Flexibility Strategies for a Residential Building Cluster: Simulation Study

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Project Overview

Objective: Investigate flexibility strategies to achieve electric peak reduction during winter demand response events

Simulation Study

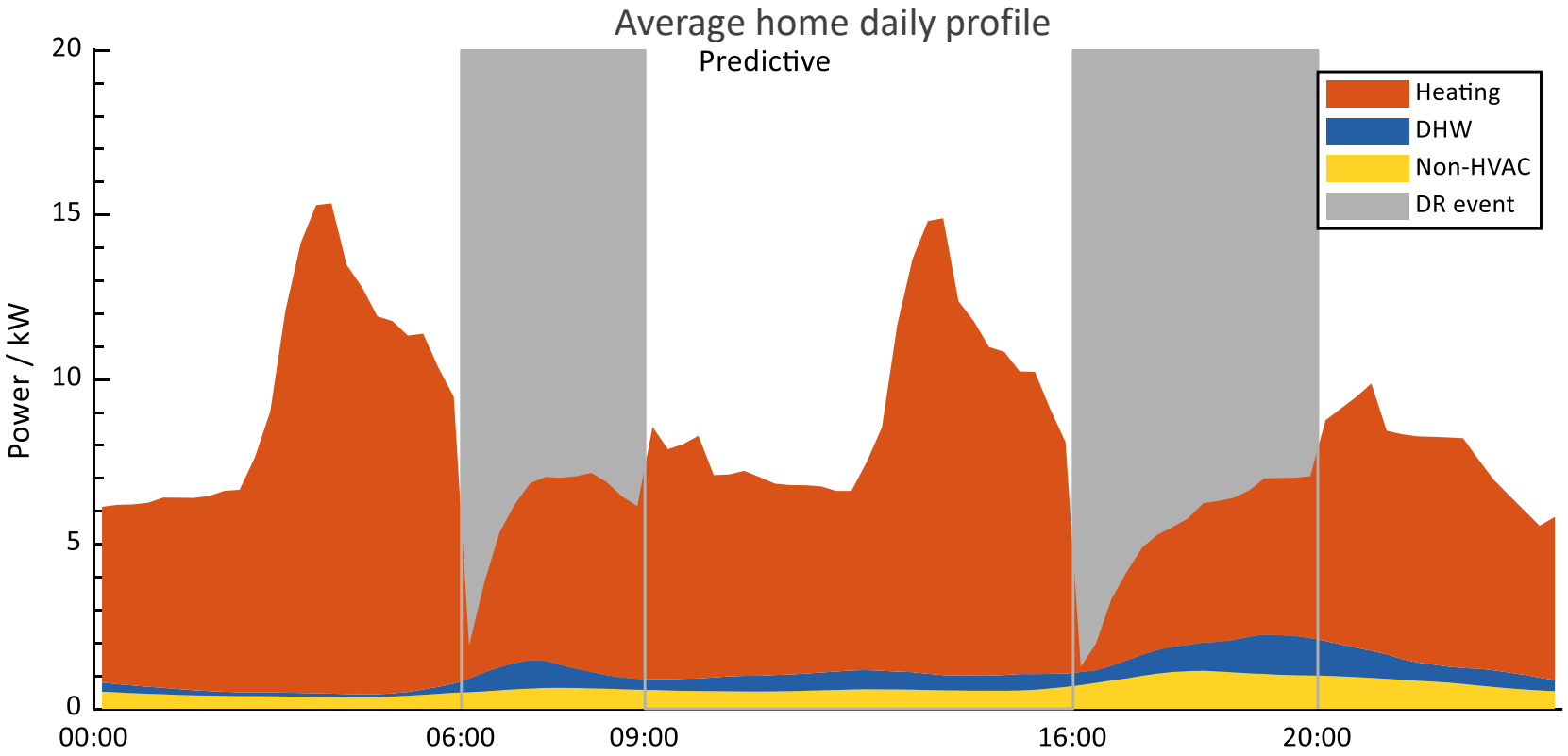
- Location: Montreal, QC
- 2400 residential buildings
- Electric baseboard heating
- Flexibility from thermal mass (heating setpoints) and water heater (lower element setpoint)

TRNSYS 18

Flexibility Cases

- Reactive: -1°C during DR
- Predictive: +3°C before DR, -1°C during DR
- + DHW cases for both options

Results



Reactive
-15% peak reduction

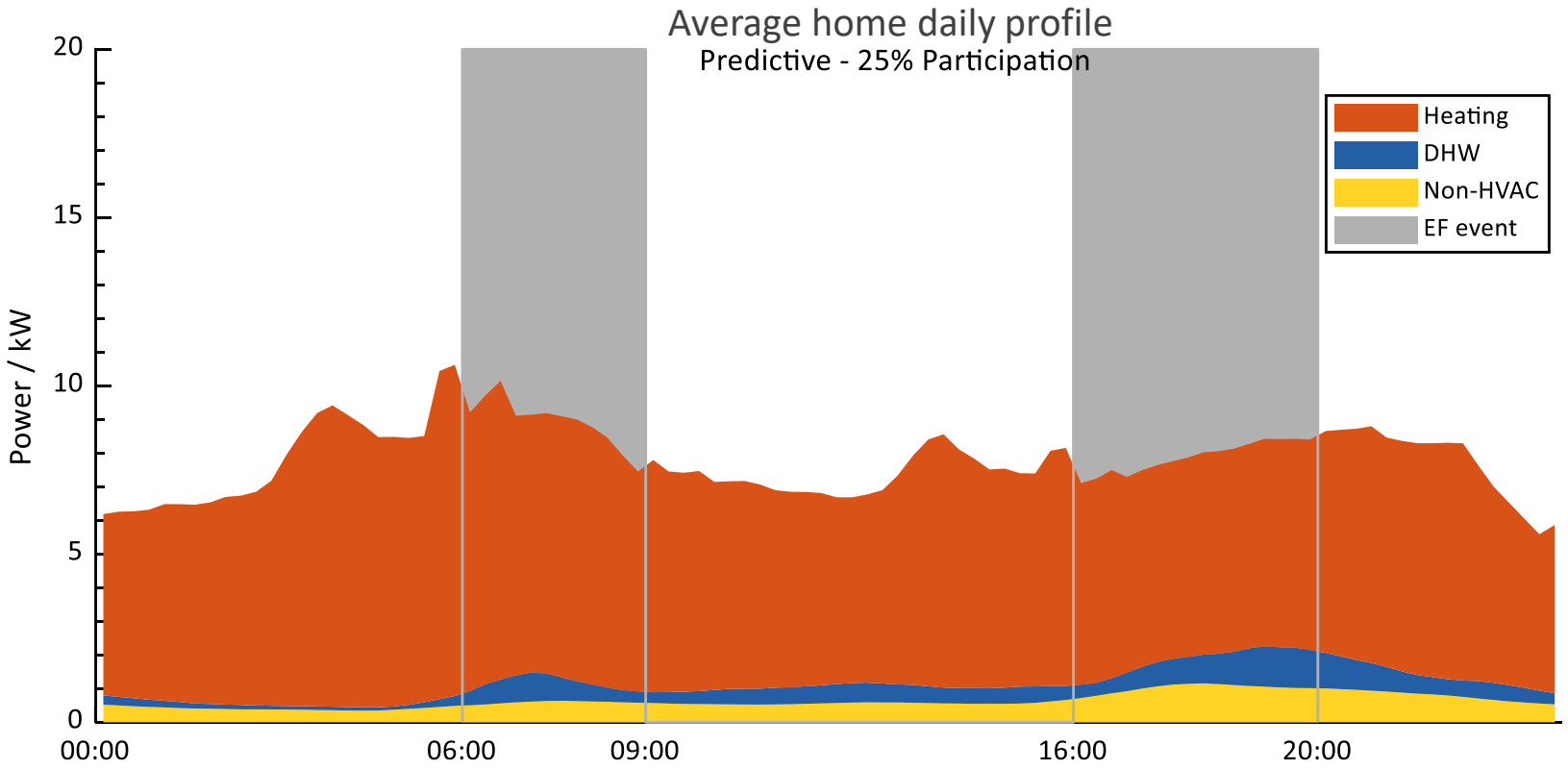
Reactive + DHW
-17% peak reduction

Predictive
-22% peak reduction

Predictive + DHW
-25% peak reduction

Common Issue: Rebound peaks higher than original baseline peaks

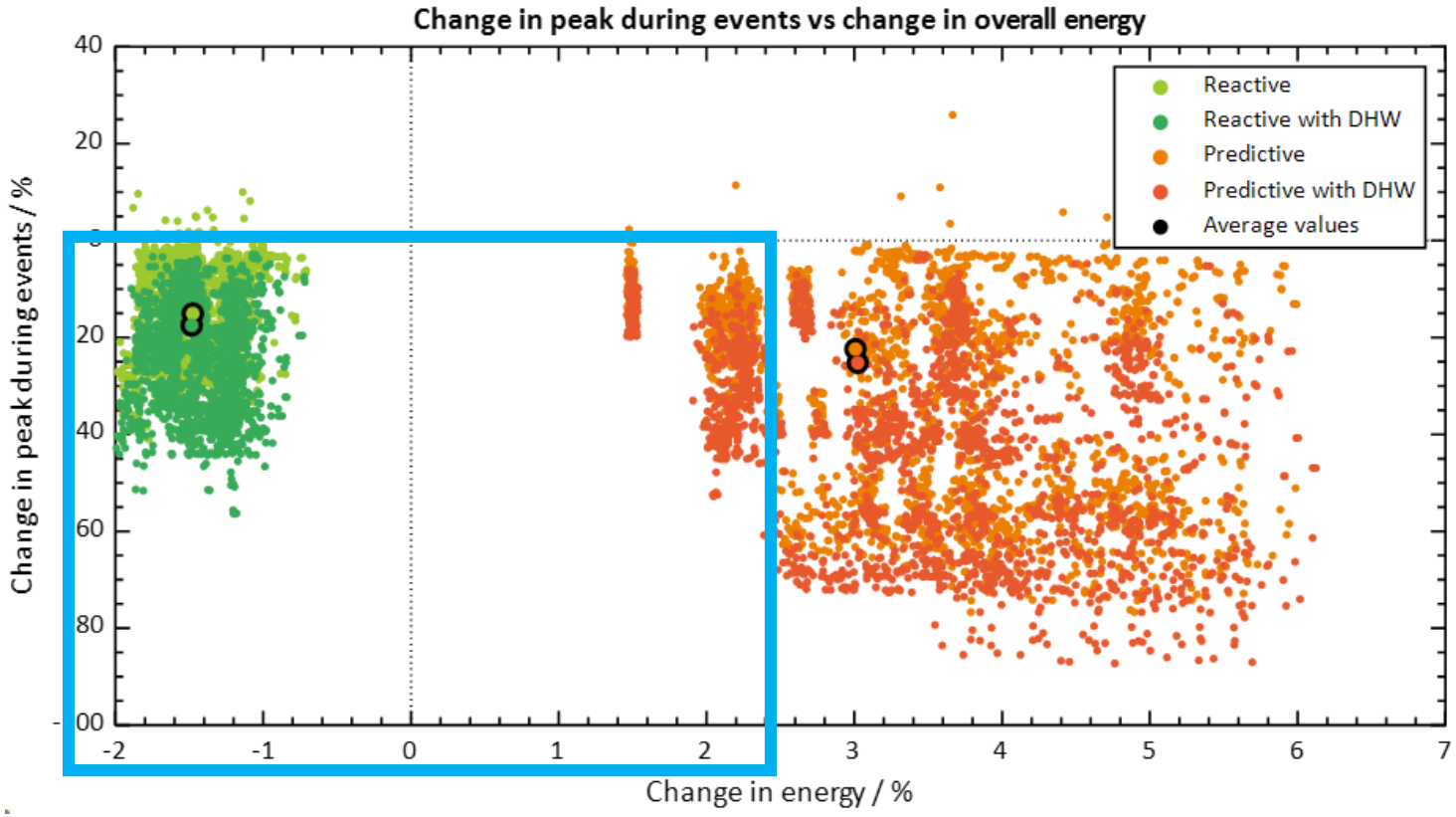
Improvement Idea



Portfolio Coordination

- Aims to reduce rebound
- Percentage of homes selected as participants, based on potential cost savings
- Peak reductions not as large as previous cases with 100% portfolio participation, however a flatter profile might be more beneficial to grid

Results



Preferable results

- Peak reduction during event
- Small or no rebound peak after event (dependant on grid's needs)
- Small or no increase in overall energy (dependant on grid's needs)

Conclusions & Next Steps

In Summary

- Flexibility importance increasing as we add more electric demand on grid
- The 4 flexibility strategies result in 15-25% average peak reductions
- Coordination can reduce overall portfolio rebound peaks, but minimizes total peak reductions
- Monthly electricity bills also showed reductions up to 25%

Furthering the Study

- Data available from a commercial office building, the portfolio can be modified to include both commercial + residential
- Further focus on coordination / aggregation of portfolio to investigate grid benefits vs individual building benefits
- Will be presented at the IBPSA eSim conference this June & the full study can be found in the conference proceedings

Thank you for your attention!