

CONTEXT & MOTIVATION

- Power systems are undergoing a transformation process on both the supply and demand sides:

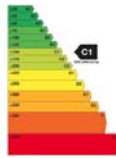
	Past	Future
Supply side	Centralised Controllable Predictable Fossil fuel based	Distributed Variable Unpredictable Renewable energy sources
Demand side	Predictable Uncontrollable	Predictable? Controllable New load categories Electrification

- Greater flexibility requirements → demand side participation over different time frames:

- Energy efficiency
- Energy arbitrage
- Ancillary services (reserve, frequency regulation)

- Energy Performance of Buildings Directive (EPBD) → assessment of EU dwelling stocks:

- Reference dwellings
- Standard assessment procedures
- Building energy rating certificates



- Integration of renewable energy sources?

OBJECTIVES

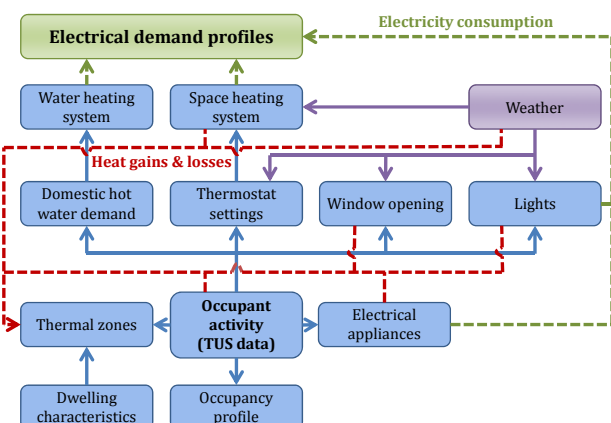
How much flexibility is embedded within Irish residential building electrical loads?

- Modelling of building archetypes representative of Irish households using EnergyPlus
- Assessment of the **load shifting** capability for each archetype model, constrained by the **comfort** of occupants and the building thermal behaviour
- Correlation of outputs from each dwelling classification and scaling up to national level

METHODOLOGY

EPDB reference dwellings → building **archetypes**:

- Operational data at high space and time resolutions
- Time-of-Use Survey data (human behaviour)



RESULTS

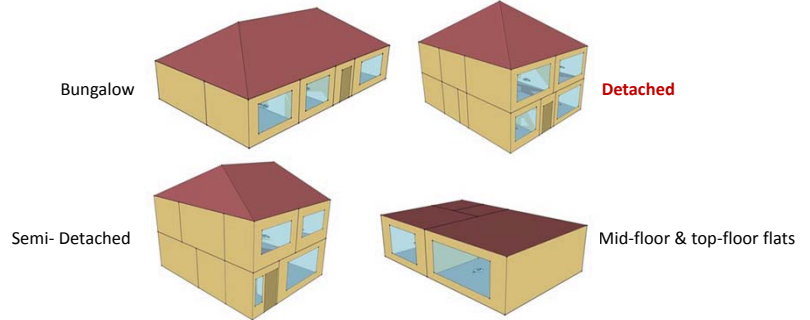


Fig. 1 Set of EPBD Irish reference dwellings

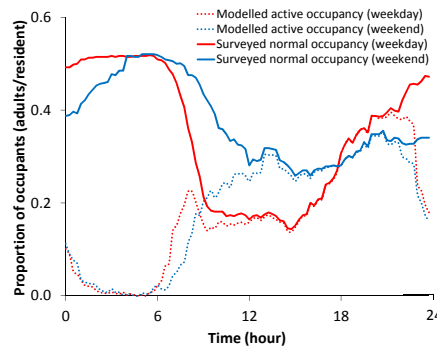


Fig. 2 Daily occupancy profiles

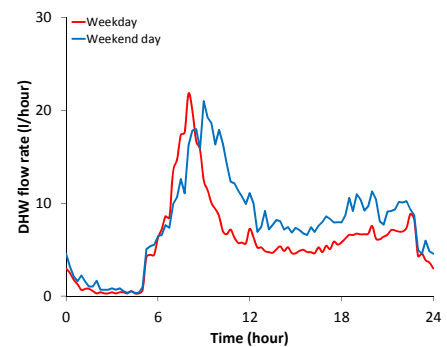


Fig. 3 Daily domestic hot water (DHW) consumption

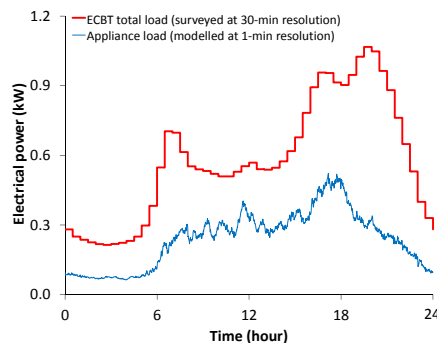


Fig. 4 Daily power consumption

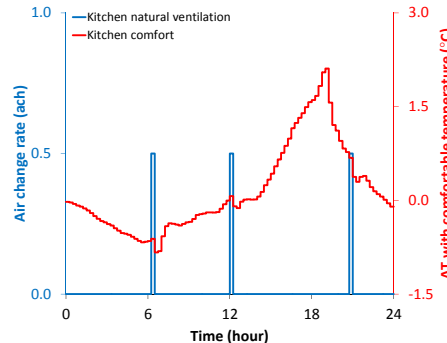


Fig. 5 Natural ventilation and thermal comfort

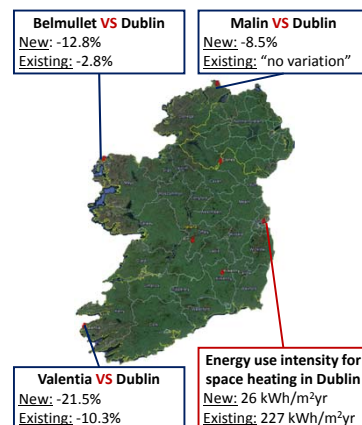


Fig. 6 Scalability to national level

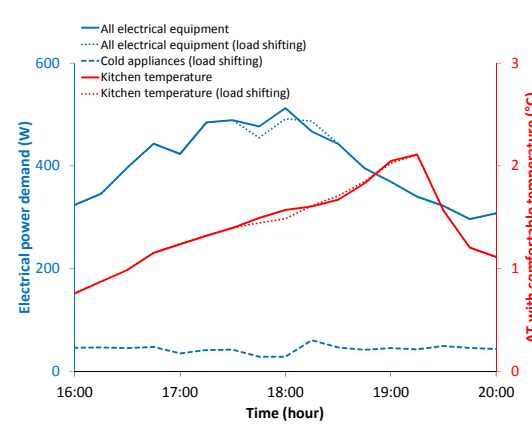


Fig. 7 Electrical load shifting and thermal comfort

FUTURE WORK

- Complete electrified versions of dwelling archetypes
- Detailed model of domestic refrigeration appliances
- Assessment of the flexibility resource by implementing load shifting strategies constrained by thermal comfort

ACKNOWLEDGEMENT

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