Building-grid interactions: Improving demand response performance of buildings through accurate estimation of electricity demand

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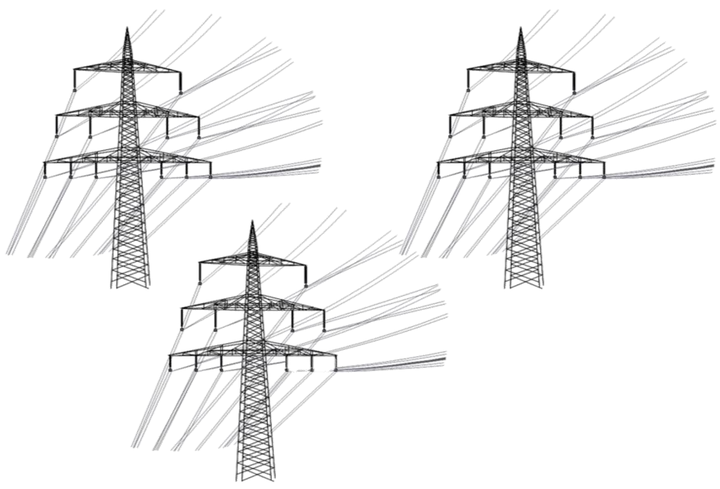
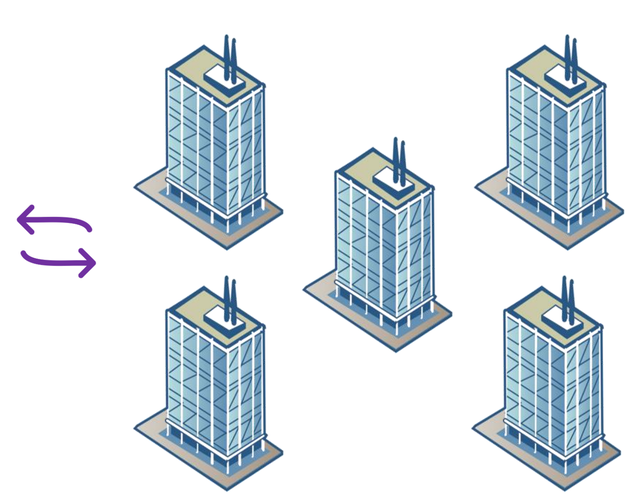
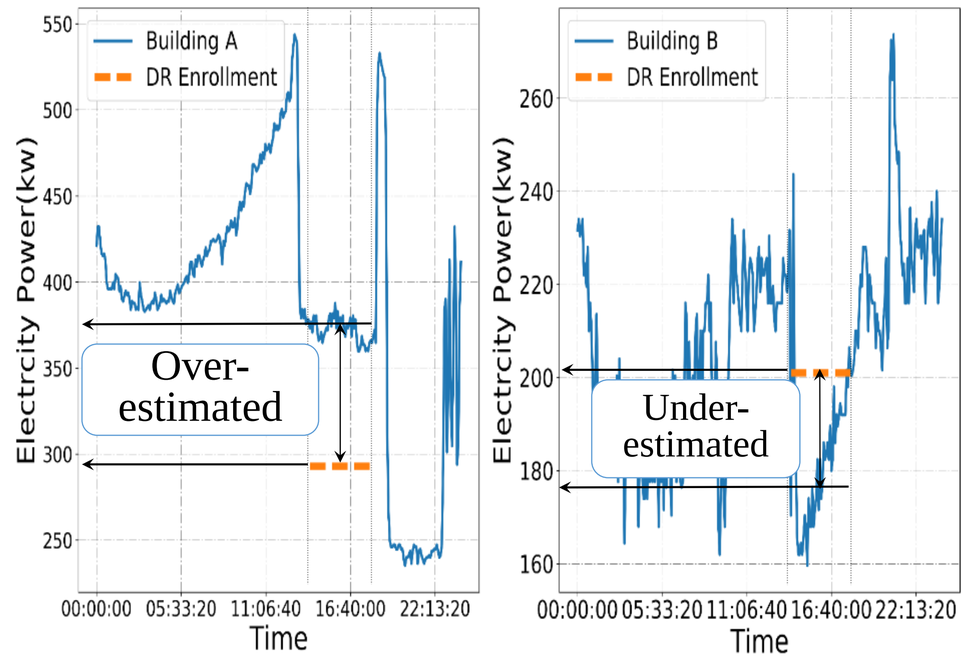
Motivation & Problem Statement

❖ Inaccurate electricity shaving capacity estimation results in penalty (over-estimate) and overlook of profit (under-estimate).







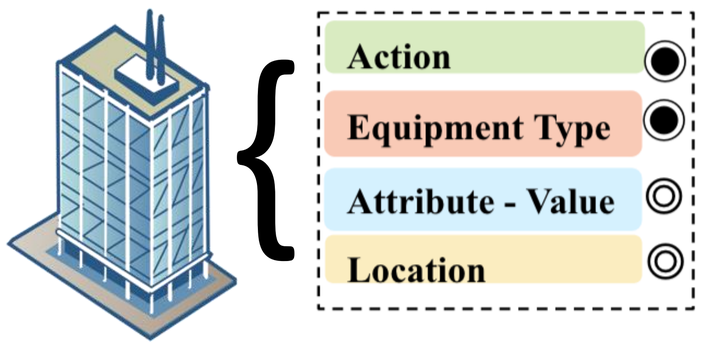
Objective & Research Approach

Identify DR related building information → **Extract DR related building information from BIMS** → **Identify driving building factors attributes** → **Estimate saving potential of buildings during DR events**

- Disaggregate DR protocols
- Synthesize DR related building information

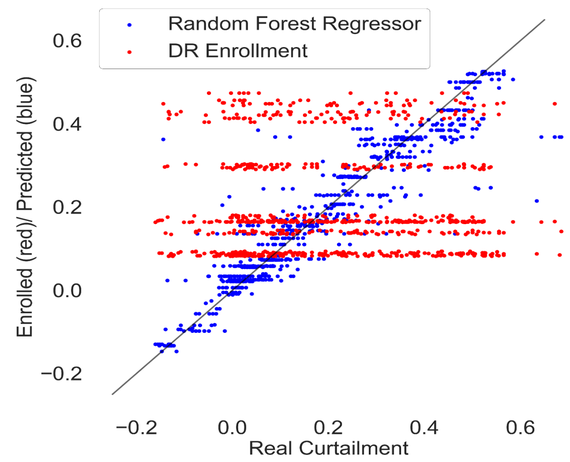
E.g.:
Before event:
A) Precool the HVAC in Auditorium and Classroom to 68 °F.
During event:
B) Increase setpoint of HVAC in precooled areas to 77°F.
C) Shut off all lights in all unoccupied offices, theaters, studios, restrooms, practice rooms, & hallways (partial lighting).
D) Shut down one elevator. Place signage in 1st floor lobby.

- Map the thermal zones with space functionalities
- Reason BIMs to extract DR related information



- Using machine learning approaches to evaluate the importance of the attributes

- Using machine learning models to estimate the saving potentials



Initial Findings & Expected Contributions

❖ Expected Contributions:

- Detailed Information requirements for buildings regard to Demand Response programs.
- An approach to estimate the electricity shaving capacity of buildings during DR events accurately and efficiently.

❖ Publications

Yu, X., and Ergan, S. (2018). “BIM coverage in demand response management: a pilot study in campus buildings.” In *Construction Research Congress 2018,* pp. 316-325, April 2-4, 2018, New Orleans, LA, U.S.A.

Yu, X., and Ergan, S. (2018). “A data-driven framework to estimate saving potential of buildings in demand response events.” *In ISARC. Proceedings of the International Symposium on Automation and Robotics in Construction, IAARC Publications,* Vol. 35, pp. 1-8, July 20-25, 2018, Berlin, German.

Yu, X., and Ergan, S. (2019). “Identification of principal factors in determining building peak energy shaving capacities during demand response events.” In *The 2019 ASCE International Conference on Computing in Civil Engineering,* June 17-19, 2019, Atlanta, GA, U.S.A. (Accepted)