Improving the Energy Rating of a Traditional Dwelling

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Aim of the Project

The Aim of this dissertation is to improve the BER of an old dwelling.

Objectives

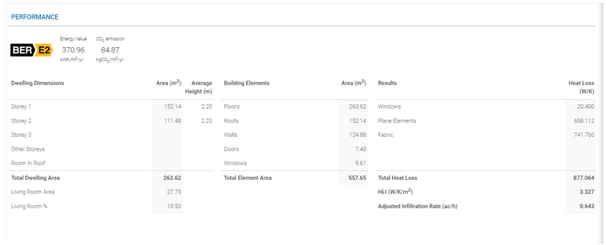
- To identify the current energy rating of the building using DEAP.
- Use BIM to sketch a model of the dwelling.
- Determine what steps must be taken to improve the energy rating of the dwelling.
- Work out how much it would cost to make all the necessary improvements to the building.

Background

This dissertation uses DEAP to find the Building Energy Rating (BER) of the old dwelling. Once the initial BER is found, improvements are made on DEAP to increase the BER helping the home become more energy efficient and comfortable for the occupants. The cost of these upgrades is calculated using scheduling on Revit and Microsoft Excel. A model of the dwelling is also made using Revit.

DEAP

The DEAP software is the official Irish method for BER assessment brought to us by the SEAI. Figure 1 below shows the initial BER of the dwelling. It has a poor E2 rating which indicates the house has high energy costs and a poor thermal comfort level.



PERFORMANCE

BER E2 — Energy value 370.96 kWh/m²/yr — CO_2 emission 84.87 kgCO₂/m²/yr

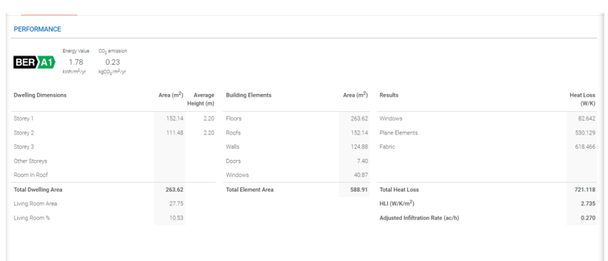
Dwelling Dimensions	Area (m^2)	Average Height (m)
Storey 1	152.14	2.20
Storey 2	111.48	2.20
Storey 3		
Other Storeys		
Room in Roof		
Total Dwelling Area	**263.62**	
Living Room Area	27.75	
Living Room %	10.53	

Building Elements	Area (m^2)
Floors	263.62
Roofs	152.14
Walls	124.88
Doors	7.40
Windows	9.61
Total Element Area	**557.65**

Results	Heat Loss (W/K)
Windows	20.400
Plane Elements	658.112
Fabric	741.760
Total Heat Loss	**877.064**
HLI (W/K/m^2)	3.327
Adjusted Infiltration Rate (ac/h)	0.643

Figure 1: Initial BER

Figure 2 shows the BER for the dwelling with all of the upgrades implemented. Solar Panels were installed to generate electricity and for water heating. Insulation was added to the external walls are roof to keep the home warm. The most effective change was installing an air to water heat pump, this improved the BER by a massive amount resulting in an A1 rating.



PERFORMANCE

BER A1 — Energy value 1.78 kWh/m²/yr — CO_2 emission 0.23 kgCO₂/m²/yr

Dwelling Dimensions	Area (m^2)	Average Height (m)
Storey 1	152.14	2.20
Storey 2	111.48	2.20
Storey 3		
Other Storeys		
Room in Roof		
Total Dwelling Area	**263.62**	
Living Room Area	27.75	
Living Room %	10.53	

Building Elements	Area (m^2)
Floors	263.62
Roofs	152.14
Walls	124.88
Doors	7.40
Windows	40.87
Total Element Area	**588.91**

Results	Heat Loss (W/K)
Windows	82.642
Plane Elements	530.129
Fabric	618.466
Total Heat Loss	**721.118**
HLI (W/K/m^2)	2.735
Adjusted Infiltration Rate (ac/h)	0.270

Figure 2: Improved BER

Revit

A model of the home in presented in figure 3, the model shown is the original dwelling without any upgrades applied. It is used as a visual aid which allows for a better understanding of the works that will take place in the home.

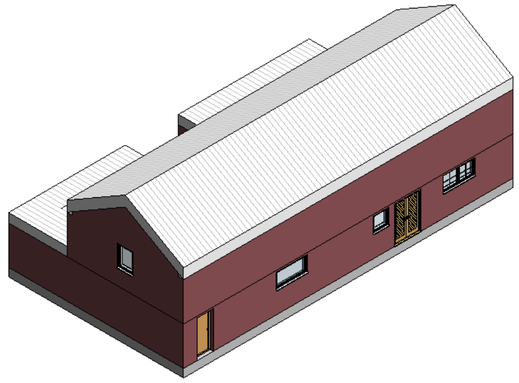
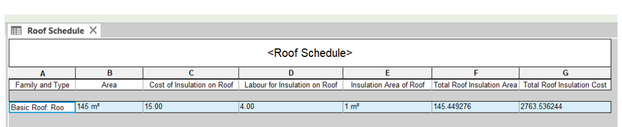


Figure 3: Revit Model

The schedule below shows the cost of insulation for the roof. The schedule is used to show exactly where the money is being spent. It displays the cost of the labour for installing the insulation and the cost to buy the insulation both calculated per meter squared. The area of the roof is shown which is used to calculate the cost of insulation per meter squared and then the total cost of insulation for the whole roof.



Roof Schedule

<Roof Schedule>

A	B	C	D	E	F	G
Family and Type	Area	Cost of Insulation on Roof	Labour for Insulation on Roof	Insulation Area of Roof	Total Roof Insulation Area	Total Roof Insulation Cost
Basic Roof: Roo	145 m²	15.00	4.00	1 m²	145.449276	2763.536244

Figure 4: Roof Schedule

Conclusions

The BER of the dwelling was greatly improved by the renovations that were made on the DEAP software. The most effective upgrade was the change to an air to water heat pump, paired with a time & temperature zone control system it is the most efficient way to heat the home. It runs off electricity, which is provided in part by the solar panels installed. The insulation added to the external walls and roof were crucial in making sure the home had a good thermal comfort level as well as the window upgrades which were also a big help in this matter.

The scheduling on Revit was very effective in showing where money was being spent, the total cost of all improvements made to the home was €49,418.03. This is just under the maximum €50,000 allowed by the Deep Retrofit Pilot Programme provided by the SEAI, which can cover up to 50% of the project costs. This means the homeowner would still have to pay approximately €25,000 but this is still a significant boost.

Acknowledgements

Special thanks to my supervisor Kaushal Shetty for his support and guidance during this project.