SMARTER -Smart Manager for Adaptive and Real-Time decisions in building clustERs

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Abstract:

Despite the current emphasis on developing green buildings, the global energy consumption issue is not being adequately addressed. In this project, we propose a new perspective on this ever-threatening issue: NetZero energy building clusters. Our objective is to develop a synergistic decision framework to enable such next-generation building clusters to work as an adaptive and robust system within a smart grid, reducing overall energy consumption and allowing for optimal operation decisions enabled by cyber support tools. Our vision is that the next generation building systems will freely form clusters, within each of which buildings can autonomously share and exchange site-generated energy, fundamentally transforming the consumption of energy in buildings, which comprises the largest sector of energy consumption. The primary research challenges we have targeted include: 1) Develop an emulator for NetZero energy building clusters to benchmark and evaluate different operation strategies; 2) Develop and calibrate networked energy consumption models for temporally and spatially distributed buildings, and, 3) Develop multi-time scale adaptive decision algorithms for dynamic operation strategies.
The three university teams (Arizona State University, Drexel University, and University at Buffalo) have worked closely with our industrial partner (Siemens Corporate Research) and have successfully developed a NetZero Building Cluster Emulator, a suite of high fidelity grey box and black box models for building energy forecasting, and a Building Energy Model Recommendation system to effectively and efficiently identify the appropriate black box models for each building with its unique characteristics. Utilizing the developed emulator and energy forecasting models, a decentralized decision framework is developed which is adaptive to the system dynamics (e.g., price, non-cooling load) and has the potential to significantly reduce the energy cost. Thirteen journal and/or conference publications have been published to document the details of our findings.

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