

**Orana Resources, Energy and
Industry Innovation Forum**

**Opportunities for Clean Energy
Adoption - Hydrogen**



About Us

Star Scientific Limited

We are a private hydrogen research and development company located on the Central Coast, north of Sydney, Australia and south of the industrial port of Newcastle, in the traditional lands of the Darkinjung people.

Founded by Andrew Horvath in 1997.

Governed by a Board of Directors, Andrew Horvath is Chair.

Backed by private investors - all share our passion to deliver clean, affordable and reliable heat and energy.

Star Scientific Limited in Australia - Design and Engineering, Technology and Manufacturing.



HERO[®] Basics

Heat profile

Star Scientific has developed the “Hydrogen Energy Release Optimiser” catalyst or HERO[®].

When introduced to hydrogen and oxygen it produces heat without combustion. In our demonstration unit, the temperature reaches over 700 degrees Celsius in around 3 minutes.

The amount of heat produced is a function of the HERO[®] catalyst surface area. The surface area is scaled to suit the amount of heat required for the specific application.

Pure oxygen gives better reaction control.
Hydrogen and oxygen means no NO_x.



Industrial heat

Transitioning industry to carbon-free heat

Heat is the key input into most human endeavour.

Heat can be for real products (construction materials, plastics, foodstuffs, chemicals, transport, textiles, tools) OR services supplied using digital infrastructure powered by green energy, such as 5G and the Internet of Things.

Carbon will be priced into global trade regardless of what governments do.



Hydrogen Pathways

The Path for hydrogen's acceptance.

Key Findings:

79 companies across 15 Industry classes (not dairy or meat).

70% of all energy needs from fossil fuels

Boilers are overwhelmingly the highest user.

51% of companies planning decarbonisation.



Hydrogen Pathways

Critical Questions

Who gets access to our early hydrogen supplies?

- Exporters?
- Heavy Industry?
- Small to Medium industry?

- Or do we just let the market decide?

Oatly Launches Climate Footprint Labels in the US

The first climate labels will appear on the company's strawberry, peach, plain and mixed berry dairy-free yogurts, called Oatgurts.



Oatly's climate footprint calculation includes the impact of agricultural inputs, transport, manufacturing, processing, packaging and distribution. *Photographer: Oatly*

By Zahra Hirji

1 February 2023 at 12:00 am AEDT *Corrected 1 February 2023 at 7:24*

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Local Developments, Global Opportunities

MARS pilot project

Star Scientific is based in the Central Coast food manufacturing hub, north of Sydney.

With their representative body, Central Cost Industry Connect, we formed the Central Coast Food Hydrogen Cluster.

Our first Pilot Project is for Mars Australia to provide GHG-free boiling water for cooking and cleaning jars.

A range of other pilots are “on the books”, across food manufacturing, brewing, distilling, shrink-wrapping, milk drying, greenhouses, wastewater treatment, etc.

Propelled by these pilots, our technology is now at TRL level 6.



Flipping fossil-fuel infrastructure

Pros and cons

Star Scientific conducted a study of a 2,880MW coal-fired facility

Pros:

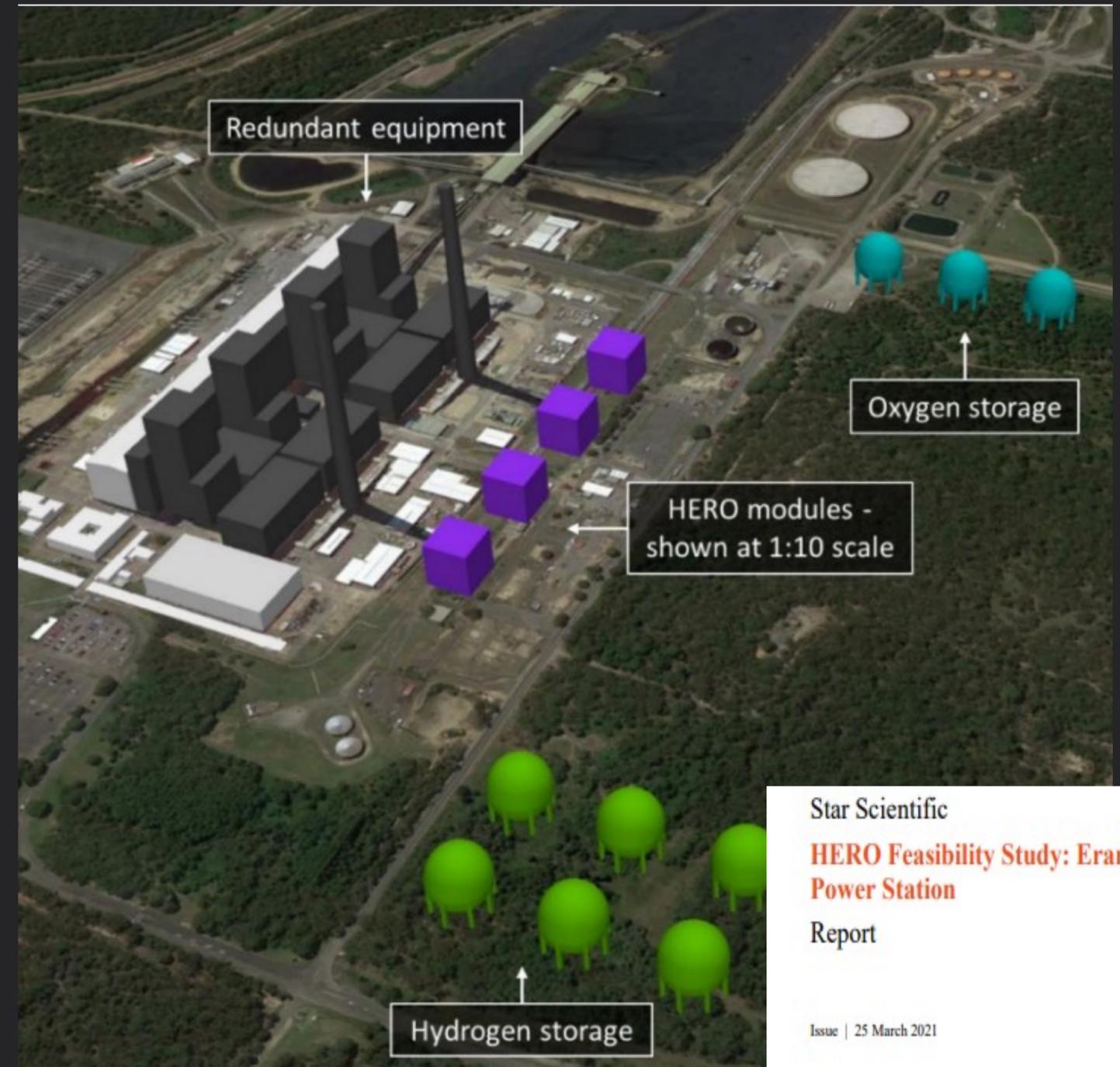
From a technical thermodynamic viewpoint, HERO can fit the plant's steam cycle, replacing coal.

There is a significant redundancy of coal handling and pollution control infrastructure, and increases in overall plant efficiency, with zero pollution.

Cons:

Volume of hydrogen required – 5,400 tonnes per day.

Technical, regulatory and social licence challenges around production and storage.



Star Scientific

**HERO Feasibility Study: Eraring
Power Station**

Report

Issue | 25 March 2021

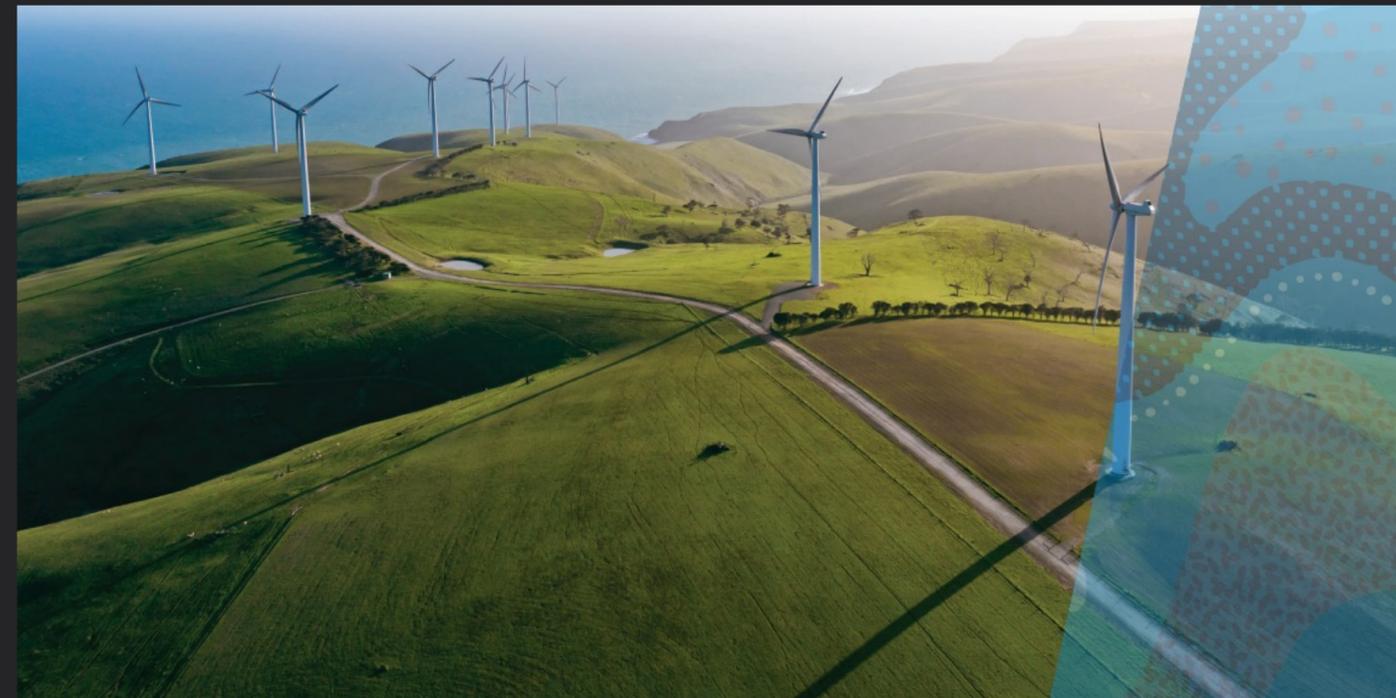
Hydrogen Pathways

If Energy, What Technology?

South Australian Power Station:

Innovation accelerant or

Technological White Elephant?



South Australia's Hydrogen Power Plant: Powering jobs and industry

ohpsa.sa.gov.au



HERO[®] and the Energy Transition: Higher Level Energy

Super-critical $s\text{CO}_2$ turbine and HERO[®]

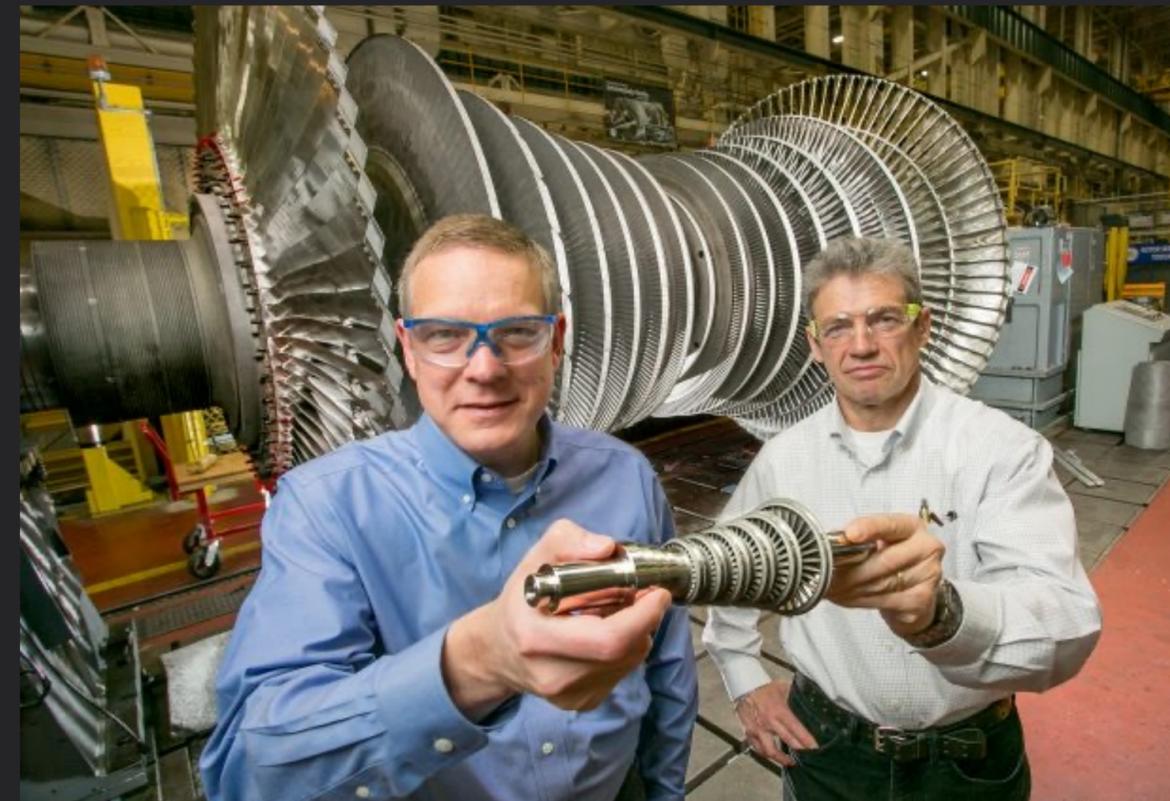
With HERO[®] as the heat source and a supply of H_2 , they can be deployed as nodal systems for micro-grids and larger, connected grids.

They can provide high levels (5MW+) of stable energy for off-grid industrial purposes such as data centres.

They are air-cooled – and have no water requirement.

They can be deployed to remote and underdeveloped communities suffering energy poverty.

Star Scientific is developing relationships with $s\text{CO}_2$ turbine vendors.



The turbine in the foreground is 10WM. Credit: GE

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