



A Survey of Methods for Achieving Efficiency in Electricity Consumption

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ABSTRACT

This paper investigates related research work on electricity consumption in buildings and outlines its context relative to improving efficiency in appliance usage by customers. The aim of this research is to study the impact of applying power-saving measures on appliance usage in order to reduce electric costs. The study focuses on a review of tools and methods involved in achieving efficient electricity consumption system with respect to minimization of electric costs and reduction of electricity wastage in the system. It also conducts a survey of various literatures involving the potential impact of incorporating power-saving measures on low-power and high-power appliances to allow for more efficient use of electrical appliances. The paper provides a number of recommendations for achieving efficiency in electricity consumption, when power-saving measures are applied to appliance usage.

Keywords

Efficiency, power-saving measures, electricity wastage, low-power appliances, high-power appliances

1. INTRODUCTION

The growing global demand for energy is making it imperative that newer and more efficient electricity appliance use is deployed. Energy efficiency is also an important issue because of the constantly changing electricity consumption pattern across the globe. These are the most important driving factors resulting in the development and implementation of different energy efficiency systems. On the basis of secondary research, the emerging trends in energy research have been identified in this study, thus providing an insight in electricity consumption efficiency. The study also provides a comprehensive description of the challenges faced by this market. The research study involves the usage of extensive primary and secondary sources: electricity consumption collected for individual appliances over a period of time, research papers, industry white papers, case studies, presentations, and other publicly available sources, to identify and collect information useful for building this extensive database for efficiency in electricity consumption. There is a need to use electric appliances in a more efficient manner so as to reduce costs. This is more so as the global energy consumption has increased due to an increase in population, production, and industrialization (International Energy Agency, 2013). Due to the importance of having an efficient power management system, past studies have focused on the efficient utilization of electric appliances in households and industrial energy consumption. A study by Lee, Kim, & Park (2012) showed electricity consumers recognized and realized that efficiency in consumption is an important attribute in power usage and management and it is also an important

differentiator between electric power distribution and consumption.

A research paper by [Fontana, Atella, & Kammen \(2013\)](#) provided a strong analogy between energy consumption in buildings and industrial growth, in terms of human, environmental, and health. The research paper suggested that achieving energy efficiency will greatly have a profound transformation effect on industrial and economic development, hence impacting on reducing energy costs. These factors will significantly increase the health span; reduce health costs, environmental pollution, production and global warming. As a result of findings from this paper, houses were made more energy efficient. For example, installation of wall and roof insulation, energy-efficient windows and doors, ultra-efficient lighting technologies, energy-saving appliances, solar power to heat water and produce electricity, geothermal heat pumps, etc. led to more efficient use of electricity. Achieving energy efficiency and resource productivity paradigm offers a new ground for business invention, sustainable growth and economic development. Kiely et al. (2010) proposed the dependence on energy-efficiency utilities as a key to stimulate faltering economies during economic downturns. (Auffhammer & Aroonruengsawat, 2012) investigated the impact of higher temperatures on global residential electricity consumption for different climatic zones. The paper suggested that electricity consumption will vary according to temperature response across different climatic zones, which allows for differential effects of days with different mean temperatures on households' electricity consumption. Section 2 discusses the impact of applying power-saving measures on appliance usage. Section 3 discusses literature on activity profile measurements for appliance usage. In Section 4, models of domestic load for appliances used in this study are described. Conclusions are drawn in Section 5.

2. EFFICIENCY IN APPLIANCE USAGE

In essence, electricity efficiency and introducing control mechanisms to electricity consumption plays important roles in minimizing electricity wastages and reducing the cost of electricity. Applying control techniques to electric appliances would improve efficiency in the use of electricity. However, the lack of sufficient control for electric appliances' use is a key limiting factor for developing enough efficiency in electricity consumption in order to minimize electric costs (Munoz, Moreno, Esquivias, Acosta, & Navarro, 2013). To illustrate the application of control techniques on electric appliances for efficient electric use, data was collected from more than 300,000 detailed single-family house sale records in the Greater Chicago area to investigate the spatial effects neighborhood adoption of energy-efficient heating,