Abstract

In the pursuit of sustainable energy practices, the reuse of electric vehicle (EV) batteries in solar energy storage systems offers a promising solution, that by extending the lifespan of these batteries and reducing waste, while supporting the integration of renewable energy sources. This study investigates the potential of reusing hybrid electric vehicle (HEV) batteries in solar energy storage systems. The study focuses on a sample of five (Hyundai Ioniq 5) battery modules, subjected to state testing to assess their capacity and suitability for second-life applications. That basically by charging and discharging the modules, then evaluating their performance. The results revealed that four batteries exhibited technical issues, like swelling and voltage drop, which makes them unfit for reuse, while only one module demonstrated satisfactory performance.

To further investigate the charging and discharging characteristics of the same modules, a simulation model was developed using MATLAB and Simulink. The model was validated by comparing its outputs with the experimental results of the good module, utilizing the Root Mean Square Error (RMSE) method. The comparison showed an acceptable agreement between the simulation and experimental data during the discharging phase. Meanwhile, the charging process was not simulated accurately due to the difference on the charging source.

Additionally, the developed simulation model was utilized to predict the remaining cycle life of the modules in their second life, considering different depths of discharge (DoD). The findings demonstrated a clear relation between DoD and the number of remaining cycles, with higher DoD values leading to a decrease in the expected cycle life.