SPARC HYDROGEN

Next Generation Green Hydrogen

APAC Hydrogen Summit and Exhibition

Sep 2024

SPARC HYDROGEN

Sparc Hydrogen was established in 2022 to commercialise Thermo-Photocatalytic water splitting technology to produce green hydrogen. Sparc Hydrogen is owned in a joint venture between Sparc Technologies, Fortescue and the University of Adelaide.

sparc TECHNOLOGIES

- 52% Sparc Hydrogen shareholder[1]
- JV management and coordination
- Technology commercialisation expertise

Fortescue

- 20% Sparc Hydrogen shareholder[1]
- Global leader in green hydrogen
- Substantial project development experience

THE UNIVERSITY of ADELAIDE

- 28% Sparc Hydrogen shareholder[1]
- Developer and contributor of IP[2]
- Leading R&D work and providing lab facilities

1 Stage 1 shareholdings; refer to Sparc Technologies ASX release 2 February 2022
2 Together with Flinders University

Sparc Hydrogen

Our mission

Sparc Hydrogen is developing next generation green hydrogen production technology using a process known as photocatalytic water splitting (PWS). This process is an alternative to producing green hydrogen via electrolysis, using only sunlight, water and a photocatalyst.

Our technology

A patent pending solar reactor demonstrated to improve the efficiency of PWS through using concentrated sunlight. Given lower infrastructure requirements and energy use the process has the potential to deliver a cost and flexibility advantage over electrolysis.

The Current Problem – Electrolysis

Significant barriers remain before green hydrogen via electrolysis is commercially and technically ready at scale

Transmission lines

- Social licence issues
- Lengthy development times

Solar PV + Wind + Batteries

- Mature technologies
- Limited cost improvements
- Social licence issues
- Supply chain risks

Electrolysers

- Expensive
- RE compatibility issues
- Yet to be effectively scaled
- Supply chain risks

The Future – Photocatalysis

Zero-electricity

- Photocatalysis does not use electricity to produce H2 from H2O

Low cost

- The simplicity of photocatalysis drives potential for very low costs

Solar driven

- Sunlight is the only energy input driving the reaction

Scalable

- Utilises a concentrated solar system which is inherently scalable

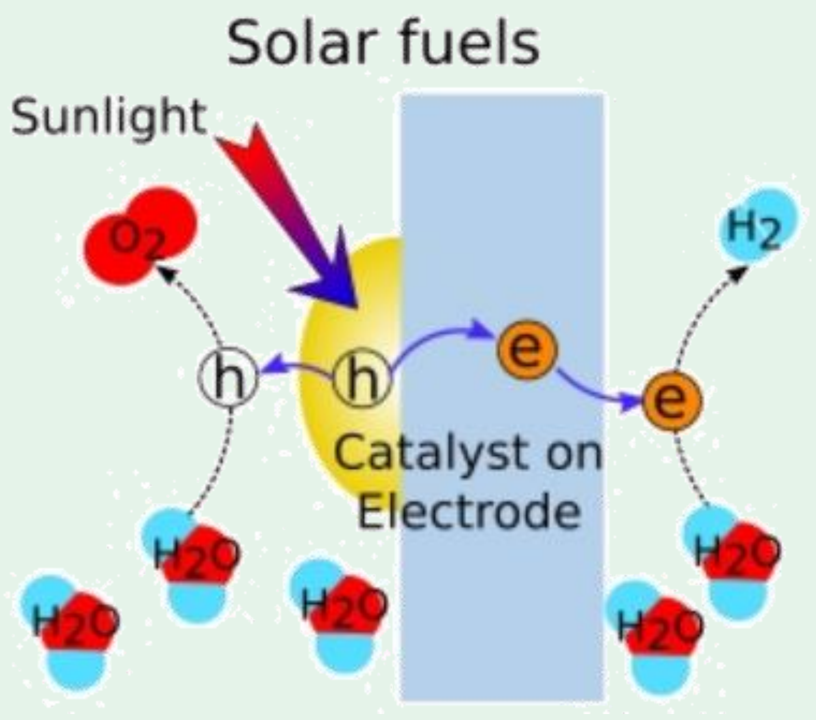
Emission-free

- Water + sunlight = green hydrogen

What is Photocatalytic Water Splitting

Sparc Hydrogen utilises a method called photocatalytic water splitting (PWS) to directly split water into hydrogen and oxygen, using sunlight

- Artificial photosynthesis process used for the dissociation of water into hydrogen (H_2) and oxygen (O_2), using light.
- Key breakthroughs in the technical field which will ultimately deliver low-cost hydrogen production from this process:
  - Patented pending solar reactor exclusively licenced by Sparc Hydrogen;
  - Reducing costs for concentrated solar fields; and
  - Constantly improving photocatalysts for water splitting.



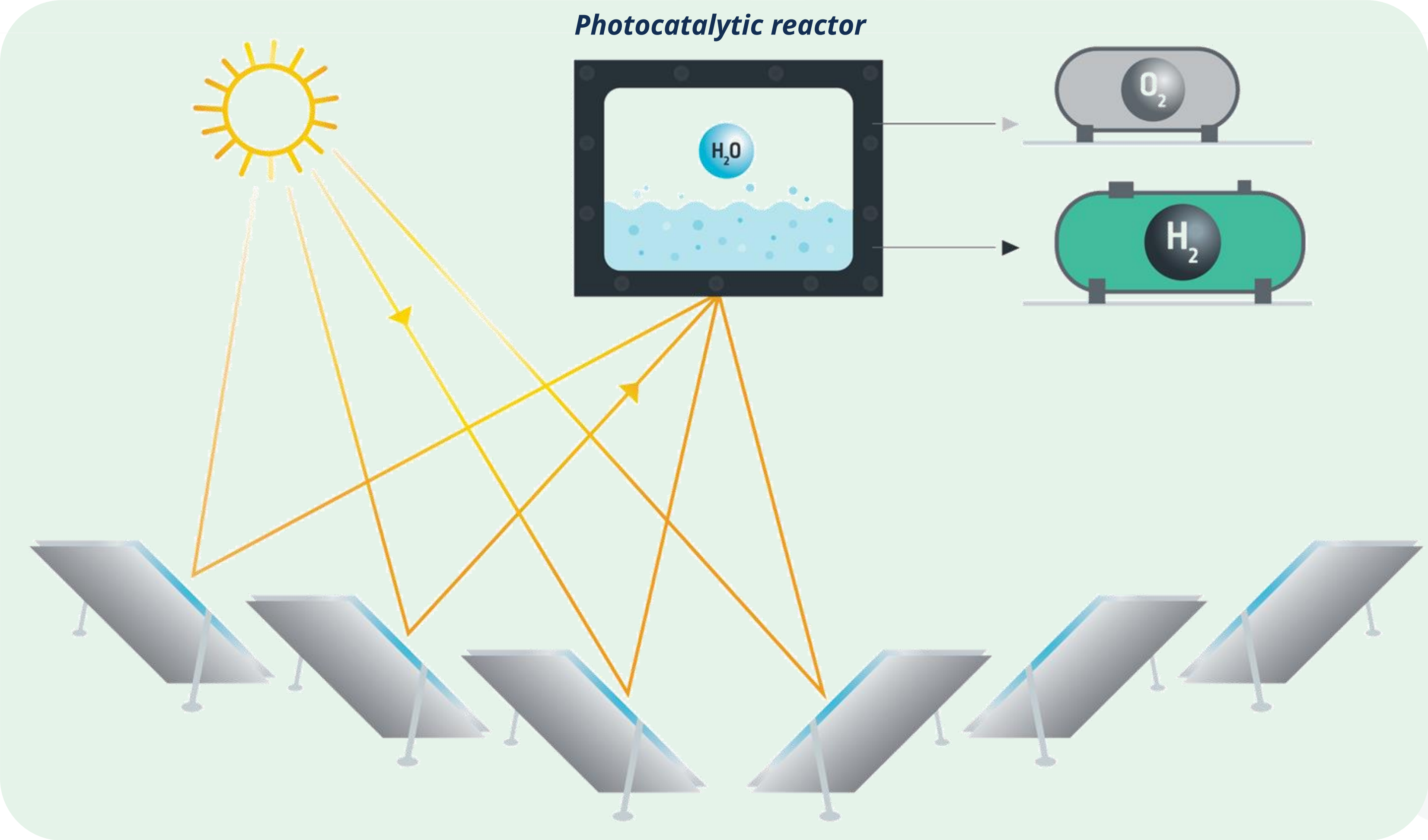
I. Excitation of electrons by light energy (photons) creates positive holes on a semi-conductor surface

II. Drives a redox reaction with H^+ ions in the water molecule combining with the free electrons on a catalyst to produce H_2

III. $H_20 \rightarrow H_2 + \frac{1}{2}O_2$

Sparc Hydrogen's Unique Approach to PWS

- Sparc Hydrogen's reactor is one of the only known globally combining concentrated solar (CS) with photocatalytic water splitting
    - Key breakthrough which allows for reduced photocatalyst use and integration with existing concentrated solar systems which are modular and scalable
- Sparc Hydrogen's reactor is being designed to:
    - allow testing of new and improved photocatalysts as they are developed
    - 'slot into' an off-the-shelf linear Fresnel CS field
    - utilise by-product heat for industry use or power generation



Sparc Hydrogen Video

https://youtu.be/7JTVzJtqudA

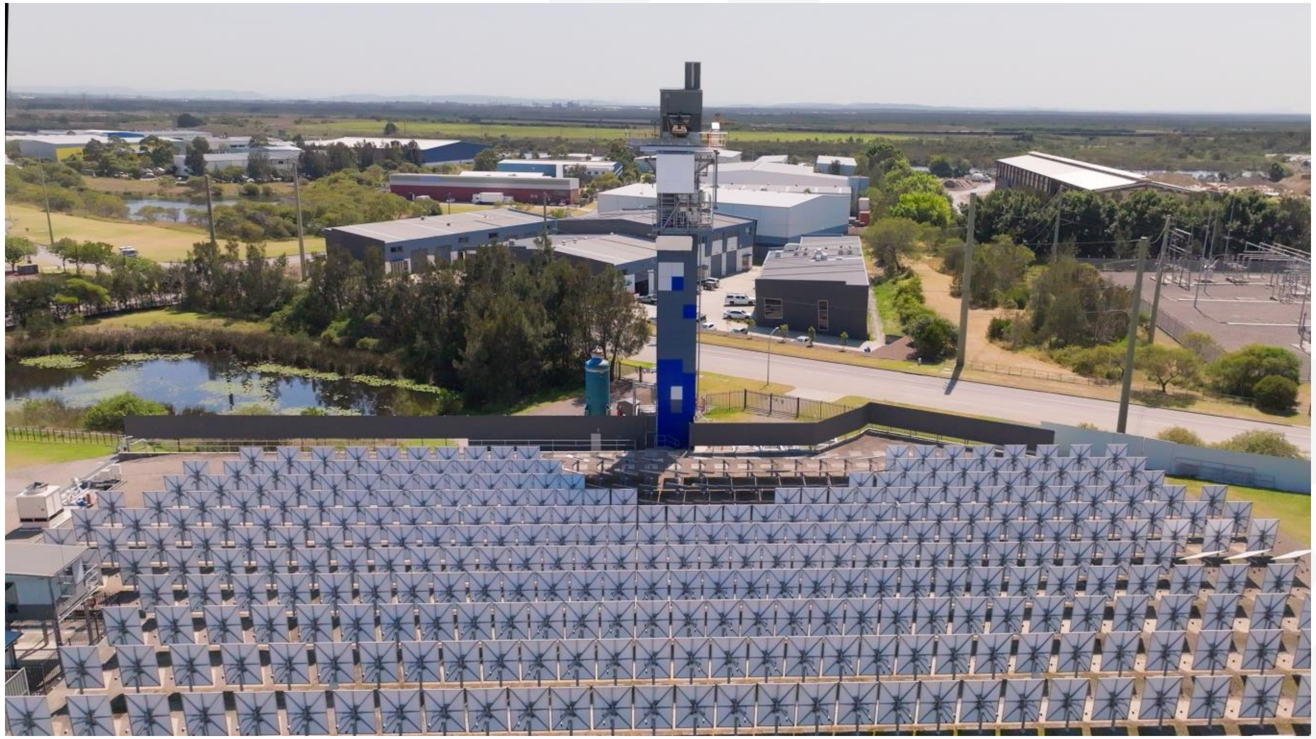
Prototyping at CSIRO Energy Centre, Newcastle

- Sparc Hydrogen designed and completed testing of a prototype PWS reactor at the CSIRO Energy Centre in Newcastle on March 2024

- This was the first demonstration of the technology outside of the laboratory and has produced vital information for reactor scale up in a linear Fresnel system / pilot

- The prototype has advanced the TRL[1] of Sparc Hydrogen's reactor from 4 to 5 and has proven to be an efficient way of testing reactor design and generating on-sun performance data

- This testing was supported by funding provided through CSIRO's Kick-Start Program

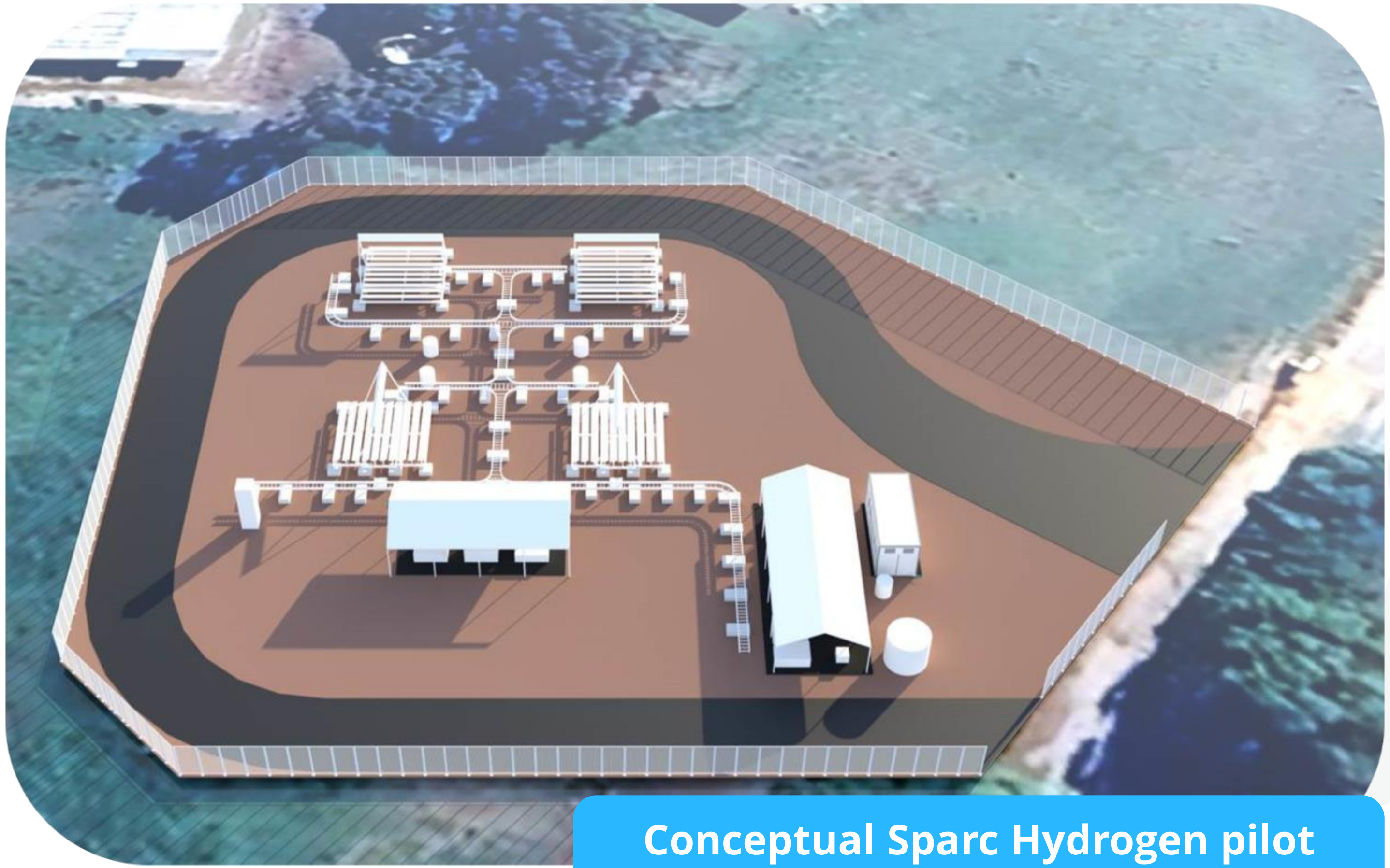


Heliostat field at CSIRO's Energy Centre Newcastle

1 ARENA, Technology Readiness Levels for Renewable Energy Sectors, Commonwealth of Australia (Australian Renewable Energy Agency) 2014

Pilot Plant Design and Engineering

- Based on encouraging results from lab testing as well as the prototyping work at CSIRO, feasibility of a pilot plant is being progressed.
- This pilot plant would be first of its kind globally and is expected to be hosed at the University of Adelaide's Roseworthy Campus near Adelaide.
- A pre-FEED study was completed in late 2023 which forms the basis for current FEED study.
- The pilot plant will reflect the next stage of reactor development for Sparc Hydrogen and, if commissioned, would increase the technology readiness level to TRL 6 – 7
- Decision to proceed is expected in Q4 2024 and construction is expected to commence shortly thereafter subject to approvals.



Conceptual Sparc Hydrogen pilot plant layout

Technology Advantages

"Such systems (photocatalytic water splitting) offer great potential for cost reduction of electrolytic hydrogen, compared with conventional two-step technologies." (CSIRO National Hydrogen Roadmap[1])

	Sparc Hydrogen	Green H_2	Blue H_2	Grey H_2
Description	**Photocatalysis**	Electrolysis powered by renewables	Grey production with CCS*	Steam methane reforming (SMR)
Feedstock	✓ **Water**	✓ Water	✗ Natural gas, Water	✗ Natural gas, Water
By-product	✓ **Oxygen**	✓ Oxygen	• Emissions sequestered	✗ CO_2, NO_x, SO_x, PM
Scope 1 & 2 emissions[2]	✓ **Nil**	✓ Nil	✗ 0.76kg CO_2 / 1kg H_2	✗ 8.5kg CO_2 / 1kg H_2
Location requirements	✓ **Solar resource**	✗ Solar +/- wind & HV infrastructure	✗ Natural gas source and suitable storage	✗ Natural gas source
Typical scale	✓ **Scalable**	✗ Very large	✗ Very large	✗ Large

* Carbon capture and storage

1 Sourced from Bruce S, Temminghoff M, Hayward J, Schmidt E, Munnings C, Palfreyman D, Hartley P (2018) National Hydrogen Roadmap. CSIRO, Australia
2 Sourced from Commonwealth of Australia, 'Australia's National Hydrogen Strategy', 2019

Development Pathway

✓ Sparc Hydrogen joint venture **established beginning 2022**

✓ Preliminary TEA **confirms commercial potential** in Q4 2022

✓ **Solar reactor prototype** on-sun testing in **Q4 2023 / Q1 2024**

Pilot plant development; construction decision due **Q4 2024**

Increasing technology and commercial readiness

Next Generation Green Hydrogen

Disruptive green hydrogen technology

World leading partners

Flexible and scalable infrastructure

Targeting industry leading costs

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Meet us at our booth for more information