SUMMER EVENT 2012

Domestic Thermal Energy Storage: A study of the present and future benefits and impacts.

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INTRODUCTION Heating is the major energy consumer and CO_2 emitter in the domestic building sector. One solution is low carbon and renewable energy technologies, and electrification. Wide scale application of these will induce the following problems:

- Large peak to off-peak demand variation
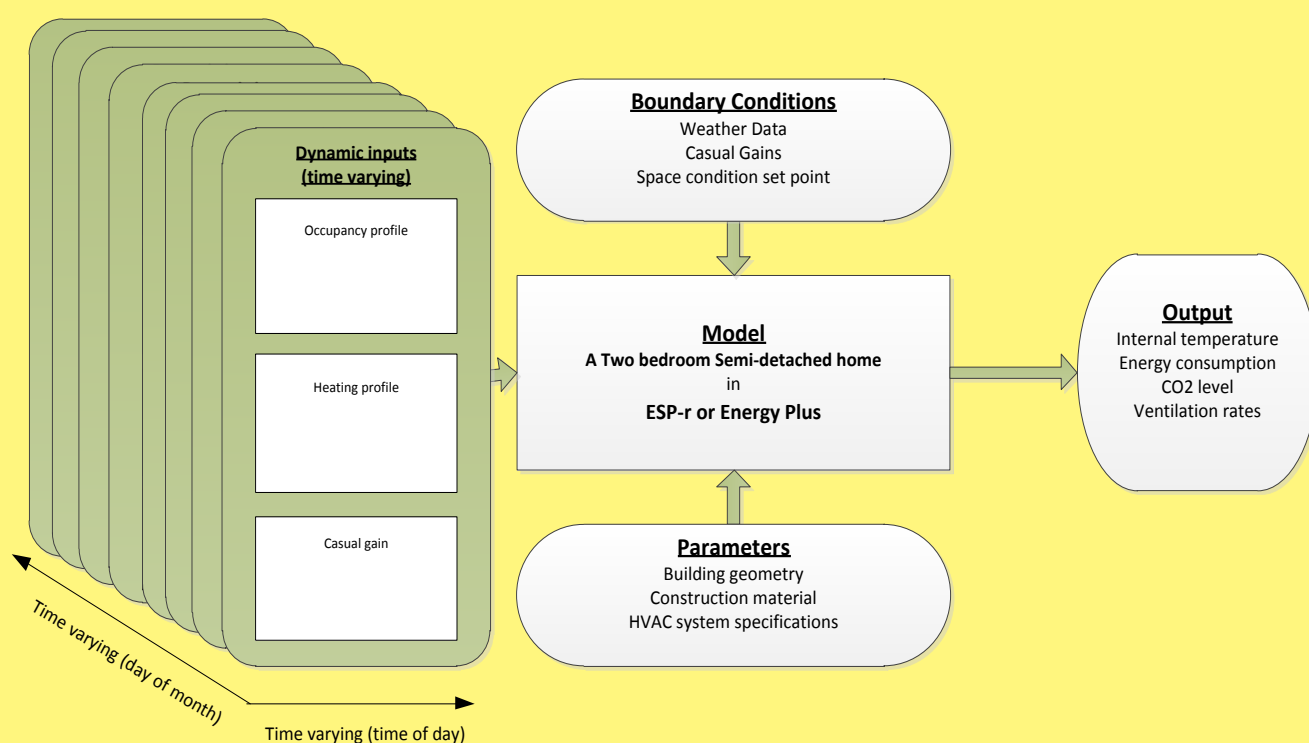- Intermittency of supply & low power quality
- Disparity between peak heat/electricity demand
- Distribution & security issues of large peak/off-peak variation

Peak half hourly heat & electricity demand
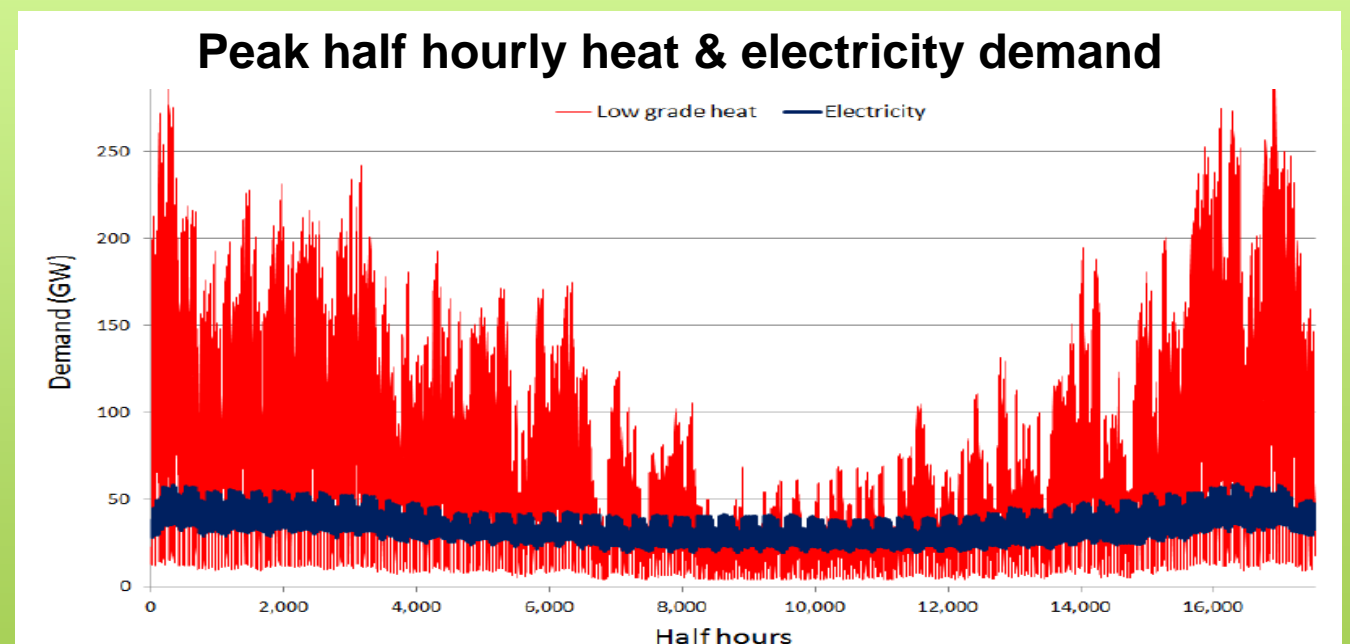
Thermal energy storage can help address these issues. But, we need to understand how, at what cost and how to maximise the benefits and impacts?

METHODOLOGY

Boundary Conditions
Weather Data
Casual Gains
Space condition set point

Dynamic inputs (time varying)
Occupancy profile
Heating profile
Casual gain

Time varying (day of month)
Time varying (time of day)

Model
A Two bedroom Semi-detached home in ESP-r or Energy Plus

Output
Internal temperature
Energy consumption
CO2 level
Ventilation rates

Parameters
Building geometry
Construction material
HVAC system specifications

Dynamic building model block diagram.

Bottom-up approach:
- Create heating load profiles
- Dynamic building modelling
- Energy performance simulation
- Sensitivity analysis (Monte-Carlo analysis)
- Validation through practical experiments
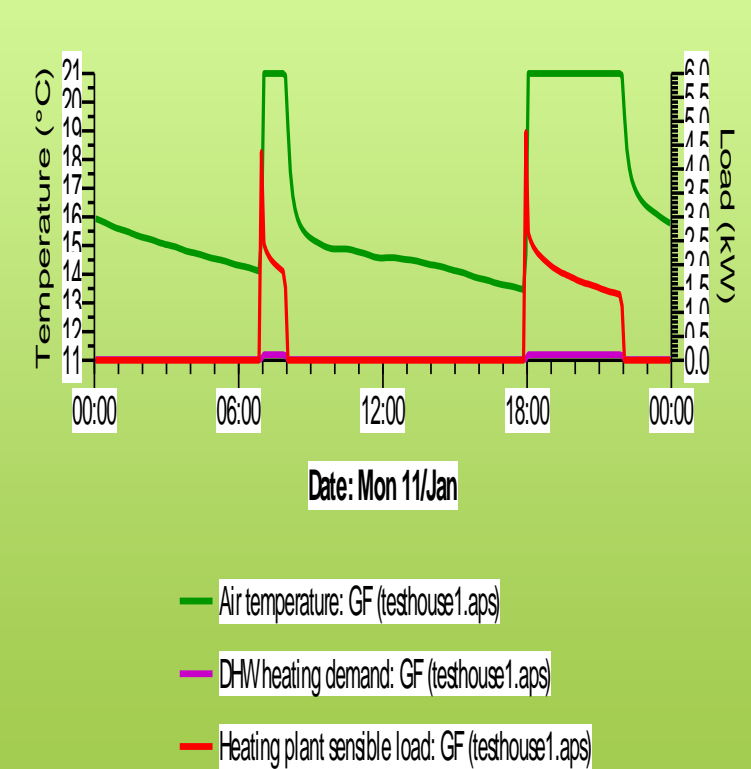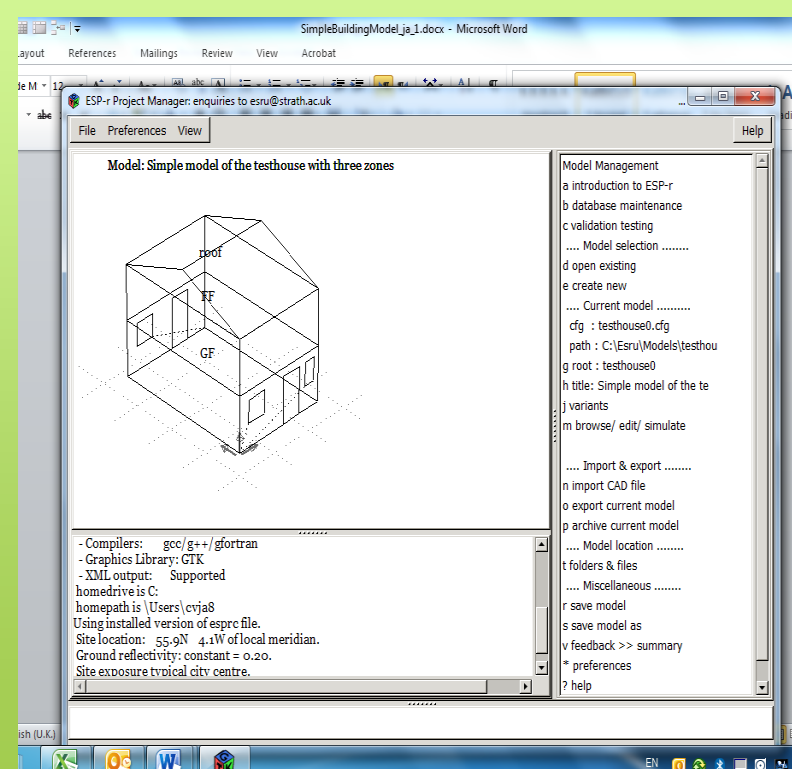- Benefit analysis

EXPECTED OUTCOME

Greater understanding of:
- Current/future heating needs
- Time shifting ability of heat demand
- Impact on households & the wider stakeholders
- The best heat storage practices

Supervisor: Dr. S. K. Firth & Prof. P. C. Eames

PROGRESS
- Literature review
- Simple building model
- Developing load profiles

ESP-r screen shots of building model and simulation results.