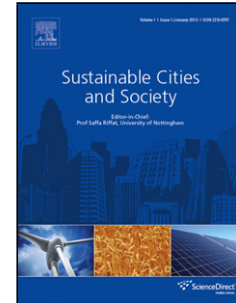


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Author: Joelle Klaimi Rana Rahim-Amoud Leila Merghem-Boulahia Akil Jrad



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A novel loss-based energy management approach for Smart Grids using Multi-Agent Systems and Intelligent Storage Systems

Joelle Klaimi^{1,2}, Rana Rahim-Amoud^{2,3}, Leila Merghem-Boulahia¹, Akil Jrad^{2,3}

¹ EDST, LaSTRe, Lebanese University, Lebanon.
joelle.klaimi@gmail.com

² ICD/ERA (UMR CNRS 6281), Troyes University of Technology, France.
leila.merghem_boulahia@utt.fr

³ Faculty of sciences, Lebanese University, Lebanon.
{rana.rahim, ajrad}@ul.edu.lb

Abstract

The Smart Grid integrates the use of Information and Communication Technologies (ICTs) in order to ensure the interaction between its computational and physical elements. Moreover, it supports bidirectional information flows between the energy users and the utility grid that motivate energy users not simply to consume but also to generate energy and to share it with the utility grid and/or with other consumers. Many researches have addressed the problem of energy management in the smart grid context and have been done in order to offer maximum savings on energy bills as efficiently as possible. However, many algorithms presented in the literature do not exploit storage systems and/or present high energy losses. Taking into consideration energy losses, this research discusses the effects of these losses on consumers' bill. Hence, we propose an agent-based solution that takes into consideration users' loss minimization in the smart grid context. The contribution of this paper is twofold. Firstly, it highlights the effects of power loss on the energy cost in an electrical system. Secondly, a novel approach aiming to help the storage system meet consumers' daily demands will be presented. Simulation results show that our proposal minimizes consumers' energy costs and losses.

Keywords: Smart grids, Multi-agent systems, Intelligent storage system, Data predictions, Energy losses

1. Introduction

GreenHouse Gas emissions (GHG) have now reached an alarming level and have provoked increased global warming. The high use of electricity plays a major role in increasing CO_2 emissions leading to GHG increase [1]. Taking into consideration the negative environmental impacts of burning fossil fuels, countries are looking toward new means of obtaining energy. In this context, the worlds' energy supply mix can be divided into two parts [2]: renewable energy like wind, water, photovoltaic, etc. and non-renewable sources like fossil, gas, etc. In order to integrate renewable energy use efficiently, the smart grid concept has been developed.

The smart grid is an enhancement of the 20th century power grid. It is an electricity network based on digital technology that is used to supply electricity to consumers via two-way digital communication. Hence, the two-way flows of electricity and information help to create a

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