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GENERATION OF HYDROGEN GAS FROMSOLAR ENERGY

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Abstract - The objective of this project is to create *clean fuel for transportation* using hydrogen powered by solar energy. Hydrogen has been generated by solar photovoltaic (PV) array and then collected for data analysis to demonstrate efficiency of the hydrogen production in all the steps of the experiment. The hydrogen produced from the electrolysis process was either stored in a metal hydride canister or directly fed into Proton Exchange Membrane (PEM) Fuel Cell to generate electricity. A hydrogen fuel cell remote control car has successfully designed, and demonstrates at least one hour operation per hydrogen charging at room temperature.

Key Words: Solar Energy, Hydrogen Production, Electrolysis, PEM Fuel Cell, Clean FuelTransportation, Hydrogen Storage, Metal Hydrides, Electrolyzer, Energy Efficiency.

1.INTRODUCTION

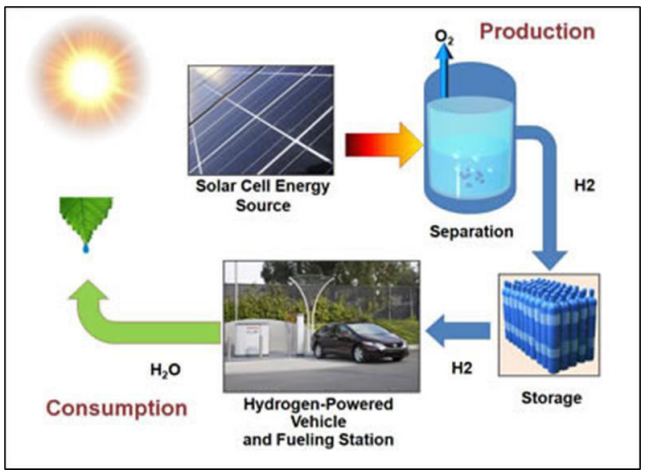
Hydrogen will be the fuel of the future and step by step will replace all current fossil fuels. In AleaSoft an analysis of the impact of hydrogen on the energy sector has been carried out as a key factor in the ecological transition and a summary of the present and future use of this gas in various sectors of the economy. Hydrogen is the most abundant element in the universe. It is used as an input in oil refining, the production of ammonia and methanol and the manufacture of steel. Current global demand for hydrogen is more than 70 million tons per year. The supply of hydrogen to industrial users is now an important business worldwide. The demand for hydrogen, which has multiplied by more than three since 1975, continues to increase, supplied almost entirely by fossil fuels, with 6% of global natural gas and 2% of global coal destined for the production of hydrogen.

Hydrogen production plays a very important role in the development of hydrogen economy. Hydrogen gas production through solar energy which is abundant, clean and renewable is one of the promising hydrogen production approaches. This project overviews the generation of hydrogen generation using solar energy as main source. It is concluded that developments of improved processes for hydrogen production via solar resource are likely to continue in order to reach competitive hydrogen production cost.

2. Literature Survey:

Gregoris Panayiotou et. al. [1] discussed the disadvantage of Renewable Energy Sources (RES) systems is their variability and dependence on environmental conditions. This problem can be overcome by storing energy in the form of hydrogen either for long or short term. One of the most promising types of such systems is the solar hydrogen energy system (SoHyS) where essentially the electricity produced by the PVs is stored in the form of hydrogen by using a variety of storage methods and means. The future trends of research in this area would be on more efficient electrolysers and more advanced and lightweight storage media in order to increase the overall effectiveness of the system.

Simon Koumi Ngoh et. al. [2] Hydrogen production plays a very important role in the development of hydrogen economy. Hydrogen gas production through solar energy which is abundant, clean and renewable is one of the promising hydrogen production approaches. This article overviews the available technologies for hydrogen generation using solar energy as mainsource.



Block diagram of generation of hydrogen gas from solar energy

3.Problem Definition:

Almost all of the current hydrogen is produced from hydrocarbons such as natural gas and coal. As a consequence, hydrogen production is responsible for the emission of around 830 million tons of carbon dioxide per year, equivalent to the combined CO2 emissions of the United Kingdom and France. However, there is a non-polluting alternative, the so-called green hydrogen. It is the hydrogen obtained through the electrolysis of water. Electricity is required for this process, so if the generation of a renewable source is used, hydrogen will be obtained without emissions in the process. With the decrease in the costs of renewable electricity, in particular photovoltaic and wind power, interest in green hydrogen is growing and several demonstration projects have been carried out in recent years. However, the challenge is not small. Migrating all current hydrogen production would represent an electricity demand of 3600 TWh, more than the annual electricity generation of the entire European Union.

4.Objectives:

The resource on exhaustible fossils sources for hydrogen production contributes greatly to the increase in the greenhouse effect. This is what would have been taken care of technically and financially (harnessing CO2 or ecotax), capable of modifying the thresholds of alternative competitive economic solutions particularly renewable energy. The development of the methods of hydrogen production based on renewable energy sources takes place as much as possible without releasing the greenhouse gas. These methods represent alternative ways for hydrogen production through fossils combustibles.

Among the many renewable techniques, solar hydrogen production preferred to be good one. In solar, some have reached a stage of industrial and commercial maturity, and others are the subject of research. These technologies beyond their diversity are grouped into three families: photochemical, thermochemical and electrochemical technologies that offer a promising alternative for the storage of solar energy. The objective of this work is to make a large inventory of fixtures of these technologies of hydrogen production through solar energy which brings out the necessary elements responding to a number of questions and even the problems earlier mentioned. The methodology of the study made below is at first technological. The environmental and economical stakes relative to an economic development of hydrogen through solar means will be approached. This will ensure some degree of reflection on the viability and future perspectives on the production and use of solar hydrogen as an energy vector especially for regions endowed with sufficient solar radiation.

5.Research Methodology to be employed:

The gram molecule of water is equal to 18 grams. Hydrogen mass in a water molecule is 2x100/18=11.11%; oxygen mass is 16x100/18=88.89%; this ratio of hydrogen and oxygen is in one liter of water. It means that 111.11 grams of hydrogen and 888.89 grams of oxygen are in 1000 grams of water. One liter of hydrogen weighs 0.09 g; one liter of oxygen weighs 1.47 g. It means that it is possible to produce 111.11/0.09=1234.44 liters of hydrogen and 888.89/1.47=604.69 liters of oxygen from one liter of water. It appears from this that one gram of water contains 1.23 liters of hydrogen. Energy consumption for production of 1000 liters of hydrogen is 4 kWh and for one liter 4 Wh. As it is possible to produce 1.234 liters of hydrogen from one gram of water, 1.234x4=4.94 Wh is spent for hydrogen production from one gram of water now A small value of current 0.02 A and voltage 0.062 V allows us to suppose that in the low current electrolyzer the water electrolysis process is similar to the process, which takes place during photosynthesis. At photosynthesis, hydrogen separated from the water molecule is used as a connecting link while organic molecule formation, and oxygen is released in the air. At low current electrolysis, both hydrogen and oxygen are released in the air.

6. CONCLUSIONS

Energy is at the core of economic growth and development in the present day world. But relentless and unchecked use of harmful energy resources like fossil fuels (coil and oil), nuclear energy has taken a toll on mother nature. The energy coffers are being rapidly depleted and within a few years all of them will become empty, leaving nothing for the future generations to build on. Their constant usage has degraded the air quality and given way to land and water pollution. Scientists and world leaders have initiated a call for action to shift our dependence from currently popular energy sources to cleaner and renewable energy sources. Search forsuch energy sources have been going on for many years. Solar energy, wind energy, ocean energy, tidal energy, biofuel, etc. have caught the attention of people. Another such important which has become popular is 'Solar Hydrogen'. Many visionary scientists have called hydrogen the energy of the future. It is produced from water by direct or indirect use of sunlight in a sustainable manner.

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