

## 5. Detached house, solid brick walls, pre-1978

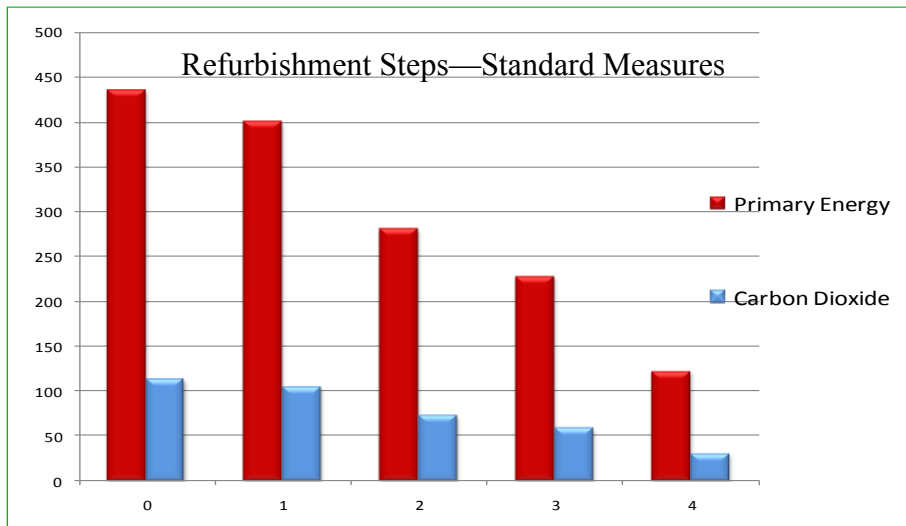


Description: Larger detached solid brick house typically found in larger towns and cities from 1900s to 1940s. Normally brick to front and block walls to side and rear. Internal dry-lining suitable for front with external wall insulation to side and rear.

Building elements :		Insulation	U - value
<b>Walls</b>	Solid brick, 325 mm	none	1.64
<b>Roofs</b>	Pitched, insulation between joists	50 mm	0.68
<b>Floors</b>	Solid floor	none	0.73
<b>Windows</b>	Single glazed, metal frame	n.a.	5.7
<b>Doors</b>	Solid wood	none	3.0
Heating systems characteristics:		Fuel	Efficiency
<b>Primary</b>	Central heating boiler, pipework uninsulated	Heating oil	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>	Insulated with lagging jacket 125mm, 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:			<b>436</b> (actual state)	<b>112</b> (actual state)	<b>F</b>	
1	<b>Roof insulation and standard package*</b>	Add	250 mm of mineral wool between and over the ceiling joists	0.13	401	104	F
2	<b>Wall insulation</b>	Add	Internal drylining. 77.5 mm phenolic / urethane boards	0.27	281	72	D2
3	<b>Windows and Doors</b>	Replace	Double glazed, low-e windows, air filled, 16mm gap Insulated doors	2.0	228	59	D1
Systems upgrade:							
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>123</b>	<b>30</b>	<b>B2</b>	

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



Primary Energy: kWh/m<sup>2</sup>/y, Carbon Dioxide emissions: kg/m<sup>2</sup>/y


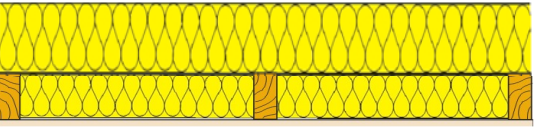
### Estimated costs and payback time\*\*

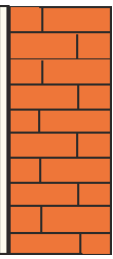
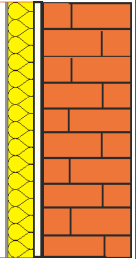
Measure	Estimated costs	Payback (y)
Step 1	€ 1,560	3.1
Step 2	€ 16,100	8.5
Step 3	€ 13,000	15.5
Step 4	€ 3,500	2.2
<b>Total:</b>	<b>€ 34,160</b>	<b>7.1</b>

### Standard upgrade summary

Consumption of primary energy reduced by:	<b>313 kWh/m<sup>2</sup>/y</b>
Emission of carbon dioxide reduced by:	<b>82 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.

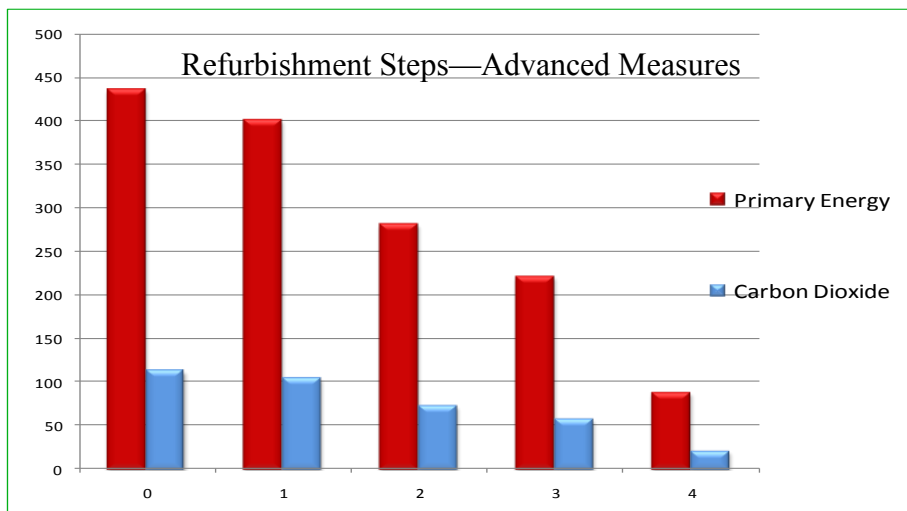
Typical roof upgrade (standard/advanced)	
50mm of mineral wool between the ceiling joists	 <p>Before:</p>
Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK	 <p>After:</p>

Typical wall upgrade (standard/advanced)			
Before		After	
	Solid brick wall 325 mm, uninsulated, U-value = 2.1 W/m <sup>2</sup> K		Internal insulation added, (on dabs or timber battens)-urethane or phenolic boards, conductivity = 0.021 - 0.025 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 thermostat	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>436</b> (actual state)	<b>112</b> (actual state)	<b>F</b>
1	<b>Roof insulation and standard package*</b>	Add	250 mm of mineral wool between and over the ceiling joist	0.13	401	104	F	
2	<b>Wall insulation</b>	Add	Internal drylining. 77.5 mm phenolic / urethane boards	0.27	281	72	D2	
3	<b>Windows and Doors</b>	Replace	Insulated PVC/wooden doors, Triple glazed, argon filled, low-E windows	2.0 1.3	222	57	C3	
<b>Systems upgrade:</b>								
4	<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>88</b>	<b>21</b>	<b>B1</b>	

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



Primary Energy: kWh/m<sup>2</sup>/y, Carbon Dioxide emissions: kg/m<sup>2</sup>/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	€ 1,560	3.1
Step 2	€ 16,100	8.5
Step 3	€ 13,025	13.7
Step 4	€ 18,100	7.9
<b>Total:</b>	<b>€ 48,785</b>	<b>8.66</b>

### Advanced upgrade summary

Consumption of primary energy reduced by:	<b>348 kWh/m<sup>2</sup>/y</b>
Emission of carbon dioxide reduced by:	<b>91 kgCO<sub>2</sub>/m<sup>2</sup>/y</b>