Fuel Your Sol: Design of a Unitized Reversible Hydrogen Fuel Cell

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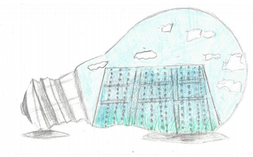
Background

One of the many prominent issues of the present is the need for renewable energy sources and the eventual reduction of dependence on traditional non-renewable energy sources. The most well-known and accepted forms of renewable energy are solar and wind, though many more exist. Of particular note to us is solar energy, which has been harnessed by a previous AIChE OPV Project, which installed a solar umbrella.

More than energy generation, another issue lies in energy storage. While traditional batteries are a viable option, it does present the problem of eventual waste: our option here is the use of a reversible fuel cell, which uses water, air, and hydrogen gas.

Purpose



Awareness

Students will be able to see more examples of renewable and environmentally friendly energy sources and storage, and thus gain understanding of them.

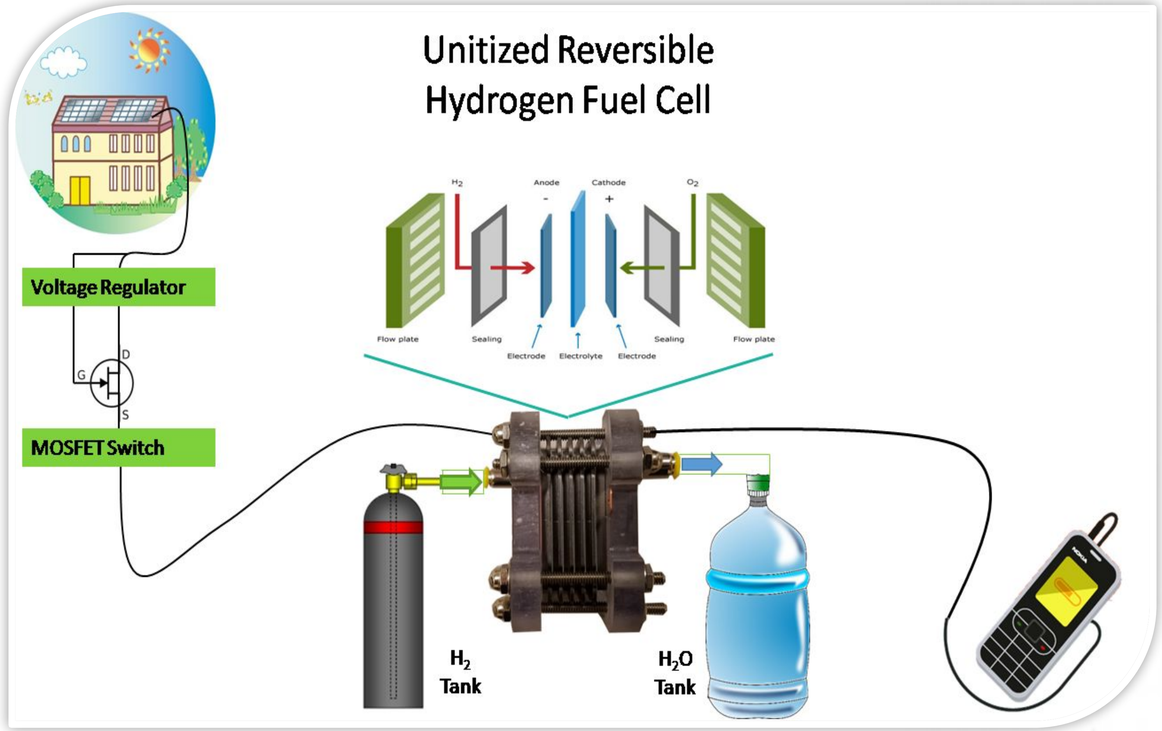
Usefulness

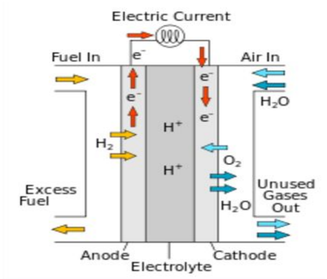
The team will build a reversible fuel cell that will be part of a system to provide power storage which the solar umbrella generates over time, making the system an independent charger

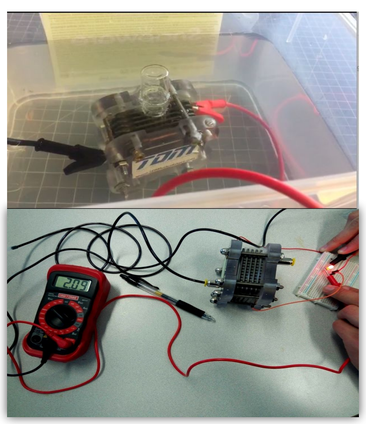
Hands-On

The team will directly learn about chemical engineering problems through the building and testing of the fuel cell, as well as its integration into a previous system.

Design





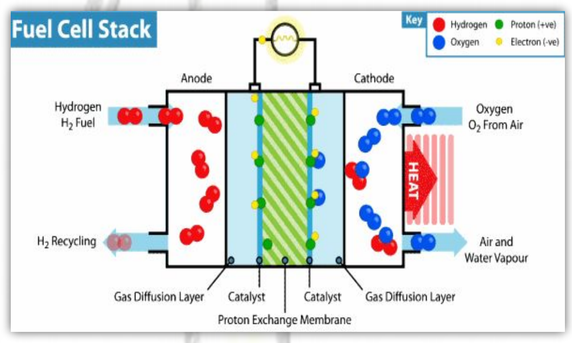


Progress

Thus far, we've finished designing, 3D printing, and electroplating our own flow plates, and have been able to run the fuel cell in both forward and reverse reactions. We've also managed to run tests and determine the gas flows of the electrolysis reaction.

Currently we're working on managing gas flows and stream directions, designing a hydrogen storage system, and integrating the fuel cell into the solar umbrella system.

Our current design is a 5 cell stacked Unitized Reversible Hydrogen Fuel Cell (URFC) paired with a solar panel to charge mobile devices. If the solar panel is not active when a mobile device is plugged into our charging station, pure hydrogen gas and air containing oxygen will be pumped into the cell, creating DC voltage output to charge the device. Water is a byproduct of this process and is stored in a tank for later use in the reversible cycle of the system.



During idle periods where there is no device being charged, the reversible process takes place. Water is fed into the URFC and is split into Hydrogen and Oxygen gas using energy from the solar panel. These gases will be stored away in separate tanks for later use when devices are plugged into the station for charging. Overall this system makes better use of the energy generated by the solar panel.

We would like to thank TGIF for their contributions to this project.