Power Management Strategies on a Stand-Alone Power System Using Renewable Energy Sources and Hydrogen Storage

Dimitris Ipsakis, Spyros Voutetakis, Panos Seferlis, Fotis Stergiopoulos, Simira Papadopoulou, and Costas Elmasides[a]

Chemical Process Engineering Research Institute (C.P.E.R.I.), CEntre for Research and Technology Hellas (CE.R.T.H.), P.O. Box 60361, 57001, Thermi-Thessaloniki, Greece
(a) Systems Sunlight SA, 67200, Neo Olvio, Xanthi, Greece

A stand-alone power system based on a photovoltaic array and wind generators that stores the excessive energy from renewable sources in the form of hydrogen via water electrolysis for future use in a polymer electrolyte membrane fuel cell is currently being installed at Neo Olvio of Xanthi in Greece. The identification of efficient power management strategies (PMS) for the system has been performed through simulated experiments with anticipated conditions over a typical four months time period for the region of installation. The PMS have been assessed on their capacity to meet the load requirements under the fluctuations of the energy provided by the renewable energy sources (solar and wind) reliably and effective utilization of the electrolyzer and fuel cell. The key parameters in the PMS are the level of the energy provided by RES and the state of charge (SOC) of the accumulator. Hence, the operating policies for hydrogen production via water electrolysis and the fuel cell mainly depend on the excess or shortage of energy from the RES and the current level of SOC. A parametric sensitivity analysis has identified the influence of major parameters in the performance of the integrated system.

Keywords: Renewable Energy Sources, Stand-Alone Power System, PEM Electrolyzer, PEM Fuel Cell, Lead-Acid Accumulator, Hydrogen Production, Power Management Strategy

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