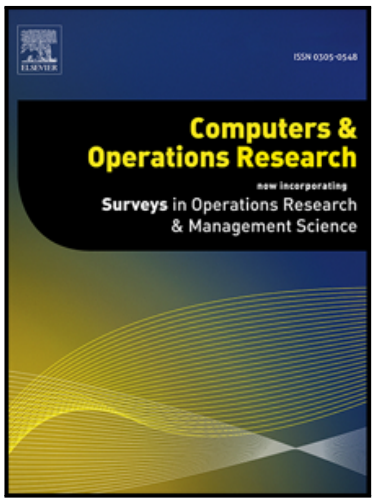

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Raffaele Carli , Mariagrazia Dotoli , Roberta Pellegrino

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A decision-making tool for energy efficiency optimization of street lighting

Raffaele Carli [a,*], Mariagrazia Dotoli [a], and Roberta Pellegrino [b]

[a] *Dept. of Electrical and Information Engineering, Politecnico di Bari, Bari, Italy*

[b] *Dept. of Mechanics, Mathematics and Management, Politecnico di Bari, Bari, Italy*

Abstract

This paper develops a multi-criteria decision making tool to support the public decision maker in optimizing energy retrofit interventions on existing public street lighting systems. The related literature analysis clearly highlights that, to date, only a few number of studies deal with the definition of optimal decision strategies complying with multiple and conflicting objectives in the planning of street lighting refurbishment. To fill this gap, we propose a decision making tool that allows deciding, in an integrated way, the optimal energy retrofit plan in order to simultaneously reduce energy consumption, maintain comfort, protect the environment, and optimize the distribution of actions in subsystems, while ensuring an efficient use of public funds. The presented tool is applied to a real street lighting system of a wide urban area in Bari, Italy. The obtained results highlight that the approach effectively supports the city energy manager in the refurbishment of the street lighting systems.

Keywords: Energy efficiency management, public street lighting, multi-criteria optimization.

1. Introduction

Pursuing energy-efficient improvements has become mandatory at all levels of the public administration, not only for environmental sustainability reasons, but also since the prediction of energy consumption accounts for a global increase of almost 40% by the year 2030 [1]. Not surprisingly, the improvement of energy efficiency is at the basis of the worldwide significant trend towards smart city researches and projects [2-5]. Referring to the actions that can be undertaken, the recommendations for energy efficiency by the International Energy Agency (IEA) cover seven different priority areas: buildings, appliances, lighting, transport, industry, energy utilities and cross-sectorial issues [6-7]. Within these areas, public (predominantly street) lighting contributes to about 2.3% to the global electricity consumption. Hence, energy-efficient programmes in this field are very welcome, since the possibilities for energy savings in street lighting are numerous and some of them even enable reductions in electricity consumption of more than 50%. This explains the growing attention reserved by policy makers to energy consumption for urban street lighting in the energy and economic balance of many cities, as the increasing commitment of city authorities towards energy efficiency and green energy for public lighting systems demonstrates [8]. Municipal planners and

* Corresponding author.
E-mail addresses: raffaele.carli@poliba.it (R. Carli), mariagrazia.dotoli@poliba.it (M. Dotoli), roberta.pellegrino@poliba.it (R. Pellegrino).