Abstract :

Proton Exchange Membrane (PEM) Electrolysers (ELSs) are considered as pollution-free with enhanced efficiency technology. Hydrogen can be easily produced from different resources like biomass, water electrolysis, natural gas, propane, and methanol. Hydrogen generation from water electrolysis, which is the splitting of water molecules into hydrogen and oxygen using electricity, can be beneficial when used in combination with variable Renewable Energy (RE) technologies such as solar and wind. When the electricity used for water electrolysis is produced by a variable RE source, the hydrogen stores the unused energy for a later use and can be considered as a renewable fuel and energy resource for the transport and energy sectors.

This paper aims to propose a novel graphical model design for the PEM-ELS for hydrogen production based on the electrochemical, thermodynamical and thermal equations. The model under study is experimentally validated using a small-scale laboratory electrolyser. Simulation results, using Matlab-Simulink™, show an adequate parameter agreement with those found experimentally. Therefore, the impact of the different parameters on the electrolyser dynamic performance is introduced and the relevant analytical-experimental comparison is shown. The temperature effect on the PEM-ELS dynamic behaviour is also discussed