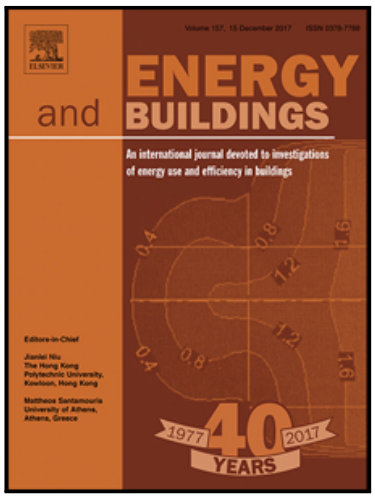

Hierarchical Control of Building HVAC System for Ancillary Services Provision

Faran A. Qureshi, Colin N. Jones

PII: S0378-7788(17)31519-0
DOI: 10.1016/j.enbuild.2018.03.004
Reference: ENB 8390

To appear in: *Energy & Buildings*

Received date: 26 April 2017
Revised date: 20 February 2018
Accepted date: 1 March 2018

Please cite this article as: Faran A. Qureshi, Colin N. Jones, Hierarchical Control of Building HVAC System for Ancillary Services Provision, *Energy & Buildings* (2018), doi: 10.1016/j.enbuild.2018.03.004

Hierarchical Control of Building HVAC System for Ancillary Services Provision[☆]

Faran A. Qureshi[a,*], Colin N. Jones[a]

[a] *Automatic Control Laboratory, EPFL, Switzerland*

Abstract

This paper examines the provision of demand-side ancillary services using building thermodynamics and heating ventilation and air-conditioning (HVAC) systems. In particular, we consider the secondary frequency control service where the load has to declare a power capacity and a nominal power at the beginning of the regulation period and then in real-time track the received regulation signal around its declared nominal power. A hierarchical control scheme is proposed in this paper. The local building controllers at the lowest level track the temperature setpoints received from the thermal flexibility controller which maximizes the flexibility of building's thermal consumption. At the highest level, the electrical flexibility controller controls the HVAC system while maximizing the flexibility provided to the grid. The two flexibility control layers are based on robust optimization methods. A control oriented model of a typical HVAC system is developed, and simulations are carried out to demonstrate the efficacy of the proposed approach. Results show that extra flexibility may be attained by exploiting the coefficient of performance (COP) of the chiller. Furthermore, occupant comfort increases as a consequence of providing ancillary services.

[☆]This work has received support from the Swiss National Science Foundation under the GEMS project (grant number 200021 137985) and the European Research Council under the European Unions Seventh Framework Programme (FP/2007-2013) / ERC Grant Agreement n. 307608 (BuildNet).

*Corresponding author

Email addresses: faran.qureshi@epfl.ch (Faran A. Qureshi), colin.jones@epfl.ch (Colin N. Jones)