

# A Review on Home Energy Management in the Presence of Charging Station

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## Abstract:

The advancement of the smart grids (SGs) is enabling consumers to schedule home appliances to respond to demand response programs (DRs) offered by distribution system operators (DSOs). This way, not only will customers save money on their energy bills and be more comfortable, but the utility company will also be able to regulate peak-hour demand and reduce carbon emissions (CE). Designing an optimization scheme to reduce the electricity bill cost, peak-to-average ratio (PAR), CO<sub>2</sub> emission, wait time, and enhance the user comfort in terms of delay, luminance, and thermal comfort is not only the aim of this work but also the need of demand-side management. The smart home energy management system (HEMS) is critical for a prosumer to intelligently and conveniently manage the use of their domestic appliances, renewable energies (RES) generation, energy storage system (ESS), and electric vehicle (EV). In this study, a novel framework will be proposed for efficient energy management of residential home considered into a cluster to reduce the electricity bill, alleviate peak-to-average ratio (PAR), and acquire the desired trade-off between the electricity bill and user-discomfort in the smart grid, in the presence of ESS and PEV in low voltage distribution network.

**Keywords:** DSM, HEMS, PAR, Plug in EV, Energy Storage System

## Introduction

Nowadays, there is an increasing electricity demand and an increasing cost of the raw materials. One essential challenge within the energy sector is how to consistently improve energy efficiency. DSM has been identified as one of the main strategies to be supported in order to increase the reliability and secure operation of electricity [14,15]. This strategy generally aims to overcome problems such as high energy costs, environmental issues, network reliability issues, and reduced energy supplies.

DSM strategies that focus on changing consumer demand for electricity include new financial incentives and education supporting changes in human behaviour. DSM strategies also focus on the integration of RES to produce clean energy whilst achieving environmental goals. These DSM approaches are most effective in the long term. There are also many other ways of reducing energy demand in the short term. For example, energy efficient lighting fixtures can be used, as well as power scheduling systems for appliances to avoid peak demand hours or replacement of old appliances with energy-efficient ones. In recent years, the growth in the electric vehicle market has caused a substantial increase in energy demand for homes because of the high-power consumption of electric vehicle charging, which has made peak load management more important in reducing grid penetration. It is a well-known fact that photovoltaic and wind generating stations has a significant impact on the stability, flexibility, and adequacy of power system. That is regarding utilities companies trying to reduce these intermittence electricity generation sources.

Two of the most effective load management strategies, in relation to the efficiency of domestic, commercial, and industrial loads, are the integration of renewable and load scheduling. These two