

PROPOSED H2PERTH PROJECT

ENVIRONMENTAL TOPICS

Woodside Energy (Woodside) is a global energy company, founded in Australia. Our focus is to provide low-cost, lower-carbon energy the world needs.

We are proposing to develop H2Perth – a domestic and export scale hydrogen and ammonia production facility within the Rockingham Industry Zone (RIZ). H2Perth would be built on approximately 130 hectares of vacant industrial land to be leased from the Western Australian (WA) Government (see Figure 1).

H2Perth would be located on the Gnaala Karla Booja (GKB) region of the Noongar Nation. The GKB region refers to the Noongar language or dialectical groups of the Binjareb/ Pinjarup, Wilman and Ganean. We acknowledge the connection of Noongar people to that Country, and their Elders – past and present.

H2Perth would be developed in three phases, providing a significant opportunity to establish a new strategic export industry for WA, supply hydrogen to local and international users seeking to lower their emissions, and support the stable transition of our local electricity grid to renewable sources.

Woodside's intention is for H2Perth to be net zero Scope 1 and 2 greenhouse gas (GHG) emissions from the start of operations.

Hydrogen Refueller @H2Perth

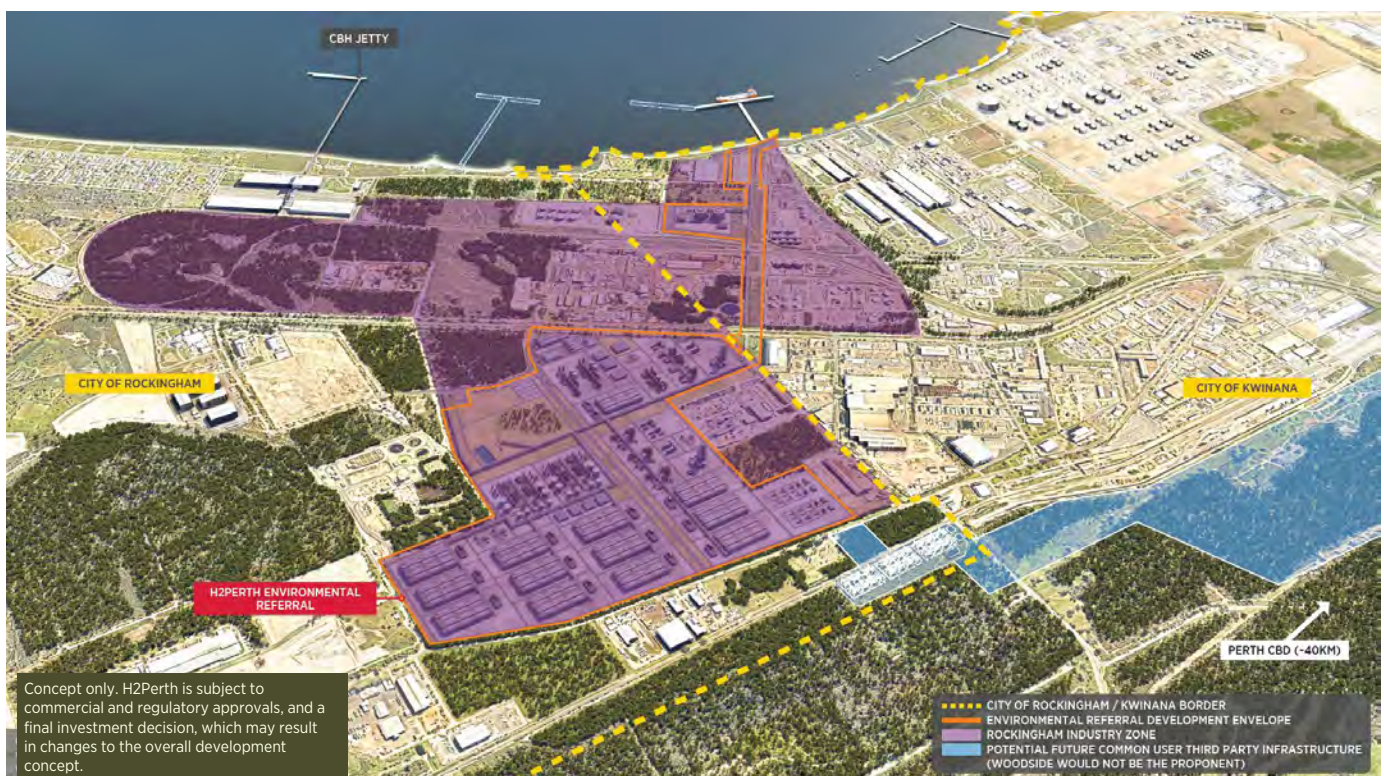
Woodside is also progressing a separate, stand-alone hydrogen opportunity called the Hydrogen Refueller @H2Perth, which was successful in securing funding from the WA Government in August 2022 through the Hydrogen Fuelled Transport Program.

Hydrogen Refueller @H2Perth aims to supply low-cost, renewable hydrogen fuel for local customers and stimulate and enable hydrogen demand in WA.

Hydrogen Refueller @H2Perth would be a self-contained hydrogen production, storage and refuelling station adjacent to the main H2Perth project.

For more information, visit the Woodside website at: www.woodside.com

Figure 1. Location of H2Perth within the RIZ



Why is Woodside progressing H2Perth?

We provide energy the world needs to heat and cool homes, keep lights on and enable industry through our portfolio of quality oil and gas assets.

But the science of climate change is clear: if the world is to limit temperature rise, it will need to change the way that it produces and consumes energy. This process – sometimes called the “energy transition” – has already begun.

As an energy producer, Woodside is investing in the products and services that our customers need, as they too reduce their emissions.

We are progressing a number of hydrogen and ammonia projects to add to our portfolio, including H2Perth.

Production of lower-carbon hydrogen is expected to grow significantly as the world reduces GHG emissions.

This is because hydrogen and hydrogen-based fuels do not release carbon dioxide when they are used.

Hydrogen is also very versatile; it can power everything petrol or gas can, and it can also be stored.

Hydrogen can be produced through a variety of different methods. At H2Perth, Woodside will make hydrogen using both electrolysis and natural gas reforming.

Although hydrogen does not emit carbon when it is used, some methods of making hydrogen do generate emissions. **Woodside intends for H2Perth to be net zero from the start of operations**, using a combination of renewable electricity, offsets and carbon capture, utilisation and storage (CCUS).



Electrolysis

Hydrogen can be made through electrolysis, where electricity is used to separate hydrogen (H_2) from water (H_2O). Depending on the source of the electricity used, this process can have close to zero emissions.

For the electrolysis component of H2Perth, Woodside is targeting 80% renewable electricity (as defined by the Australian Clean Energy Regulator) from the start of operations, with remaining emissions to be offset.



Natural gas reforming

Hydrogen can be made through natural gas reforming, which converts methane (CH_4) to hydrogen (H_2). Carbon dioxide (CO_2) is also produced as part of this process, however these emissions can be managed, and the hydrogen produced generates no emissions at the point of use.

Woodside is progressing a number of CCUS opportunities around the world. The application of CCUS technologies at H2Perth is currently being assessed. We intend to select a technology that has the potential ability to capture 85% of the CO_2 produced from the natural gas component of the project – once a CCUS opportunity is established, and subject to commercial and regulatory approvals.

Woodside intends to manage emissions that have not already been captured and stored using offsets. Additional GHG emissions avoidance and reduction measures will also be investigated. Natural gas reforming is also expected to cease by 2050 or earlier.



Net zero from the start of operations

Taken together, both components of H2Perth are intended to be net zero emission from the start of operations, targeted for 2027.

Both electrolysis and natural gas reforming lead to an identical hydrogen product, and are each expected to play a role in the future energy mix.

H2Perth will make hydrogen using both techniques because our customers have different end-use cases, volume and schedule requirements and price sensitivities. Accordingly, we plan to offer a hydrogen portfolio that is diversified across locations, timeframes, production methodologies, carbon management tools and price points.



H2Perth project overview

Project snapshot	
Proposed activity	Production of gaseous hydrogen and its conversion to ammonia (and potentially liquid hydrogen) for export and local supply
Proposed location	The RIZ in the Rockingham and Kwinana Local Government Areas
Estimated project duration	90 years, targeting first production in 2027
Production methods	Electrolysis (from first production for project duration) Autothermal reforming of natural gas (from first production, expected to cease by 2050 or earlier)

Phased development

Woodside is targeting the below timeframe, based on construction estimated to start in 2024, subject to government approvals and internal decision making.¹

	Estimated total ammonia production (approximate tonnes per annum)	Estimated total natural gas requirement	Estimated total electrolysis requirement
Phase 1 Start up, targeted for 2027	0.84 mtpa (potentially up to 1 mtpa)	65 TJ/day	150 MW, potentially up to 250 MW
Phase 2 Start up three years from Phase 1, targeted for 2030	1.45 mtpa	65 TJ/day	1000 MW
Phase 3 Start up three years from Phase 2, targeted for 2033	3.25 mtpa	65 TJ/day ²	3250 MW

Environmental assessment

As part of the environmental approval process, we propose to refer H2Perth to the WA Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986 (WA)* and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*. These government departments will consider the project and stakeholder feedback, to set appropriate levels of assessment for an opportunity of this type and scale. Our target submission date is by the end of 2022.

The scope of our proposed submission is a three phased ammonia and hydrogen development. There are a number of interdependent elements that sit outside Woodside's environmental approvals strategy for H2Perth as they either involve multi-user infrastructure or represent future expansion opportunities for H2Perth. These include:

- additional marine export facilities;
- electricity transmission lines and general substation; and
- areas designated for future liquid hydrogen production.

Environmental and social impacts

A number of environmental studies have been undertaken to support the environmental assessment for H2Perth. These studies establish environmental baselines, identify environmental and social sensitivities, help guide the concept designs and operational planning for H2Perth, as well as inform mitigation strategies.

Preliminary findings from environmental studies that have been undertaken to date are outlined in this information sheet. Woodside will continue to engage with the community as the project concept matures and mitigation strategies are developed.

1. Estimates are based on current concept design as at November 2022 and may change during detailed design.
2. Natural gas reforming is expected to cease by 2050 or earlier.

Greenhouse gas emissions

POTENTIAL IMPACTS

GHG emissions from the construction and operation phases of the project have the potential to contribute to global GHG emissions. The principal sources of GHG emissions for H2Perth would be:

- the Scope 1 emissions from use of natural gas in one of the production processes.¹
- the Scope 2 emissions from the electrolysers and other processing equipment that draw electricity from the grid.²

GHG emissions estimates are indicated below.³

Woodside intends to manage the GHG emissions from H2Perth, so that the facility would be net zero from the start of operations, through the mitigation measures outlined below.

	Estimated natural gas Scope 1 GHG emissions (million tonnes CO ₂ -e per annum)	Estimated electricity consumption Scope 2 GHG emissions ⁴	Estimated gross Scope 1 and 2 emissions ^{5, 6}	Estimated net Scope 1 and 2 emissions
Phase 1 65 TJ/day natural gas, 150 MW electrolysis (potentially up to 250MW) 150 MW processing	1.1	0.4 (potentially up to 0.5) (assuming electrolysis is powered by 80% renewable electricity) ⁷	1.5 (potentially up to 1.6) ⁷	0
Phase 2 65 TJ/day natural gas, 1000 MW electrolysis 250 MW processing	1.1	1.0 (assuming additional electricity is 90% renewable) ⁸	2.1	0
Phase 3 65 TJ/day natural gas, 3250 MW electrolysis 450 MW processing	1.1	Starting at 1.0 in 2033 (assuming additional electricity is 100% renewable) Transitioning to 0 from 2040 (assuming all electricity is 100% renewable)	Starting at 2.1 in 2033 Transitioning to 1.1 from 2040	0
2050 0 TJ/day natural gas, 3250 MW electrolysis 450 MW processing	0	0 (assuming all electricity is 100% renewable)	0	0

MITIGATION MEASURES

Woodside's intention is for H2Perth to be net zero Scope 1 and 2 GHG emissions from the start of operations, targeted for 2027. We plan to achieve this through the following measures:

Scope 1

- Woodside has set a target to invest US\$5 billion by 2030 in new energy products and lower carbon services. We are progressing a number of hydrogen and CCUS opportunities around the world.⁹ The application of CCUS technologies at H2Perth is currently being assessed. We intend to select a technology that has the potential ability to capture 85% of the CO₂ produced from the natural gas component of the project – once a CCUS opportunity is established, and subject to commercial and regulatory approvals.
- Using carbon offsets. Woodside has an established carbon business to develop and acquire large-scale carbon offsets.
- Investigating the potential to apply additional GHG emissions avoidance and reduction measures.
- Transition to electrolysis-only production by 2050 or sooner.

Scope 2

- Targeting 80% renewable electricity in Phase 1, and offsetting the remaining 20%.
- Targeting an increase to 90% renewable electricity for additional requirements in Phase 2, and offsetting the remaining 10%.
- Increasing to 100% renewable electricity for additional requirements in Phase 3, with all emissions associated with the non-renewable component offset.
- Targeting 100% renewable electricity by 2040.

GHG emissions from H2Perth are proposed to be measured and reported on an annual basis. Woodside intends to include efforts made to avoid and reduce GHG emissions in the H2Perth Greenhouse Gas Management Plan (GHGMP).

Woodside plans to frequently review the GHGMP to ensure new and emerging technologies are considered and adopted, where appropriate, to further reduce or avoid GHG emissions.

Woodside will also work with contractors on emissions reduction strategies during construction.

1. Scope 1 GHG emissions: direct GHG emissions that would occur during H2Perth operations from sources that are owned or controlled by Woodside.
2. Scope 2 GHG emissions: indirect GHG emissions that would occur during H2Perth operations from the generation of purchased energy consumed by Woodside.
3. Estimates are based on current concept design as at November 2022 and may change during detailed design. Timeframes shown are targets, based on construction estimated to start in 2024, subject to government approvals and internal decision making.
4. Scope 2 emissions calculated using a maximum national emission factor of 0.815 tCO₂-e per MWh of electricity in 2027, linearly reducing to 0.711 tCO₂-e per MWh in 2033.
5. All calculations assume a plant utilisation rate of 93%. Aggregated emissions numbers shown for each phase.
6. Although H2Perth would have gross Scope 1 and 2 emissions, Woodside intends for H2Perth to be net zero from the start of operations, using a combination of renewable electricity, offsets and CCUS.
7. Reflects the potential to scale-up electrolysis production from 150 MW to 250 MW.
8. The additional electricity demand for each Phase, rather than cumulative electricity demand.
9. Individual investment decisions are subject to Woodside's investment hurdles. Not guidance.

Water consumption and discharge

POTENTIAL IMPACTS

Water consumption and discharge has the potential to impact water supply and water quality.

KEY STUDY FINDINGS

Dispersion modelling of the proposed Sepia Depression Ocean Outlet Landline (SDOOL) discharge plume is underway to determine impacts relative to the current condition and if the discharge criteria specified in Ministerial Statement 665 would continue to be met.

MITIGATION MEASURES

H2Perth proposes to use water to produce hydrogen through both autothermal reforming and electrolysis, as well as for cooling water.

Water needs are proposed to be met through the existing wastewater network near the H2Perth site, which would help to minimise the impact on residential water supply and avoid the need for seawater desalination.

Treated wastewater from industry, wastewater treatment plants and water resource recovery facilities in the vicinity of the project area is currently discharged into the Indian Ocean via the SDOOL. Discharge of wastewater via the SDOOL is regulated under Ministerial Statement 665 and managed by the Water Corporation.

We propose to discharge process wastewater via the SDOOL, subject to meeting the appropriate environmental impact requirements. No new contaminants are proposed to be added to the SDOOL from H2Perth.

Ongoing monitoring of wastewater discharge is proposed to be undertaken at the H2Perth site during commissioning and operations to ensure H2Perth discharge through the SDOOL continues to meet criteria specified in Ministerial Statement 665.

Flora, vegetation and fauna

POTENTIAL IMPACTS

Loss of native flora, vegetation and fragmentation of fauna habitat due to clearing.

KEY STUDY FINDINGS

A detailed flora, vegetation, fauna and black cockatoo assessment was undertaken in November 2021 for H2Perth, supporting the previous studies completed by DevelopmentWA.

Vegetation and flora

Two vegetation communities of conservation significance were recorded within the survey area, one of which forms part of the Tuart Woodlands of the Swan Coastal Plain ecological community.

Vegetation quality within the development envelope ranged from degraded to completely degraded, with much of the area cleared.

No conservation significant flora species were identified in the survey area.



Vegetation on the proposed H2Perth site, observed during spring environmental surveys.

Vertebrate fauna

Eight fauna habitats were mapped in the project area.

Five species of conservation significance have a high likelihood of occurring in the area, the Carnaby's Cockatoo, the Forest Red-tailed Black Cockatoo, The Pacific Swift, the Perth Slider and the Quenda. Evidence of the Quenda was recorded during the survey of the project area.

The Western Brush Wallaby has a medium likelihood of occurring in the area.

Black cockatoos

No evidence of black cockatoos was recorded in the area, although black cockatoo habitat was identified. The habitat was considered by the WA EPA and DCCEEW in the assessment of the DevelopmentWA approval for clearing of the Rockingham Industry Zone Strategic Environmental Assessment (RIZ SEA) area and led to the establishment of an offset management plan. As part of the plan's implementation, sites of similar habitat have been identified and are protected as a black cockatoo habitat offset.

MITIGATION MEASURES

The majority of clearing is proposed to be undertaken within the RIZ SEA area zoned for heavy industrial use. The land owner, DevelopmentWA, has a managed offset area in place for clearing within the H2Perth development envelope (a condition of Ministerial Statement 1043/EPBC 2010/5337).

The ammonia pipelines are proposed to run along an existing cleared service corridor so no additional clearing is required. Exclusion zones and access controls are proposed to be established to prevent unnecessary clearing and disturbance during construction.

Heritage

Desktop surveys show that no registered heritage sites are located in the development envelope. The desktop survey did show two registered sites at the periphery which can be avoided and an isolated artefacts area. This area is not a registered site and is proposed to be managed in collaboration with Traditional Owners.

Initial cultural heritage surveys were conducted in July 2022. No new sites were identified. Noting the area size, further surveys are proposed to be undertaken as part of the cultural heritage management process in partnership with Traditional Owners.

Air emissions

Air emissions from the construction and operation of the project have the potential to impact ambient air quality in the surrounding area, in addition to their greenhouse effects.

An air quality assessment that included modelling the key point sources of air emissions found that the project complied with all relevant environmental air quality criteria as per relevant regulations.¹

Testing of a worst-case operations potential impact from ammonia and nitrogen dioxide emissions from flaring found that emissions would be well within acceptable air quality criteria as per relevant regulations.¹



1. Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999, redetermined in 2019; The National Environment Protection (Ambient Air Quality) Measure (as amended 2016); The National Environment Protection (Air Toxics) Measure (as amended 2011)

Surface and groundwater

The key environmental receptor for the local water catchment is Cockburn Sound, which acts as a discharge point for surface and groundwater. Due to the location of the proposed plant, there is no risk to Cockburn Sound from surface water discharging directly from the site.

The flow of potentially contaminated groundwater may impact the marine water quality in the Sound, however a stormwater management system is proposed to be designed and constructed to reduce the likelihood of discharge of contaminants to the shallow groundwater aquifer.

Further studies

Noise

A noise modelling assessment is currently being undertaken for the project, aligned with regulatory requirements. This is intended to determine the potential to impact sensitive receptors, such as adjacent industrial properties and nearby residential and commercial developments.

Landscape and visual impact assessment

A landscape and visual impact assessment is currently being undertaken for the project. Based on the location and height of the project infrastructure and distance from sensitive receptors, visual impacts are not expected. Woodside intends to implement mitigation measures to reduce potential visual impacts as much as possible.

Traffic impact assessment

A traffic impact assessment is currently being undertaken for the project. This is intended to determine the potential impact of project traffic using information on the nature, type, frequency, and likely routes of vehicle movements, and of the anticipated size of the workforce during construction and operation.

A traffic management plan is proposed to be prepared to cover construction and operation. The plan is intended to outline mitigation measures to reduce potential traffic impacts as much as possible. Potential mitigation measures include different access routes, travel arrangements and shift rotation.

Providing feedback and further information

If you would like further information or to comment on H2Perth, please contact Woodside by email to feedback@woodside.com or call toll free 1800 442 977. There will be many opportunities to engage and provide feedback across all phases of the project.

www.woodside.com