

# 1. Detached House, stone walls, pre-1978



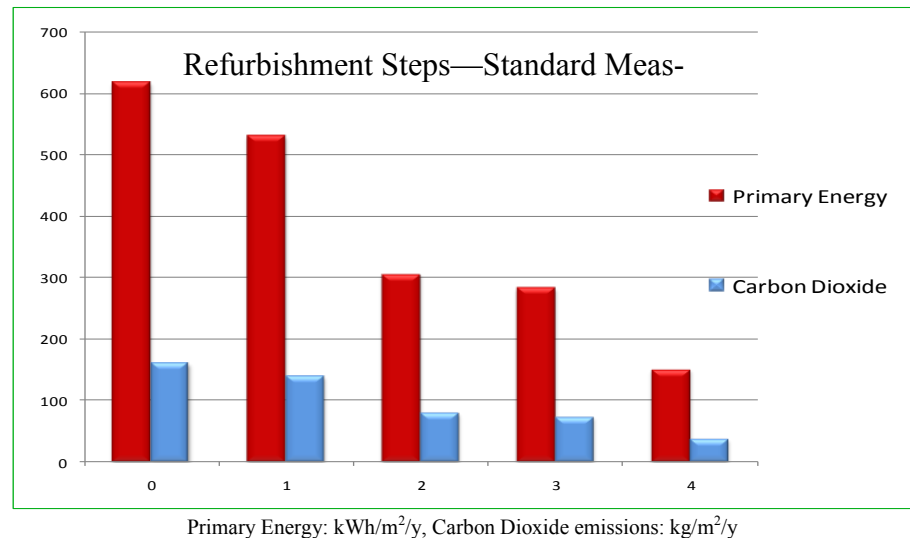
Description: Stone walls were common up to the 1930s in rural areas/ towns. Walls can be 300mm to 400mm thick. The type of stone will influence the insulation options as not all stone wall types are suited for additional insulation.

Building elements :		Insulation	U - value
<b>Walls</b>	Solid stone	None	2.1
<b>Roofs</b>	Pitched, insulation between joists	50 mm	0.68
<b>Floors</b>	Solid	none	0.65
<b>Windows</b>	Single glazed, wooden frame	n.a.	4.8
<b>Doors</b>	Solid timber	none	3.0

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


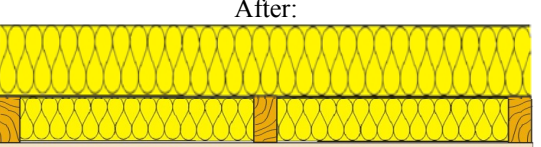
Refurbishment steps — standard				Prim. energy kWh/m <sup>2</sup> /y	Carbon Dioxide kgCO <sub>2</sub> /m <sup>2</sup> /y	Energy Rating	
0	Building fabric upgrade steps:			Expected U-values	<b>618</b> (actual state)	<b>159</b> (actual state)	<b>G</b>
1	<b>Roof insulation and standard package*</b>	Add	250 mm of mineral wool between and over the ceiling joists	0.13	531	138	G
2	<b>Wall insulation</b>	Add	External insulation or internal drylining. Thickness of the insulation: 70-100 mm	0.27	306	79	E1
3	<b>Windows and Doors</b>	Replace	Double glazed, low-e windows, air filled, 16mm gap Wooden/PVC doors, insulated	2.0	284	73	D2
<b>Systems upgrade:</b>							
4	<b>Space and water heating system and controls</b>	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.		<b>151</b>	<b>37</b>	<b>C1</b>


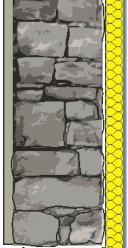
\*also includes draughtstripping, 80mm lagging jacket for HW cylinder and low energy bulbs.



Estimated costs and payback time**		
Measure	Estimated costs	Payback (y)
Step 1	€ 1,060	1.5
Step 2	€ 18,600	8.8
Step 3	€ 4,225	19.9
Step 4	€ 3,500	2.9
<b>Total:</b>	<b>€ 27,385</b>	<b>6.5</b>
Standard upgrade summary		
Consumption of primary energy reduced by:	<b>467 kWh/m<sup>2</sup>/y</b>	
Emission of carbon dioxide reduced by:	<b>122 kg CO<sub>2</sub>/m<sup>2</sup>/y</b>	

\*\*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.

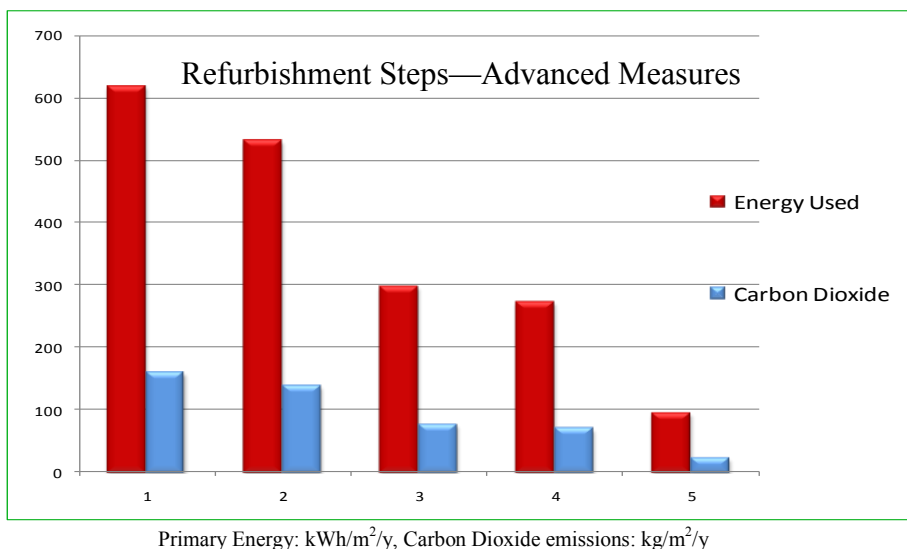
Typical roof upgrade (standard/advanced)	
50mm of mineral wool between the ceiling joists	 <p>Before:</p>
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK.	 <p>After:</p>

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

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

Refurbishment steps — advanced					Prim. energy kWh/m <sup>2</sup> /y	Carbon Dioxide kgCO <sub>2</sub> /m <sup>2</sup> /y	Energy Rating	
0	Building fabric upgrade steps:				Expected U-values	<b>618</b> (actual state)	<b>159</b> (actual state)	<b>G</b>
1	<b>Roof insulation and standard package*</b>	Add	250 mm of mineral wool between and over the ceiling joist	0.13	531	138	G	
2	<b>Wall insulation</b>	Add	External wall insulation. Thickness: 90-150 mm	0.21	298	77	D2	
4	<b>Windows and Doors</b>	Replace	Triple glazed, argon filled, low-e windows and doors	1.3	273	70	D2	
Systems upgrade:								
5	<b>Space and water heating system and controls</b>	Replace	Ground source heat pump 400% 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).		<b>95</b>	<b>23</b>	<b>B1</b>	

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



### Estimated costs and payback time\*\*

Measure	Estimated costs	Payback (y)
Step 1	€ 1,060	1.5
Step 2	€ 20,460	9.3
Step 3	€ 5,600	23.5
Step 4	€ 16,100	9.6
<b>Total:</b>	<b>€ 43,220</b>	<b>9.6</b>

### Advanced upgrade summary

Consumption of primary energy reduced by:	<b>523 kWh/m<sup>2</sup>/y</b>
Emission of carbon dioxide reduced by:	<b>136 kgCO<sub>2</sub>/m<sup>2</sup>/y</b>

\*\*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