

Hydrogen Energy Power System for a Stand-alone Weekend-home Application

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Abstract

With an increase in renewable energies penetration and a market potential for the introduction of hydrogen into stand-alone energy systems, aspects related with the immaturity of some of the technologies which integrate the hydrogen sub-system, represent important unresolved technical issues, entailing unavailable components or availability at high costs. As a consequence, there is a growing initiative in the development and implementation of such a systems, that may demonstrate improved energy efficiency, response time, and safety in the storage option looking for an increase in the energy round-trip efficiency of the hydrogen sub-system.

In this work, a novel demonstration of a Hydrogen Weekend Bungalow powered as a stand-alone renewable hydrogen energy system is presented. The main system components are:

- 1.25 kW PV Solar Panel with DC- hydrogen generator;
- 10 Nm³ Hydrogen Storage tank on the base of metal hydrides;
- Novel Hydrogen Cooker - 2 x 1000W and Hydrogen Refrigerator –power - 50W;
- Fuel Cell 500 – 1000 W with Converter - 48 V DC - 220 VAC, 1.5 kW ;
- Hydrogen and water control system.

During the day, electricity from PV panels is collected and stored as hydrogen. The Fuel Cell is supplied from hydrogen from a vessel containing a metallic hydride storage solution. The hydrogen storage tank is able to supply a novel Hydrogen Kitchen and Fuel Cell with hydrogen for production of minimum 10 kWh electricity and/or 20 kWh thermal power in total. Hydrogen can be directly converted to thermal energy by hydrogen burners being of a simple, safe and sturdy construction and free CO_x and low NO_x emissions. Hydrogen burners with a thermal power output from 500 to 5000 kW have been developed by Labtech, the equipment meets the UNIDO requirement for the development of a H₂ cooker with portable hydride storage. It is considered an important solution for areas which have no grid and no effective energy carrier.

References

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