Load Prob. Model

Probabilistic model of building load

Parameterization:

- Building type
- Random timing
- Mean load
- Peak load

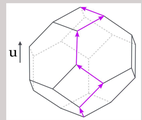
Prior distribution

Hypothesise measurement

Sample building monitoring measrmnt. Determine corresponding posterior (less uncertainty)

Posterior distribution

System Design



Linear (Scenario) Program Model

Objective; sum of electricity cost, carbon emissions cost, and grid connection charge

Simulation

District energy system simulation

CityLearn used to simulate district for sampled scenarios

Quantify true average cost of designed system

Average system cost

Prior

VoI = Difference

Pre-Posterior

Average over hypothesised measurements

Construct probability models from data (prior and posteriors)

Data

Case study from Cambridge Uni

6 yrs of historic elec. usage data from 9 buildings + solar generation, electricity price & carbon intensity

Results

1. Installing solar-battery systems reduces overall operating cost by 40%, including 65% reduction in carbon emissions
2. Building monitoring reduces overall cost by 1.5% on average
3. Reducing uncertainty in only mean load provides majority of available decision support benefit
4. Reducing load uncertainty reduces cost uncertainty by 60%

Conclusions

1. Building load monitoring is not economically worthwhile for supporting district energy system design in case study
2. Existing analyses erroneous suggest load uncertainty reduction important
3. Current industry practice of using (distributions of) standard building load profiles for energy system design is sufficient
4. Further study required to determine if VoI remains low in other energy systems

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