

GENERAL DETAILS

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Name of Project: Hydrogen Fuel Cells – Powering a Cleaner World

Research Plan

Title-Hydrogen Fuel Cells – Powering a Cleaner World

Introduction

This project is based on *hydrogen fuel cells*. Hydrogen is the lightest and most abundant element in the universe, and when used in fuel cells, it can produce clean electricity with water vapor as the only byproduct. Unlike fossil fuels, hydrogen fuel cells do not emit greenhouse gases or harmful pollutants, making them a revolutionary method for producing sustainable energy. In this project, we will demonstrate how hydrogen can power a small model of a car or rocket, showing the potential of this clean energy technology in real-world applications.

Selection of Problem and Background Information

The world today faces a serious energy crisis due to the depletion of fossil fuels and the harmful environmental impacts of their use. To overcome this, scientists and engineers are exploring renewable and clean energy solutions. Hydrogen is a promising energy carrier because it can be produced from water and used to generate electricity in a fuel cell without pollution. A hydrogen-powered car or rocket model can demonstrate how this technology may replace conventional engines. This technology is especially important in remote areas, space exploration, and for reducing global carbon emission

Objective

The main objective of this project is to show how hydrogen can be used as a fuel to generate clean electricity in a hydrogen fuel cell. My hypothesis is that hydrogen, when passed through a proton exchange membrane (PEM) fuel cell, will produce electricity that can power a small motor. The independent variable will be the **amount of hydrogen gas supplied**, while the dependent variable will be the **voltage/current output of the fuel cell**. Controlled variables will include the type of fuel cell, the temperature, and the type of motor used

Hypothesis

My hypothesis is that hydrogen fuel cells can generate electricity efficiently to power small devices such as a model car or rocket. Increasing the supply of hydrogen should increase the power output.

Procedure

Independent	Variable:	Amount	of	Hydrogen	Gas	Supplied
Dependent	Variable:	Voltage	and	Current		Output

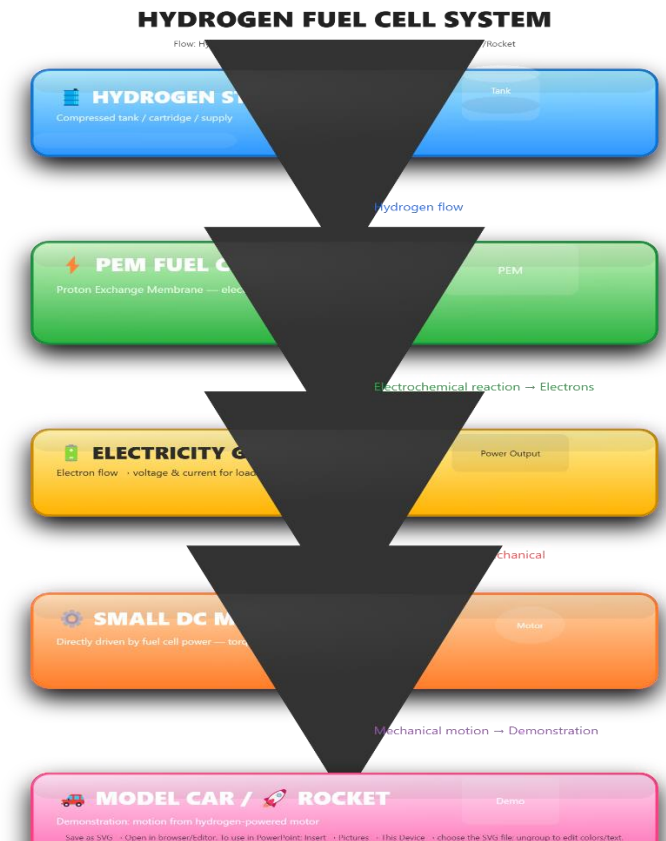
Controlled Variables: Temperature, Type of Fuel Cell, Motor Type

Materials:

- Hydrogen fuel cell kit (1)
- Small DC motor (1)
- Fan blade or rocket launcher attachment (1)
- Plastic tubing for gas flow
- Balloon or small hydrogen storage container
- Alligator clips and connecting wires
- Digital multimeter
- Distilled water (for hydrogen generation, if electrolysis is used)
- Electrolyzer unit (optional, for generating hydrogen from water)

Method:

1. If using an electrolyzer, fill it with distilled water and connect it to a power source to generate hydrogen gas. Collect the hydrogen in a balloon or storage unit.
2. Connect the hydrogen supply tube to the hydrogen input port of the PEM fuel cell.
3. Connect the fuel cell output terminals to a small DC motor or LED light using wires and alligator clips.



4. Record the voltage and current produced using the digital multimeter.
5. Vary the amount of hydrogen supplied and note the corresponding voltage/current.
6. Test the system by attaching the motor to a small car chassis or rocket model to demonstrate hydrogen-powered motion.

Data Analysis

Record the amount of hydrogen used versus the voltage/current output of the fuel cell.

Data Table:

Amount of Hydrogen Supplied (ml)	Voltage (V)	Current (mA)	Output (Power in mW)
10 ml			

20 ml			
30 ml			

This data will show how hydrogen supply affects power output. The model car/rocket should move faster or run longer with higher hydrogen input.

Bibliography (References)

- U.S. Department of Energy. “Hydrogen Fuel Cells.” <https://energy.gov/eere/fuelcells>
- National Renewable Energy Laboratory (NREL). “Hydrogen Basics.” <https://www.nrel.gov/hydrogen>
- Fuel Cell & Hydrogen Energy Association. “How Fuel Cells Work.” <https://www.fchea.org>