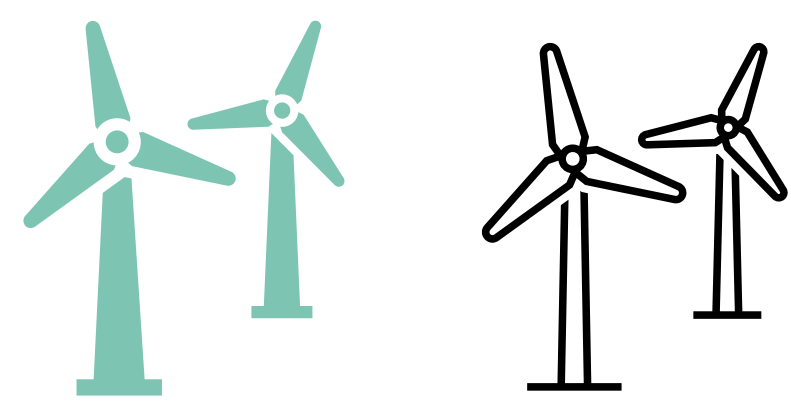


GREEN HYDROGEN ENERGY

USING A COMBINED BATTERY AND ELECTROLYSER

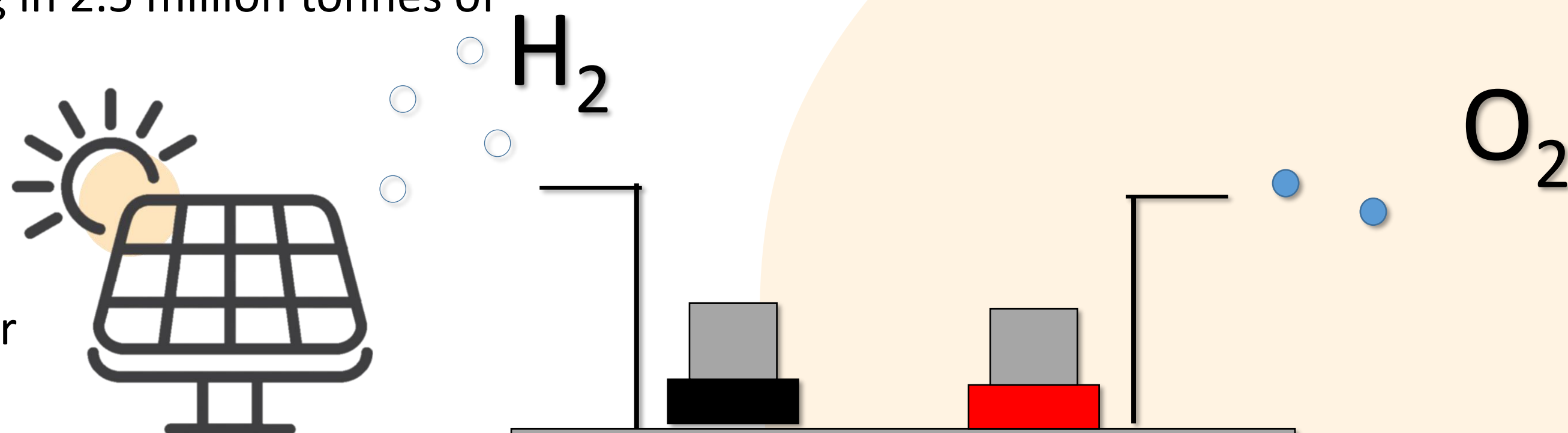
6.5 TWh



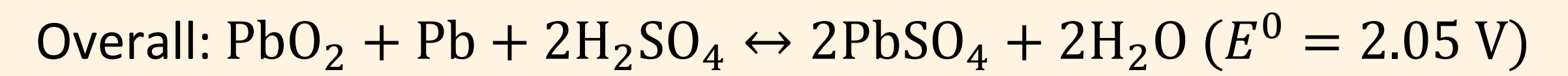
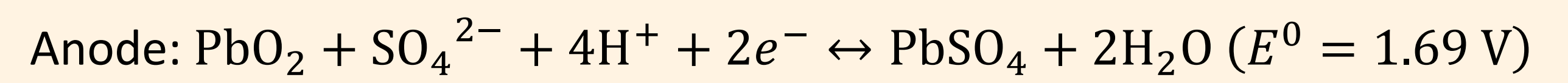
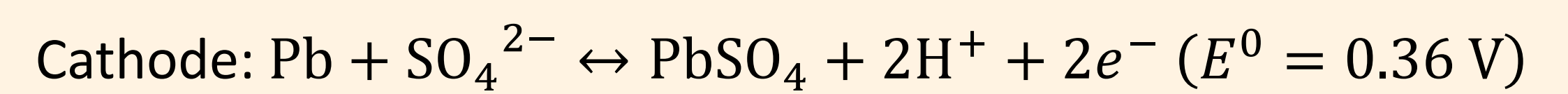
OF WIND POWER CURTAILED IN THE UK

In the UK, from January 2021 to April 2023, £1.5 billion was invested to curtail over 6.5 TWh of wind power, resulting in 2.5 million tonnes of CO₂ emissions¹

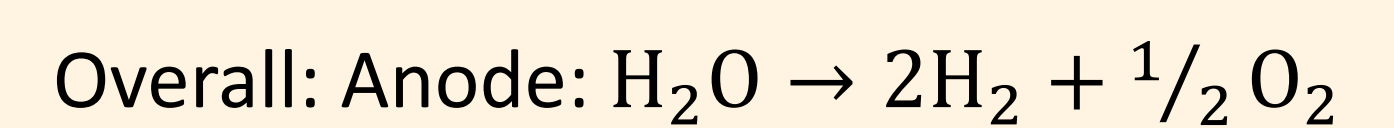
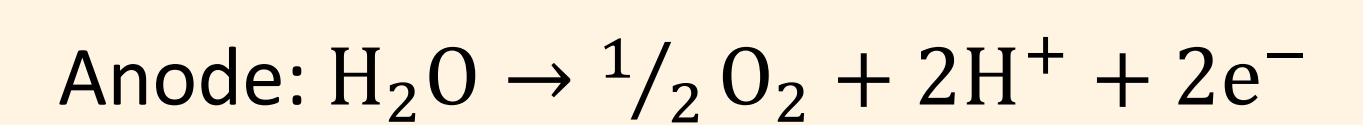
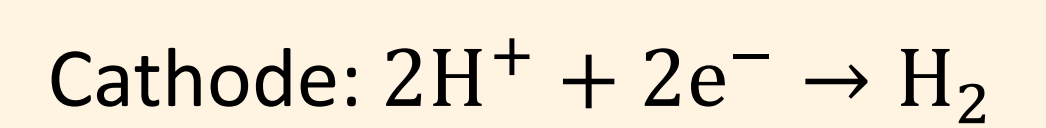
Renewable energy produced by either wind or solar can be stored in the combined battery and electrolyser as either electrical or chemical energy.



Battery



Electrolyser



700,000

PREMATURE DEATHS EACH YEAR



In Africa, about 1 billion people rely on polluting fuels, like wood, charcoal and kerosene for cooking, lighting and heating.

This causes around 700,000 premature deaths yearly—10% of total mortality in the region.²

The battery electrolyser cell has been designed to allow separation of pure hydrogen gas produced, which can be used for clean cooking where the only waste product is water.

Catalysts for hydrogen evolution

Table 1: H₂ production from lead acid batteries when metal impurities are present at 5000 ppm or saturations level³

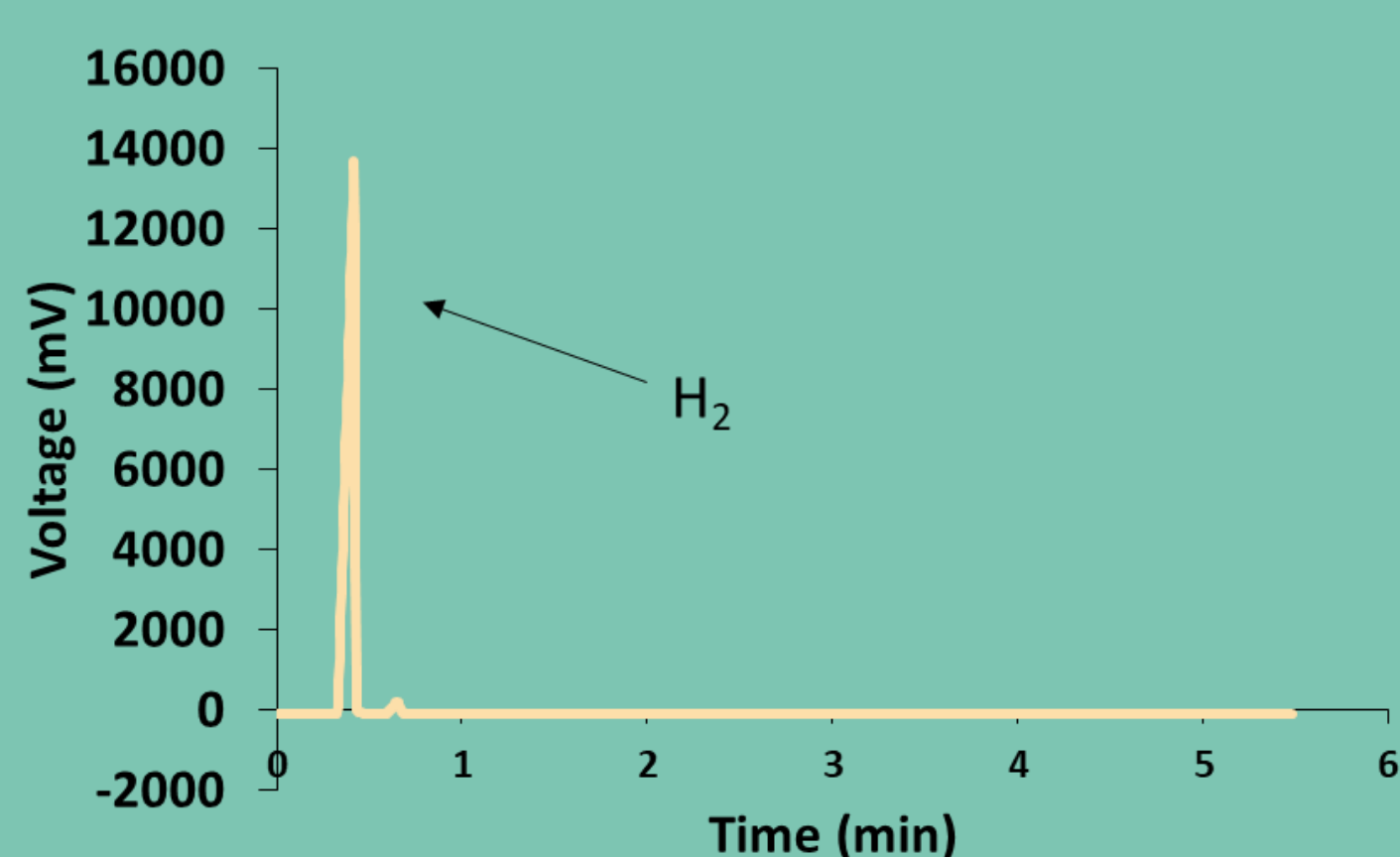
Elements	Maximum allowance (ppm)	Gas generated (cm ³)
Ni	1	1076.4
Co	1	5500.8
Sb	1	2557.3
Fe	160	309.7
Mn	3	936.2
Te	1	1498.4

Note: The standard cells averaged a value of 230.5 cm³ of gas generated during the 4 h period.

- Increasing cost with uptake of renewables
- Cheap and abundant, non-toxic
- Rate metals (not viable)

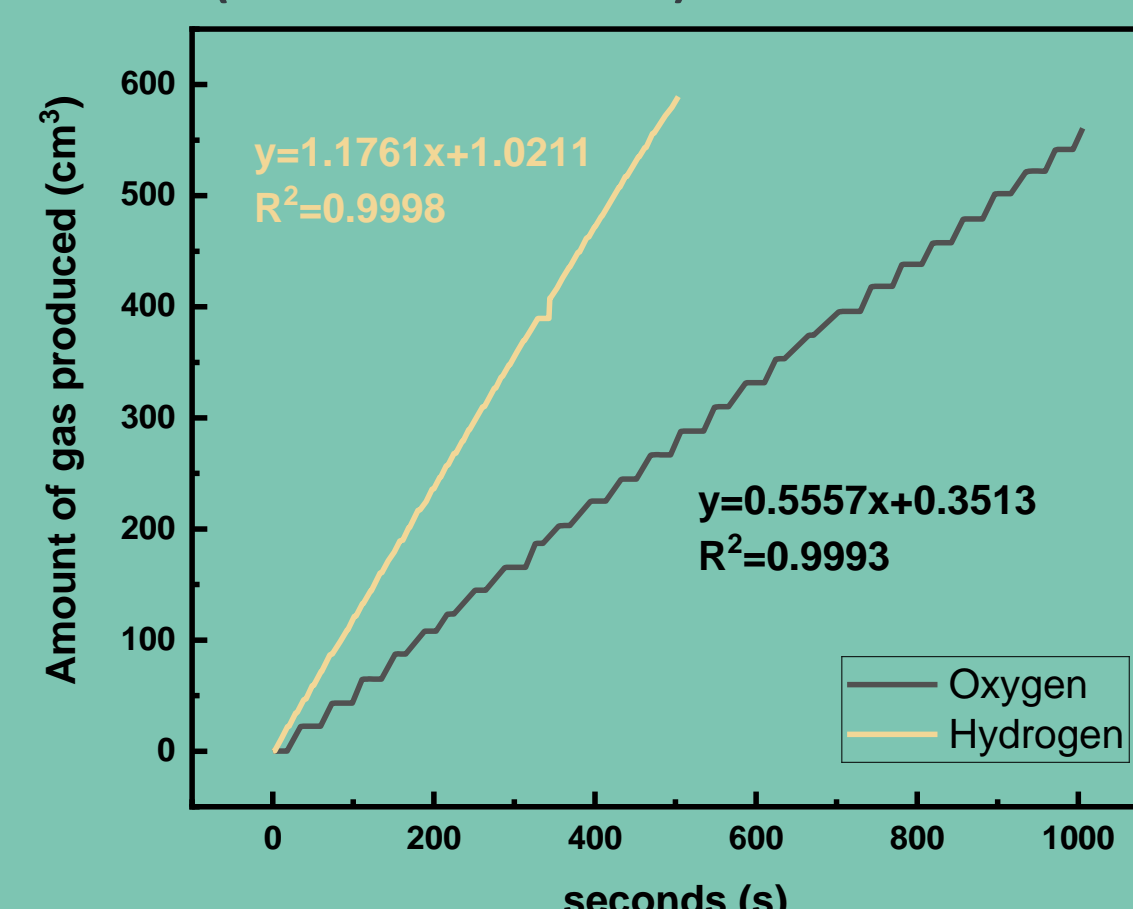
GAS CHROMATOGRAPHY

was performed to confirm the separation of hydrogen and oxygen gas from each electrode of the combined battery and electrolyser cell.



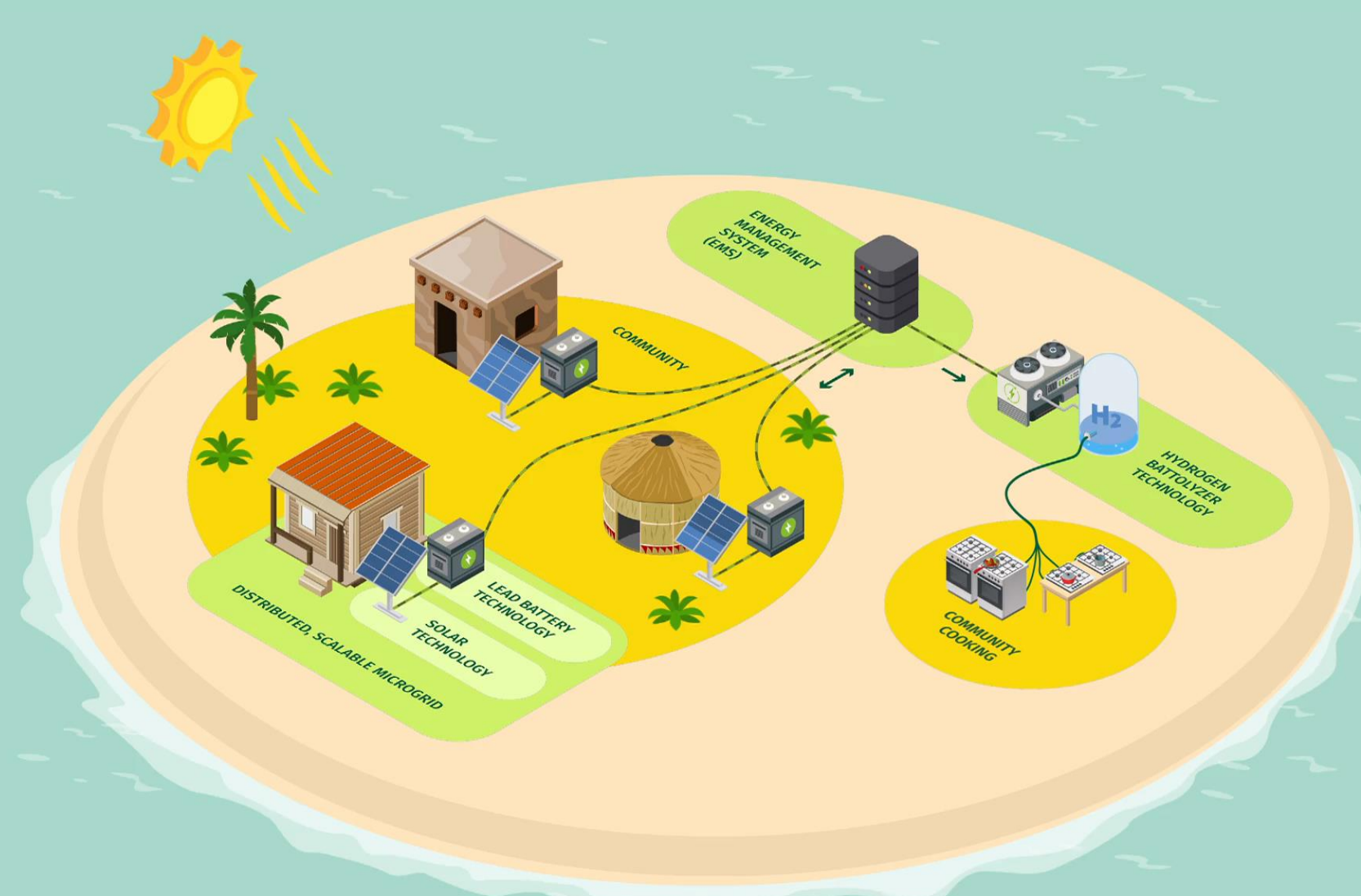
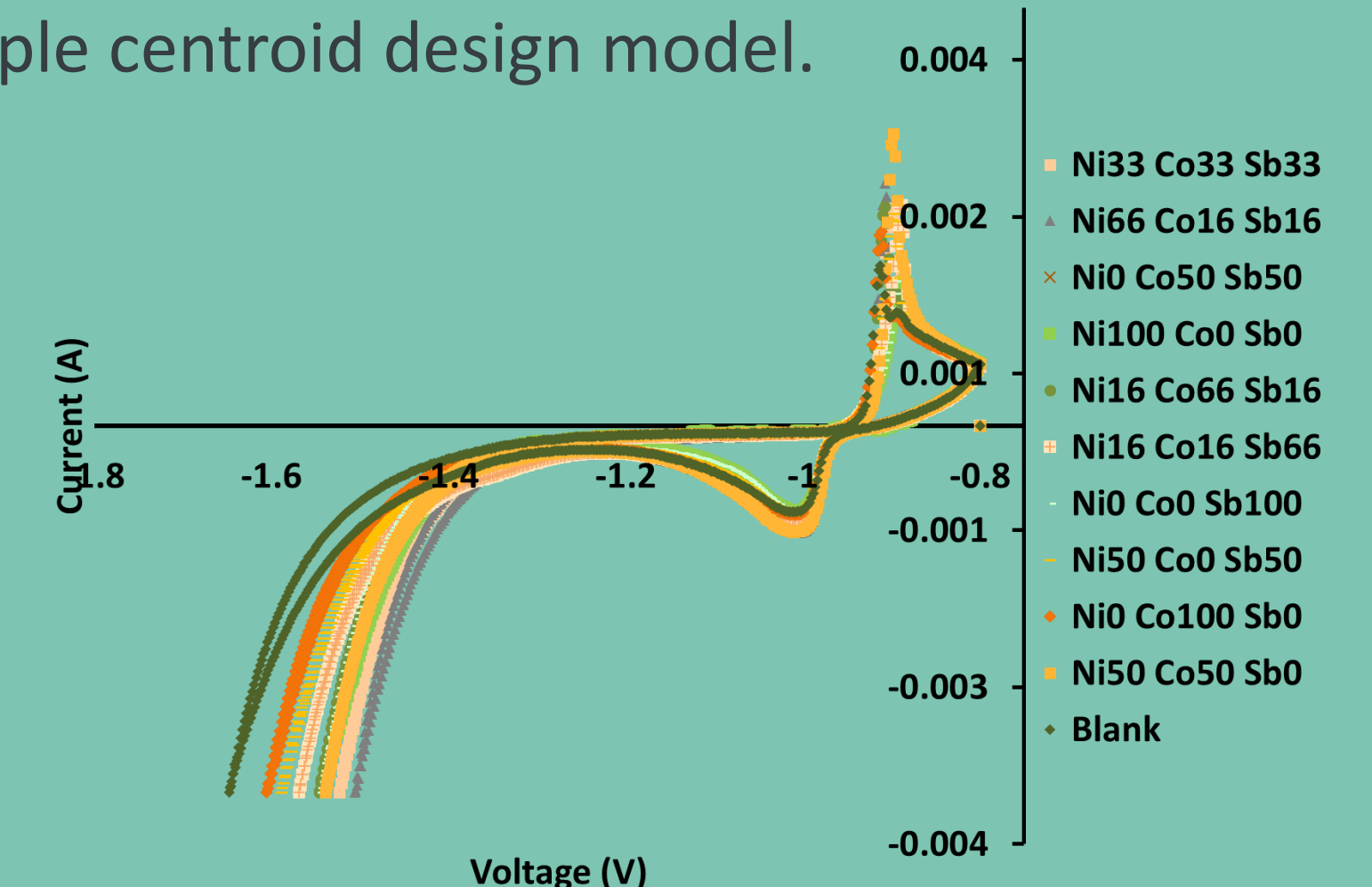
HYDROGEN YIELD

was collected using the displacement method. The rate of H₂ was 1.2 cm³ S⁻¹ (72 cm³ min⁻¹) and O₂ was 0.6 cm³ (32 cm³ min⁻¹).



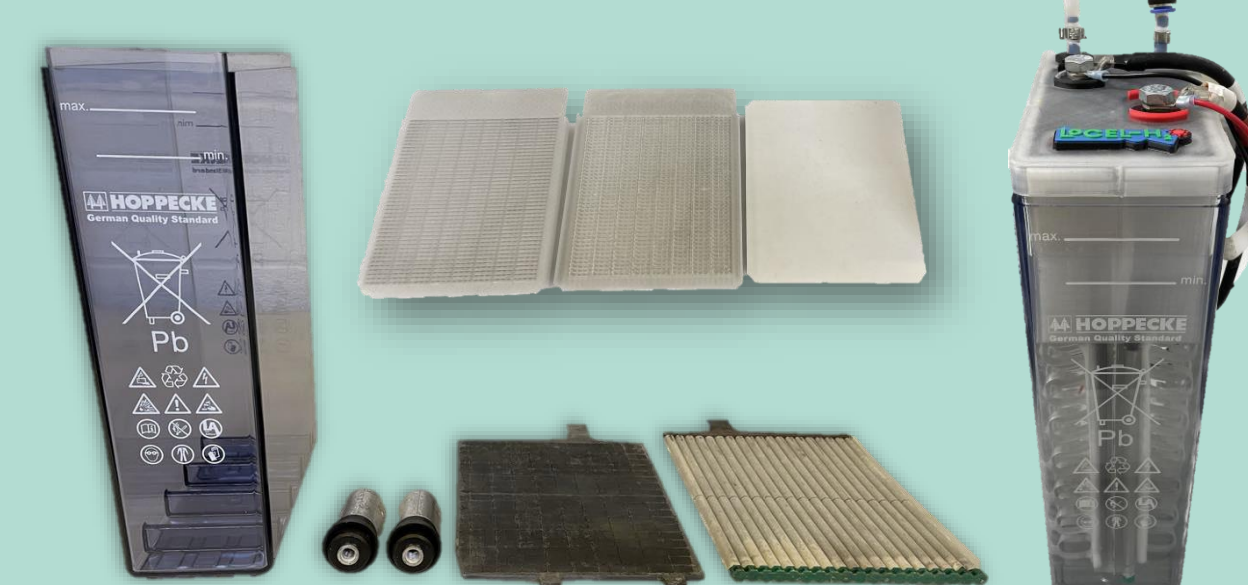
CYCLIC VOLTAMMETRY

was performed using ratios of additives determined by design of experiments (DOE) using a simple centroid design model.



The combined battery and electrolyser, developed as part of the LoCEL-H2 project, uses advanced lead batteries and green hydrogen production to deliver a new source of clean, reliable, and sustainable energy storage for off-grid communities in Africa.

The cells are manufactured from off the shelf components and purpose designed 3D printed parts, using acid resistant materials.



99%

RECYCLABLE MATERIALS



Are being used for the manufacture of cells for two pilot programs, one located in Zambia and the other in the Ivory Coast.

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- D. Pavlov, Lead-Acid Batteries: Science and Technology, 2011.

