13. End of terrace house, cavity walls, pre-1978

Description

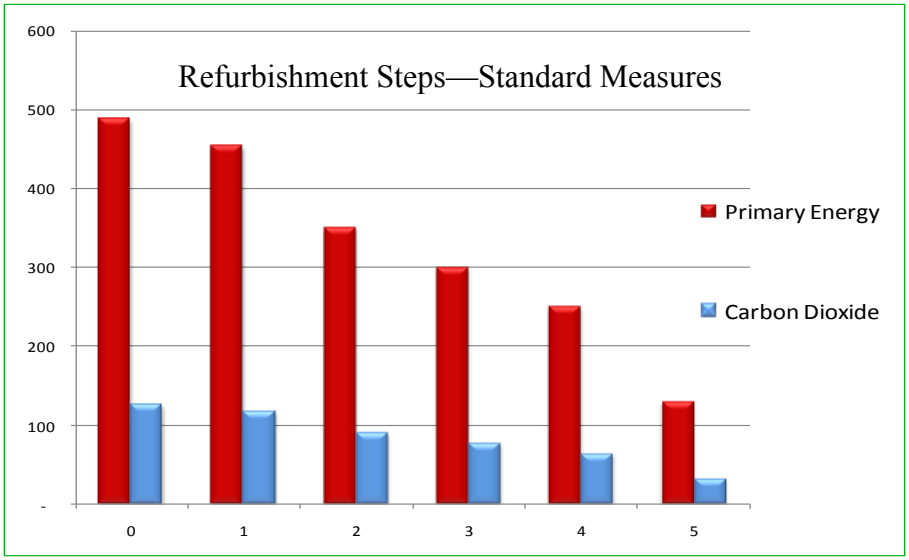
1970s end of terrace/ semi-detached house with 12 inch (300mm) cavity walls containing a 100mm empty cavity. This house type has uninsulated solid floors and a standard pitched roof insulated at ceiling level between the attic joists. Most likely found in north, west & south of Ireland.

Building elements :		Insulation	U - value
Walls	300 mm cavity walls	None	1.78
Roofs	Main roof insulated on ceiling Flat roof over the extension	50mm Flat roof - 0	0.68 2.3
Floors	Ground solid concrete floor	None	0.79
Windows	Single glazed, wooden frame	n.a.	4.8
Doors	Solid timber doors	none	3.0

Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, pipework uninsulated.	Heating oil	65%
Secondary	Open fire in grate	Solid, smoke-less	30%
Hot water	From primary heating system. Electric immersion heater is used in summer.		
Cylinder	No thermostat, insulated with 25mm loose jacket.		
Controls	Time clock only		

Refurbishment steps — standard				Prim. energy kWh/m²/y	Carbon Dioxide kgCO₂/m²/y	Energy Rating
0	Building fabric upgrade steps:			Expected U-values	**489** (actual state)	**126** (actual state)	**G**
1	**Roof insulation and standard package***	Add	250 mm mineral wool between and over the ceiling joists.	0.13	455	118	G
2	**Wall insulation**	Add	100 mm cavity fill (beads)	0.32	352	91	E2
3	**Flat roof insulation**	Add	110 mm rigid urethane/phenolic boards	0.22	301	77	E1
4	**Windows and Doors**	Replace	Double glazed low-e windows, air filled, 16mm gap, PVC/wooden doors, insulated.	2.0	251	64	D1
	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.		**131**	**32**	**B3**

*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	€ 780	2.6
Step 2	€ 990	0.9
Step 3	€ 3,400	6.7
Step 4	€ 9,750	19.1
Step 5	€ 3,000	2.6
Total:	**€ 17,920**	**5.1**

Standard upgrade summary

Consumption of primary energy reduced by:	**359 kWh/m²/y**
Emission of carbon dioxide reduced by:	**94 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.

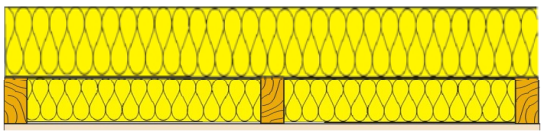
Typical roof upgrade (standard/advanced)

50mm of mineral wool between ceiling joists

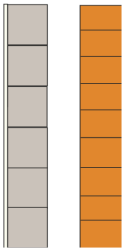
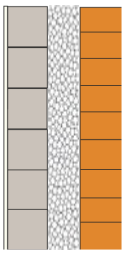
Before:

Typical roof upgrade includes topping the attic insulation up to 300 mm. Conductivity = 0.04 W/mK

After:



Typical wall upgrade (standard)

Before		After	
	Empty cavity walls, outer brick and inner block with plaster-work, uninsulated. U-value = 1.78 W/m^{2}K		Empty cavity filled with the beads through the number of holes drilled in the outer brickwork. Conductivity of beads up to 0.033 W/mK

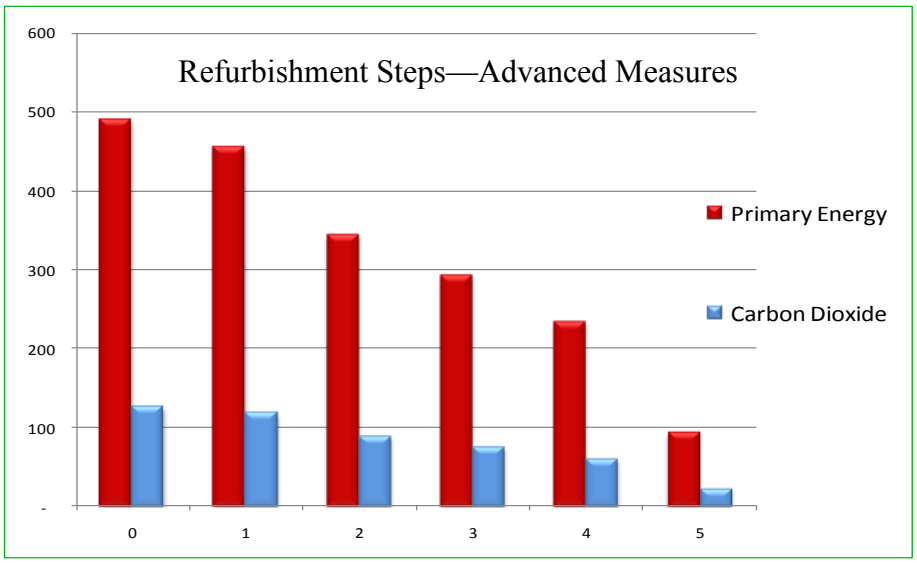
Heating system upgrade

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, load compensation
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 thermostatic	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	**490** (actual state)	**126** (actual state)	**G**
1	**Roof insulation and standard package***	Add	250 mm mineral wool between and over the ceiling joists.	0.13	455	118	G
2	**Wall insulation**	Add	Cavity fill with combination of external insulation or drylining (50-80 mm)	0.21	344	88	E2
3	**Flat roof insulation**	Add	110 mm rigid urethane/phenolic boards	0.22	293	75	D2
4	**Windows and Doors**	Replace	Triple glazed low-e windows, argon filled, 16mm gap. PVC or wooden doors.	1.3 2.0	233	59	D1
	Systems upgrade:						
5	**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)		**93**	**22**	**B1**

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



Primary Energy: kWh/m^2/y, Carbon Dioxide emissions: kg/m^2/y

Estimated costs and payback time**

Measure	Estimated costs	Payback (y)
Step 1	€ 780	2.6
Step 2	€ 12,500	11.0
Step 3	€ 3,400	6.6
Step 4	€ 13,500	22.5
Step 5	€ 11,100	7.3
Total:	**€ 41,280**	**10.1**

Advanced upgrade summary

Consumption of primary energy reduced by:	**397 kWh/m^2/y**
Emission of carbon dioxide reduced by:	**104 kgCO$_2$/m^2/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

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