

A Data-Driven Approach to Evaluating Energy Savings Per Household: Insights from Ireland's Retrofit Grant Programmes

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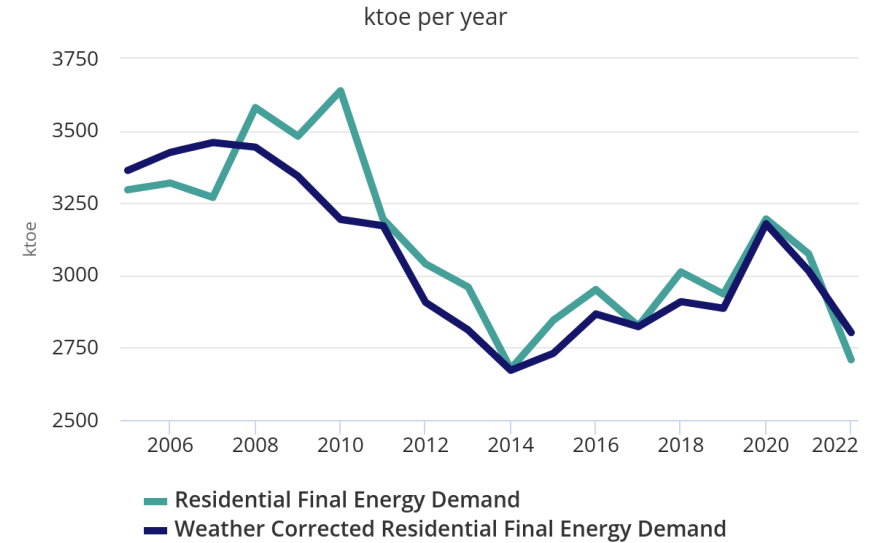
Sustainable Energy Authority of Ireland, Dublin, Ireland



Context: Ireland's Climate Plan & Retrofit Targets 2030



The residential sector accounts for almost **one quarter** of the energy used in Ireland.
15.5% of the energy-related CO₂ emissions.



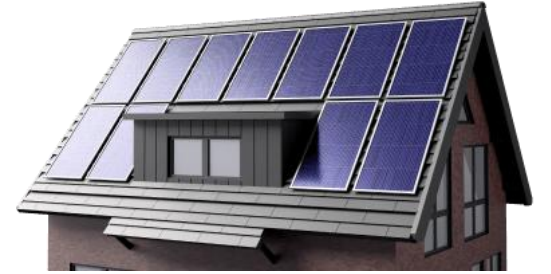
500,000 homes upgraded to **BER B2** and **400,000** heat pumps in existing homes.



61% of all energy used in households was for **space heating**, **20%** for water heating, **16%** for lighting & appliances, and **2%** for cooking.

Irish Retrofits Energy Programme

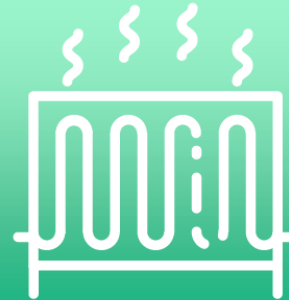
- Better Energy Homes (BEH) and Solar PV (SPV) schemes grants supporting individual energy upgrade.
- National Home Energy Upgrade Scheme also known as One Stop Shop (OSS) Service.
- Better Energy Warmer Homes Scheme (WHS) which provides fully funded energy upgrades for vulnerable energy poor homes.



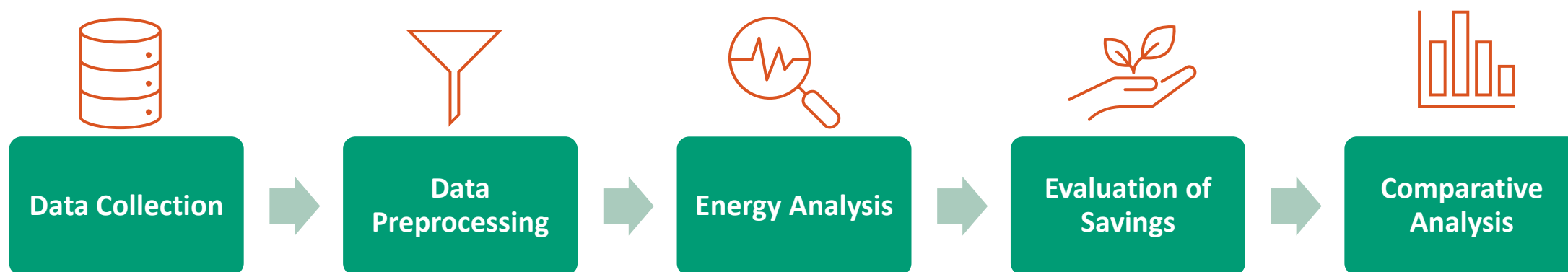
Retrofits Energy Programme Impact Analysis Initiative

Objective:

- **More precise evaluation of energy programmes:** By assessing the impact on a per dwelling basis, policymakers can better understand the variability and specific outcomes of its programmes.
- **Enhanced data-driven decision making:** Detailed impact estimates will inform future policy and programme activities, ensuring they are based on robust and accurate data.
- **Increased transparency for reporting impacts:** The ability to provide detailed impact assessments will enhance reporting capabilities to government and other stakeholders, fostering greater accountability and trust.

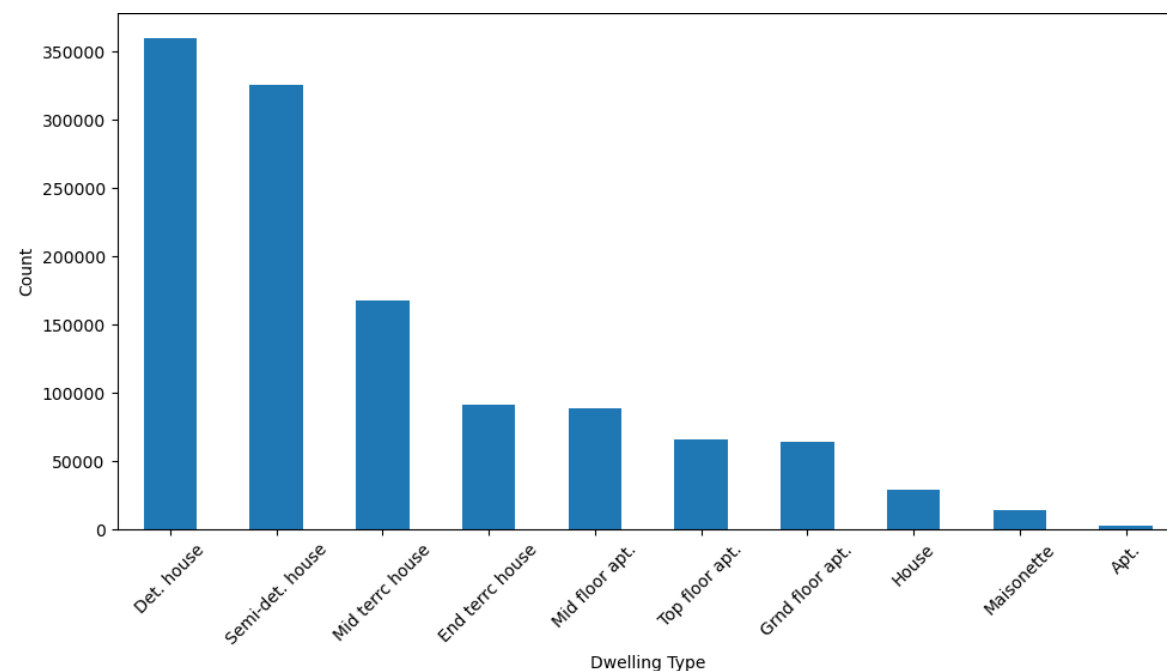
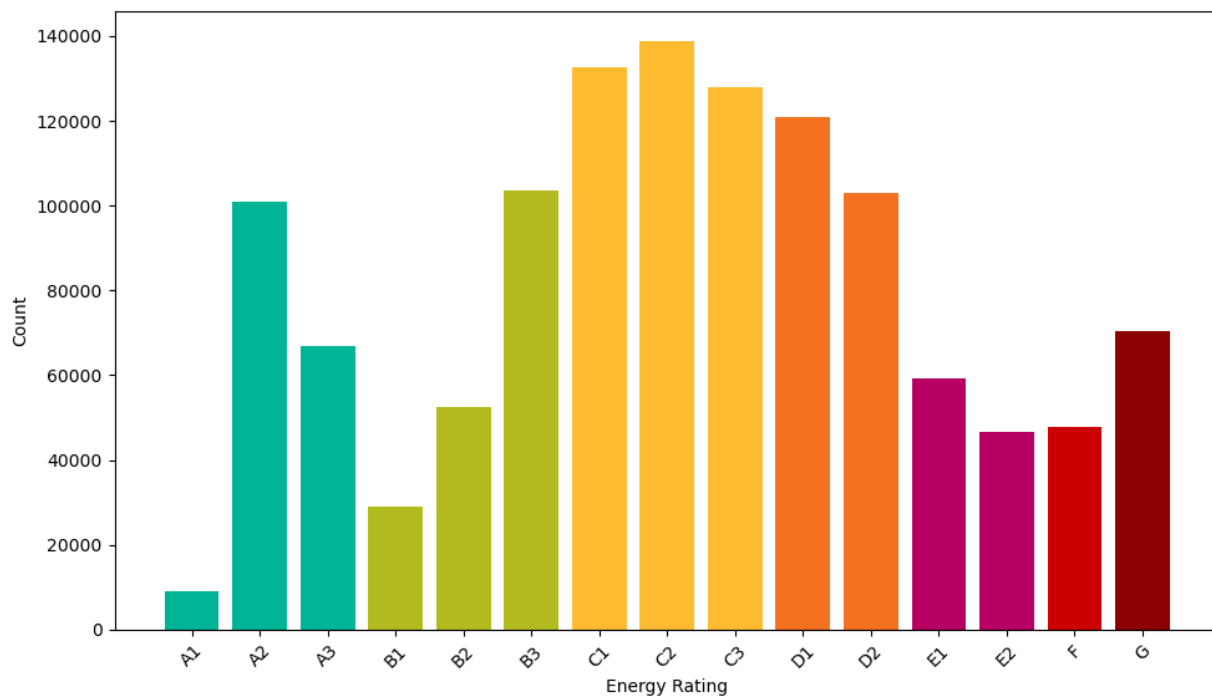


Methodology process diagram for the data driven Enhanced Impact Reporting



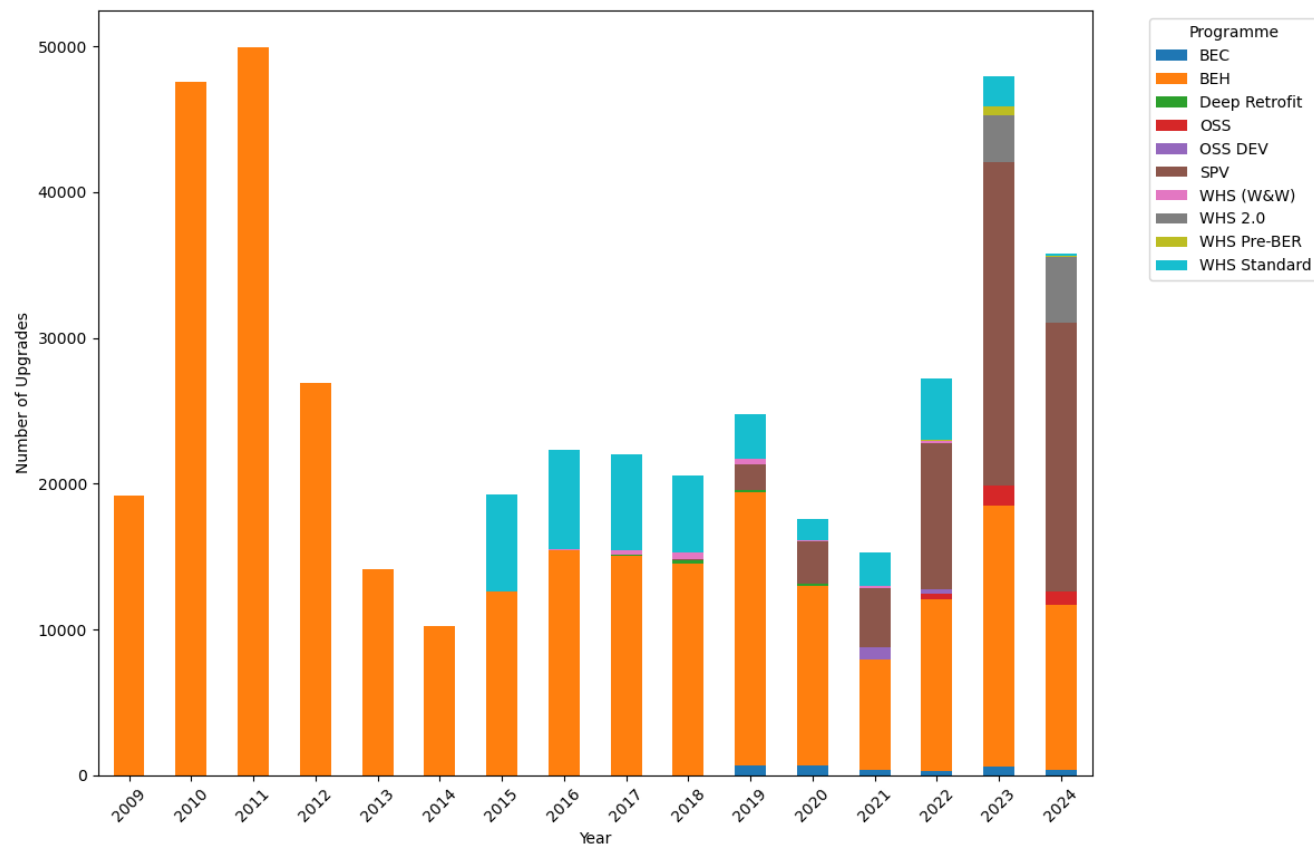
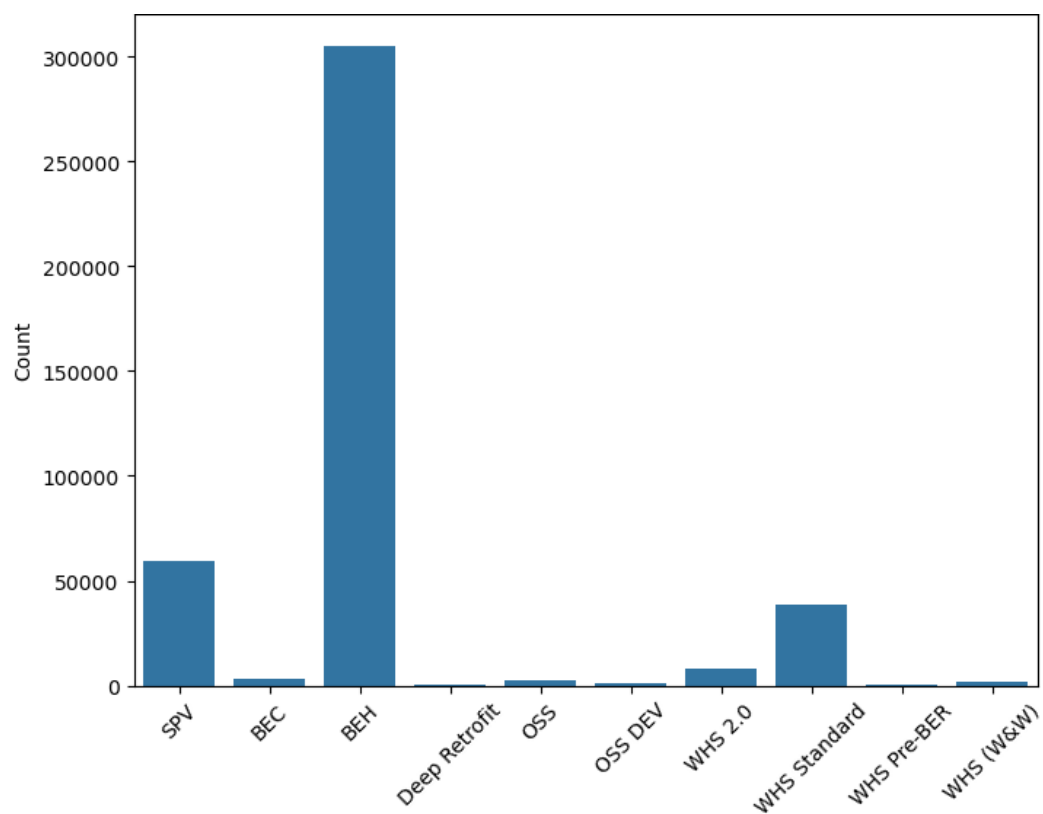
Irish Residential Energy Performance Certificates

1,209,140 Records, Over 47% of dwellings fall into the C and D energy ratings



Irish Retrofit Programme Database

- Better Energy Homes (BEH)
- Solar PV (SPV)
- One Stop Shop (OSS)
- Warmer Homes Scheme (WHS)
- Better Energy Community (BEC)



National Home Energy Upgrade Scheme via One Stop Shops (OSS)

- Complete home energy upgrade for homes **built before 2011**
- Existing BER of **B3 or lower**
- Must reach at **least B2** (100 kWh/m²/yr or better improvement)
- Delivered via **One Stop Shops (OSS)**
- End-to-end service: assessment, design, grant management, contractors, QA, finance



STEP 1

Contact a **SEAI** registered One Stop Shop



STEP 2

Home Energy
Summary Report



STEP 3

Home Energy
Upgrade Loan
Scheme



STEP 4

Apply for your
low-cost, flexible
loan



STEP 5

Once approved for
your loan, you can
start your home
energy upgrade
and carry out work.



Data Preprocessing and Estimation and Calculation

Data Cleaning & Consistency

- Standardize formats across datasets
- Resolve discrepancies to ensure reliable analysis

Duplicate Removal

- Detect and remove duplicate EPC entries
- Retain only the most recent record per dwelling

Data Integration

- Link datasets accurately to enrich analysis
- Ensure seamless cross-referencing of information

Energy Metric Recalculation

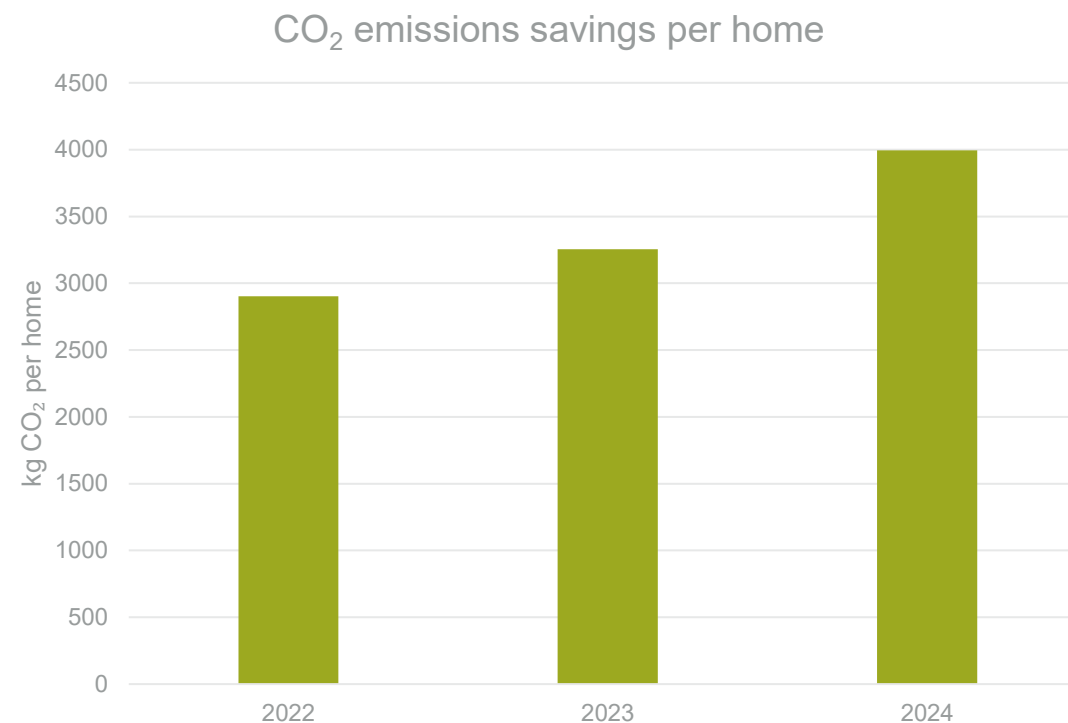
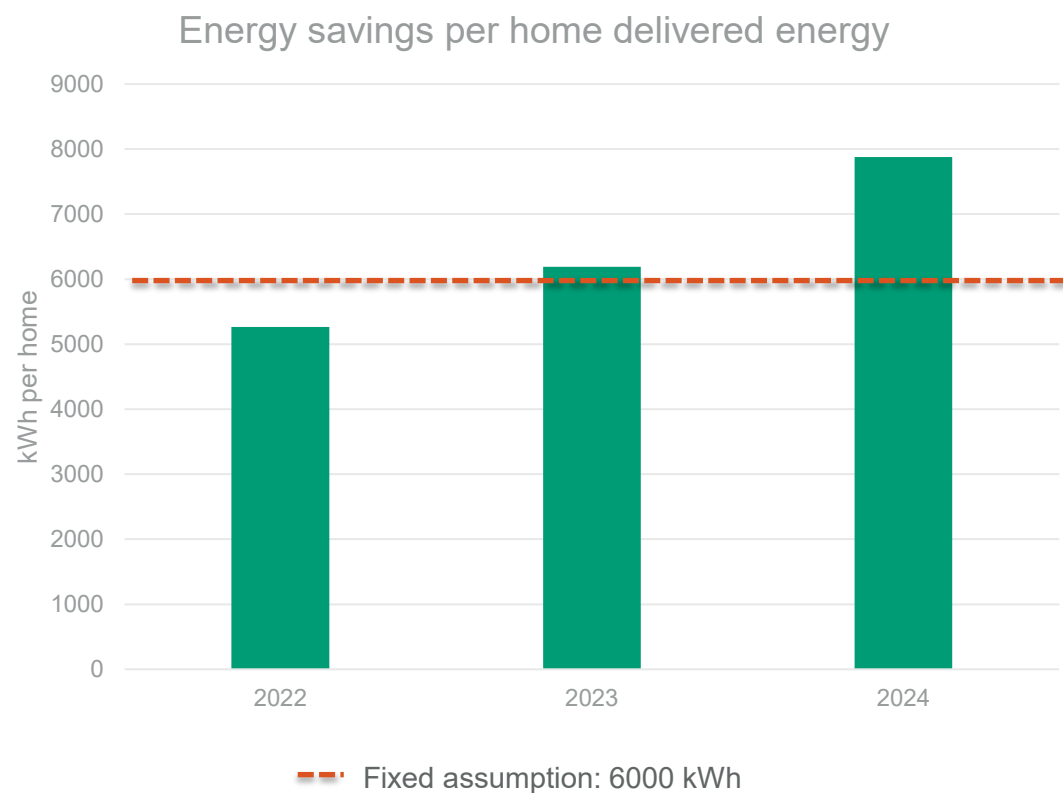
- Recalculate **primary** and **delivered** energy values
- Exclude renewable energy to focus on conventional usage

Retrofit Record Selection

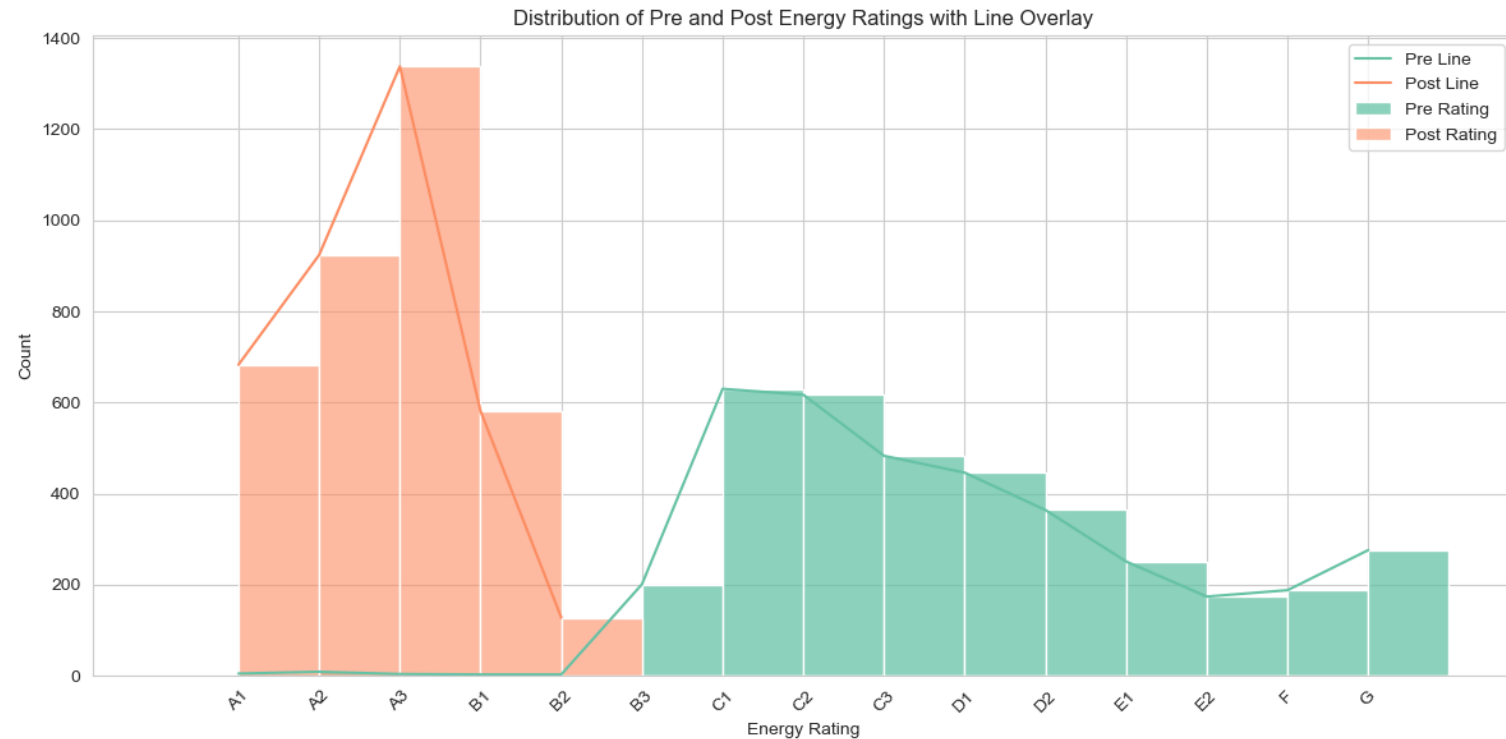
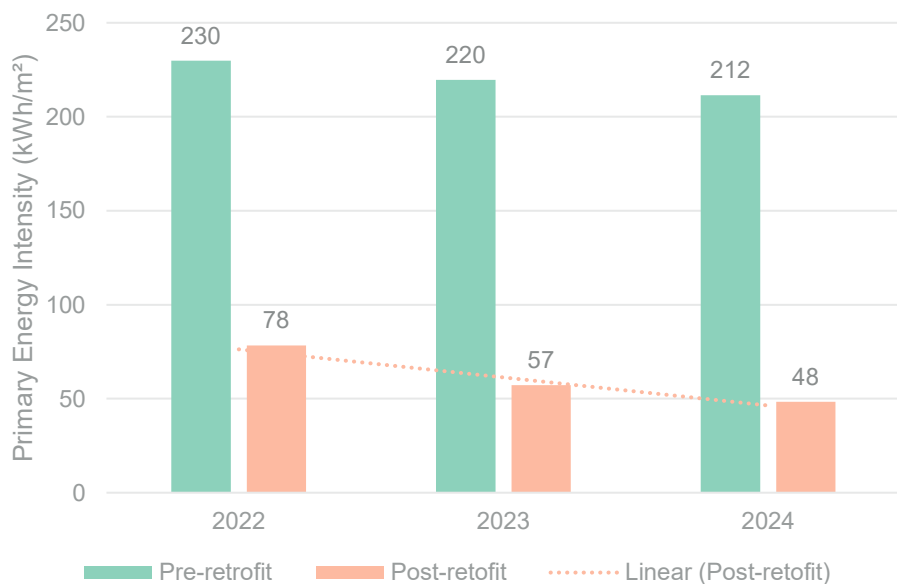
- Filter for homes with **both pre- and post-retrofit** EPCs
- Enables meaningful impact assessment of retrofit measures



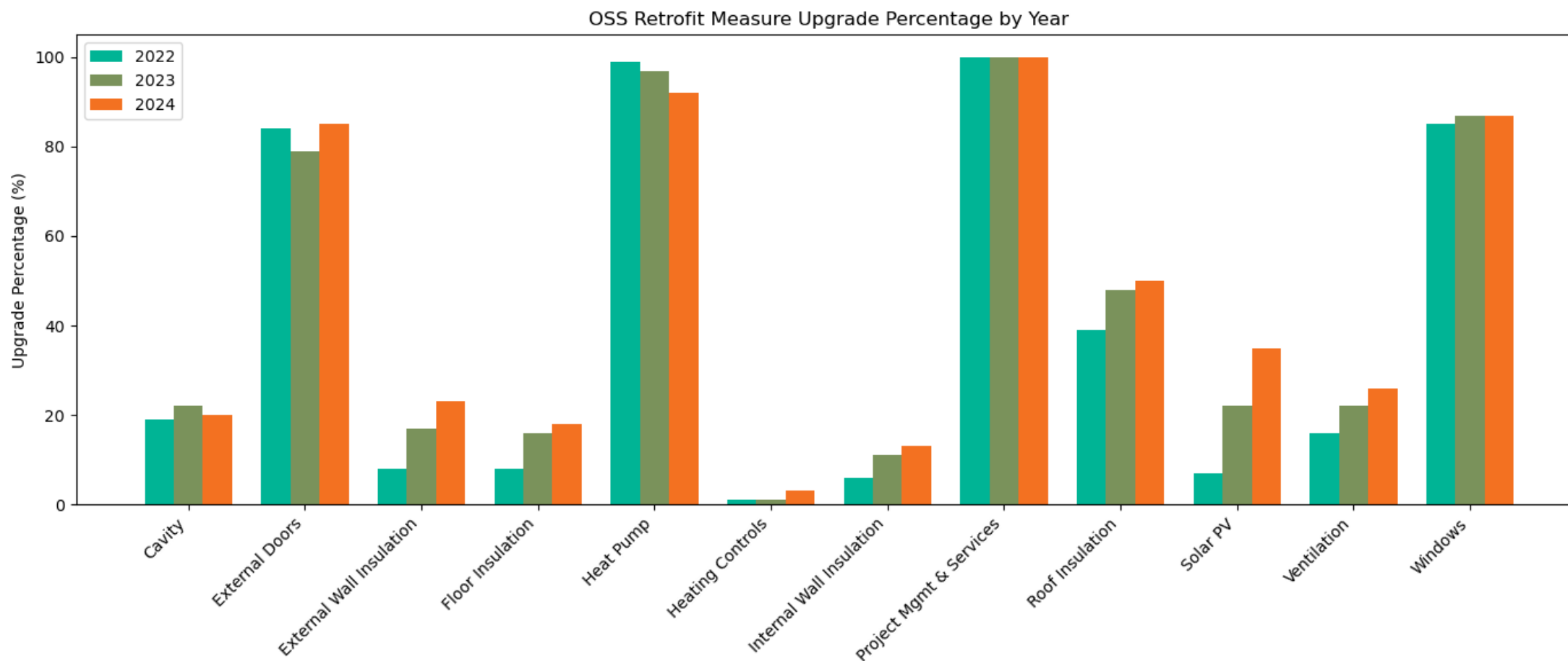
Energy and CO₂ per home saving trend and comparison



Pre- and Post- Home Energy Savings Analysis



Trends in OSS Retrofit Measure Upgrades highlights evolving priorities and adoption rates in national retrofit activity.



Next step

Per-Home, Data-Driven Evaluation

- Enables credible, large-scale programme analysis
- Moves beyond fixed assumptions for greater accuracy

Addressing Missing Pre-Retrofit BER Data

- ~68% of homes lack pre-retrofit BER
- Machine learning will predict missing values

Cumulative & Lifecycle Impact Analysis

- Evaluates long-term energy and carbon benefits
- Focus on both cumulative and lifecycle impacts

Data Storage & Accessibility

- All results securely stored in SEAI's Azure database
- Key personnel have access for ongoing decision-making



Thanks 😊



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