



Report

Public Knowledge Sharing Report (KSR) 3 - Operations Phase

Christmas Creek Renewable Mobility Project

31 March 2026



ACKNOWLEDGEMENT



Government of **Western Australia**
Department of **Energy and Economic Diversification**

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LIST OF DEFINITIONS

Abbreviation	Definition
APA	APA Group – energy infrastructure organisation
FCEC	Fuel cell electric coach/bus
FEED	Front-end Engineering Design
HRS	Hydrogen refuelling station
KSR	Knowledge Sharing Report
kW	Kilowatt (equal to 1,000 watts)
MW	Megawatt (equal to 1,000,000 watts or 1,000 kilowatts)
OEM	Original equipment manufacturer
OPEX	Operational expenditure



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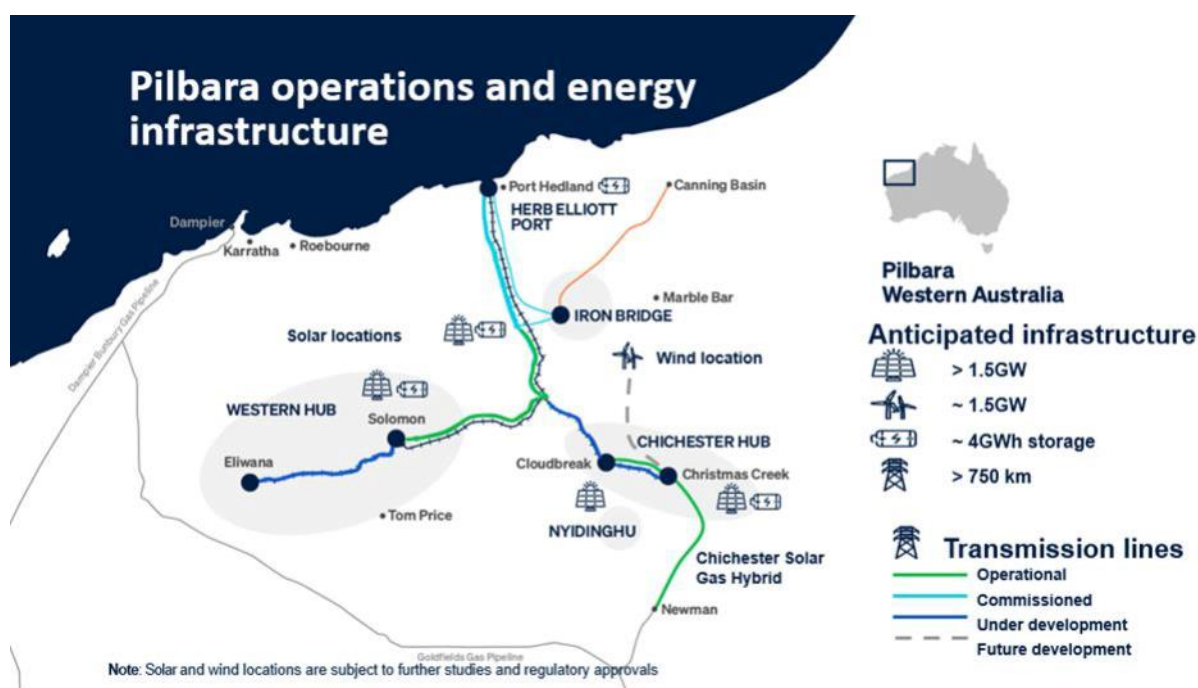
1 INTRODUCTION

1.1 About Fortescue

Established in 2003, Fortescue is a proud West Australian company that has evolved into a global business and world-leading iron ore producer. Fortescue is recognised for its culture, innovation and industry-leading development of infrastructure, mining assets and green energy initiatives. Our commitment to decarbonisation sets us apart in the heavy industry landscape.

Fortescue's primary focus lies in extracting iron ore from Western Australia's Pilbara region. Through renewable energy projects and mining technology developments, Fortescue plans to rapidly diversify its business to become an integrated, global green technology, energy and metals group. Fortescue is investing in the development of new technologies in electrification of heavy mining equipment, electrolyser manufacturing, green hydrogen and ammonia production and numerous use cases for green fuel.

Key to this transition is an industry leading target to achieve real zero Scope 1 and 2 terrestrial emissions across Fortescue's iron ore operations by 2030 and enable net zero Scope 3 emissions by 2040. For Fortescue's size and scale, there is no other heavy industry company in the world that is taking comparable action to eliminate emissions.





2 PROJECT SUMMARY AND OVERVIEW

2.1 Summary

The Christmas Creek Renewable Hydrogen Mobility Project (Project) sought to develop and deploy onsite hydrogen generation (via electrolysis) and refuelling infrastructure to support a fleet of fuel cell coaches (FCECs) at Fortescue's Christmas Creek mine, 1300 km north of Perth and 400 km south of Port Hedland.

Energy for this project was sourced from a local grid owned and operated by APA (formerly Alinta) powered by a 60MW solar farm and gas generation.

The Hydrogen Refuelling Station (HRS) was scaled to allow production and refuelling requirements of the entire fleet to be achieved during daylight hours to align with when solar generation is expected on APA's grid, thus avoiding the consumption of fossil fuels.

The Project was awarded \$2,000,000 as a grant under the Western Australian Government's Renewable Hydrogen Fund.

2.2 Project Scope

The scope of the Project was to develop, deploy and operate a gaseous hydrogen plant at Christmas Creek mine site, including:

1. HRS that is fully operational to support 10 FCECs
2. A station design capable of generating, storing and dispensing hydrogen while also having the capability to efficiently utilise renewable energy sources
3. Full system instrumentation and data acquisition capability supporting remote monitoring and detailed analysis of Christmas Creek HRS performance characteristics
4. Detailed system documentation and a simplified modular design allowing trained Fortescue staff or third-party vendors to perform system operations, maintenance and repair functions
5. Deploy 10 FCECs for ongoing operations at Christmas Creek

2.3 Key Components

Quantity	Details
10	FCECs
2	700 kW electrolyser and associated balance of plant (total 1.4MW)



2	Compressors and associated balance of plant
2	350 bar dispensers
13	High pressure storage vessels
1	Transformer

3 CHANGES TO FEED AND COMMISSIONING STAGES

The operational stage of the Project saw several minor changes compared to what was described in the front-end engineering design (FEED) and commissioning stages, detailed in earlier Knowledge Sharing Reports (KSR). These changes are detailed below.

Dual system

The HRS was divided into two separate identical systems (trains A and B) to provide potential redundancy, allowing hydrogen production to still occur if either system was down. In this dual system, hydrogen supply comes from electrolysis and two low pressure buffer tanks to level out differences in supply and demand of hydrogen. Two ionic compressors (A and B) compress the hydrogen coming from the electrolysis from ~20 bar to target pressure (~450 bar). Each compressor has an output of ~27.5 kg/hr (the output can vary with the inlet pressure and temperature). The compressed hydrogen is then stored in 13 Type 2 (steel) hydrogen storage tubes. During refueling, hydrogen flows from the storage tubes to the dispenser. Before the dispenser, the hydrogen flows through a solid-state heat exchanger which is cooled down to -15°C by a chiller.

Operational philosophy

Fortescue has also considered the operational philosophy and behaviours of compressors and electrolyzers to best determine the optimal operation of equipment. Fortescue determined that the optimal operation is to run the electrolyzers and compressors for longer durations at a lower output, rather than operating in a replenish high output mode. By reducing the output of the electrolyzers to approximately 75% capacity and matching the low-pressure storage input flow with the compressor output, Fortescue minimised the cycle times of both the electrolyzers and compressors. This has resulted in a lower stack decay rate and lower wear and tear on the components that make up the system.

There was no detrimental impact on supply as analysis of FCEC refuel times and days has determined that storage can be optimised to suit FCEC schedules. The ability to flex and increase output from the electrolyzers as well as ramping up compression still remains in times of increased demand, but the system overall is running more efficiently and reliably.



4 OPERATIONS REPORT

4.1 Overview

As per the Project scope, Fortescue successfully operated the HRS to support FCECs for a continuous period of 12 months.

The Project was executed with no significant environmental or safety incidents.

4.2 OPEX

Operational expenditure (OPEX) for operation of HRS for the period March 2024 to March 2025 is approximately \$5.3 million¹.

OPEX for operation of FCECs for the period March 2024 to March 2025 is approximately \$0.1 million.

4.3 Hydrogen

4.3.1 Hydrogen dispensed on a weekly basis

Production of hydrogen and dispensation was variable and was based on demand from the FCECs as well as prototype testing schedule. As such, weekly usage has varied from as little as 70kg, up to 988kg.

Over the 12 months of operations, Fortescue executed 1,043 successful FCECs fills, making a significant contribution to the decarbonisation of our personnel transportation fleet.

4.3.2 Hydrogen production

Given hydrogen production was based on demand from FCECs, Fortescue was able to flex operational requirements and thus only operate the HRS during daylight hours when renewable energy generation was at its peak.

Over the period between 1 March 2024 to 1 March 2025, Fortescue produced 16,988kg of hydrogen (an average of 1,415.7kg per month). 100% of the energy used in hydrogen production was from renewable generation.

4.4 FTE numbers during operations

The HRS uses four extensively trained, trade qualified technicians and two statutory supervisor positions. These FTE are on eight days on/six days off rotation.

The Project is overseen on a weekly basis by an Operations and Maintenance Superintendent who holds the gas authorisation for the plant's operational license.

¹ OPEX figures are calculated on a pro-rata basis, based on the amount of hydrogen which was used for the HRS as opposed to other uses (of the 16,988kg hydrogen produced in total, 12,020kg was used for the HRS).



The operational workforce continues to be supported by Fortescue's extensive technology, engineering and asset management team as well as original equipment manufacturer (OEM) technical remote engineering support.

4.5 Environment

Environmental reporting is carried out quarterly on confirmation of reject water dispersion and production volumes.

There have been no environmental incidents since construction and commissioning of the facility.

4.6 Regulatory impacts

Fortescue continues to work closely with the governing body (Western Australian Department of Local Government, Industry Regulation and Safety) on regulations and licensing. Regular interactions are held to monitor compliance and the evolution of licensing.

During the period of operation, the maintenance and operations team were well represented with three Gas Authorisations issued for P class facility servicing and maintenance. The total Maintenance team were trained and issued with I(a) and I(b) Supervised Gas Fitting licenses.

4.7 Safety impacts, incidents, constraints and mitigations

Fortescue follows a stringent risk management standard and procedure to proactively manage material risk of a significant incident at the plant.

As part of the approvals process, extensive modelling (quantitative risk assessment) was undertaken by third party specialists to consider the effects of a containment release of hydrogen. The results showed that for the onsite risk, the maximum total IRPA (individual risk per annum of a fatality) contribution from the HRS is estimated to be 1.2×10^{-6} . This is far less than the Fortescue on site risk criteria of 1×10^{-3} .

During the 12 months of operation, there was no "loss of containment incidents" and no safety impact to the facility. The facility was well managed through extensive security protocols both physical and virtual (cybersecurity) to ensure that only trained and competent personnel had access to operate and maintain the equipment.

Emergency responders undertook extensive training to be well prepared and equipped, and undertook regular drills to ensure preparedness. Lessons learnt and efficiency opportunities were evaluated and recorded after exercises to continually improve the response protocols.

Operational Readiness has been subject to operational scrutiny during the period of operation and been streamlined to ensure the facility is maintained in alignment to both OEM and regulatory standards.

Fortescue conducted internal and third-party audits on Electrical Equipment in Hazardous Areas and Static, Lightning and Earthing systems to ensure that it continued to meet or exceed statutory requirements and best practice. Processes and systems were implemented out of the audit results to mitigate risk in any areas that were identified as being deficient.



4.8 Pressure vessels design certificates

Fortescue developed an “In-service Management of Pressure Equipment Procedure” for inspection, testing, maintenance and repair of the pressure vessel through commissioning, operating and disposal phase. The key objective of in-service pressure equipment management is to manage the risk of harm to people, equipment and the environment, to maintain compliance with regulatory requirements and to ensure reliable production, through:

- Verifying at commissioning, all design and regulatory requirements have been met and equipment has been installed correctly
- Verifying the equipment condition during operation
- Verifying repairs and maintenance do not compromise equipment integrity
- Maintaining accurate registers and details of all relevant pressure equipment

The hydrogen vessels have hazard level “C” and above. Fortescue maintains:

- Design Registration Certificate
- Item Plant registration certificate
- MDR including Hydrotest, General Arrangement drawings
- Commissioning Report
- Inspection Records
- PSV Certificates

An inspection plan for each item is created and maintained using SAP system which has the type(s) of inspection needed (e.g. internal, external):

- Inspection intervals for each inspection type which is aligned with the requirements of:
 - AS3788 – Pressure equipment – In service inspection
 - AS2030 – Gas cylinders (Series)