 3	€ 3,400	12.5
Step 4	€ 4,750	45.6
Step 5	€ 1,140	35.8
Step 6	€ 11,100	18.7
Total:	€ 36,155	18.7
Advanced upgrade summary		
Consumption of primary energy reduced by:	492 kWh/m²/y	
Emission of carbon dioxide reduced by:	102 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.