

Design and Analysis of HEMS (EV, PV, ESS, RT Appliances) using MATLAB

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Abstract: *In this project, we proposed a home energy management system (HEMS) that includes photovoltaic (PV), electric vehicle (EV), and energy storage systems (ESS). The proposed HEMS fully utilizes the PV power in operating domestic appliances and charging EV/ESS. The surplus power is fed back to the grid to achieve economic benefits. A novel charging and discharging scheme of EV/ESS is presented to minimize the energy cost, control the maximum load demand, increase the battery life, and satisfy the user's-traveling needs. The EV/ESS charges during low pricing periods and discharges in high pricing periods. In the proposed method, a multi-objective problem is formulated, which simultaneously minimizes the energy cost, peak to average ratio (PAR), and customer dissatisfaction. The multi-objective optimization is solved using binary particle swarm optimization (BPSO). The results clearly show that it minimizes the operating cost from 402.89 cents to 191.46 cents, so that a reduction of 52.47% is obtained. Moreover, it reduces the PAR and discomfort index by 15.11% and 16.67%, respectively, in a 24 h time span. Furthermore, the home has home to grid (H2G) capability as it sells the surplus energy, and the total cost is further reduced by 29.41%.*

Keywords: Energy Grid, Electric Vehicle, Single Feed, Solar, Photo Voltaic, Battery, Distribution, Bidirectional Controller.

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