World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

# Computer-Assisted Management of Building Climate and Microgrid with Model Predictive Control

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**Abstract :** With 40% of total world energy consumption, building systems are developing into technically complex large energy consumers suitable for application of sophisticated power management approaches to largely increase the energy efficiency and even make them active energy market participants. Centralized control system of building heating and cooling managed by economically-optimal model predictive control shows promising results with estimated 30% of energy efficiency increase. The research is focused on implementation of such a method on a case study performed on two floors of our faculty building with corresponding sensors wireless data acquisition, remote heating/cooling units and central climate controller. Building walls are mathematically modeled with corresponding material types, surface shapes and sizes. Models are then exploited to predict thermal characteristics and changes in different building zones. Exterior influences such as environmental conditions and weather forecast, people behavior and comfort demands are all taken into account for deriving price-optimal climate control. Finally, a DC microgrid with photovoltaics, wind turbine, supercapacitor, batteries and fuel cell stacks is added to make the building a unit capable of active participation in a price-varying energy market. Computational burden of applying model predictive control on such a complex system is relaxed through a hierarchical decomposition of the microgrid and climate control, where the former is designed as higher hierarchical level with pre-calculated price-optimal power flows control, and latter is designed as lower level control responsible to ensure thermal comfort and exploit the optimal supply conditions enabled by microgrid energy flows management. Such an approach is expected to enable the inclusion of more complex building subsystems into consideration in order to further increase the energy efficiency.

**Keywords :** price-optimal building climate control, Microgrid power flow optimisation, hierarchical model predictive control, energy efficient buildings, energy market participation
**Conference Title :** ICSRD 2020 : International Conference on Scientific Research and Development
**Conference Location :** Chicago, United States
**Conference Dates :** December 12-13, 2020