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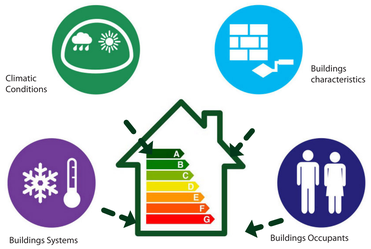
TOWARDS BETTER BUILDINGS PERFORMANCE ESTIMATIONS?

A FRAMEWORK FOR INTEGRATING DYNAMIC OCCUPANTS BEHAVIOURS IN DYNAMIC BUILDINGS SIMULATION TOOLS



PROBLEM:

Considerable disparity between predicted and actual building energy performance which may be attributed to the way occupants behaviours are modelled in Dynamic Building Simulation Models (DBSM).

A co-simulation tool has been developed to investigate introducing dynamic ocupants' behaviours to DBSM to estimate the buildings' thermal and energy performance. The co-simulation system links an Agent-Based Model(ABM), simulating dynamic occupant behaviour, to EnergyPlus[3] using the Functional Mock-up Interface standard[2] (FMI), allowing for a real-time exchange of inputs/outputs at short time intervals between the two dynamic models.

CO-SIMULATION DEVELOPMENT

The ABM was developed in Repast Simphony[1] (Java) platform including three types of agents:

Person-agent (Occupants)	Room-agent (Rooms)	Flat-agent (The dwelling)

Methods to test what would influence occupant behaviour when confronted with a thermal discomfort.

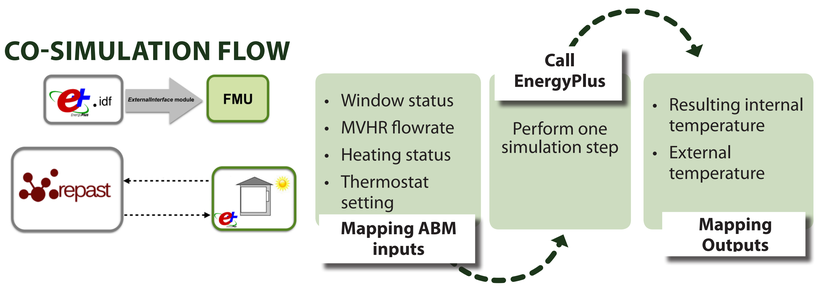
- FAMILY TYPE
- PERSONAL ADAPTIVE THERMAL THRESHOLDS
- ENVIRONMENTAL ATTITUDE
- SENIORITY

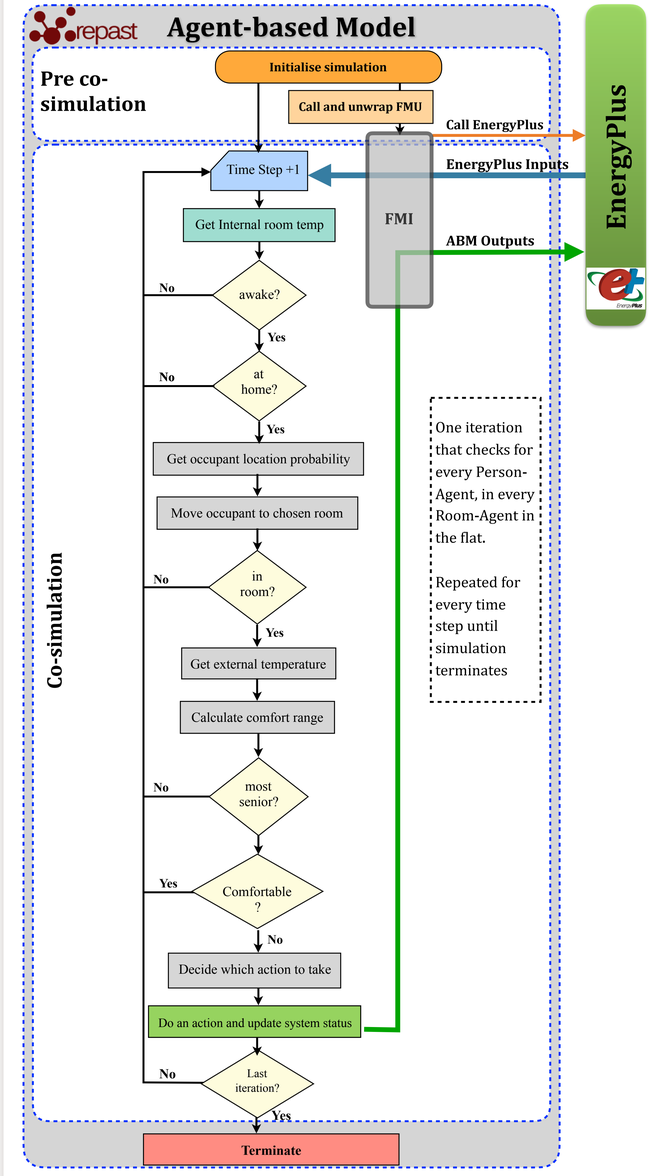
CASE STUDY

1- Comfort-secnario: Person-agents maintain their thermal comfort

2- Conserving-scenario: Person -agents try to reduce energy consumption by toleating slight thermal discomfort.

CO-SIMULATION FLOW

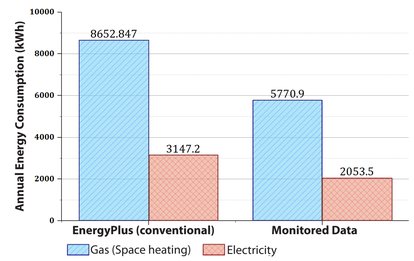


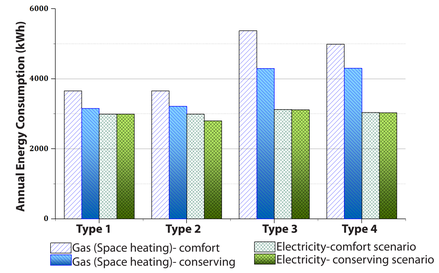


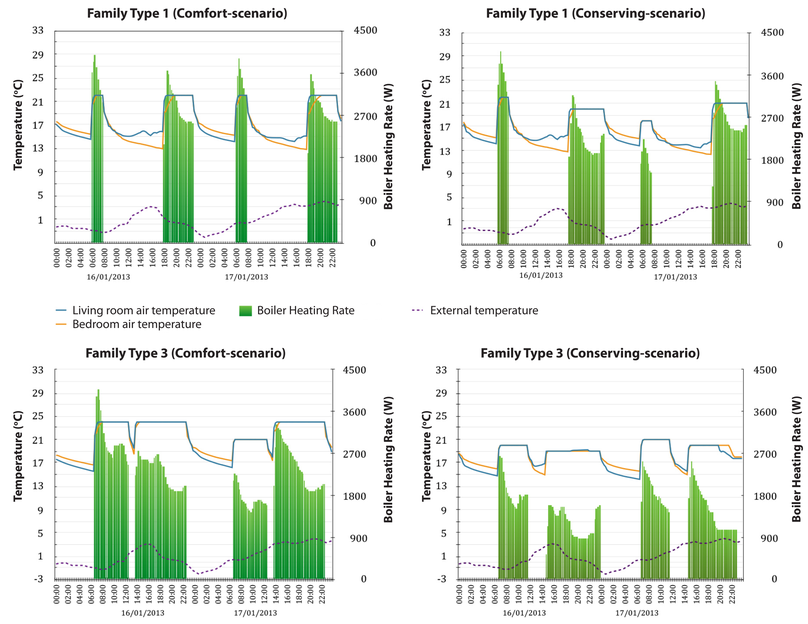
RESULTS

A conventional EnergyPlus simulation of the case study was conducted based on National Calculation Methods[4] (NCM) schedules and occupancy assumptions. The results of the conventional simulation was compared to the actual energy consumption of the case study.

Then a co-simulation of the four different family types, under comfort scenario and conserving scenatio, was conducted and compared with the conventional EnergyPlus simulation.







1 Argonne National Laboratory (2015). The Repast Suite.
2 MODELISAR. (2015). Functional Mock-up Inter-face for Model Exchange and Co-Simulation, Version 2.0. Technical report.
3 EnergyPlus (2014). Introduction to EnergyPlus.
4 Energy Performance of Buildings Directive (2015). NCM: Uk's national calculation method for non-domestic buildings.