



# HYDROGEN TO ENERGY



FLL INNOVATION PROJECT 2023



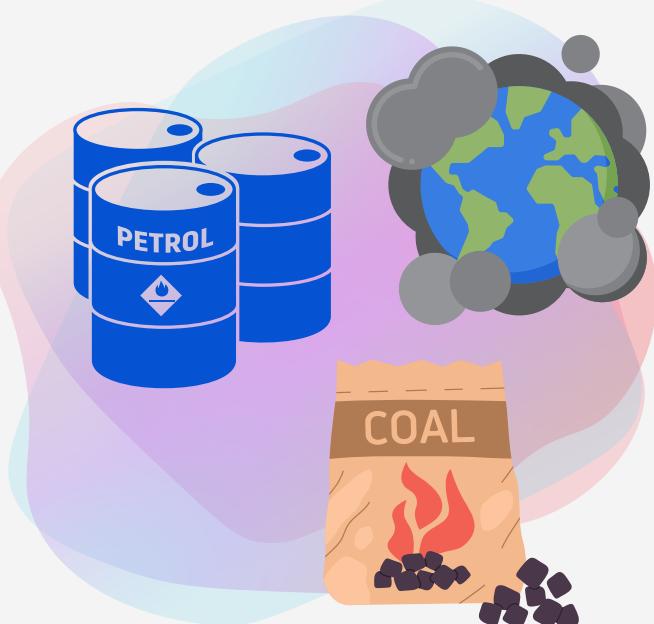
**JAWATHA ROBOT CHAMPIONS**  
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# INTRODUCTION

Renewable energy comes from natural, replenishable resources like the sun, wind, and water. It is a sustainable and clean alternative to fossil fuels that helps reduce our carbon footprint and ensures energy security. Hydrogen is a clean and versatile fuel that can be used to power a wide range of applications, from transportation to electricity generation. When burned, it only produces water, making it an environmentally friendly option for a sustainable future. Hydrogen, while a promising fuel source, faces challenges with availability. It is not freely available in nature, but instead must be produced using other energy sources, such as natural gas or renewable electricity. The development of cost-effective and sustainable hydrogen production methods is crucial for its widespread use.

# PROBLEM IDENTIFICATION



The need for renewable energy is driven by the increasing global demand for energy, the limited supply of fossil fuels, and the environmental concerns associated with their use. The continued burning of fossil fuels contributes to climate change, air pollution, and water contamination, which have negative impacts on human health and the environment.

Renewable energy sources such as solar, wind, hydro, and geothermal power offer a cleaner and more sustainable alternative. However, the problem we are facing is the high cost of renewable energy technology and the need for more research and development to make it more efficient and affordable. We also need to develop better energy storage systems to ensure reliable and continuous energy supply.



After researching multiple sources, we have come to the conclusion that the main issue is the lack of renewable energy sources. So, we decided to create an efficient and pollution-free system to obtain energy.

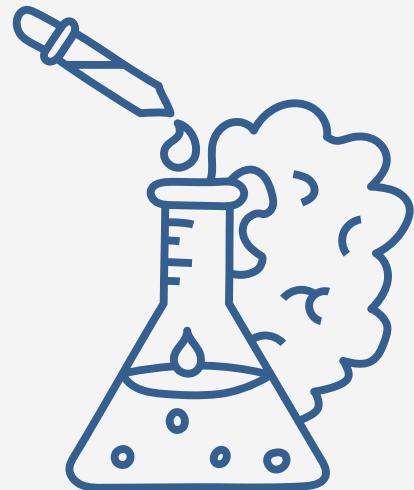


# CONCEPTS EXPLORED

While developing our project, we explored several ideas and ultimately decided to focus on the hydrogen fuel cell. We also considered improving concentrated solar power, but we determined that hydrogen power is a more efficient solution. Our project involved investigating various concepts and ideas to determine the best approach to address the challenge at hand. These are some of the concepts and ideas that we investigated while creating our project:

## CHEMICAL REACTIONS

Chemical reactions occur when two or more substances (reactants) interact to form one or more new substances (products) with different chemical properties. The reactants are transformed by the breaking and forming of chemical bonds, leading to changes in the energy and structure of the molecules involved.



## ELECTROLYSIS

Electrolysis is a process where an electric current is used to break apart a substance (usually a liquid) into its individual parts. This is done by passing the current through the liquid, which causes a chemical reaction that separates the substance into its components. The separated components can then be collected and used for different purposes.

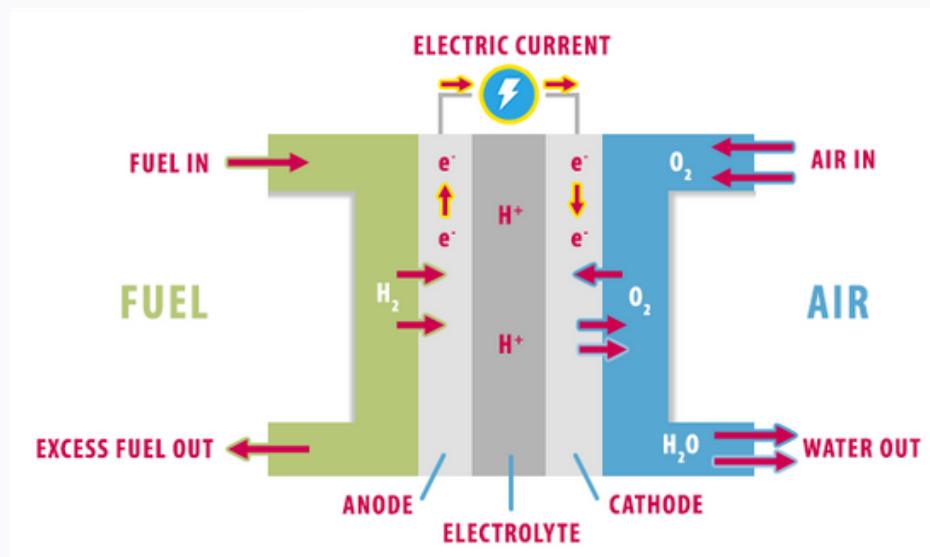


## CONCAVE MIRRORS

Concave mirrors are curved mirrors that have a reflective surface that curves inward. They are capable of reflecting light rays inwards to converge at a single point, known as the focal point. The reflective surface of a concave mirror can be used to create a concentrated beam of light, making them useful in a variety of applications, including solar panels.



# THE HYDROGEN FUEL CELL



## Definition

A hydrogen fuel cell is a device that converts the chemical energy of hydrogen and oxygen into electrical energy, heat, and water. In the hydrogen fuel cell, hydrogen and oxygen combine without burning.

## How it works

The fuel cell consists of an anode, a cathode, and an electrolyte, just like a common battery. The hydrogen is fed into the anode, and the oxygen is fed into the cathode. The anode and cathode are separated by the electrolyte, which allows the hydrogen ions to pass through while blocking the electrons. As the hydrogen ions react with the oxygen, they produce water and electrons. The electrons are then used to generate electricity, which can be used to power a vehicle or other electronic device.

## Limitations

The widespread adoption of fuel cells has been limited by the high cost of producing and storing hydrogen, and the limited availability of refueling infrastructure.

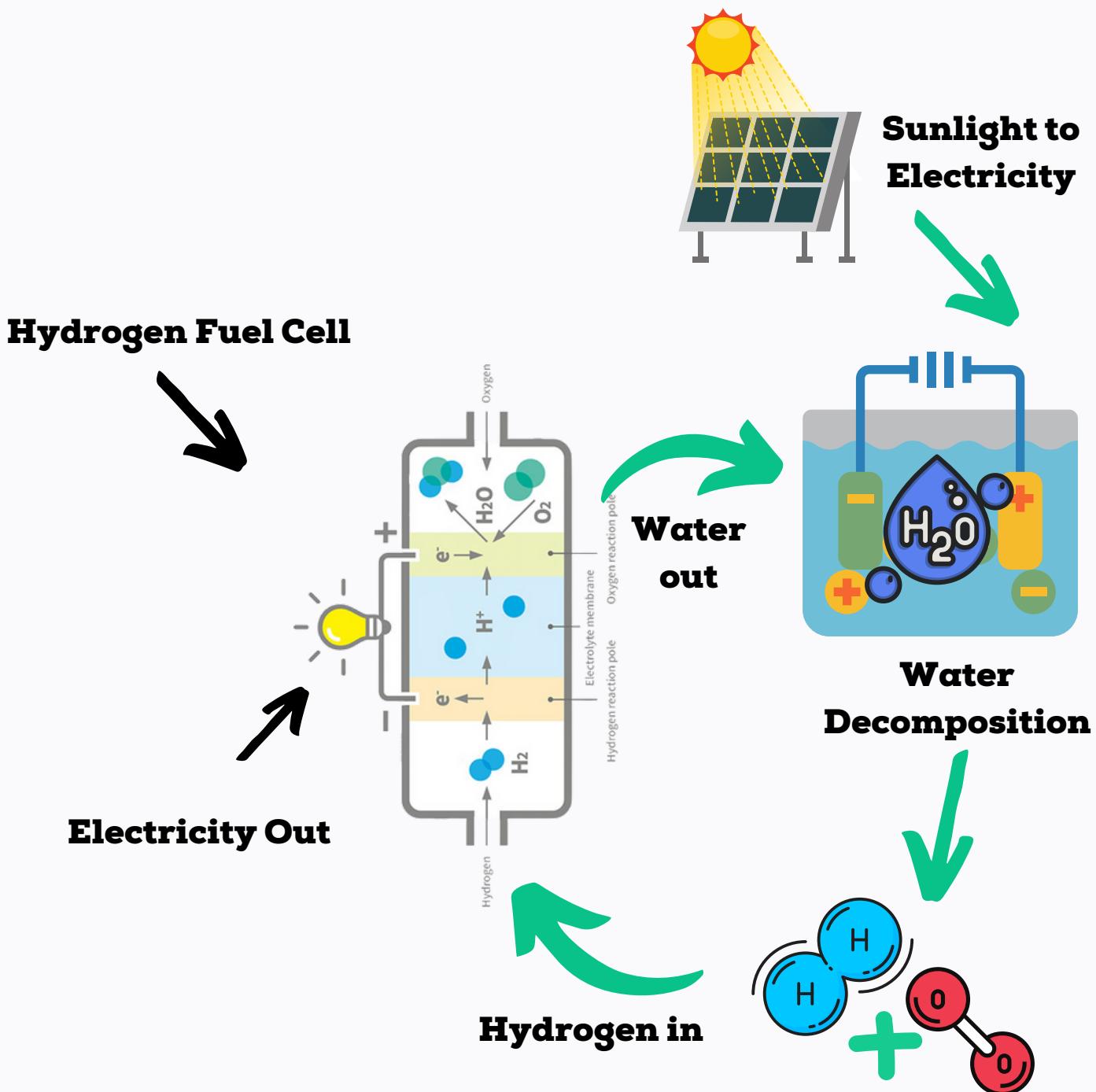
## Advantages

The process of converting hydrogen into electricity in a fuel cell is highly efficient, producing only water as a byproduct, and no harmful emissions.

The reaction gives out plenty of energy. 1 kg of hydrogen gives about 2.5 times as much energy as 1 kg of natural gas (methane).

# OUR SOLUTION

Electrolytic decomposition is a process where water is split into its components, hydrogen and oxygen, by passing an electric current through it. However, obtaining the required electricity can be a challenge. To address this, we can use renewable energy sources like wind, hydroelectric, or solar power. In our case, we use solar panels to generate electricity, which we then use to obtain hydrogen through electrolysis. The hydrogen can then be used as a fuel in a hydrogen fuel cell, which produces more energy. The process only produces heat and water, which can be reused to obtain more hydrogen. Additionally, hydrogen can be burned with oxygen to produce energy.



# IMPACT

The impact of hydrogen fuel cell technology is significant, as it has the potential to revolutionize the energy industry and reduce the world's dependence on fossil fuels. Its energy output is much higher than that of traditional combustion engines.

In addition to its efficiency, hydrogen fuel cell technology has many other benefits, such as being environmentally friendly, reducing greenhouse gas emissions, and having a longer lifespan than traditional batteries. Moreover, fuel cell vehicles have a much longer range than electric vehicles, making them ideal for long-distance travel.



Despite the many advantages of hydrogen fuel cell technology, its widespread adoption still faces many challenges, such as the cost of production, infrastructure development, and safety concerns. However, as technology continues to improve and costs decrease, hydrogen fuel cell technology is expected to play an increasingly important role in meeting the world's energy needs in a sustainable and environmentally friendly manner.