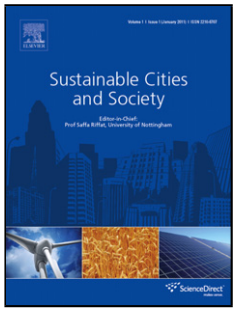

Title: Control strategies for decreasing energy costs and increasing self-consumption in nearly zero-energy buildings

Authors: Adrian Fratean, Petru Dobra

PII: S2210-6707(17)31650-5
DOI: https://doi.org/10.1016/j.scs.2018.03.019
Reference: SCS 1026

To appear in:

Received date: 28-11-2017
Revised date: 13-3-2018
Accepted date: 17-3-2018

Please cite this article as: Fratean, Adrian., & Dobra, Petru., Control strategies for decreasing energy costs and increasing self-consumption in nearly zero-energy buildings.*Sustainable Cities and Society* https://doi.org/10.1016/j.scs.2018.03.019

Control strategies for decreasing energy costs and increasing self-consumption in nearly zero-energy buildings

Adrian Fratean*, Petru Dobra

Department of Automation, Technical University of Cluj-Napoca, Memorandumului 28, 400114, Cluj-Napoca, Romania

Highlights

- Heating/cooling controllers for nZEBs in an energy market with time of use pricing
- Energy consumption and costs reduction by implementing demand side management
- Energy costs reduction by using on-site energy generation and storage
- Linear programming for optimum allocation of on-site production
- Model predictive control for energy consumption and costs reduction

Abstract

This article presents an extensive evaluation which analyzes the contribution of several control methods to decreasing the energy consumption associated with heating and cooling of buildings and the contribution of the local energy production to minimizing energy costs in nearly zero-energy buildings (nZEB). A set of three heating and cooling control methods is mixed with a set of cost-based optimum allocation of on-site energy production using linear programming, variable indoor temperature setpoint for following the production curve and a battery storage system. When designing nZEBs, the aim is not only to reduce the energy consumption, but also to reduce the lifecycle costs, and a big part of them is associated with energy needed for heating and cooling. nZEBs are supposed to have local renewable energy generation, which must be consumed in a cost optimal way for keeping the total lifecycle costs low. This research helps nZEB design collectives to assess the opportunity of implementing controls as the ones described in this study and policy makers to extrapolate the results and estimate how the energy consumption reduction targets can be reached by implementing such technologies. The analysis of the control strategies is made based on real buildings located in Bucharest, Romania.

Keywords: energy, nZEB, control, heating, cooling, optimization, MPC, distributed energy resources

* Corresponding Author:
Tel: 0040 742 882 602
E-mail: adrian.fratean@aut.utcluj.ro