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PNNL-32956

Dynamic Decarbonization through Autonomous Physics-Centric Deep Learning and Optimization of Building Operations

CRADA 552 (PNNL 78823)

June 2022

Draguna L Vrabie

PassiveLogic, Inc.

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Abstract

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Abstract

This project directly addresses the primary goal of Area of Interest 2 in the CRADA call: to advance optimization-based integrated energy management systems in commercial and residential buildings. Pacific Northwest National Laboratory (PNNL) and its industry partner PassiveLogic aim to accomplish this by reaching three key objectives. First, to ensure a broad impact in the building controls industry, PNNL will extend its open-source library for predictive control synthesis by augmenting its capabilities with data-driven self-learning of building models and auto-calibration of predictive controllers. The effort will focus on building use cases selected in collaboration with PassiveLogic. The team will specifically address the development of methods for data-driven adaptation of building models, investigation of model architectures that best address specific building types, and automated synthesis of differentiable predictive controllers that optimize diverse objectives. Second, PNNL will collaborate with PassiveLogic to integrate the aforementioned methods with PasiveLogic's advanced controls platform. The collaborative integration effort will inform the developments under the first objective by providing specific data on the attainable performance of model learning on resource-constrained edge computing platforms. This software integration effort will increase the technical maturity of the developed libraries by exploring the use of software integration tools and methods. Third, PNNL and PassiveLogic will work to improve the technology readiness of the developed predictive controllers by testing their performance in relevant test environments, such as high-fidelity simulation, hardware in the loop, and actual test buildings.

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