WORLD STEEL ASSOCIATION

PARTNERSHIPS FOR TRANSFORMATION

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PART OF A BETTER FUTURE

Woodside Energy
INTRODUCTION

Disclaimer, important notes and assumptions

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OVERVIEW

Woodside led the development of the liquified natural gas industry in Australia and is applying this same pioneering spirit to solving energy challenges

Woodside is **Global Energy Company**, operating 5% of global LNG supply in 2021

Over 65 years experience and over 30 years of exporting LNG to Asian markets, **playing a major role in their transition to cleaner fuels**

**Operate a number of world-class assets** including the Pluto LNG facility and the landmark North West Shelf project as well as three floating production storage and offloading facilities.

Facilities are **renowned for their safety, reliability, efficiency and environmental performance**, delivering record breaking production,

4,700 employees with a global presence.

**Committed to reducing operated emissions** – 15% by 2025 and 30% by 2030 with the aspiration of becoming net-zero by 2050 or sooner. ¹

Rapidly **expanding Technology and Carbon functions**, including dedicated teams for Hydrogen, Carbon to Products, CCS, Robotics & Intelligent Systems

Woodside **completed a merger** with BHP Petroleum on 1 June 2022

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¹ “Target is for net equity Scope 1 and 2 emissions. Relative to a starting base of the gross annual average equity Scope 1 and 2 emissions over 2016-2020 and may be adjusted (up or down) for potential equity changes in producing or sanctioned assets with an FID prior to 2021. The starting base will be adjusted for the combined Woodside and BHP petroleum portfolio.”
**NEW ENERGY**

**Woodside’s Climate Strategy**

**STRATEGY**

- **Reduce our net equity greenhouse gas emissions (Scope 1 & 2)**
- **Invest in the products and services our customers need as they reduce their emissions**

**TARGETS**

- **15%** by 2025
- **30%** by 2030
- **Net zero aspiration by 2050 or sooner**

Net equity emissions reduction targets

**PROGRESS**

- 10% reduction on 2016-2020 gross annual average in 2021
- On course to achieve 2025 target of 15% reduction
- Released Climate Report 2021

- **$5 billion**
  Invested in new energy products and lower-carbon services by 2030

- H2Perth, H2TAS, H2OK and Heliogen
- Woodside Solar Project
- Exploring carbon capture and storage options

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1. Target is for net equity Scope 1 and 2 emissions. Relative to a starting base of the gross annual average equity Scope 1 and 2 emissions over 2016-2020 and may be adjusted (up or down) for potential equity changes in producing or sanctioned assets with an FID prior to 2021. The starting base will be adjusted for the combined Woodside and BHP petroleum portfolio.
2. Targeted investment in new energy products and lower-carbon services by 2030. Individual investment decisions are subject to Woodside’s investment hurdles. Not guidance.
3. Woodside heritage basis.
Energy investments are fundamentally different in nature with different risk/return profiles.

**Scope 1 and 2 greenhouse gas emissions from projects in all categories need to be managed to meet our net equity emissions targets.**

<table>
<thead>
<tr>
<th>Capital allocation framework</th>
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<tbody>
<tr>
<td><strong>FOCUS</strong></td>
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<tr>
<td>OFFSHORE</td>
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<tr>
<td>Generate high returns to fund diversified growth, focusing on high quality resources</td>
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<tr>
<td>High cash generation</td>
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<tr>
<td>Shorter payback period</td>
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<td>Quick to market</td>
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<tr>
<td>IRR &gt; 15%</td>
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<tr>
<td>Payback within 5 years¹</td>
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| **CHARACTERISTICS**        |
| Pipeline                    |
| Leveraging infrastructure to monetise undeveloped gas, including optionality for hydrogen |
| Stable long-term cash flow profile |
| Resilient to commodity pricing |
| Long-term cash flow         |
| Strong forecast demand      |
| Upside potential            |
| IRR > 12%                   |
| Payback within 7 years¹     |

| **NEW ENERGY**             |
| Diversified                |
| New energy products and lower carbon services to reduce customers’ emissions; hydrogen, ammonia, CCUS² |
| Developing market          |
| Lower capital requirement  |
| Lower risk profile         |
| IRR > 10%                  |
| Payback within 10 years¹   |

| **EMISSIONS REDUCTIONS**   |
| 30% net equity emissions reduction by 2030, net zero aspiration by 2050 or sooner² |

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1. Payback refers to RFSU + X years.
2. Target is for net equity Scope 1 and 2 emissions. Relative to a starting base of the gross annual average equity Scope 1 and 2 emissions over 2016-2020 and may be adjusted (up or down) for potential equity changes in producing or sanctioned assets with an FID prior to 2021. The starting base will be adjusted for the combined Woodside and BHP petroleum portfolio.
3. CCUS refers to carbon capture utilisation and stored 2 emissions over 2016-2020 and may be adjusted (up or down) for potential equity changes in producing or sanctioned assets with an FID prior to 2021.

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NEW ENERGY PRODUCTS

Our near-term customer focus areas

Inputs

- Renewable electricity
- Natural gas

Carbon-neutral hydrogen production

- Electrolysis
- Steam methane reforming
- CO₂ management

Transport and storage

- Ammonia or other hydrogen carriers
- Liquid hydrogen

End use

- Heavy vehicle transport
  - Solution for heavy transport.
  - Expected to play a key role in realisation of climate targets.
  - Truck OEMs scaling up hydrogen fuel cell operations.
  - Line of sight with the right customers to diesel parity now.

- Power generation
  - Transportable, market competitive option for reducing power generation emissions.
  - Ammonia has both green (with renewables) or blue (offsets with CCUS) options.

- Industrials and chemicals

Near-term customer focus areas for Woodside
NEW ENERGY

Woodside Projects

H2Perth
Proposal for a world-scale hydrogen and ammonia production facility
Phased development: First phase focused on lower-carbon, low-cost and early hydrogen: 65 TJ/day natural gas and up to 250 MW electrolysis
Project designed to abate, store and/or offset all emissions associated with the production of hydrogen and ammonia
Later expansion to be driven by additional renewable energy developments

H2TAS
Proposal for renewable hydrogen production for export as ammonia
Phased development: First phase 300 MW electrolysis capacity
Planned to be powered by a combination of wind and hydropower

Heliogen Collaboration
Commercial-scale demonstration deployment of Heliogen’s AI-enabled concentrated solar technology
Initial phase targeting 5 MWe
Concentrated solar energy system to deliver clean energy with nearly 24/7 availability

Woodside Solar Project
Proposed solar photovoltaic power facility
Solar facility could supply up to 100 MW of solar energy to Pluto LNG and other customers
Complemented by battery energy storage systems
First construction subject to primary approvals and targeted in 2022
Energy transition plan

2021

Market development
- Build relationships across value chain
- Technology flexible (hydrogen, CCS, renewables)
- Secure land and customers for projects
- Grow offsets portfolio to support base business
- Develop CCS opportunities
- Leverage existing capabilities

Mid-2020s

Early new energy transition
- Achieve start-up of new energy projects
- Scale-up carbon offset projects
- Export ammonia from Australia
- Develop CCU opportunities
- Progress CCS opportunities

2030+

New energy at scale
- Export liquid hydrogen from Australia
- Scale-up CCS activities
- Expand production to match market scale

NEAR-TERM CUSTOMER FOCUS AREAS

Hydrogen for heavy vehicle transport
- Expected to play a key role in realisation of climate targets
- Truck manufacturers scaling up hydrogen fuel cell operations
- Line of sight to diesel price parity

Ammonia for power generation
- Transportable, price competitive option to reduce carbon emissions
- Exploring opportunities with existing customers

CCS refers to carbon capture and storage. CCU refers to carbon capture and utilisation.
All dates and plans are Woodside targets unless otherwise specified and subject to market conditions, regulatory approvals, government approvals and commercial agreements.
Partnerships for Transformation; do’s and don'ts's

do’s
1. Create a company policy and language:
2. Include innovation in company process
3. Create roles for innovation leadership
4. Make production No#1 internal customer
5. Formalize Grants and R&D Credits
6. Form a few major partners, longer term 5-7Yrs

don'ts’s
1. Don’t make it a gift
2. Don’t do research without an adoption track
3. Don’t overlook current customers
4. Don’t overlook future customers
5. Don’t overlook all the TECOP steps in your innovation pathway especially P and O and C
6. Don’t overlook 3rd party technical assurance
FUTURELAB Elements

- **FutureLab** can be considered in terms of 4 main elements:

  1. **Hubs** – Connection to leading-edge R&D capabilities at major Australian and US universities, as well as industry-based innovation networks.

  2. **Crowds** – Access to large curated communities of problem solvers via global crowdsourcing platforms and technology search and landscaping services.

  3. **Exchange** – Woodside’s scalable idea management platform for accelerated sourcing of ideas and feedback in Team and Corporate challenges.

  4. **Spark** – Woodside’s structured interface to the global start-up and SME community, sourcing innovations and investment opportunities aligned with our current value chain and future challenges.
FutureLab is the gateway to a global network of thought leaders and problem solvers. This includes well established Hubs at leading Australian universities. It also incorporates interfaces with global university partners and industry-based innovation clusters. Targeted research programmes are supplemented by more agile and innovative leverage of Hub expertise. FutureLab Hubs provide access to technical authority for disciplines in which Woodside has limited experience or capability.
MONASH UNIVERSITY

Timeline

2016
Darton initiated 3D printed spare parts on demand in both metals and polymers

2016-2017
Built layout model of Pluto Ova Plant to optimize equipment position and pipe routing. Reduced plant footprint by estimated 20% and cost by 25%.

2017-18
Wind Tunnel testing of various Woodside structural assets

2019
Plant layout system installed at Woodside and applied to other plants, e.g., NexGen

2019
STOPAD officially approved for use on chilled steel vessels and plant fluid

2019
CO2 probe site trial at KOC

2020
Inventory management system to estimate lead times and confidence intervals for very given product combination

2021
Innovated 3D printed monolayers, manufactured at Monash, into critical hypochlorite solution at offshore asset

2021-2022
Interactive system built for a minimal cost network of 12 production facilities to support Woodside’s KOK project

2021-2022
Pick-up of 4M reading within Woodside, including an app for ordering 3D printed parts

June 2016
FutureLab officially opened at Monash University as a 5-year philanthropic partnership, with Nick Biddle as Chair:
- Chris Hutchinson (lead additive manufacturing of metals) and Sebastian Thoms (lead corrosion) linked with Mike Bream as Woodside focal, and
- Maria Garcia de la Banda (lead data sciences) linked with Daniel Hackett

2018
Chris Hutchinson and Maria Garcia de la Banda become co-chairs

2019
Michael Firth invented full-time Woodside presence at Monash, creating stronger ties with multiple technical leads

2020
Bayesian Networks demonstrate advantage for risk management w.r.t. Woodside’s approach

End 2020
Partnership renewed for 5 years with Chris and Maria as co-chairs, Jason Hill as new Woodside Monash Partnership Manager

July 2021
Lee Ojima seconded to Perth as Additive Manufacturing Subject Matter Expert. Erin Brodie onboarded as FutureLab Research & Innovation Manager

2018
Chris and Elizabeth Cuff, former Dean of Engineering, visit Woodside Perth to discuss expanding the partnership into hydrogen

2018-2019
Development and implementation of the Woodside Monash Energy Partnership (WMNEP) by Jacob Jansen, Daron Hornby, Matt Naive, Andrew Hall, and Chris Hutchinson

2019-2020
Launch of the WMNEP

2020
Projects commence in New Energy Technologies, Delphi DPw, Conversion and Utilisation Energy Leadership

2020-2021
Paul Wobby appointed as Director of WMNEP with Matt Hulse as Associate Director

2021
Monash Carbon Capture and Conversion student team wins XPRIZE CARBON REMOVAL competition (US$250K Prize)

2022
$2M ARC Research for Carbon Utilisation and Recycling awarded by the Australian Research Council, with Woodside as lead partner.

Change of data science focal point at Woodside

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Examples from Monash

**ARC Industrial Transformation Research Hub**
Australian Research Centre for Carbon Utilisation and Recycling
$21 million centre over 5 years (2023-2028) | 5 AU Universities | 21 Industry Partners | 3 International Centres
- Industry contribution: 4.5M | Government: 5M | University cash: 1M | Total In-kind: 11M

**ARENA Transformative Research Accelerating Commercialis**
Ultra low cost solar – Low-weight PV System Deployment
$5.5 million initiative over 4 years (2022-2026)
- 2 AU Universities and 2 Industry Partners
- Industry contribution: 1.5M (cash), 0.5M (in-kind)
- Government: 2.4M (cash)
- University: 1.1M (in-kind)

**ARC Linkage Program**
3-D Printed Catalytic Monoliths for Energy Efficient Carbon Conversion
$1.73M initiative over 3 years (2023-2025)
- 1 AU Universities and 1 Industry Partner
- Industry contribution: 300k (cash), 360k (in-kind)
- Government: 400k (cash)
- University: 40k (cash), 630k (in-kind)
FutureLab Exchange (FLEX)

- FutureLab Exchange is Woodside’s idea management platform.
- It is a highly scalable and simple way of accelerating the capture of ideas and feedback for specific challenges.
- It can be used by individual teams or for much larger-scale corporate challenges.
- Exchange can be also be used to capture and evaluate ideas in real time during ‘ideation’ events.
- The platform can be opened to input from our innovation partners.
- It is highly inclusive and encourages openness and a collaborative mindset.

FutureLab Exchange is custom-built on ideation platform templates provided by Crowdicity and Planview Spigit.
FUTURELAB
Case Study - Innovation for Operations

KGP FutureLab

The Problem
• No opportunity to regularly connect site-based Operations and Maintenance staff with new developments and innovation in relevant technologies.

The Solution
• KGP FutureLab has been activated as a locus for interaction between Technology and site-based staff. The FutureLab Team run regular Technology Showcases to connect Operations and Maintenance with the latest developments in corrosion management, 3D printing, robotics etc.

The Outcome
• FutureLab has built trust and credibility with the site-based community and people are now proactively coming forward with operational problems for FutureLab and the Production Technology Team to solve.

3D-printed prototype of a new scaffolding clip protector designed by FutureLab in response to an HSE-based challenge brought to the Team by site-based staff.
Thank you for your attention