



**Description**

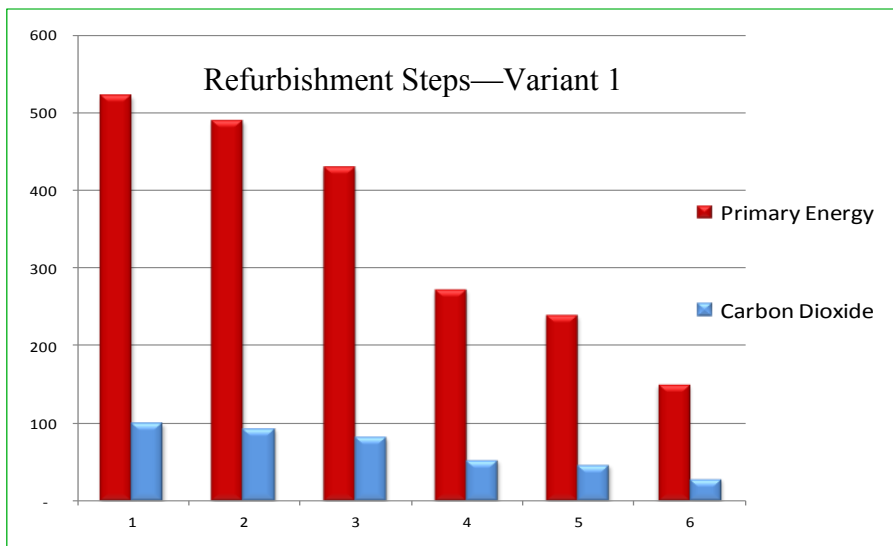
Top floor flat of 1940s block of flats in Dublin city centre. This flat has both mass concrete walls facing the courtyard with 325mm solid brick walls facing the street. It has a flat concrete roof. External insulation would be the optimum solution if the block was upgraded as a single project.

Building elements :		Insulation	U - value
<b>Walls</b>	Front wall and stairwells: mass concrete	none	2.2
	Rear wall: 325mm solid brick	none	1.64
<b>Roofs</b>	Flat roof, concrete slab	none	2.3
<b>Windows</b>	Single glazed, wooden frame	n.a.	4.8
<b>Doors</b>	Solid timber	none	3.0

Heating systems characteristics:		
Feature:	Variant 1-gas heating	Variant 2 -electric heating
<b>Heating</b>	Gas boiler, 68% efficient	Electric storage heaters
<b>Hot water</b>	From the gas boiler, immersion heater supplementary in summer	Electric immersion heater
<b>Controls</b>	Programmer only	Manual charge control
<b>Cylinder</b>	Insulated with 25 mm lagging jacket	

**Refurbishment steps — variant 1 (gas heating)**

				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>522</b> (actual state)	<b>99</b> (actual state)	<b>G</b>
1	<b>Basic measures</b>	Add	100% Draughtstripping, Replacing all bulbs with CFLs, Installing 80 mm lagging jacket on the cylinder	n.a.	490	92	G
2	<b>Wall insulation</b>	Add	Internal drylining. 52.5 mm thick phenolic /urethane boards	0.5	430	81	F
3	<b>Roof insulation</b>	Add	Internal drylining. 52.5 mm thick phenolic /urethane boards	0.5	272	52	D2
4	<b>Windows and Doors</b>	Replace	Double glazed, low-e windows, air filled, 16mm gap Insulated solid doors	1.6 2.0	239	46	D1
<b>Systems upgrade:</b>							
5	<b>Space and water heating system and controls</b>	Replace	Condensing boiler 90% efficient with room thermostat and TRVs, independent water heating. Hot water cylinder insulated with 50 mm spray foam.		<b>149</b>	<b>28</b>	<b>B3</b>



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

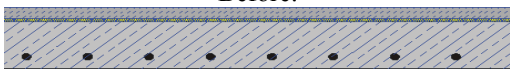
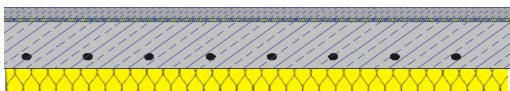
**Estimated costs and payback time\***

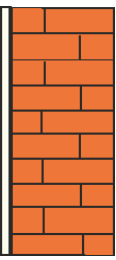
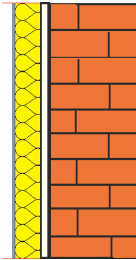
Measure	Estimated costs	Payback (y)
Step 1	€ 140	1.4
Step 2	€ 1,625	12.3
Step 3	€ 2,990	8.7
Step 4	€ 2,450	33.8
Step 5	€ 3,000	12.4
<b>Total:</b>	<b>€ 10,205</b>	<b>11.5</b>

**Standard upgrade summary**

Consumption of primary energy reduced by:	<b>373 kWh/m<sup>2</sup>/y</b>
Emission of carbon dioxide reduced by:	<b>71 kg CO<sub>2</sub>/m<sup>2</sup>/y</b>

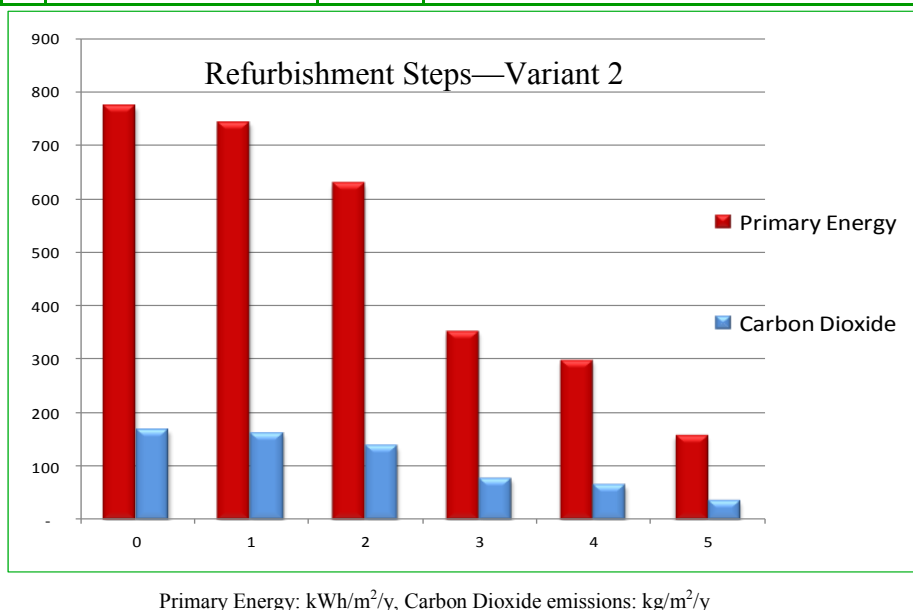
\*Note: 1. Costs are indicative only, based on typical prices (2011). 2. Measures analysed are one of many options, especially for the renewable heating systems.

Typical roof upgrade	
Concrete slab, uninsulated	
Internal drylining boards fixed to the ceiling	
Conductivity = 0.023 W/mK	

Typical wall upgrade	
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:	Variant 1—gas	Variant 2—electric
<b>Heat generator</b>	Regular condensing boiler	Air to air heat pump
<b>Efficiency:</b>	90%	360%
<b>Fuel:</b>	Mains gas	Electricity
<b>SH Controls type:</b>	Programmer, Room thermostat, TRV's	Time and temperature zone control
<b>Hot water source (HW):</b>	Primary heating system	Electric immersion
<b>HW Cylinder:</b>	96 litre, factory insulated	96 litre, factory insulated
<b>HW Controls type:</b>	7-day programmer, Cylinder thermostat	7-day programmer, Cylinder thermostat
<b>Ventilation:</b>	Natural	Natural

Refurbishment steps—variant 2 (electric heating)				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>772</b> (actual state)	<b>166</b> (actual state)	<b>G</b>
1	<b>Basic measures</b>	Add	100% Draughtstripping, Replacing all bulbs with CFLs, Installing 80 mm lagging jacket on the cylinder	n.a.	742	160	G
2	<b>Wall insulation</b>	Add	Internal drylining. 52.5 mm thick phenolic /urethane boards	0.5	628	135	G
3	<b>Roof insulation</b>	Add	Internal drylining. 52.5 mm thick phenolic /urethane boards	0.5	351	76	E2
4	<b>Windows and Doors</b>	Replace	Double glazed, low-e windows, air filled, 16mm gap Insulated solid doors	1.6 2.0	297	64	D2
<b>Systems upgrade:</b>							
5	<b>Space and water heating system and controls</b>	Replace	Air to air heat pump, 250% efficient, individual temperature controls for each room. High efficiency hot water cylinder, heated by the immersion heater.		<b>156</b>	<b>34</b>	<b>C1</b>



Estimated costs and payback time*		
Measure	Estimated costs	Payback (y)
Step 1	€ 140	1.9
Step 2	€ 1,625	7.6
Step 3	€ 2,990	5.8
Step 4	€ 2,450	24.1
Step 5	€ 4,300	22
<b>Total:</b>	<b>€ 11,505</b>	<b>10.4</b>

Advanced upgrade summary	
Consumption of primary energy reduced by:	<b>616 kWh/m<sup>2</sup>/y</b>
Emission of carbon dioxide reduced by:	<b>132 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](http://www.iher.ie)