A Comparison of Energy Ratings and an Analysis of Energy Performance Improvements for a Domestic Dwelling.

Eoin McDonald – K00268943

Aim of the Project

To report on the enhancement of the proposed dwellings energy performance by utilising building information software.

Project Objectives

- Research and investigate the current building standards, guidelines and regulations for the dwelling while considering energy consumption.
- Create a model of the dwelling using REVIT software while adhering to the original building plans, include all heating, cooling and thermal characteristics.
- Conduct a heating and cooling loads analysis on the dwelling using the REVIT software to quantify the buildings current energy demands, use these results to determine its building energy rating (BER) by using the dwelling energy assessment procedure (DEAP) software.
- Identify and implement improvements using the software that could be made to optimise the dwellings energy performance and BER rating.
- Compare and analyse the initial and improved BER results, report on the impact and cost of the proposed energy efficiency improvements.

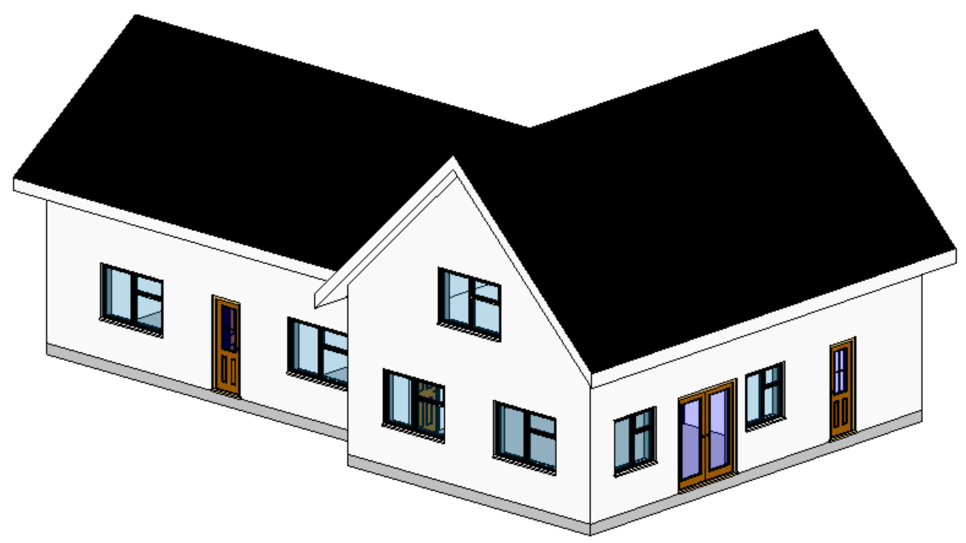

Figure 1: Domestic dwelling under testing

Background

This section looks at the key ideas and technologies behind making homes more energy efficient, especially through retrofitting. It covers important policies like the EU Buildings Directive that push for better energy performance in older buildings. It also goes into detail on upgrades like insulation, heat pumps, mechanical ventilation, and solar panels, explaining how they help improve BER ratings and lower energy use. On top of that, it looks at how software like DEAP and BIM can be used to properly assess and plan energy improvements. All this research ties into the rest of the dissertation, backing up the decisions made in the methodology and results sections.

Table A.8
BER labels in EPC database and ranges used in the TIMES Ireland Model.

Label		Energy
EPC	TIM	kWh/m^2/yr
A1, A2, A3	A	≤ 75
B1	B1	76-100
B2	B2	101-125
B3	B3	126-150
C1, C2, C3	C	151-225
D1, D2	D	226-300
E1, E2	E	301-380
F	F	381-450
G	G	> 450

Figure 2: BER ratings

Methodology

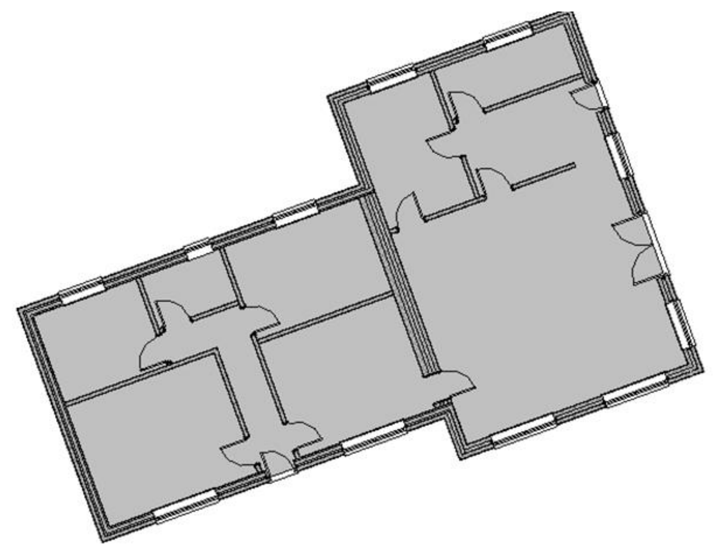

Figure 3: Development of house in REVIT

The methodology focused on accurately assessing the energy performance of a 1950s bungalow and testing improvements using DEAP and REVIT software. DEAP was used to establish the original BER rating and model various upgrades, such as insulation, heat pumps, mechanical ventilation, and solar panels, to measure their impact. REVIT helped simulate heating and cooling loads to ensure the correct sizing of heating systems, preventing inefficiencies. Each step was taken to reflect real-world retrofit scenarios and align with SEAI guidelines, ensuring that the recommended improvements were both practical and cost-effective.

Results

Figure 4: Dwelling pre renovations

Figure 5: Dwelling post renovations

Figure 6: MHVR, 10 Panels extra insulation

The BER analysis shows how retrofit measures could improve the energy efficiency. The dwelling started at a BER of G (Figure 4), with high energy demand and emissions.

Initial renovations, like insulation and glazing, improved it to B3 (Figure 5). Further upgrades, like the addition of mechanical ventilation, heat pumps, and PV panels, boosted it to A3 (Figure 6), proving the effectiveness of combining multiple strategies.

Energy Performance	HP, MHVR and 6 PV panels	Everything	Everything and 10 PV panels	MHVR, 10 Panels and extra insulation
Rating	A3	A3	A2	A3
Energy Value (kWh/m2/yr)	73.25	59.07	45.77	72.59
CO_2 (kgCO2/m2/yr)	9.38	7.56	5.86	20.36

Table 1: A rating possibilities

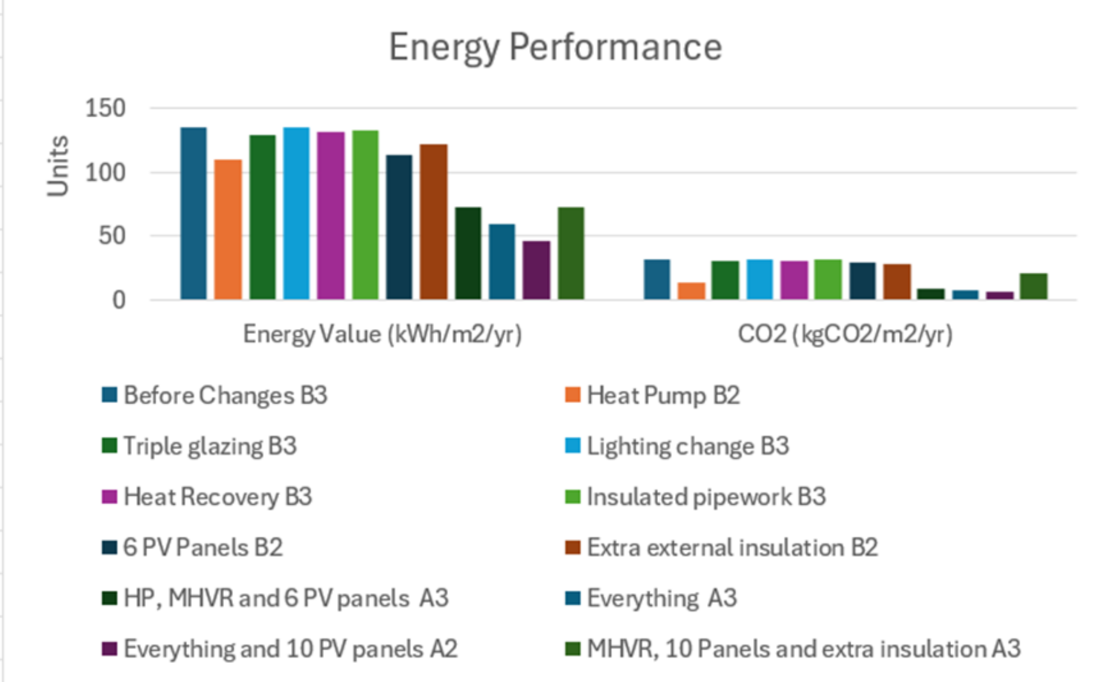

Figure 7: DEAP BER Results

Figure 7 presents different upgrade combinations and their impact on BER ratings, energy values, and carbon emissions. It demonstrates how layering energy-efficient measures—such as heat pumps, renewable energy, and additional insulation—further enhances energy performance. The optimal combination of upgrades achieved an A2 rating, showing the best balance between energy savings and BER improvements.

Conclusion

- Each objective for this dissertation was researched, performed and results discussed in depth.
- The background/ literature review examined retrofitting strategies like insulation, heat pumps, ventilation, and renewables, alongside national and EU energy policies.
- DEAP and REVIT simulations assessed how retrofits impact a 1950s bungalow's BER, energy demand, and CO_2 emissions.
- Both simulations and case studies showed deep retrofits improved BER from G (1,509.05 kWh/m²/yr) to A2 (45.77 kWh/m²/yr), cutting emissions drastically.
- A combined approach—insulation, efficient heating, ventilation, and renewables—proved essential for maximizing energy savings and sustainability.

Special thanks to Dr Adrian Chaplin BEng, PhD my supervisor and Ms Clodagh Moore for presenting the dissertation class.