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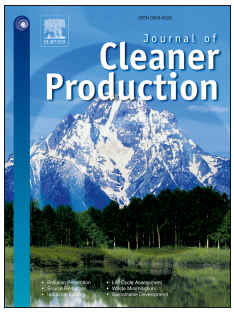

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Performance indicators matrix as a methodology for energy management in municipal water services

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ABSTRACT

Holistic management of water and energy resources is critical for municipalities facing increasing energy prices and stringent regulatory requirements. Management for energy efficiency in water supply and wastewater collection systems demands evaluation of how energy is consumed and how efficiently such energy is spent. The present work proposes a performance indicators matrix that allows the evaluation and monitoring of energy consumption, energy costs and CO_2 emissions, leading to the identification of opportunities for performance improvement for continuous and sustainable development in municipalities. The methodology for the development of the indicators performance matrix was based the application of the activities from integrated management systems - the integrated management energy (ISO 50001), quality (ISO 9001) and environment (ISO 14001) systems. A set of criteria and performance indicators adapted from international guidelines and literature indicators, which complement energy efficiency measure by municipalities, were chosen by consensus between experts and stakeholders. Indicators were classified according to their strategic objective in four categories: environmental (E), technical (T), social (S) and governance (G). The indicator matrix was tested in a case study, namely the municipality of Loulé in Portugal. Results showed that experts and stakeholders attribute more importance to indicators from the strategic objectives *Environmental protection* and *Promote efficient use of water resource* (34.3%), meaning that most of the chosen indicators are directly related with energy efficiency. Results of meta-evaluation of the tool showed optimal performance for most of the indicators.

Keywords: Energy, water, wastewater, sustainable, municipality management.

1 INTRODUCTION

Water and energy are intrinsically and inexorably linked in urban environments, being these interconnections called 'water–energy nexus'. Water is needed for energy production for extraction and mining, fuel production (e.g. H_2, ethanol, biofuels), thermoelectric cooling, hydropower and emissions

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