University of Colorado Boulder

Water Energy Nexus IRT

2018 Seed Grant Final Report

Title: Reducing Water Consumption via Free Market Renewable Integration

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Research Objective(s): In this project, we designed market pricing signals to change how and when buildings use energy to affect the portfolio of online (i.e., grid connected and producing energy) power plants.

Research Activities/Methodology: We worked with an CS undergrad, ECEE masters student, and a couple CS graduate students to develop the theory behind and implement in Python the proposed framework. We used publicly available data such as locational marginal price and generation location from electric system operators PJM and MISO to uncover correlations between price and generation. We then developed a multi-smart home framework in Python to respond to signals representing real-time water and carbon intensity in order to provide grid services such as frequency regulation.

Results: Our results indicated that using publicly available electricity market data, we could develop carbon and water "pricing" signals that reflected which power plants were currently online. From these signals, simulated buildings are able to react and shift when they use power (in the paper, when they charge their electric vehicles) depending on what they care about most – money, saving carbon, or conserving water. We believe this is an important first step towards reducing the water consumption of thermoelectric power plants by modifying the current electricity market paradigm, and the initial results have indicated that if many buildings participate, these signals can improve renewable integration and reduce water consumption.

Accomplishments: From the work done on this project, we were able to put together a conference paper for the 2019 Architectural Engineering Institute conference in Tysons, VA, titled "Towards Real-Time Water and Carbon Responsive Buildings." This paper, accompanied by a ten-minute oral presentation, shows our results which indicated that using publicly available electricity market data, we could develop carbon and water "pricing" signals that reflected which power plants were currently online.

Conclusions/Next Steps: The PI is currently discussing future directions of this project with other collaborators at CU. We hope that if a collaboration can be reached we will be able to put together a grant proposal.