ENERGY SYSTEM DESIGN FOR AN AFFORDABLE AUTONOMOUS SOLAR PV POWERED DWELLING WITH SEASONAL ENERGY STORAGE

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Solar photovoltaics (PV) are destined to play an increasing role in homes of the future. New Zealand's temperate climate offers the opportunity to cost-effectively power an energy efficient house throughout the year using only solar energy available within the immediate vicinity. To achieve this goal with technical efficiency, both diurnal and seasonal storage must be provided. Seasonal energy storage requirements for PV generation are particularly challenging, and in New Zealand insolation can vary by a factor of 3 between seasons and PV capacity factors are typically between 10% and 14%. The affordable autonomous solar powered dwelling project has been initiated to develop and demonstrate the near commercial status of a combination of battery and hydrogen energy technologies [1] that can deliver a novel technology solution for efficient "energy independent" rural dwellings. An affordable home design currently in series production in New Zealand has been chosen as a test platform and demonstrator for the new energy technologies involved and installation is planned at a rural test site within the next 12 months. In this project, hydrogen storage is shown to be the key to cost-effective seasonal energy storage. In addition to identifying the characteristics of hydrogen that make it attractive as a storable energy vector, a realistic scenario is developed of the seasonal energy storage requirements for a dwelling powered solely by the sun. The complementary benefits from adding intermittent renewable sources such as wind and microhydro are identified [2]. Technology components, energy system operation and the project plan for a pilot scale house are outlined. The project aims to demonstrate firstly that the expertise to create these unique advanced technology homes at an affordable price is available in New Zealand, and secondly to attract investment for business innovation and commercialisation of these technologies within New Zealand.

[1] Gardiner, A I, et. al., Experience with a Small "Remote" Island Hydrogen Energy Storage System and Projections to Large Scale Grid Storage Applications, http://www.all-energy.com.au/en/Sessions/2891/Experience-with-a-Small-Remote-Island-Hydrogen-Energy-Storage-System-and-Projections-to-Large-Scale-Grid-Storage-Applications
[2] Pearson, T, The Many Benefits of Utilising Combined Wind and Solar Generation in Micro Grids, http://www.all-energy.com.au/en/Sessions/3414/The-Many-Benefits-of-Utilising-Combined-Wind-and-Solar-Generation-in-Micro-Grids

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