

RWE

The Role of Hydrogen in the Energy Transition



Learning objective

Add your chosen Learning objective to this slide (see lesson plan)

Vocabulary for learning

 **Hydrogen**

 **Electrolysis**

 **Conduct**

 **Oxygen**

 **Ions**

 **Products**

 **Energy resource**

 **Renewable**

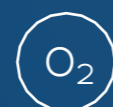
 **Electrode**

Learning objective



Hydrogen

The first element of the periodic table of elements, it usually exists as two atoms bonded together.



Oxygen

The eighth element of the periodic table, it usually exists as two atoms bonded together.



Conduct

To conduct means to carry electrical charge like in a wire or solution.



Electrolysis

The method by which electricity is used to split a chemical molecule.



Renewable

A resource which will not run out, It is replaced at the same rate that it is used.



Products

The chemicals released after a chemical reactions.



Energy resource

A material or process that can generate heat, make something move or generate electricity.



Ions

Charged atoms that have lost or gained an electron.



Electrode

A circuit component in electrolysis which is placed in the chemical.

Retrieval Practice

1. Which greenhouse gas is released by the burning of fossil fuels?
2. Name three sources of renewable energy.
3. State two consequences of global warming.
4. Why is it important to replace fossil fuels in production of electricity?

CHALLENGE ACTIVITY:

Thinking about your lesson in Geography, which type of clean energy store is the company RWE looking to produce?

Which type of renewable energy could they use for this?

Retrieval Practice

1. Carbon dioxide and water vapour are released by the burning of fossil fuels.
2. Geothermal, hydroelectric, wave, tidal, wind, solar and biomass are sources of renewable energy.
3. Droughts, floods, forest fires and habitat loss are consequences of global warming.
4. It is important to replace fossil fuels in production of electricity as they are a finite resource which will run out and they contribute to global warming.

CHALLENGE ACTIVITY:

The RWE project will develop hydrogen production from water with the use of renewable energy for example from wind turbines. This is known as “green hydrogen”.

Meet Yasmin

Yasmin works as a hydrogen product developer for RWE. In this short video she talks about why she wants to work in green hydrogen production, how water can be split into hydrogen and water, and some of the many job roles at RWE.

Click on Yasmin's picture or the link below to watch the video (2 mins and 56 seconds)

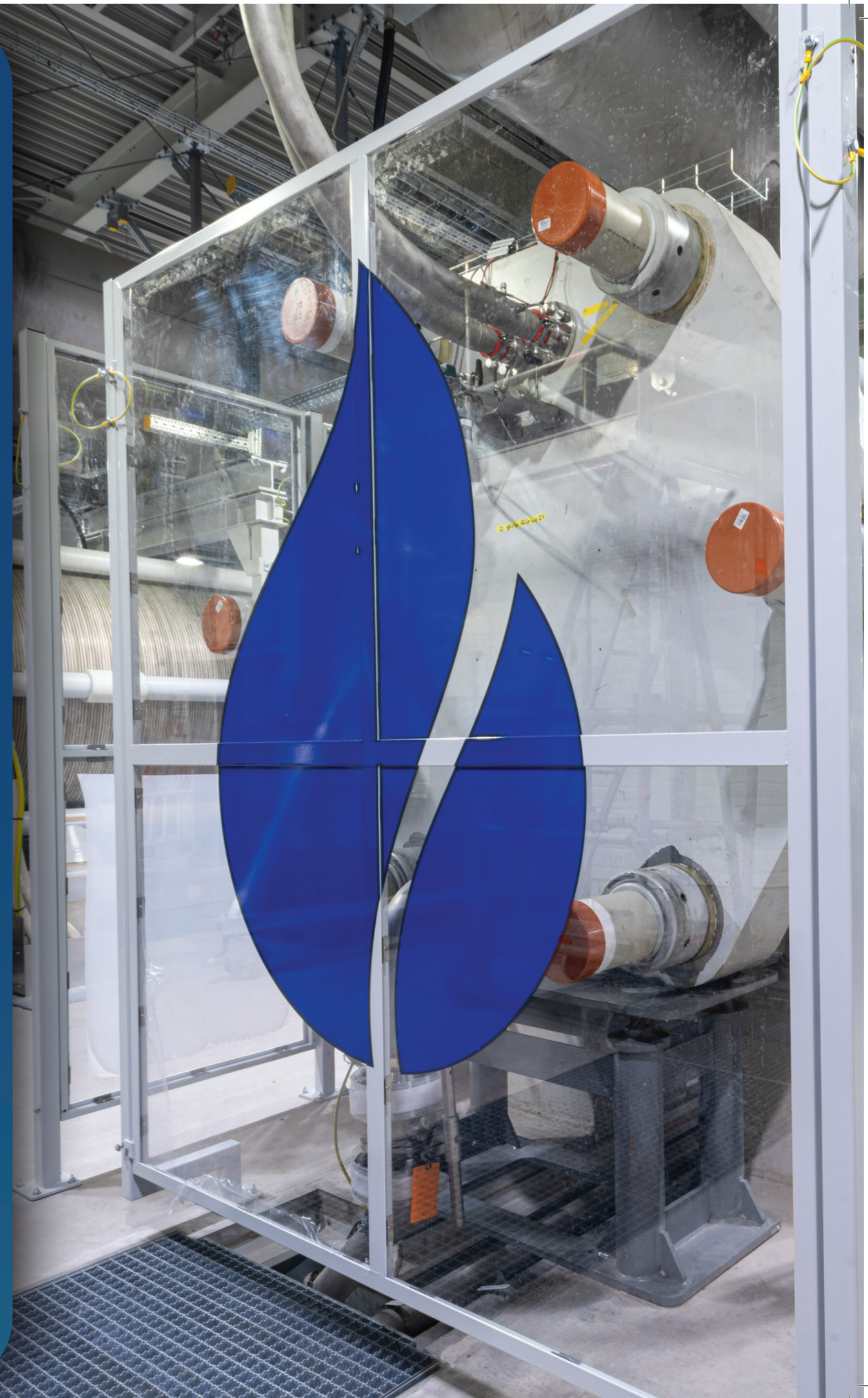
[RWE personnel video on Vimeo](#)



Electrolysis is really useful in industry

Electrolysis is used in the extraction of aluminium for the manufacture of drink cans, kitchen foil and aeroplane parts. This industry produces a useful by-product, carbon dioxide which is sold to the fizzy drink industry.

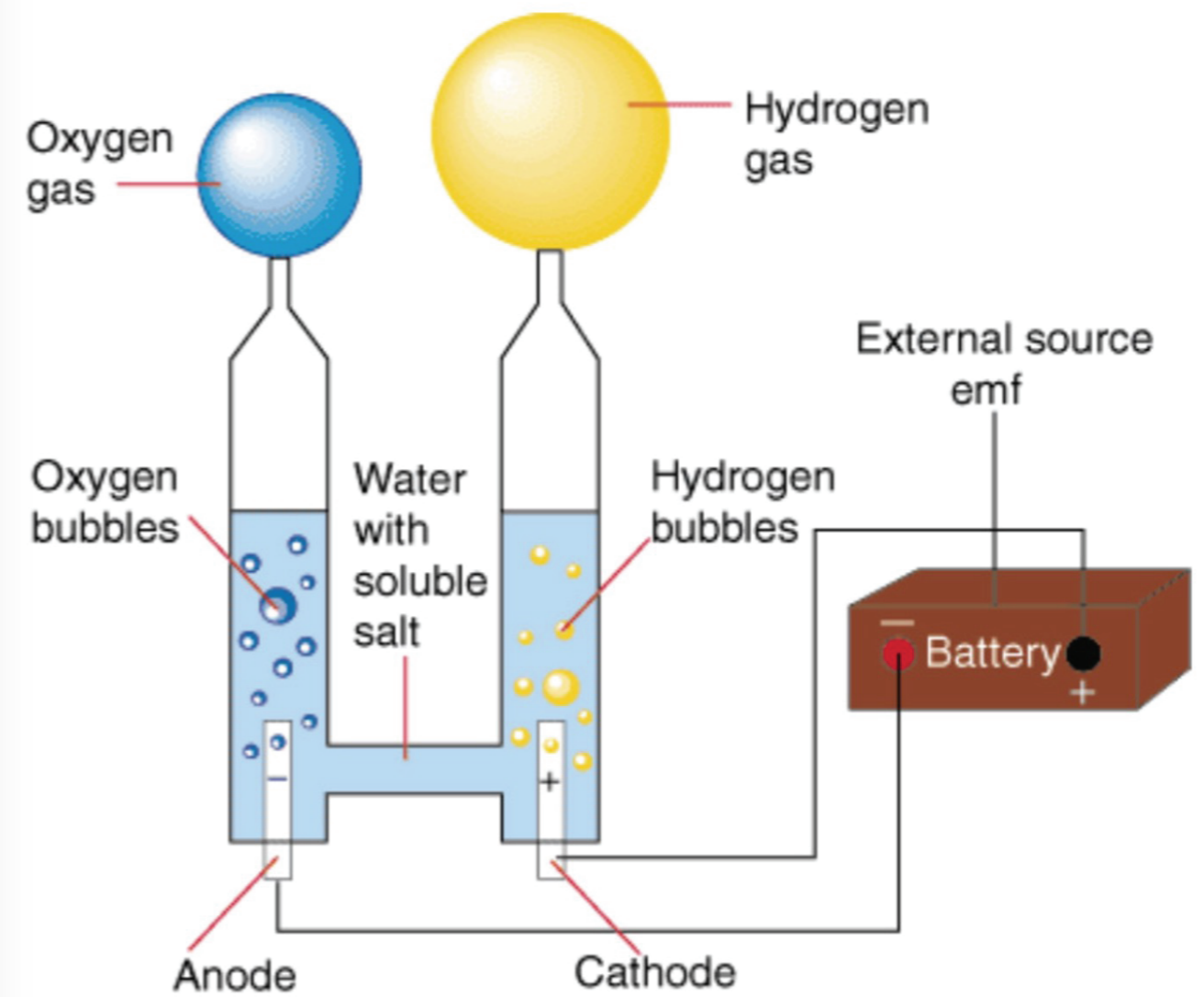
Electrolysis can also be used to extract other chemicals; we are going to focus on the production of hydrogen by electrolysis of water.



Electrolysis of water

Water can be split into hydrogen gas and oxygen gas using electricity.

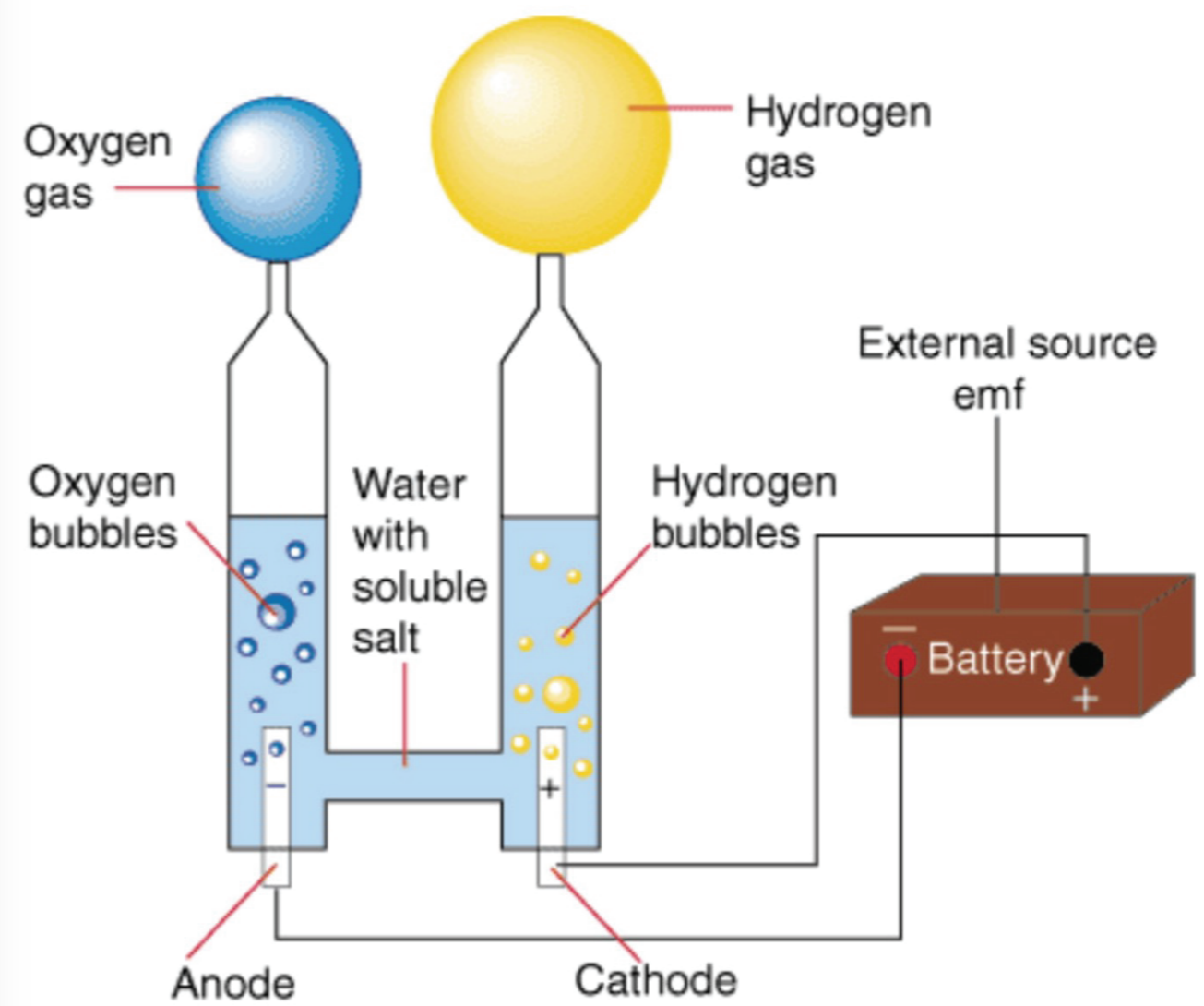
Water → Hydrogen + Oxygen



<https://nextgiantleap.org/scarcity-zero/chapters/chapter-five-water-and-hydrogen?nopaging=1>

Electrolysis of water

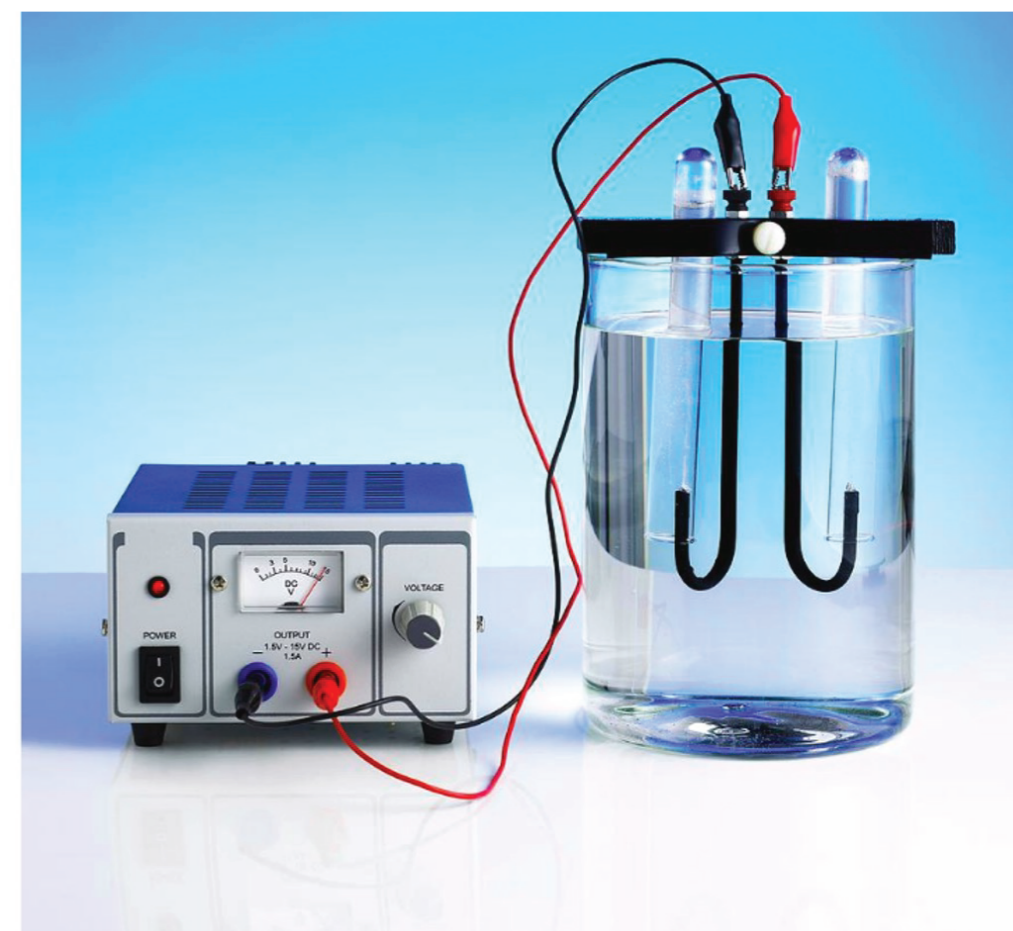
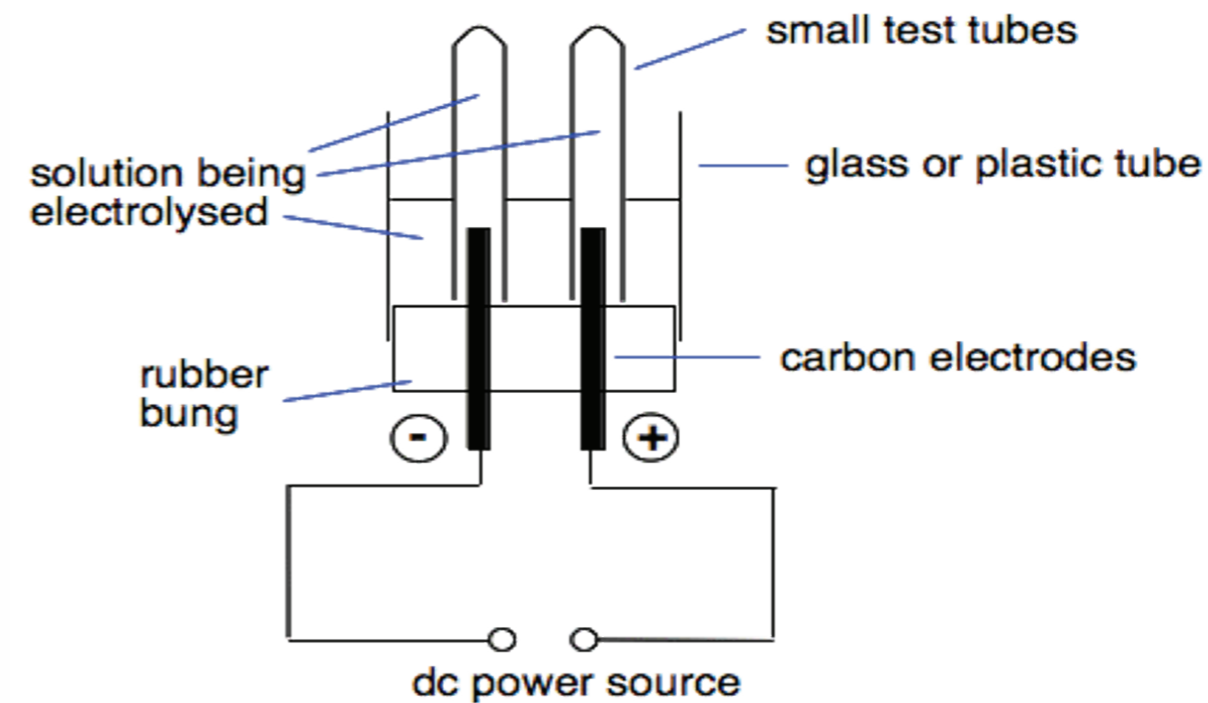
This takes a lot of energy and is therefore endothermic. In this reaction, two O-H bonds must be broken and this takes 928,000 J / mol of water.



Electrolysis of water

METHOD:

1. Set up the circuit shown in the diagram.
The electrodes **must not touch**.
2. Place small ignition tubes full of the acidified water upside down on the electrodes.
3. Adjust the voltage of the power pack to 4V - 8V. (You will need a steady stream of bubbles)
4. Leave the experiment running for 5 minutes or until one of the tubes is full of gas.



Testing the gases produced

METHOD:

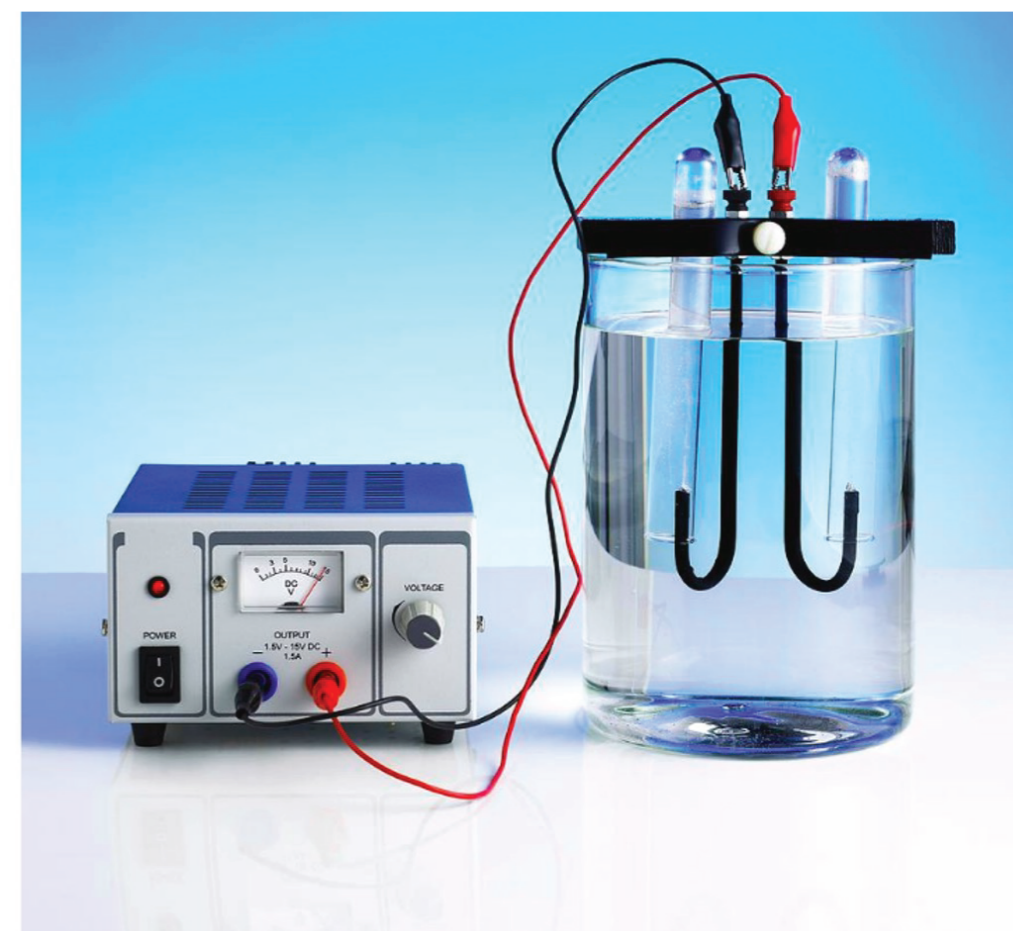
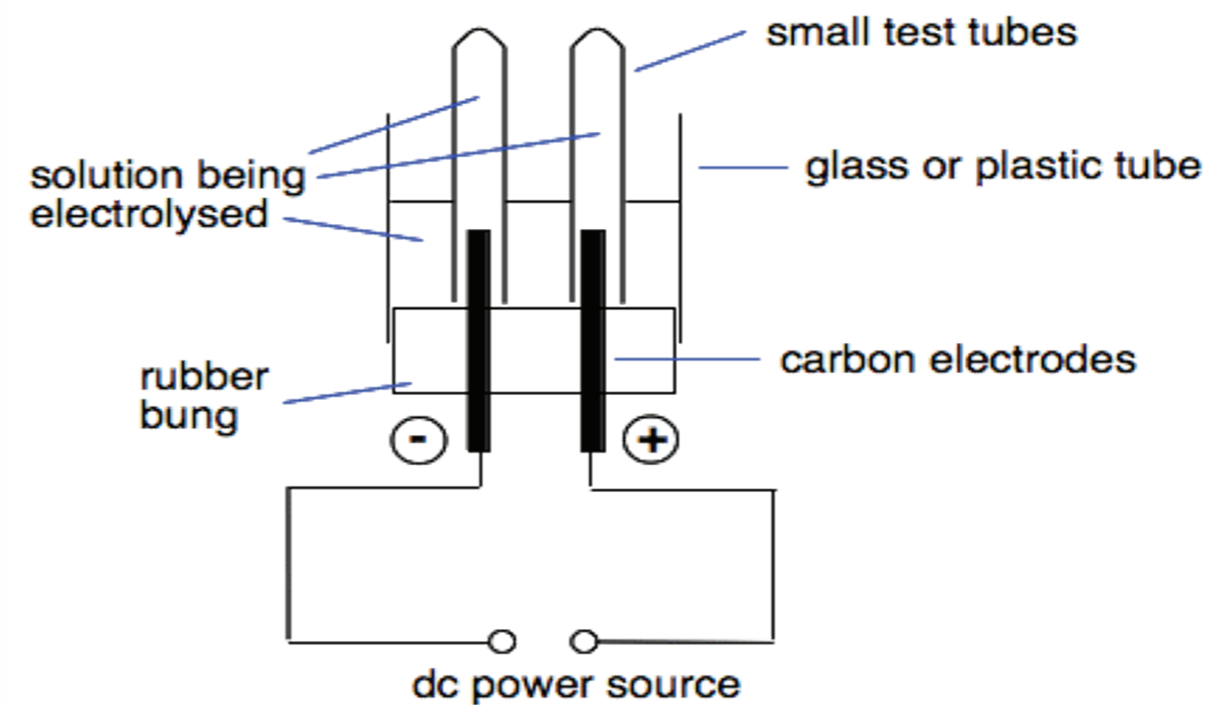
1. Collect the gas produced at the negative electrode (cathode) and test it with a lit splint.

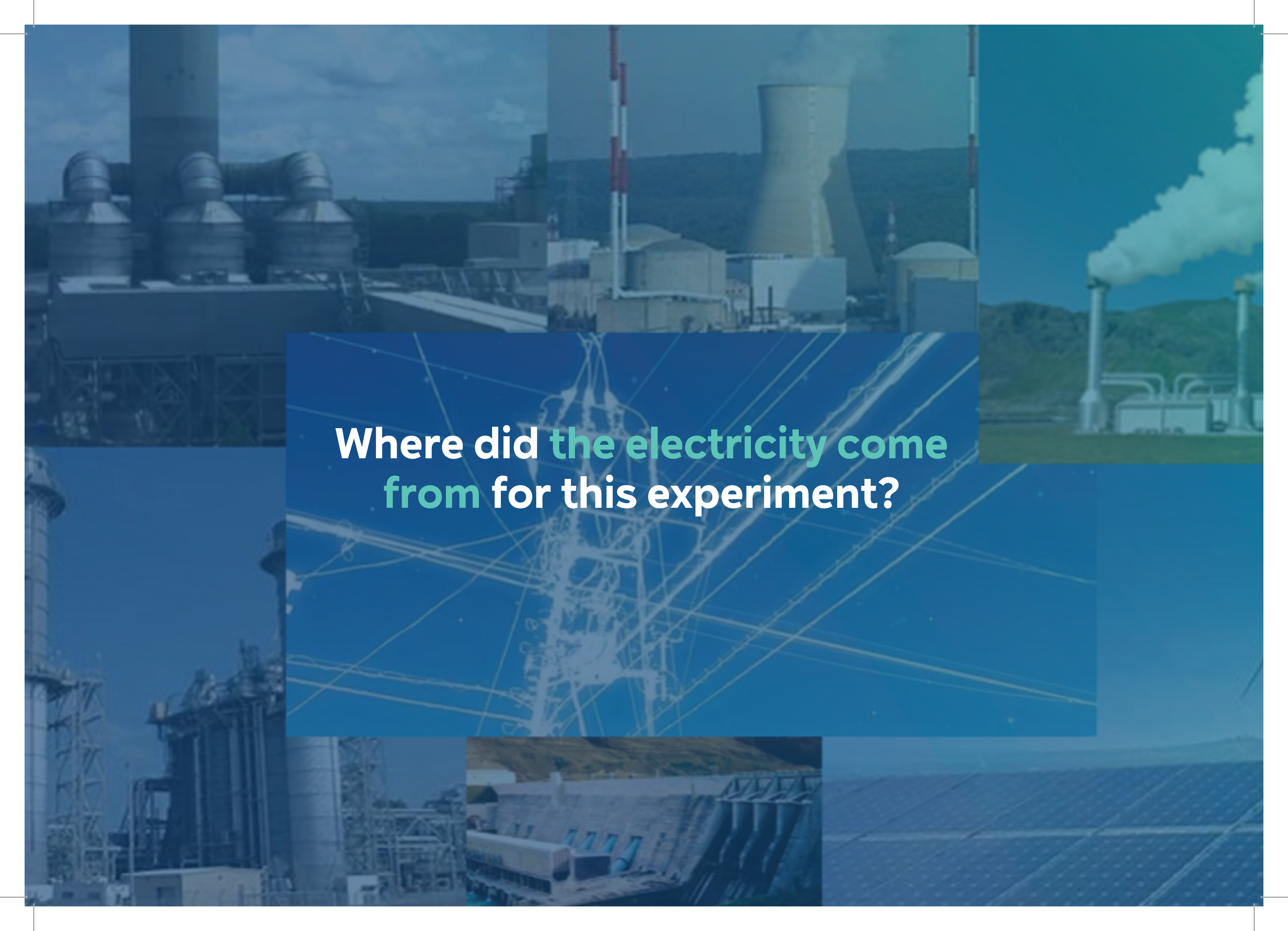
2. Record your results.

3. Test the gas produced at the positive electrode (anode) and test it with a glowing splint.

4. Record your results.

5. Which gas was produced at each electrode?



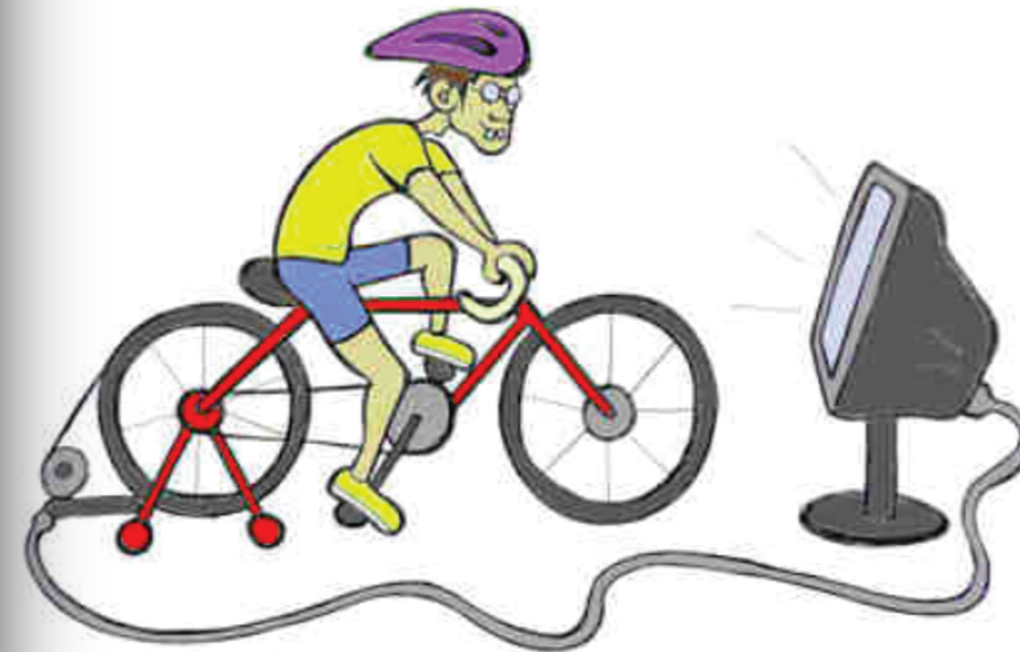


Where did **the electricity come from** for this experiment?

How could we produce the electricity needed without fossil fuels?

One cycle can produce **0.3 kWh of energy.**

How much power can a bicycle generator produce?



<https://electricbikes.guide/how-to-use-bicycle-to-generate-electricity/>

How much power do we need?

One LEDTV can use 0.1kWh of energy. So, one hour of cycling could power three hours of TV



How much power do we need?

An average home could use 6 kWh per day. So, one home would need twenty hours of cycling - Obviously, we need a different source of power.



How much power do we need?

RWE are developing industrial sized hydrogen electrolysis plants using renewable energy from wind turbines.

