18. Hydrogen house

Clean energy for future living?

Overview

The Hydrogen house is a large model house with many electrical items inside, all of which run from hydrogen fuel cells in the roof of the house.

How it works?

The Hydrogen House is a 4-storey model house that has lights, moving parts, and sounds to simulate a busy real-life house. All the electrical components are powered by fuel cells, supplied by hydrogen from either the Hydrostik or a balloon of hydrogen. When supplied with hydrogen, the fuel cells can provide a current of around 2 Watts each, and each house comes with 3 fuel cells. The fuel cells are controlled by an Arduino open-source microcontroller, coupled with a specially designed fuel cell controller shield from Arcola Energy. This regulates the fuel cell output to 5 volts as well as managing the purging and current pulsing of the fuel cell; these control strategies ensure the 'health' of the fuel cell over time.

Why is this important?

The house is another demonstration that hydrogen can theoretically power anything that requires an electrical current. A lot of research and applications of hydrogen power have focussed on transport, such as the hydrogen powered buses and cars that exist in the UK and beyond. However, why not go further, and imagine a house connected to a network of gas pipelines that supply hydrogen gas? Fuel cells could use this gas to supply electrical energy, and the gas itself could even be used to supply heat for cooking.

More stories to tell

What else could we use hydrogen for?

As the hydrogen house, car and bus show, we can get electrical energy from hydrogen to power appliances. But we can also use hydrogen gas for cooking and heating, because it's a flammable gas that gives off heat when burned. Initiatives such as the Solar Hydrogen Cooking Gas Project in Jamaica used hydrogen supplied in compressed gas cylinders which allowed families to cook on converted stoves. Compared with traditional sources such as charcoal and firewood, hydrogen is far cleaner and safer in the long term, avoiding regular exposure to carbon emissions.

Hydrogen in the future

Hydrogen already has many uses in industry in the UK and beyond. This is because it burns cleanly at a very high temperature, and so is used in some welding applications and in the Haber – Bosch process to manufacture ammonia. Its use as a fuel is exciting around the world, with Japan planning on hydrogen playing a key role in the transport logistics of the 2020 Olympic Games in Tokyo. Some researchers see both hydrogen fuel cell technology and future battery technology as incredibly important contributors to future power demands.

The Activity

1. Where possible, it is recommended that the hydrogen gas is provided by a balloon that can be plugged into the inlet valve on the roof of the house. This way, it should be very clear to the audience that the power for the house is only there because of the gas being supplied from the balloon. For added effect, this activity can follow straight on from the hydrogen bus activity, and the balloon can be transferred straight from the roof of the bus to the roof of the house, making it very obvious that the same source of hydrogen is powering both items.

Maintenance

1. The house contains several small electrical items that will need to be regularly checked for damage, and tested before use.

2. The hydrogen fuel cells, if treated properly, should have a life of at least two years, although they can last considerably longer. There will be a separate document detailing how best to care for these cells on The Secret World of Gases website, and what to do if they are not working. Do not attach balloons of air, oxygen or carbon dioxide, as this will damage the hydrogen fuel cells.

Health and Safety

Every delivery centre must undertake their own risk assessments for the specific audiences, locations and conditions they are presenting in. Sample assessments are available on The Secret World of Gases website. Below is a guide to the key risks and hazards:

1. The house uses a supply of hydrogen gas, which is flammable. Keep naked flames away from the hydrogen balloon.

2. The house is also reasonably large and heavy. Use the carrying handles and trolley provided and when possible, have two members of staff to move it. Follow your Centre's manual handling guidance.