This resource was developed as part of the HyAcademy.eu project.

HYDROGEN
FUEL OF TOMORROW

Discover how the universe's most abundant element is helping us save the planet and power our future.

HyAcademy.EU

creative commons

UK Research and Innovation

Clean Hydrogen Partnership

Co-funded by the European Union

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

The European Hydrogen Academy and Net-Zero Hydrogen Academy are supported by the Clean Hydrogen Partnership and its members under Grant Agreement No: 101137988, by UK Research and Innovation (UKRI), and the Swiss Confederation Secretariat for Education, Research and Innovation (SERI)

Introduction

Part 1: The Basics

❑ Meet Hydrogen: Atomic Superhero

Hydrogen is the **lightest** and simplest element. It consists of only one proton and one electron.

Super light

It's the **most abundant** substance in the universe, making up 75% of all normal matter!

Everywhere

It has the highest energy content by weight of any common fuel

-

3x more than gasline

Powerfull

THE CHALLENGE

Part 2 : The Energy Crisis

❑ Why we need a change now?

+ 1.1 º C

Global Temperature Rise

75 %

Energy from Fossil Fuels

Burning coal, oil, and gas releases CO2, trapping heat and causing climate change

We need a clean alternative to keep our world cool


Global CO2 Emissions Trend
Annual Global CO2 Emissions from Fossil Fuels and Industry
CO2 emissions have been rising for decades.
CO2 Emissions (Billion Metric Tons)
45
40
35
30
25
20
15
10
5
0
1960 9.0 B
1973 15.1 B
1980 17.0 B
1990 21.1 B
2000 24.5 B
2010 33.1 B
2020 34.8 B
2023 36.8 B
1960
1970
1980
1990
2000
2010
2020
2023
Year
From 9.0 billion metric tons in 1960 to 36.8 billion metric tons in 2023!
Small choices today for a cleaner, healthier planet tomorrow!
Source: Global Carbon Project (2023)
* The image design made with AI

PRODUCTION

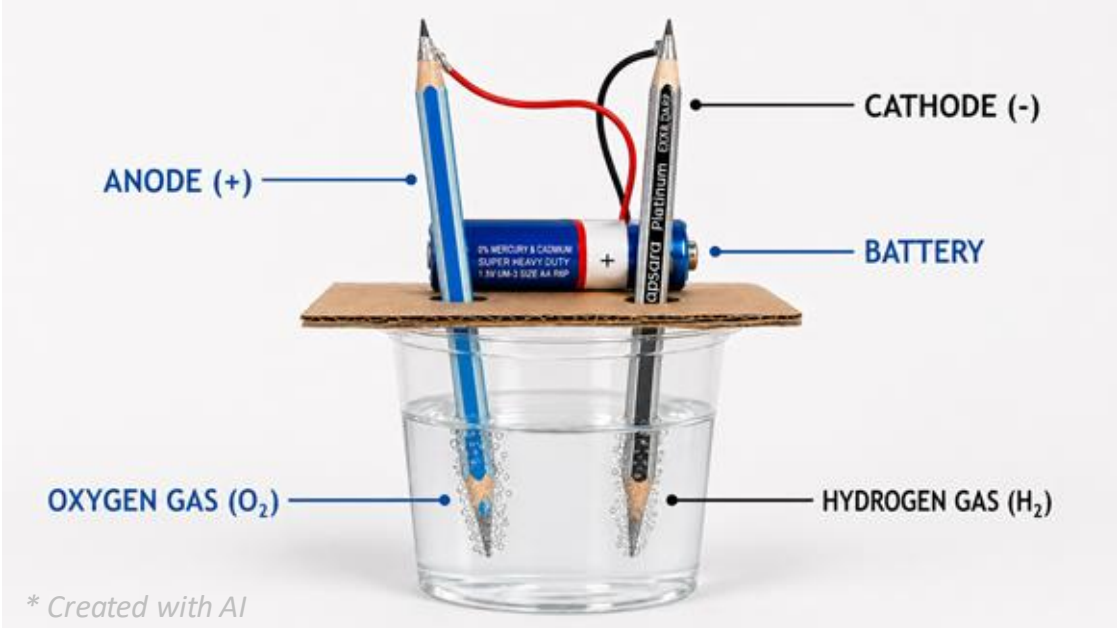
Part 3 : Making Hydrogen

❑ Electrolysis: Splitting Water?

How it works?

Pure hydrogen doesn't exits on its own on Earth. We have to "free" it from molecule like water (H_2O)

1. Pass an **Electric Current** through water.
2. The energy splits H_2O into **Hydrogen** and **Oxygen**
3. If we use renewable energy, the process is **100 % clean**!



The Hydrogen Rainbow

Green

Made using renewable energy (wind/solar)
Zero emissions!

Blue

Made from natural gas, but CO_2 is **captured** and stored.

Grey

Made from natural gas, but the CO_2 is **released** into the air.

❑ Green Hydrogen: The Goal

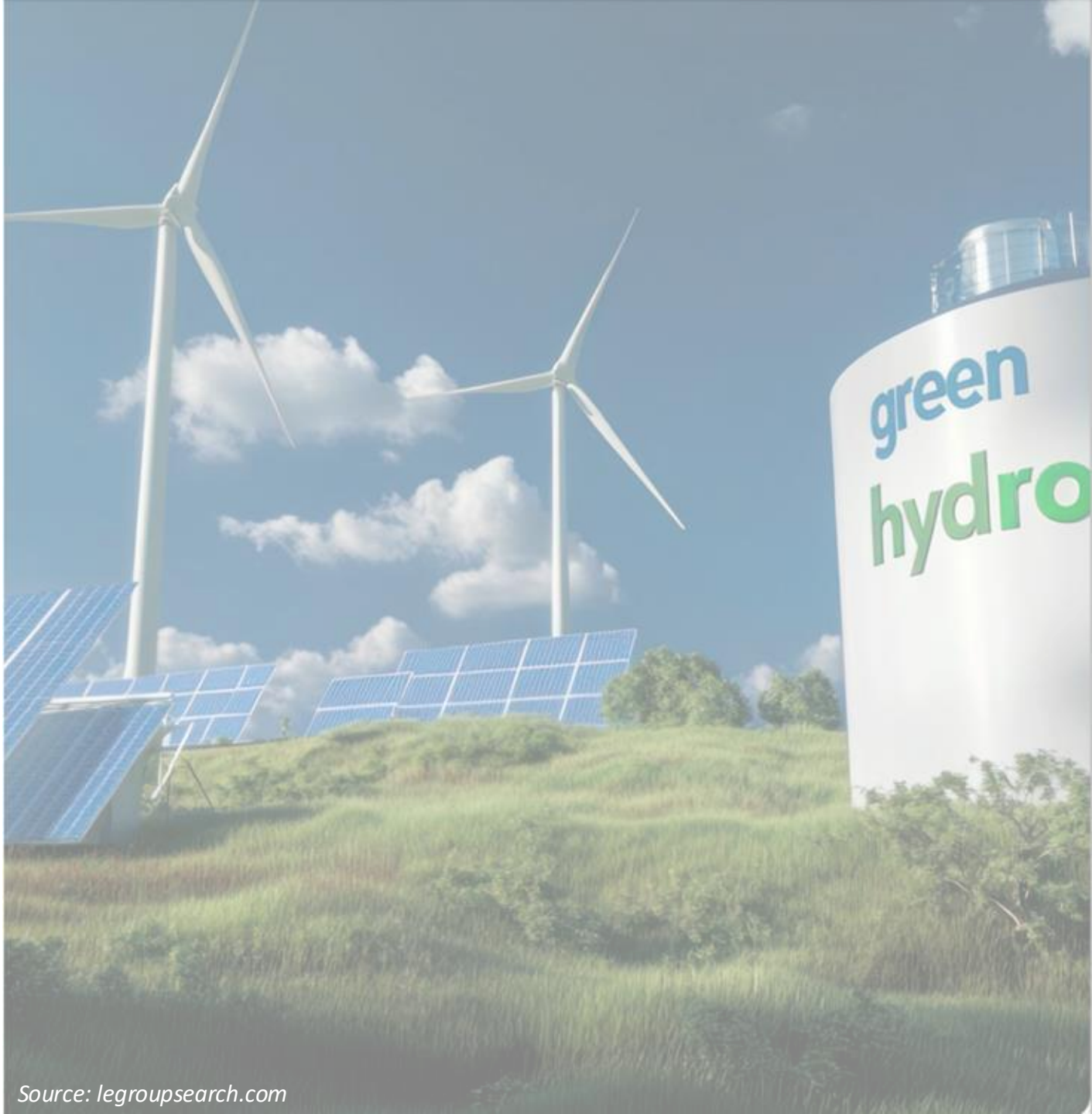
Imagination Exercise:

🤔 Let's imagine a factory that takes in only **sunlight**, **wind**, **water** and produces a powerfull fuel to run your city.

This is the Green Hydrogen Economy.

By using surplus renewable energy, we can store electricity as gas and use it whenever we need it!

- **Zero CO2 produced**
- **Energy Independence**
- **Infinite Ressources**

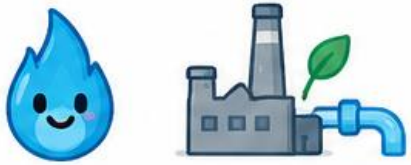


Source: legroupsearch.com

❑ Hydrogen Production Compared

Type	Input Source	Environmental Impact	Cost ($)
Green	Renewable+Water	Zero Emissions	Higher (Falling)
Blue	Natural Gas+CCS	Low Emissions	Moderate
Grey	Natural Gas	High Emissions	Low
Brown	Coal	Very High Emission	Lowes

ENERGY SOURCES COMPARED

TYPE	INPUT SOURCE	ENVIRONMENTAL IMPACT	COST ($)
GREEN 	Renewable + Water 	Zero Emissions 	Higher (Falling) 
BLUE 	Natural Gas + CCS 	Low Emissions 	Moderate 
GREY 	Natural Gas 	High Emissions 	Low 

** The image design is made with AI*

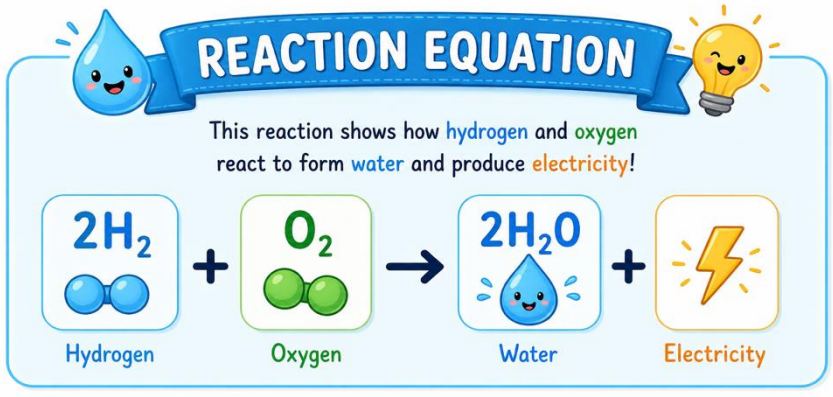
APPLICATIONS

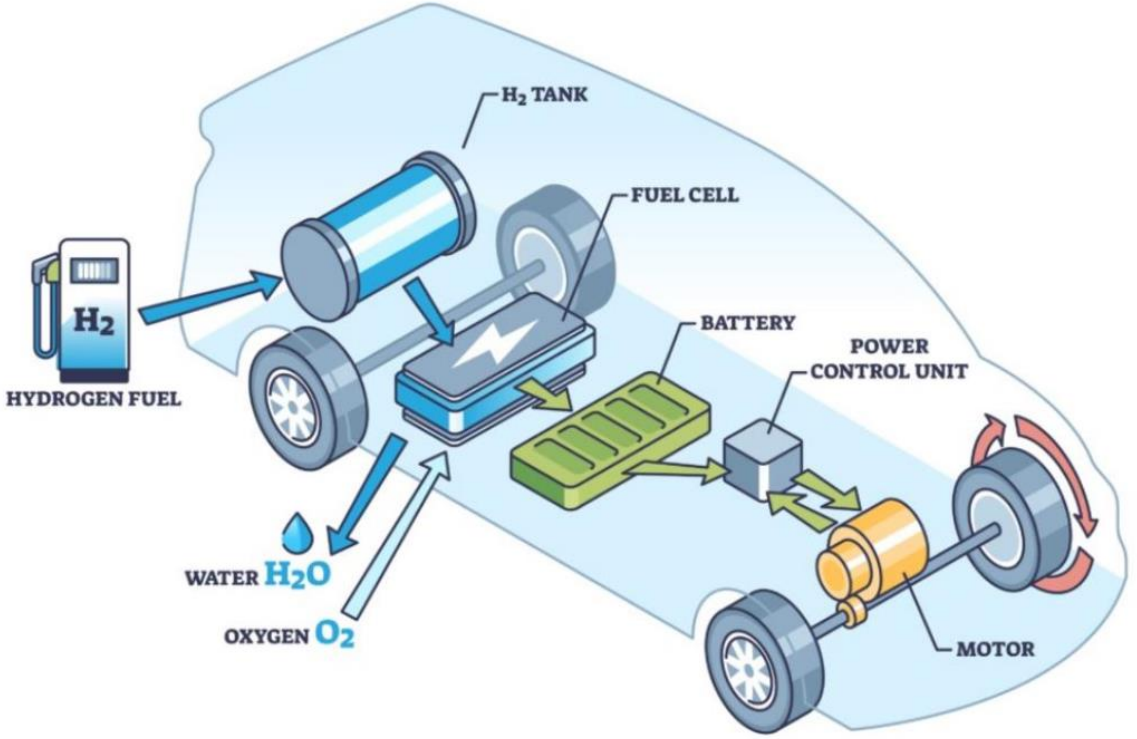
Part 4 : Hydrogen in action

❑ Fuel Cells: Magic Energy Boxes

A FUEL CELL is like a battery that never runs out – AS long as you give it hydrogen

- **Anode:** Hydrogen enters
- **Cathode:** Ozygen (from air) enters
- **Result:** Electricity + Water Vapour

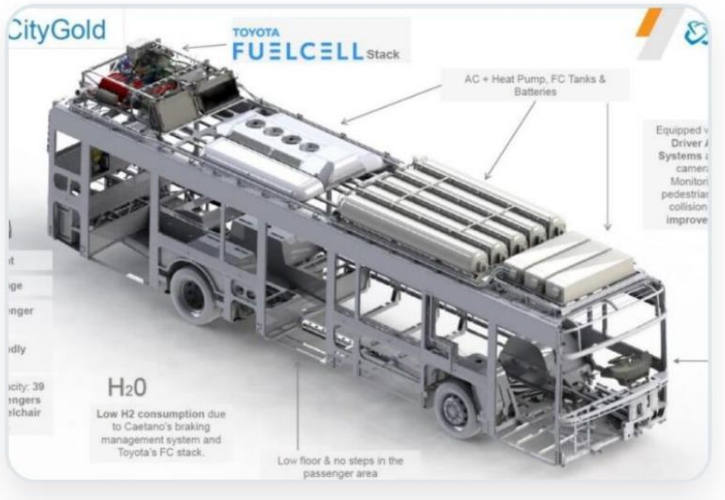




Source: meech.com

** AI imagine design*

❑ Hydrogen on the move

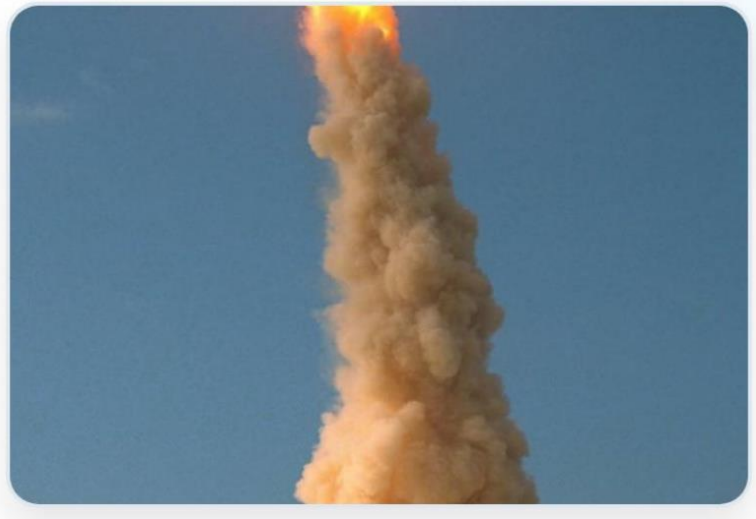


Public Transport

Clean buses with only water from the exhaust

Aviation

Decarbonizing long-distance flights



Space Exploration

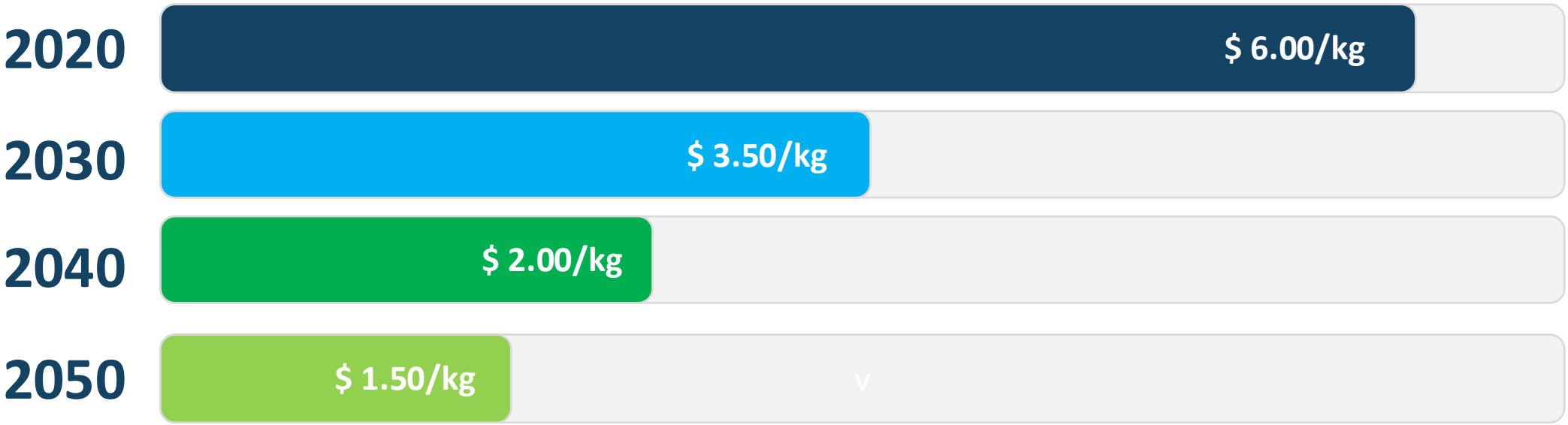
Powering the rockts that takes us into space

** Sources for photos: ceesen.org, futurism.com, reedit.com*

OUTLOOK

Part 5 : The Roadmap Ahead

❑ Green Hydrogen Cost Evolution



As technology improves and more **Electrolyzers** are built, the cost of clean energy will go down, making it cheaper than fossil fuels

❑ The path to a Net-Zero 2050

** image desing with AI*

❑ A Vision from History

“ Water will one day be emplyed as fuel, that hydrogen and oxygen will constitute it…will furnish an inexhaustible source of heat and light.”

- Jules Verne, The Mysterious Island (1874)

The future he imagined is now our reality.

This resource was developed as part of the HyAcademy.eu project.

ANY QUESTIONS

Thank you for your attention!

Keep Exploring:

https://hyacademy.eu

search for Hydrogen

HyAcademy.EU

creative commons

UK Research and Innovation

Clean Hydrogen Partnership

Co-funded by the European Union

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

The European Hydrogen Academy and Net-Zero Hydrogen Academy are supported by the Clean Hydrogen Partnership and its members under Grant Agreement No: 101137988, by UK Research and Innovation (UKRI), and the Swiss Confederation Secretariat for Education, Research and Innovation (SERI)