B9BA103 Data Mining

Analysis of BER Rating

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Choice of Algorithm and Evaluation Metrics

Choice of Algorithm

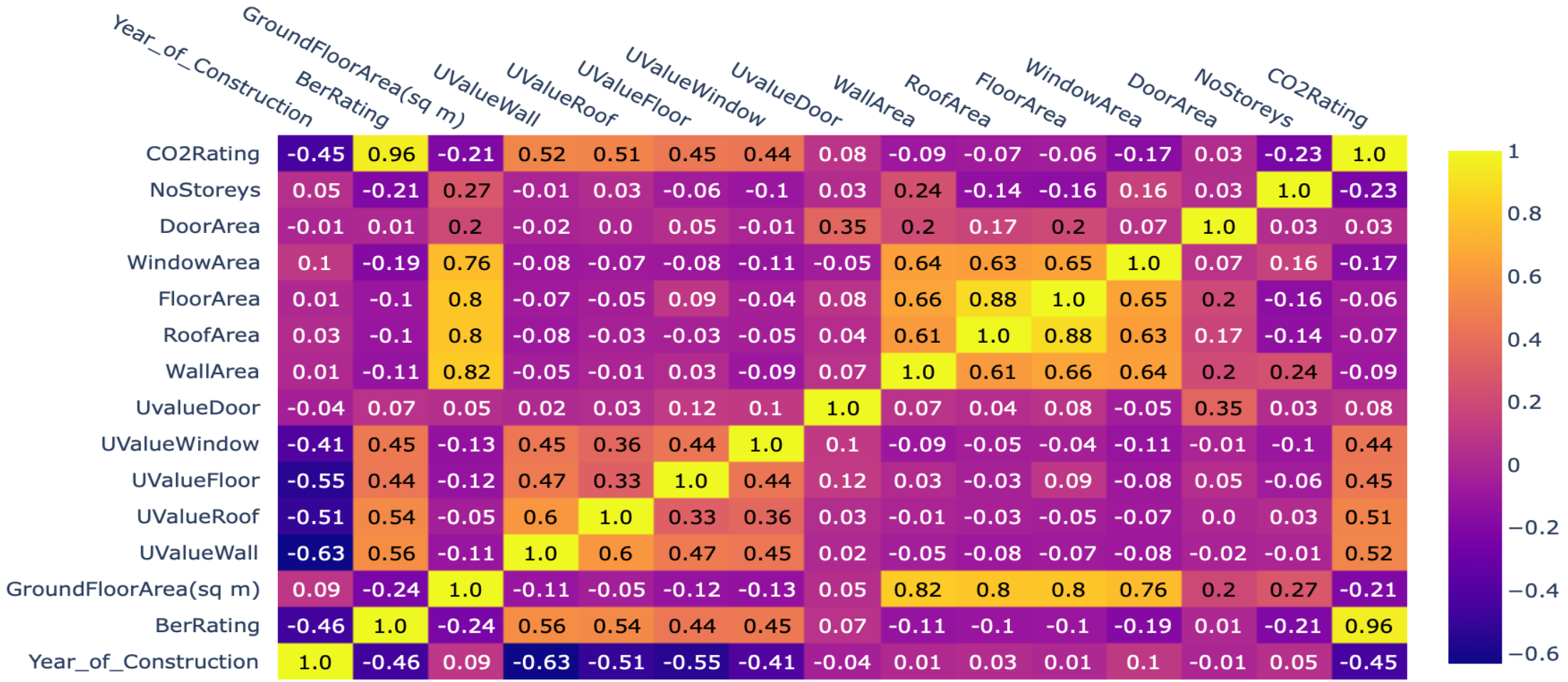
Algorithm	Recall Score	F1 Score	Avg Processing time
Adaptive Boost	98.7 %	97.4 %	18 Minutes
Random Forest	97.6 %	96.2 %	2 Minutes
Logistic Regression	95.8 %	84.8 %	15 Minutes

Table 1.1 Results with Co_2

Algorithm	Recall Score	F1 Score	Avg Processing time
Adaptive Boost	98.7 %	94.6 %	17 Minutes
Random Forest	92.7 %	92.2	2 Minutes
Logistic Regression	96.4 %	85 %	14 Minutes

Table 1.2 Results without Co_2

Heatmap – Highly corelated features



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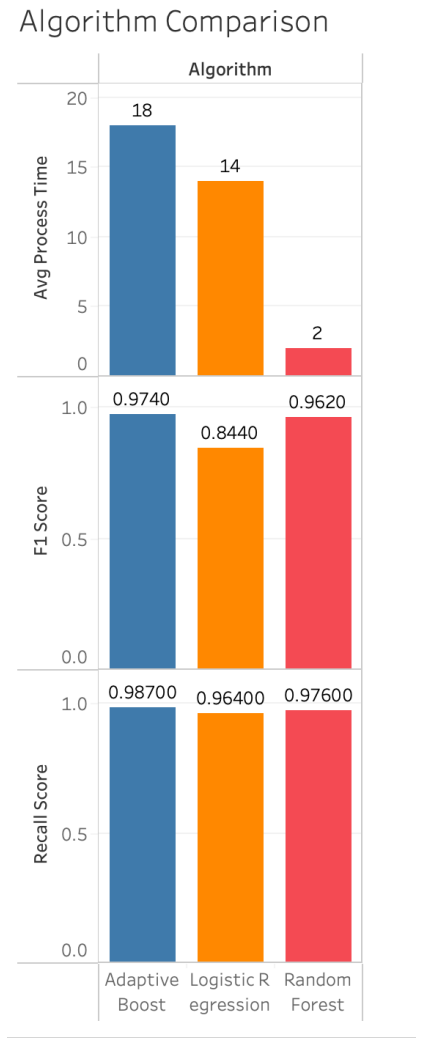
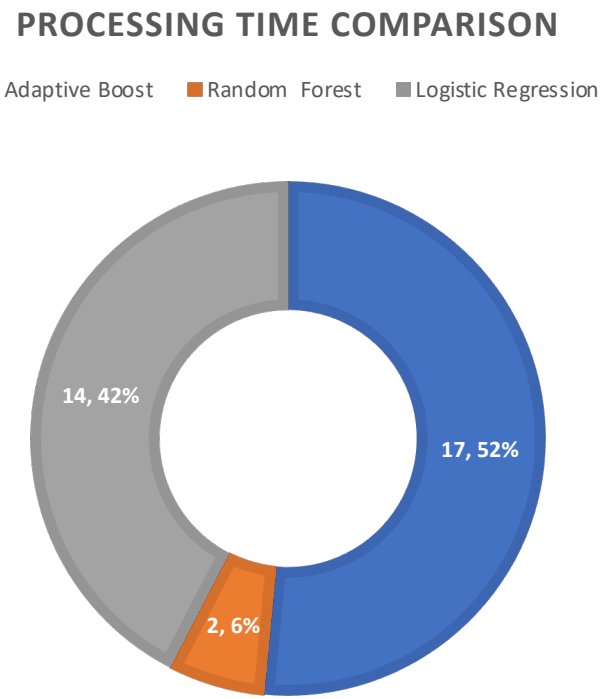
Choice of Evaluation Matrix

- F1 Score : Mean of Precision and Recall for Imbalanced Data set
- For Predicting BER Rating of the house its suitable because of Imbalanced Data sets





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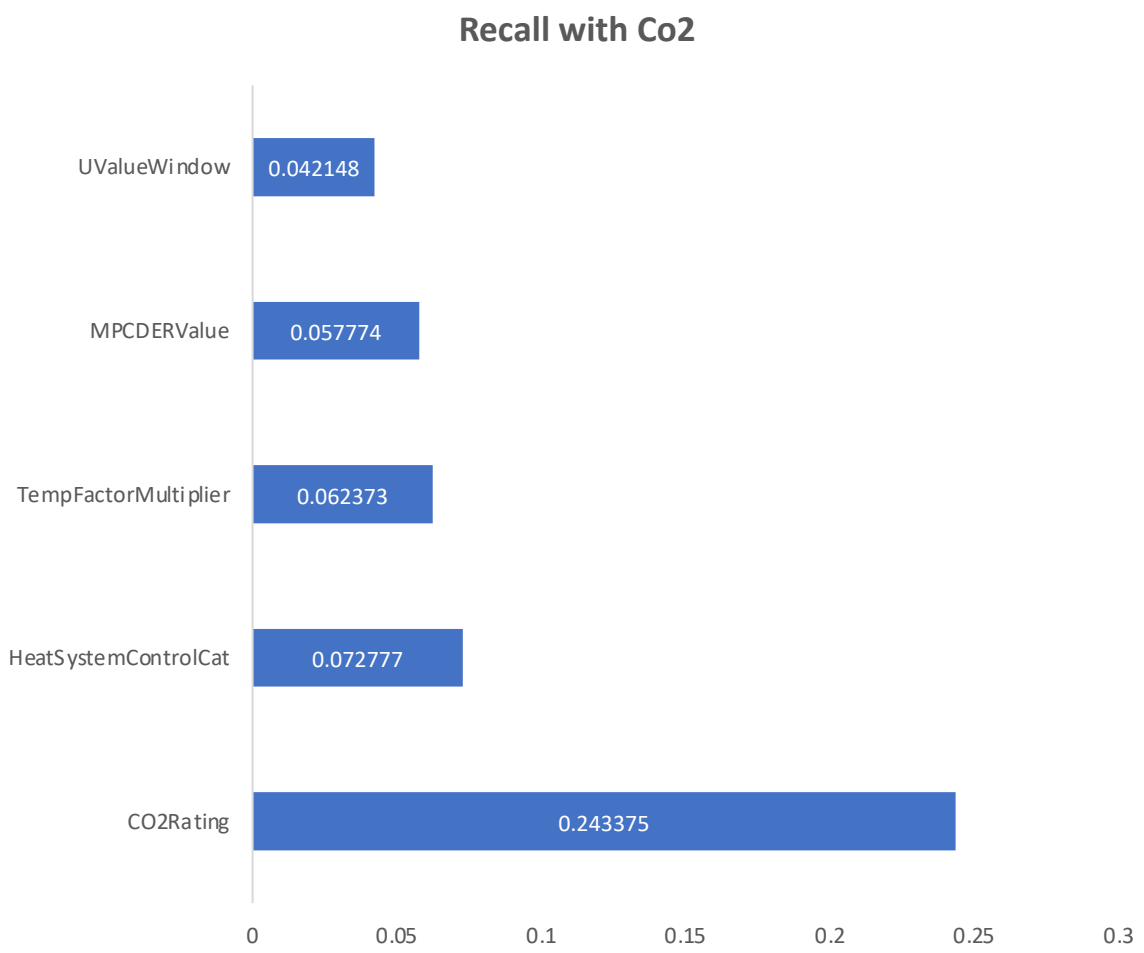
Significant Factors

Important Features

Features	Significance
CO2Rating	Direct Impact on Environment
HeatSystemControlCat	Plays an important role in locally controlling heating in house
TempFactorMultiplier	-
MPCDERValue	-
UValueWindow	U value determines the effectiveness of insulation of the window



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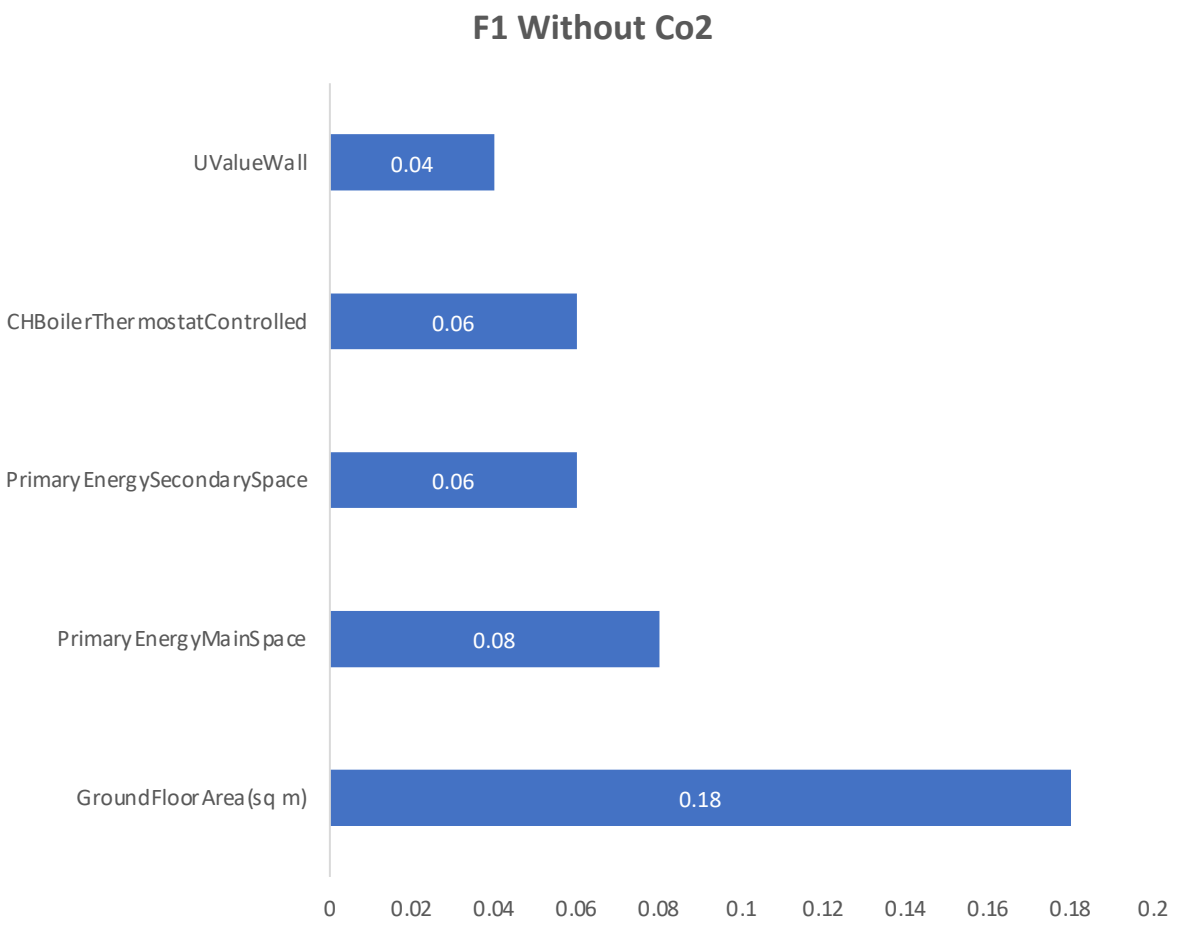
Important Features

Features	Significance
GroundFloorArea(sq m)	Area that house has impacts heating
PrimaryEnergyMainSpace	Energy source of the house
PrimaryEnergySecondarySpace	Secondary Energy source
CHBoilerThermostatControlled	Boiler with the thermostat control
UValueWall	U value determines the effectiveness of insulation of the window



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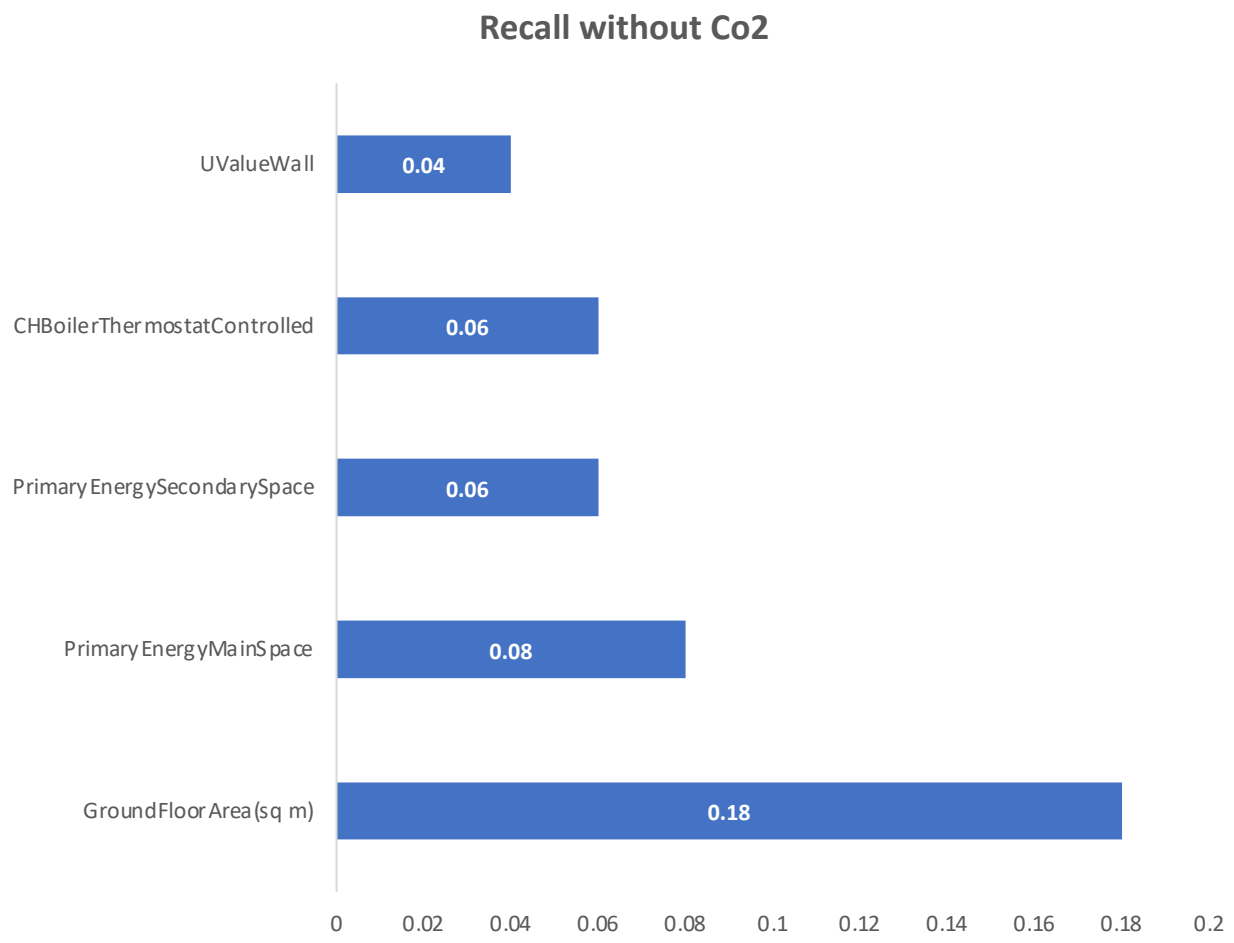

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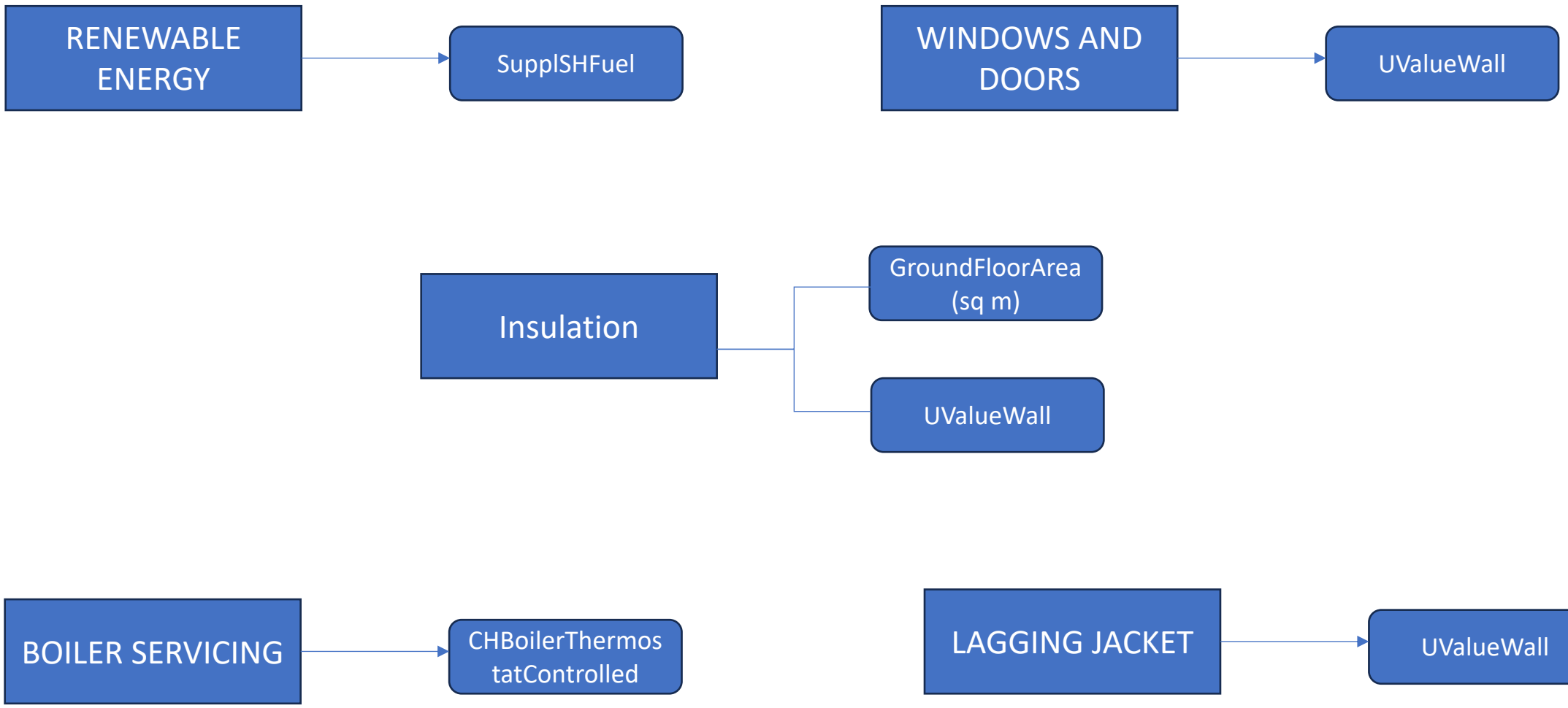
Cost Benefit Analysis

Categories to Important features



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Cost of upgrade

CATEGORY	AVERAGE COST	ANNUAL AVERAGE SAVINGS
INSULATION	€ 1200 to € 6000	Up to €600
RENEWABLE ENERGY	€ 5000 to € 7000	€900 to €1300
BOILER SERVICING	€ 130	
WINDOWS AND DOORS	€ 450 to € 1700	Up to € 200
LIGHT BULBS	€ 4 Each	€ 50 to € 120
LAGGING JACKET	€ 2,400 to € 8000	up to €600
TOTAL	**€ 8950 to € 22830**	**€ 1350 to € 2820**

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Cost Benefit analysis

Upgraded Property with Rating B and Above	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	SUM
Investment	€ 11,500										
Electricity Cost	€ 850	€ 1,700	€ 2,550	€ 3,400	€ 4,250	€ 5,100	€ 5,950	€ 6,800	€ 7,650	€ 8,500	€ 22,500
Gas Cost	€ 450	€ 900	€ 1,350	€ 1,800	€ 2,250	€ 2,700	€ 3,150	€ 3,600	€ 4,050	€ 4,500	
Co2 Rating	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	1 Tonne	10 Tonnes
Old Property with Rating C	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**SUM**
Investment											
Electricity Cost	€ 1,500	€ 3,000	€ 4,500	€ 6,000	€ 7,500	€ 9,000	€ 10,500	€ 12,000	€ 13,500	€ 15,000	€ 24,500
Gas Cost	€ 950	€ 1,900	€ 2,850	€ 3,800	€ 4,750	€ 5,700	€ 6,650	€ 7,600	€ 8,550	€ 9,500	
Co2 Rating	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	3.2 Tonne	32 Tonnes

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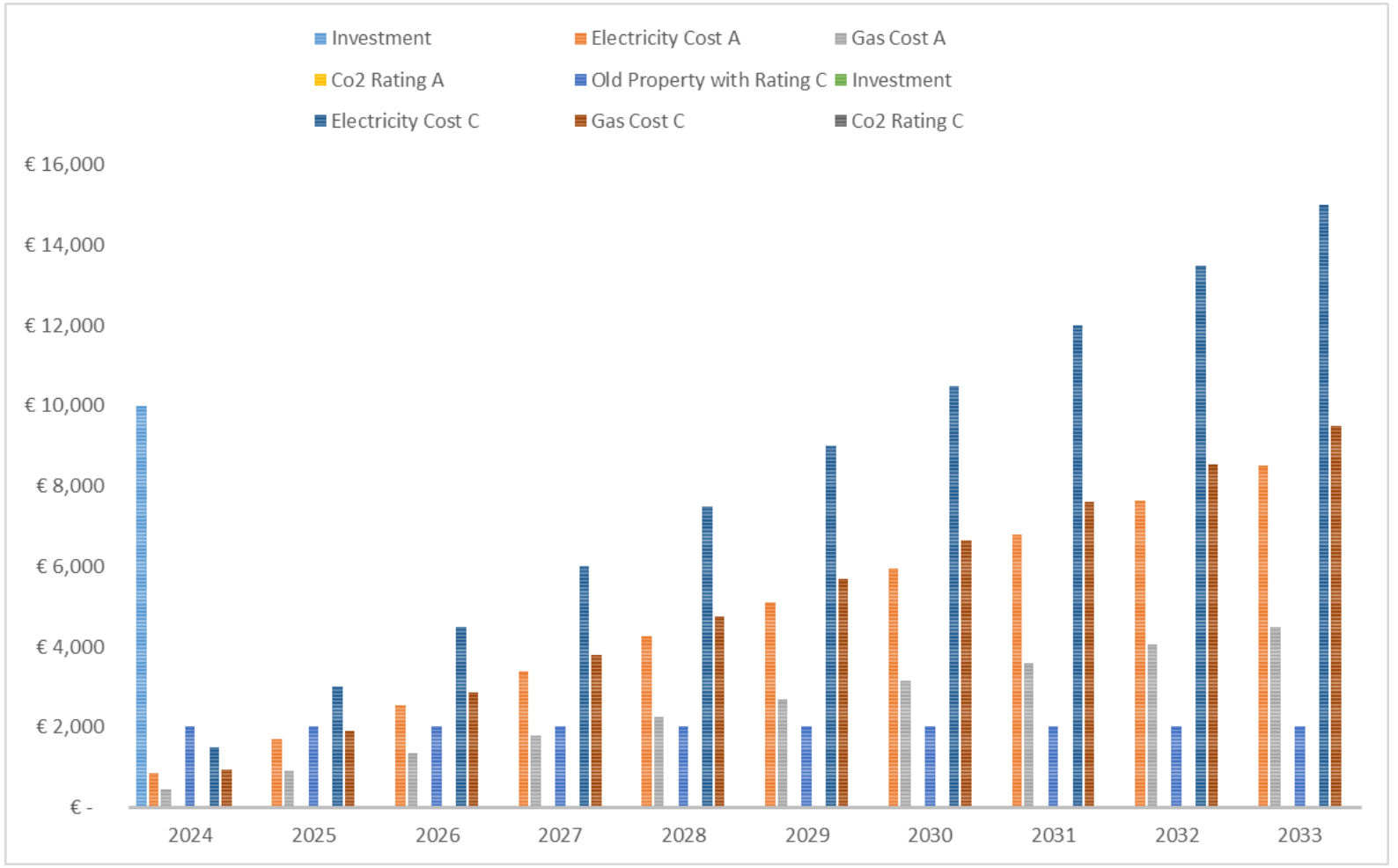

Cost benefit analysis chart

THANK YOU

Appendix

COST OF INSULATION

Attic Insulation Cost:
Checking what insulation lies between the ceiling joists in your attic – it should be between 300mm and 400mm.
In older homes, insulation is usually non-existent or is about 100mm in depth.
Often the first step in insulating your home, attic insulation for a standard three-bedroom house may cost around €450 to €700.

Floor Insulation:
To insulate the ground floor, you might spend €900 to €1,400.
You can save up to €600 per year on heating bills by insulating the attic and walls of your home properly.

https://www.anpost.com/Money/Low-Fixed-Rate-Loans/Green-Loans/Top-tips/BER-rating-guide

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COST OF RENEWABLE ENERGY

Solar PV Panels comparison table

System Size	No. of Solar Panels	8 Panels	10 Panels	12 Panels
	Kilowatt Peak (max output)	3.4 kWp	4.3 kWp	5.2 kWp
	Annual Generation	2,700 kWh	3,500 kWh	4,200 kWh
Annual Savings	Self Consumption of Solar Electricity	€720	€800	€860
	Micro Generation of Exported Electricity	€200	€330	€440
	Annual Savings	€920	€1,130	€1,300
System Cost	Average Supply and Installation	€7,066	€8,163	€8,874
	SEAI Grant	-€1,950	-€2,100	-€2,100
	Net Cost	€4,966	€6,283	€6,774
Return	Payback Estimate	5 Years	5 Years	5 Years

Savings base on average electricity rate of 41c/kWh and microgeneration rate of 21c/kWh that is exported. All prices calculated at 0% since 1st May 2023.

*An average solar PV system can save over 50% per year on electricity, based on an average consumption of a house being 4200kWh/units. 8 x Solar PV panels or 3.2kWp will generate approx. 2700 units per year (50% of 4200,kWh/units = 2100kWh/units).
Average cost of pv panels € 5000 to €7000

https://www.electricireland.ie

COST OF WINDOWS

- Replacement window costs vary greatly, from €450 to €1,700 depending on a number of factors. The factors that influence the window replacement cost are the size, style and material of the window to be replaced.

Casement Window	**Average cost per window**
uPVC Casement Window	€450 - €560
Wooden Casement Window	€800 - €1,000
Aluminium Casement Window	€850 - €1,000
Sash Window	**Average cost per window**
uPVC Sash Window	€800 - €1,000
Wooden Sash Window	€1,250 - €1,700
Aluminium Sash Window	€1,350 - €1,700

https://www.window24.ie/window-prices/window-replacement-cost/

COST OF VENTILATION

- The national average cost for installing a ventilation system ranges from $2,400 to $8,000. Most people spend $4,000 on installing a demand control ventilation system. At the low end of the price range, you could spend as little as $120 for an attic exhaust fan replacement with installation included. At the high end, some people pay as much as $10,000 to install a brand new hybrid ventilation system in their home.

- https://www.cleanenergyireland.ie

How to improve your home’s BER rating

Improving the energy efficiency of your home can lead to a higher Building Energy Rating (BER) and long-term savings on your utility bills.

- INSULATION : One way to enhance energy efficiency is by ensuring proper insulation throughout your home. Although insulating can initially be an investment, it pays off in reduced heating expenses over time. The Sustainable Energy Authority of Ireland (SEAI) offers various grants for insulation upgrades, including those for attic, wall, and cavity insulation.
- RENEWABLE ENERGY : Another avenue to explore is renewable energy sources, such as, which can lower energy costs in the long run. SEAI provides grants for renewable energy adoption, such as solar electricity and water heating.
- BOILER SERVICING : Regular maintenance, like annual boiler servicing, not only extends equipment lifespan but also enhances efficiency, minimizing energy waste.
- WINDOWS AND DOORS : Upgrading old windows and doors with better-glazed alternatives reduces drafts and improves overall insulation, contributing to energy savings.
- LIGHT BULBS : Swapping out traditional light bulbs for energy-efficient LED bulbs is another simple yet effective way to cut down on electricity usage.
- LAGGING JACKET : Finally, insulating your hot water tank with a lagging jacket can help retain heat and improve your BER rating while reducing energy costs. By implementing these measures, you can create a more energy-efficient home, resulting in both environmental and financial benefits.