PROJECT CASE STUDY – PROGRAM 2

RP2.006: Hydrogen supply within HILT regional hubs – H_2 cost and synergistic opportunities

Project Leaders:	Dr Tara Hosseini, Commonwealth Scientific and Industrial Research Organisation (CSIRO)
HILT CRC partners:	CSIRO, The University of Adelaide, ANU, Grange Resources, Fortescue, LIBERTY Steel, Hatch
Industries:	Alumina and aluminium Cement and lime Iron and steel
Commenced:	01 June 2023
Total project value:	$617,000 (cash and in kind)

Complementary HILT CRC projects:

RP2.001: Green hydrogen supply modelling for industry

RP2.014: Low-cost reliable green electricity supply for low-carbon heavy industry

RP3.007: Unlocking investment in energy infrastructure for net-zero industrial hubs

Hydrogen, especially green hydrogen produced from renewable energy sources like wind and solar, is considered an essential element of the transition to a low-carbon economy. However, there are major challenges to commercially sustainable, reliable hydrogen production and delivery, such as cost uncertainties and the intermittency of renewable energy sources. Furthermore, hydrogen production, storage and transportation costs vary significantly based on location and method.

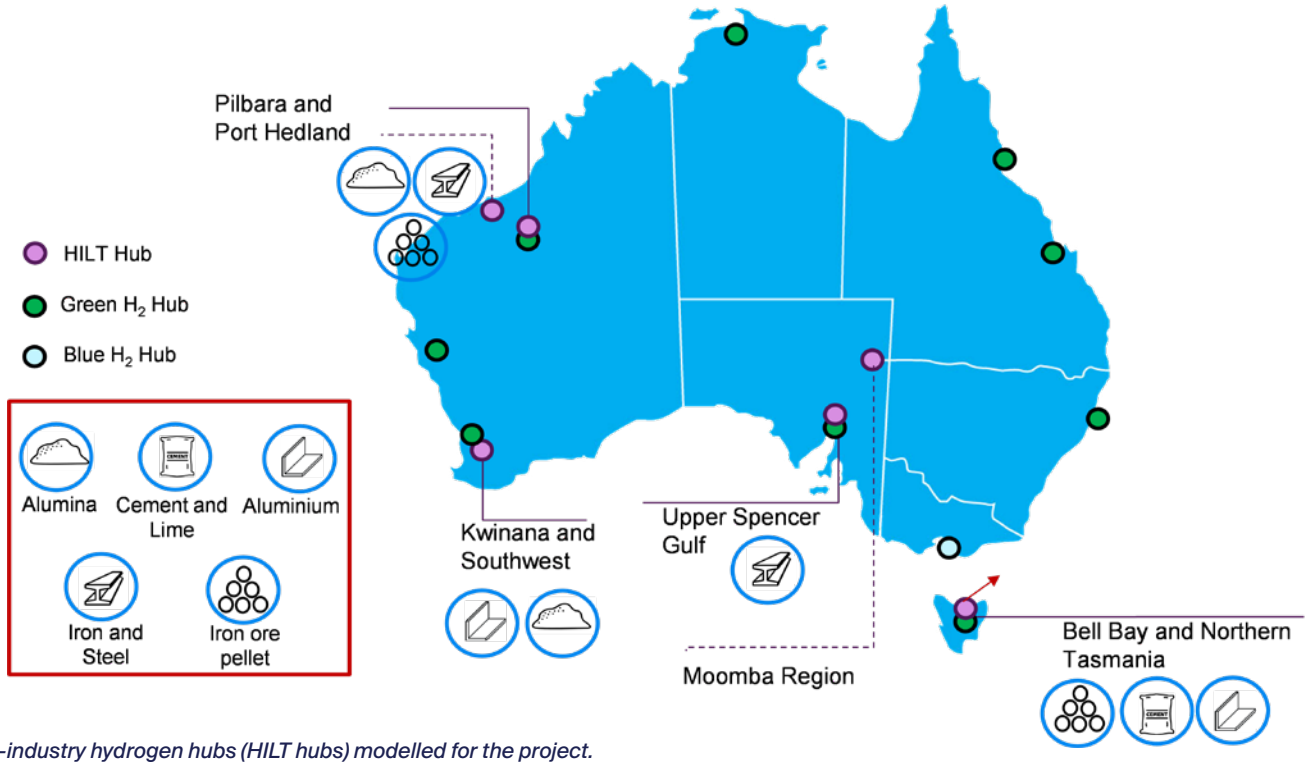
Regional hydrogen hubs have the potential to bring together hydrogen producers and users in a single location, reducing costs through shared infrastructure and economies of scale. The project aimed to:

- Accelerate the decarbonisation of heavy industries through strategic hydrogen deployment.
- Provide industries and policymakers with a clear framework for understanding the cost dynamics of hydrogen supply within different Australian regions.

THE CHALLENGE

There are several critical challenges to developing hydrogen hubs in Australia:

- **Cost uncertainty:** Fluctuating hydrogen costs, driven by factors such as the price of renewable energy and the cost of transportation and storage, can complicate or delay decisions by heavy industry to invest in decarbonisation.
- **Intermittency of renewable energy:** Mismatches between hydrogen production and demand, caused by intermittency, require effective storage solutions, which in turn increase costs.
- **Supply chain costs:** From energy generation to end use, each step contributes to overall costs.
- **Regional constraints:** Factors like land availability and labour costs vary widely between regions.



Heavy-industry hydrogen hubs (HILT hubs) modelled for the project.

PROJECT APPROACH

The project created a detailed cost estimation framework for hydrogen supply across six key industrial hubs aligned to HILT's Core industry partners: Northern Tasmania; Upper Spencer Gulf and Moomba, South Australia; Port Hedland, Kwinana, and the Pilbara, Western Australia. This framework factors in regional differences in renewable energy availability, hydrogen production costs, storage and transportation infrastructure.

Project Leader Dr Tara Hosseini notes that the project was premised on aggregating hydrogen users within specific regions to reduce costs through shared infrastructure.

"Our goal is to create hydrogen hubs that take advantage of co-location benefits," she says. "By clustering producers and users together, we can reduce the costs of transportation and storage, making hydrogen more cost-competitive for heavy industries."

OUTCOMES AND INDUSTRY IMPACT

Across the six hubs analysed, the project identified optimal hydrogen delivery costs for various demand levels.

"Green hydrogen costs varied significantly across regions due to geographic factors, such as labour costs, the distance between hydrogen production sites and end users, and renewable resource availability," Dr Hosseini says. "The cost of delivered hydrogen ranged from US$3.50/kg to US$8/kg."

Demand had minimal impact on green hydrogen costs, but for blue hydrogen (produced from natural gas), costs were significantly influenced by production scale and location-specific factors.

The project has developed a cost estimation tool that will allow industries and policymakers to assess the relative costs of hydrogen production at different scales and under various operational conditions. The tool will help industries make informed decisions about their decarbonisation strategies.

INDUSTRIAL EFFICIENCY AND ECONOMICS

Dr Hosseini notes that the project's outcomes provide valuable insights for both industry and government.

"Industries can use the results to make informed decisions about their decarbonisation plans," she says. "They will also inform the development of effective policies based on unlocking regional economic and environmental potential."

A new HILT CRC project, *Unlocking investment in energy infrastructure for net-zero industrial hubs*, will build on this project by also considering electricity and natural gas and different regionally specific scenarios for transitioning energy supply and heavy industry demand. This will enable cost-optimised evaluations of energy infrastructure needed to reach net-zero carbon emissions by 2050.

"THESE INSIGHTS WILL BE INVALUABLE FOR INDUSTRIES LOOKING TO DECARBONISE – BY PROVIDING CLEAR, DATA-DRIVEN ESTIMATES OF HYDROGEN COSTS, WE CAN HELP BUSINESSES PLAN FOR A SUSTAINABLE FUTURE."

– Dr Tara Hosseini, CSIRO