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AN INTELLIGENT HYBRID ENERGY MANAGEMENT SYSTEM FOR A SMART HOUSE CONSIDERING BIDIRECTIONAL POWER FLOW AND VARIOUS EV CHARGING TECHNIQUES

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ABSTRACT

Compelled by environmental and economic reasons and facilitated by modern technological advancements, the share of hybrid energy systems (HES) is increasing at modern smart house (SH) level. This work proposes an intelligent hybrid energy management system (IHEMS) for an SH connected to a power network that allows a bidirectional power flow. The SH has electrical and thermal power loops, and its main components include renewable energy from wind and photovoltaics, electric vehicle (EV), battery energy storage system, a fuel cell which serves as a micro-combined heat and power system, and a boiler. The proposed IHEMS models the components of the SH, defines their constraints, and develops an optimization model based on the real coded genetic algorithm. The key features of the developed IHEMS are highlighted under six simulation cases considering different configurations of the SH components. Moreover, the standard EV charging techniques are compared, and it is observed that the charging method which is flexible in timing and power injection to the EV is best suited for the economic operation of the SH. The simulation results reveal that the proposed IHEMS minimizes the 24-hour operational cost of the SH by optimally scheduling the energy resources and loads.

KEYWORDS: *EV, IHEMS, Renewable Energy, Hybrid Energy Systems*