8. Terraced house, mass concrete, pre-1978

Description

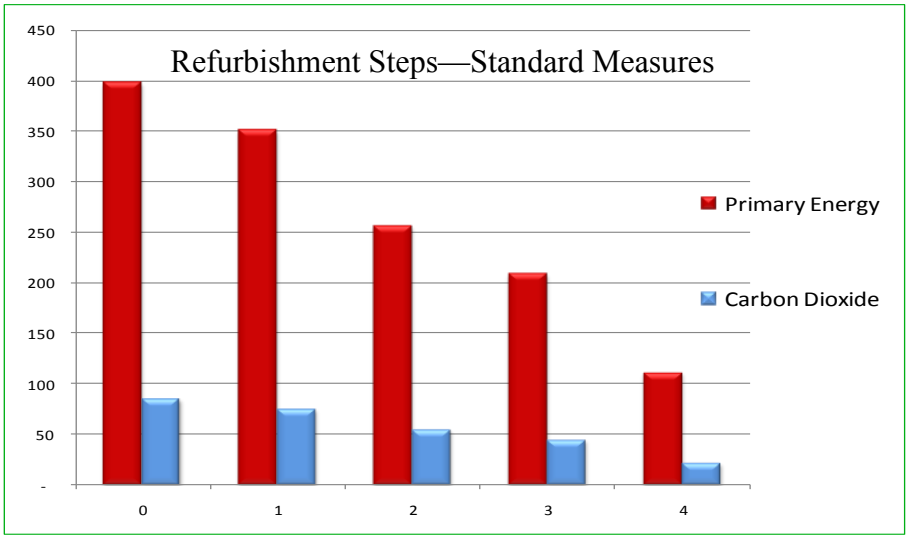
Terraced house, very common in Dublin in 1930s and 1940s. Originally built by Dublin Corporation with mass concrete walls and solid floors. This house type is an ideal candidate for external wall insulation as space is limited internally.

Building elements :		Insulation	U - value
Walls	Solid mass concrete	none	2.2
Roofs	Pitched, insulation between joists	50 mm	0.68
Floors	Solid floor	none	0.61
Windows	Single glazed, metal frame	n.a.	5.7
Doors	Solid wooden	none	3.0

Heating systems characteristics:		Fuel	Efficiency
Primary	Central heating boiler, pipework uninsulated	Mains gas	65%
Secondary	Open fire in grate	Smokeless	30%
Hot water	From primary heating system. Electric immersion used in Summer.		
Cylinder	Insulated with loose jacket, 25mm, no cylinder thermostat		
Controls	Programmer only		

Refurbishment steps — standard					Prim. energy kWh/m²/y	Carbon Dioxide kgCO₂/m²/y	Energy Rating
0	Building fabric upgrade steps:			Expected U-values	**398** (actual state)	**85** (actual state)	**F**
1	**Roof insulation and standard package***	Add	250 mm of mineral wool between and over the ceiling joists	0.13	351	75	E2
2	**Wall insulation**	Add	External wall insulation. Thickness: 70-100 mm	0.27	257	55	D1
3	**Windows and Doors**	Replace	Double glazed, low-e windows, air filled, 16mm gap Insulated doors	2.0	209	44	C3
	Systems upgrade:						
4	**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.		**112**	**22**	**B2**

*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**

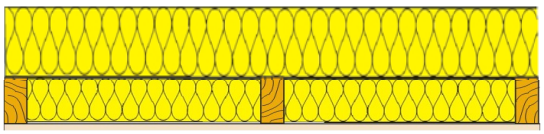
Measure	Estimated costs	Payback (y)
Step 1	€ 750	3.4
Step 2	€ 5,280	14.6
Step 3	€ 4,930	27.2
Step 4	€ 3,000	7.1
Total:	**€ 13,960**	**11.8**

Standard upgrade summary

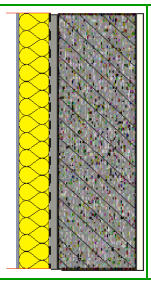
Consumption of primary energy reduced by:	**286 kWh/m²/y**
Emission of carbon dioxide reduced by:	**63 kg CO_2/m²/y**

**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 the 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/advanced)

Before		After	
	Solid mass concrete wall, 250 mm uninsulated, U-value = 2.2 W/m^{2}K		External insulation added, EPS, urethane or phenolic boards, conductivity = 0.021 - 0.031 W/mK

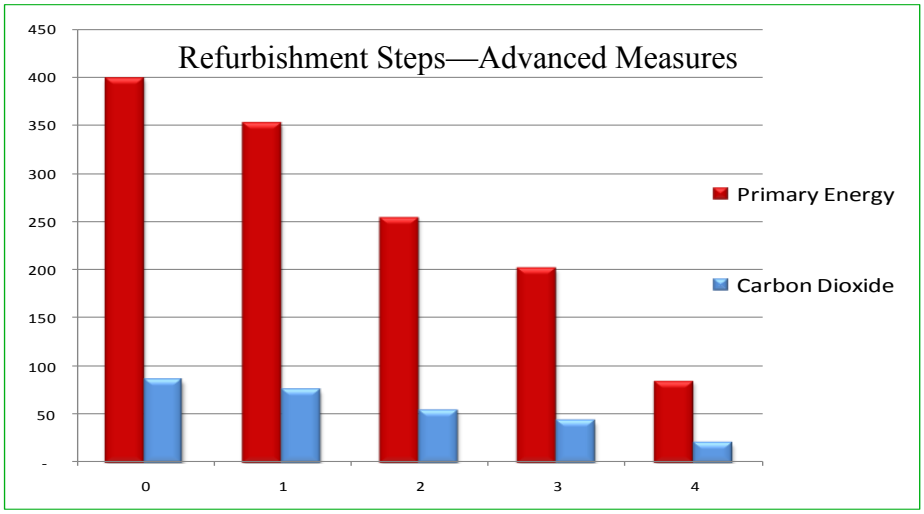
Heating system upgrade

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 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	**398** (actual state)	**85** (actual state)	**F**
1	**Roof insulation and standard package***	Add	250 mm of mineral wool between and over the ceiling joists	0.13	351	75	E2
2	**Wall insulation**	Add	External wall insulation. Thickness: 90-150 mm	0.21	254	54	D1
3	**Windows and Doors**	Replace	Insulated PVC/wooden doors Triple glazed, argon filled, low-e windows	2.0 1.3	201	43	C3
	Systems upgrade:						
4	**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).		**85**	**20**	**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	€ 750	3.4
Step 2	€ 5,800	15.6
Step 3	€ 6,650	32.9
Step 4	€ 11,100	28.9
Total:	**€ 24,300**	**20.6**

Advanced upgrade summary

Consumption of primary energy reduced by:	**313 kWh/m^2/y**
Emission of carbon dioxide reduced by:	**65 kg CO$_2$/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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