HESC

Successful Completion of Pilot Project Report

The Fuel of the Future is Here

Contents

The Hydrogen Energy Supply Chain (HESC) Project	3
Technical Achievements	4
Community Views on Hydrogen and HESC	6
Community Surveys	8
HESC Vision for a Commercial Project	9

The Hydrogen Energy Supply Chain Project

The Hydrogen Energy Supply Chain (HESC) Pilot Project commenced in 2018 with the announcement of the plan to build a gasification plant in the Latrobe Valley and a hydrogen liquefaction plant in Hastings.

By mid-2019 development approvals for the Pilot Project were secured and construction commenced.

In January 2022, the Suiso Frontier, the world's first liquid hydrogen carrier ship, left Hastings with its cargo of liquid hydrogen and in February was safely unloaded at the receiving terminal in the port of Kobe, Japan. This marked the successful completion of the HESC Pilot Project.

This report provides an overview of the engineering and technical achievements of the project, community and stakeholder views of the project and the future shape of a commercial scale HESC Project.

Project Partners

The HESC Pilot Project was created as a partnership between the governments of Japan, Australia and Victoria and experienced industry partners in Japan and Australia.

The industry project partners were Kawasaki Heavy Industries, Ltd (KHI), Electric Power Development Co., Ltd. (J-POWER), Iwatani Corporation (Iwatani), Marubeni Corporation (Marubeni), AGL Energy (AGL) and Sumitomo Corporation (Sumitomo). Royal Dutch Shell (Shell), ENEOS Corporation and Kawasaki Kisen Kaisha, Ltd. (K-Line) were also involved in the Japanese portion of the project.

The governments of Australia and Victoria contributed $100 million in funding to the $500 million project. The rest was invested by the Japanese Government and Project Partners.

The HESC Project was born from a shared goal of the Japanese and Australian Governments to find less carbon-intensive energy sources to reduce greenhouse gas emissions.

Modelling shows HESC at a commercial production scale of 225,000 tonnes of liquid hydrogen per year, with carbon capture and storage, would reduce global CO2 emissions by 1.8 million tonnes per year (equivalent to the emission of about 350,000 petrol-driven cars).

Kawasaki · J-POWER Group · Iwatani · Marubeni · agl · Sumitomo Corporation · HEA

Supported by

Australian Government · Victoria State Government · METI Ministry of Economy, Trade and Industry · NEDO

Technical Achievements

Extracting hydrogen from coal and biomass

The Latrobe Valley facility, operated by J-Power, comprised a small-scale, purpose-built gasification and refining plant.

Japanese and Australian engineering teams, supported by local contractors, research institutions and staff, shared significant skills and technical know-how to build and operate the plant.

Hydrogen gas from the Latrobe Valley plant was transported via existing hydrogen tube trailer trucks to Hastings, to be liquefied.

The plant achieved:

- Successful production of 99.999% pure hydrogen gas through gasification of Latrobe Valley coal.
- Successful production of 99.999% pure hydrogen gas through gasification of a mix of biomass and Latrobe Valley coal.

Liquefaction of Hydrogen Gas

The liquefaction plant at Hastings received hydrogen gas, chilled the gas down to -253 degree Celsius and compressed the gas to 800 times less is gaseous volume. At this temperature and compression, hydrogen gas (GH2) becomes liquid hydrogen (LH2).

Liquid hydrogen is a highly valuable and transportable fuel. When used in various industrial and transport applications to create heat or electricity, hydrogen leaves no emissions apart from water (H2O).

The Hastings liquefaction plant was operated by KHI and Iwatani.

The plant achieved a number of technical milestones including:

- Construction of Australia's first hydrogen liquefaction plant
- Hydrogen gas derived from Latrobe Valley coal and biomass successfully being liquefied and stored in LH2 containers
- Facilitating the arrival of the Suiso Frontier and LH2 loading operations with local authorities, ship operators and shipping agents

Suiso Frontier

While the Australian end of the HESC supply chain was being built, the Japanese end of the HESC supply chain was developed. A receiving terminal and storage facility was established in Kobe and KHI built the Suiso Frontier, the world's first ocean-going liquid hydrogen carrier ship.

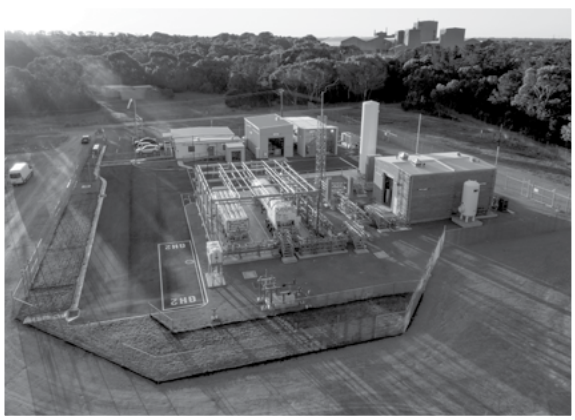
The Suiso Frontier arrived in the Port of Hastings on January 20, 2022 and left a week later with the world's first trans-ocean shipment of liquid hydrogen. It arrived at the Port of Kobe on the February 25, 2022 and safely unloaded the Australian-produced hydrogen in late February, marking the successful completion of the Pilot Project.

HESC Latrobe Valley site.
Managed by: J-Power/J-Power Latrobe Valley

Pilot Infrastructure

Now the Pilot Project is complete, the facilities built for the pilot will be under care and maintenance or used for further hydrogen research and development.

Several research and commercial organisations are seeking access to the Hastings liquefaction plant to conduct further research and trials.



Community Views on Hydrogen and HESC

During the four years of the Pilot Project the HESC Project Partners have conducted many community drop-in sessions, held webinars and made contributions to community and stakeholder meetings and conferences.

50,000+ visitors to the HESC website

130+ stakeholder meetings have been in held (in person and online) with national, state and local stakeholders

Billions of people have been reached through global, national and local media coverage

In addition, HESC Project Partners have actively engaged with community leaders and groups in the Latrobe Valley and Hastings areas.

The Project Partners are grateful for the support of Latrobe City Council and Mornington Peninsula Shire Council for supporting the project and facilitating access to community groups and views.

COVID-19 restrictions during 2020 and 2021 made traditional community engagement difficult and the team shifted to mainly online activity, with an emphasis on webinars, one-on-one seminars with stakeholders and the community e-newsletter.

The HESC Community and Stakeholder Engagement team have worked hard to make the project and Project Partners accessible to the community and be transparent about our operations and plans for the future.

Not everyone, or every organisation in the Latrobe Valley or Hasting area, or the wider Australian community, supports everything about HESC and we recognise the legitimate questions raised about how the project would reduce greenhouse gas emissions and the impacts of a major industrial development.

Here we summarise some of the key issues raised and HESC's responses.

	Community Perspective	HESC Response
Jobs	Stakeholders in both Latrobe Valley and Mornington Peninsula are keen to understand what types of jobs would be available in a commercial scale HESC project. Mornington Peninsula stakeholders felt that employment benefits would flow to Latrobe Valley more than the Mornington Peninsula.	Modelling from KPMG found that more than 1,000 jobs per year would be created in the operational phase and that number was even higher during construction. Job allocation was shared between the regions, with a slightly higher proportion in the Mornington Peninsula region compared to the Latrobe Valley region.
Opportunities for local businesses	Business groups frequently asked about opportunities for local businesses to participate in the construction and operation of commercial-scale HESC.	The HESC Project would rely heavily on local people and organisations to supply materials and services during the construction and operation of the project.

	Community Perspective	HESC Response
Why hydrogen extracted from coal?	Environmental groups and many stakeholders question why a fossil fuel would be used as a source for hydrogen when hydrogen made with renewable electricity is on the horizon.	There are a number of reasons why this project makes sense in a low carbon world. At commercial scale with CCS, it would save some 1.8 million tonnes per year of CO2 going into the atmosphere, equal to the emissions of about 350,000 cars. When we add biomass, the process can be carbon neutral (as is hydrogen produced from renewables). Secondly, most research indicates that this form of hydrogen production is 2 to 3 times less expensive than renewable hydrogen. Additionally, the scale of our global warming challenge is so great, we need to move now with a cost-effective and reliable supply of cleaner energy. Australia will need many options to satisfy global demand for hydrogen energy.
Does Carbon Capture & Storage (CCS) work?	A number of community groups and stakeholders are sceptical about whether CCS is economically or technically viable.	Yes. HESC will capture CO2 from our gasification facility and CarbonNet will then transport and inject the CO2 into depleted oil and gas reservoirs in Bass Strait. These natural geological formations have been safely storing oil and gas for millions of years. CarbonNet has been in development for over 10 years and has been progressing in parallel with HESC, enabling both projects to proceed concurrently. Over the past 45 years, 27 CCS projects have been developed, safely storing 40mtCO2. There are 135 more in various stages of development around the world. CCS is recognised by IPCC and IEA as another tool to help us achieve carbon neutrality by 2050.
Localised environmental impacts	Stakeholders in the Latrobe Valley want to understand what the emissions would be from a gasification plant; Hastings stakeholders are concerned about port development and marine pests.	Firstly, gasification is a very different process compared to how energy is produced in thermal power stations. Rather than burning coal to make steam to drive turbines, in gasification, we extract the hydrogen from the coal and biomass, under high pressure and temperature, with the inclusion of oxygen. Through our gasification and refining process, the majority of the CO2 is captured and will be safely stored in the CarbonNet CO2 storage system. Latrobe Valley coal has limited impurities and other minor emissions will be in line with environmental standards. HESC acknowledges the environmental significance of Westernport Bay and has taken measures to avoid any marine pest impacts during the Pilot Phase, including a marine pest monitoring survey.

Community Surveys

HESC has conducted telephone surveys with residents in both the Latrobe Valley and Mornington Peninsula areas over the past two years to understand community attitudes to hydrogen and to HESC.

Overall support for the use of hydrogen fuel as a possible solution for energy and environmental challenges was strong (close to 60% support) across both regions.

Support for the production of hydrogen with coal gasification was higher in the Latrobe Valley (48%) compared to 29% in the Mornington Peninsula region. Those who neither supported or opposed were 30% in Latrobe Valley and 28% in the Mornington Region.

When survey respondents were asked if the process of producing hydrogen using coal and capturing carbon was a stepping-stone until it was economically possible to produce hydrogen with renewable energy and electrolysis, support increased to 70% in Latrobe Valley and 55% in Mornington Peninsula.

Many Latrobe residents foresaw increased employment (mentioned unprompted as a prospective benefit by 64% of respondents) and economic benefits (33%, again unprompted) from producing hydrogen with Latrobe Valley coal. Mornington Peninsula region residents could also see these benefits but to a lesser degree (37% and 22% respectively).

HESC Vision for a Commercial Project

HESC's vision is to produce carbon neutral hydrogen through extraction from a mix of Latrobe Valley coal and biomass, capturing and storing CO2 via the CarbonNet Project and optimising energy efficiency in the HESC supply chain.

Modelling shows if 225,000 tonnes of carbon neutral liquid hydrogen (LH2) was produced by HESC in a commercial phase it would contribute to reducing global CO2 emissions by some 1.8 million tonnes per year (equivalent to the emission of about 350,000 petrol-driven cars), while providing valuable infrastructure for other hydrogen projects in the region.

In a commercial phase, the project will create 30,000 full-time jobs across the Gippsland and Mornington Peninsula regions over the life of the project.

The Future

Much more work is needed to take HESC from a pilot project to a commercial reality.

Over the next few years, the Project Partners will review the results from the pilot phase and continue to engage with local communities, regulators and potential customers for HESC hydrogen, in readiness to build and operate a commercial-scale project.

Activities that will be undertaken include:

1. Continuing to test and demonstrate maritime transport of liquid hydrogen with the Suiso Frontier making further trips between Australia and Japan
2. Preparing for regulatory approval processes
3. Investigating economics of the commercial-scale project and its business model
4. Engaging potential 'off-takers' in Australia and Japan
5. Improving technologies to reduce costs and carbon intensity across the supply chain. This includes further development of the ortho-para conversion catalyst for creating LH2 in partnership with CSIRO, Australia's national science agency

The HESC Project Partners will continue to implement a comprehensive stakeholder engagement program to build a social licence in the communities the project would operate.

HESC

T: 1800 875 251
E: info@hydrogenenergysupplychain.com
hydrogenenergysupplychain.com