Australian National University

HYDROGEN FUELS PROJECT

PART OF THE ANU GRAND CHALLENGE:

ZERO-CARBON ENERGY FOR THE ASIA-PACIFIC

This Grand Challenge winning project – to deliver zero-carbon energy to the Asia-Pacific – is a blueprint for the prosperity of Australia and our region. This project will deliver exactly what the world needs at this juncture in our history: big thinking, practical solutions, and collaboration across research, industry and the community.

ANU Vice-Chancellor, Professor Brian Schmidt.

TACKLING THE GREATEST CHALLENGE OF OUR TIME

1 goal
to research new Australian export industries based on Renewable Energy

5
interconnected, interdisciplinary research projects

$10m
investment from ANU plus investment from key partners

40+
team members

5
year funding time frame 2019-2023

5
ANU academic colleges

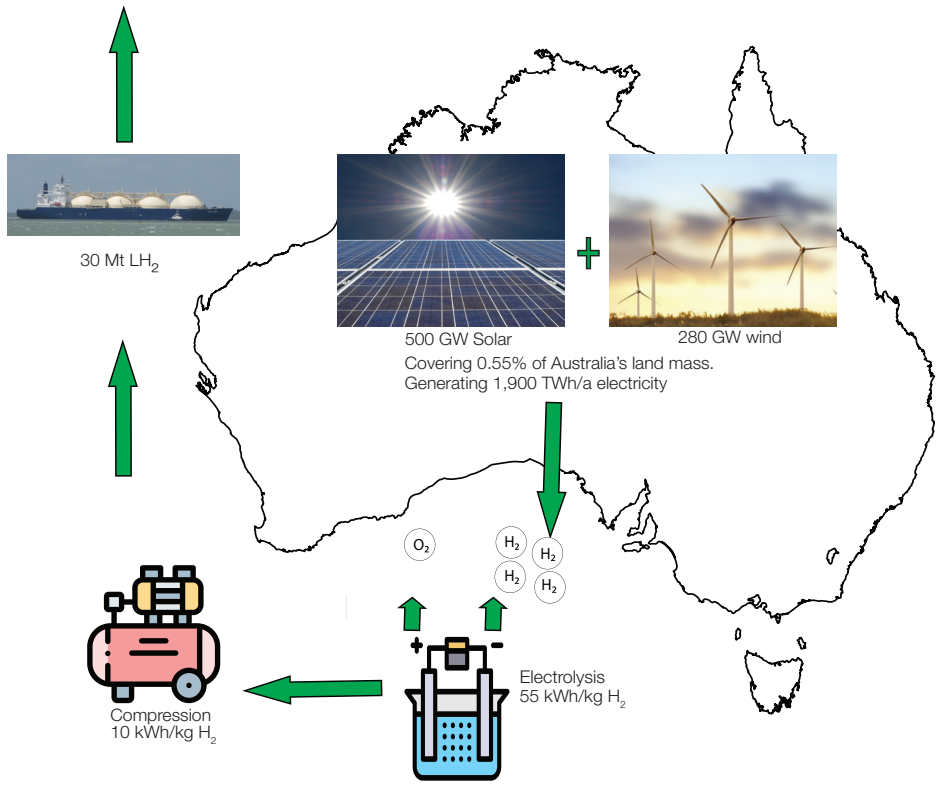
The ANU Grand Challenge: Zero-Carbon Energy for the Asia-Pacific aims to push the frontiers that will help future-proof the way Australia trades with the world based on the nation's abundant renewable energy. It comprises five transdisciplinary projects: Renewable Energy Systems, Hydrogen Fuels, Energy Policy & Governance in Asia-Pacific countries, Renewable Metal Refining, and Indigenous Engagement with Renewable Energy Industries.

Over the coming two decades the Asia-Pacific is expected to account for almost two-thirds of global energy use growth if stated policies are maintained and implemented[1]. Australia already plays a leading role in supplying the region with coal, liquefied natural gas, iron ore, and alumina. Large-scale fossil fuel exports from Australia, together with the carbon-intensive processing of raw materials in our export markets, account for 8% of the Asia-Pacific's total annual greenhouse gas emissions. A new Australian export model is needed: one that could make a major contribution both to meeting the region's growing energy and resource needs, and keeping the world within safe-operating climate constraints.

Fortunately, Australia has the potential to become a renewable energy export powerhouse. Australia is one of the world's most richly-endowed countries in renewable energy potential, blessed with sunshine, wind, and a large landmass. Australia's renewables industry is already booming. In recent years Australia has been installing solar and wind generation capacity at the fastest rate per capita – more than 200 watts per capita per annum – of any developed country[2]. There is enormous potential for these resources to be used to develop a zero-carbon export industry.

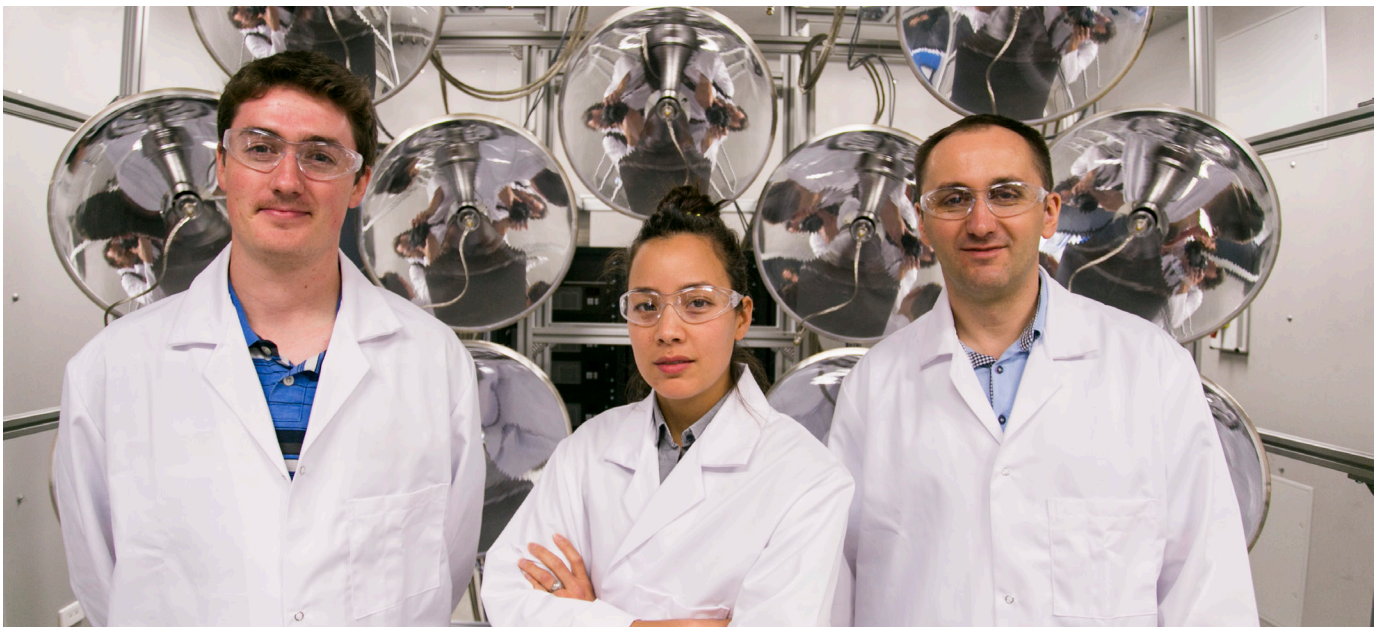
[1] World Energy Outlook (IEA, 2019).
[2] Stocks, M., Blakers, A. & Baldwin, K. "Australia is the runaway global leader in building new renewable energy". The Conversation (September 25, 2019).

HYDROGEN PROJECT



Hydrogen made with zero carbon emissions could potentially be a major new globally traded commodity that might enable countries with high energy needs and limited renewable energy potential to decarbonise their economies. Zero-carbon hydrogen can be produced via electrolysis powered by renewable electricity - such as wind and solar. The figure above demonstrates Australia's potential to produce renewable hydrogen for export. Replacing Australia's LNG exports (75 Mt in 2018-2019) with hydrogen containing the same amount of energy (equivalent to 30 Mt) would require 1,900 TWh of renewable energy annually - seven times our current electricty output. Assuming this electricity is provided by new build renewables, split equally between wind and solar energy output, Australia would need 280 GW of wind and 500 GW of solar power generating capacity. That's equivalent to an annual installation rate of 37 GW for the next 20 years. This is a massive expansion of Australia's renewable energy generation, and would require decades of nation-building scale investments. But, it represents a fraction of Australia's total renewable resources, and would require 0.55% of Australia's land mass (assuming solar and wind are co-located). Interest in the opportunity for an Australian hydrogen economy is growing. In 2019, the Commonwealth Ministers representing Australia's energy sector released the Australian National Hydrogen Strategy, developed by the Chief Scientist. It aims to deliver a "clean, innovative, safe and competitive industry" for Australia[3], and highlights the potential for a hydrogen export industry.

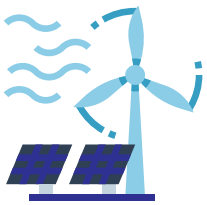
[3] COAG Energy Council Hydrogen Working Group. (2019).



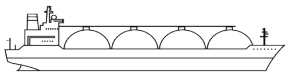
0.55%
total land area of Australia required for Renewable Energy for hydrogen

500 GW = **280 GW**
solar energy generating capacity = wind energy generating capacity

7 times
Australia's current electricity production for H_2 export using renewables



30 Mt LH_2
Liquid Hydrogen energy equivalent to current annual LNG exports



The ANU has a unique portfolio of research spanning the hydrogen value chain, which achieves high-impact social, political, environmental, economic and technological results including:

- Proposals for governance frameworks to support the export of hydrogen from Australia to the Asia-Pacific and beyond.
- Design, scope, and analysis of certification systems to support international trade in green hydrogen and green hydrogen derivatives as premium low-emissions products.
- Evaluation of the key social, economic, and political demand drivers for Australian exports to the Asia-Pacific.
- Emerging technologies for hydrogen generation, storage and use in industrial processes to lower costs and underpin the competitiveness of zero-carbon hydrogen fuels including:
  - Novel liquid organic hydrogen carrier materials for storage
  - Development of highly efficient electrocatalysts
  - High-performance, low-cost photoelectrochemical cells to create hydrogen from sunlight
  - Hydrogen generation from concentrated solar energy
  - Zero emissions 'green steel' and other refined minerals

Our goal: create the expert technical, socio-economic, and geopolitical knowledge for Australia to become a leading exporter of zero-carbon hydrogen within 15 years, ensure the competitiveness of Australia's future hydrogen exports, and work with domestic & regional partners.

Partner with us

The ANU is investing $10 million in the Zero-Carbon Energy for the Asia-Pacific program from 2019 - 2023. We are looking for opportunities to collaborate with industry, government, Indigenous organisations, and community groups to co-design, further develop and implement our research program. We welcome inquiries from those who have a collaborative research interest in our program, its objectives, and deliverables.

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