

# FUTURELAB

Your portal to the FutureLab program



woodside.com.au/innovation





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Let's get started



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### Welcome to FUTURELAB

Woodside is the pioneer of the LNG industry in Australia and the largest a global portfolio and are recognised for our world-class capabilities as an integrated upstream supplier of energy.

We started with a bold idea and the drive to see it through, and more than 60 years later this pioneering spirit still guides us to safely and sustainably unlock energy for our future. From world-record drilling depths in the 1950s, to deploying the latest advances in robotics and cognitive computing, our story is one of progress.

Technology and innovation are essential to our long-term sustainability.

As the world becomes more interconnected, information, insights and ideas from disparate organisations can be rapidly shared and built on to deliver new solutions to existing challenges.

FutureLab was created to bridge a gap that exists between 'business as Australian natural gas producer. We have usual' and 'business as possible'. We are measurable ways. growing a community of exceptional thinkers and innovators that can work together to accelerate growth for better ways of working, a better workplace, and a better world.

> FutureLab supports innovation across our network by facilitating idea realisation and enabling collaboration.

> By working with researchers, entrepreneurs, subject-matter experts and parallel leading industries, we aim to leverage our capabilities to solve industry challenges and create shared opportunities along the way. We encourage blue-sky thinking.

Since FutureLab was established, we've connected dozens of new industry and aligned partners. We've supported academic research by global thought leaders and funded the work of bright young minds.

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But more than that. FutureLab has delivered better in tangible,

Our Woodside Heroes are tapping into the unparalleled expertise from our partnerships to improve industry standards in vessel positioning and electrical junction box maintenance, among other successes.

And more than 30% of Woodsiders have participated in an innovation campaign or action-learning event, continuously improving their professional and social innovation skills.

With a host of new projects well advanced and plans for new collaborations underway, it's an exciting time to become part of FutureLab.

#### Together, we're turning bold into better.

### Technology, meet

Technology is crucial to our business, allowing us to perform at the highest level and stay ahead in an ever-changing world.

Woodside's technology strategy focuses on four key areas to accelerate growth. FutureLab supports this by exploring opportunities to improve our capabilities in these areas:

#### **Conventional Technology**

Looking for breakthroughs that will lift production, reduce costs and improve our performance from exploration through to production and sales.

#### New Energy

Supporting the transition to low carbon energy, including promoting the development of a market for LNG fuels, integrating renewables and battery storage into our facilities' power supply and pursuing opportunities in the development of hydrogen as an energy source.

Harnessing technologies including smart wireless surveillance via sensors and robots, data storage, analytics and machine learning that can provide insights to enable better decisions and avoid disruptions to operations.

#### **Carbon Management**

#### Intelligent Assets

Accelerating the development of technology to manage Woodside's carbon and greenhouse gas emissions.  $\bigcirc$ 

### Understanding your CHALLENGE

Challenges come in all shapes and sizes, and understanding the specific problem at hand is integral to coming up with realistic solutions.

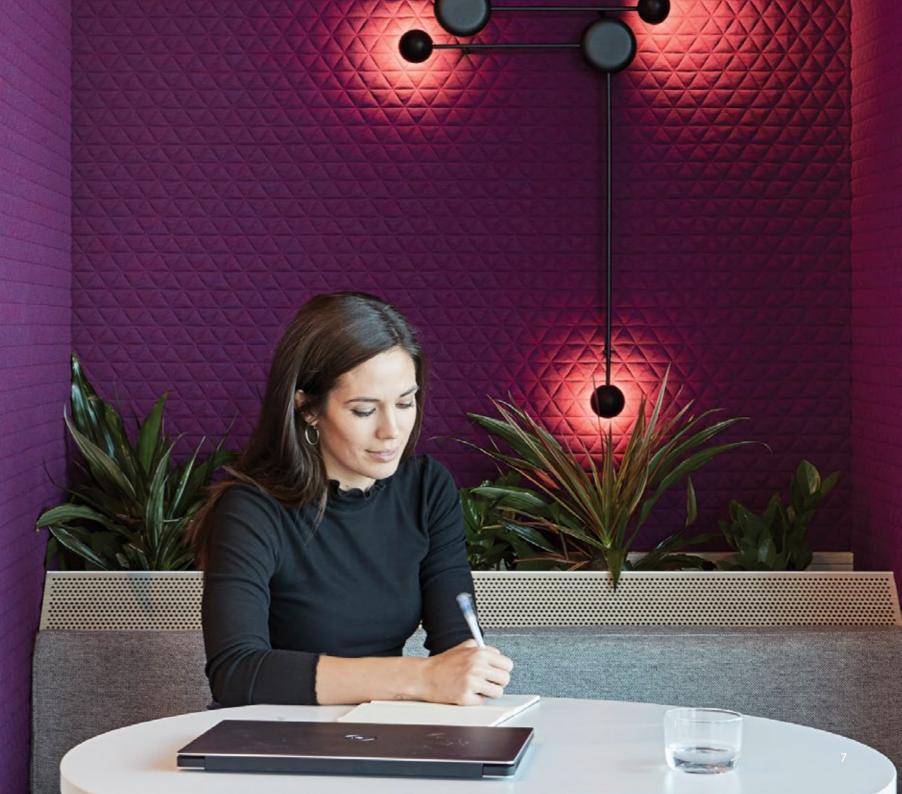
Your challenge may not need to evolve into a prototype - you might just need help locating the right expertise to progress existing research or develop a virtual interface.

Creating a challenge statement will help you know how to reach out to FutureLab effectively. And it will guide us in linking you with the right resources.

#### A good challenge statement has:

- All the information necessary to fully describe the current situation.
- Reference to the desired end state when the problem is solved.

We encourage you to continue to refine your challenge statement if you find it does not ask the right questions.



### The FutureLab INNOVATION • PROCESS

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FutureLab's innovation process utilises our 'think big, prototype small, scale fast' approach.

The 40:20:40 rule helps you apply this concept to problem-solving, ensuring effort is invested in the right areas to expedite high-value ideas into applicable outcomes.



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#### SCALE FAST



#### Prototyping and deployment

- Develop a working example/prototype.
- Qualify and implement the solution into the relevant environment in a timely manner to ensure solutions create value.
- Communicate your success.

#### Mature to Procure (M2P)

• Secure strategic partnerships to deploy the solution on a larger scale.

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#### **Expertise**

Access subjectmatter experts and innovative people.

#### **•** Hosting

Utilise a FutureLab space across our network

#### Learning

Facilitate and participate in activities to develop professional, technical and innovation skills.

#### **Q** Engagement

Connect with industry, academics and our community partners to share knowledge and positive influence.

# FUTURELAB

#### Campaigns

Facilitate and participate in events dedicated to problem-solving.

#### Construction

Build prototypes and perform experiments.

#### Research

Commission long-term or bespoke research.



## HOSTING

Spaces across our network can be reserved for innovation activities through FutureLab.

Woodside's campus in Perth. Mia Yellagonga (MY), was designed to promote collaboration in concentrated

areas, equipped with state-of-the-art audiovisual amenities and work spaces suited to any level of interaction.

Boolah Daa Moort offers large spaces suitable for running workshops and seminars.

Our Cara auditorium hosts up to 400 people, perfect for keynotes, launches or panel sessions.

Level 3 of MY's Karlak tower offers formal and informal spaces to hold meetings with Woodsiders specifically.



#### Pop-Up FutureLab

The pop-up FutureLab is our latest

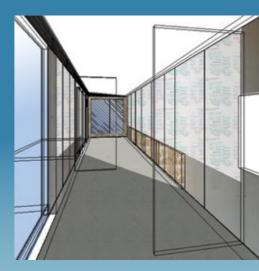
Designed to facilitate hands-on problemsolving, tech demonstrations, education sessions, and operations support, the lab is mobile and can be deployed in urban and remote locations to suit the needs of the client.



Collaboration spaces on level 3, Mia Yellagonga.

#### The lab can support business and community events, like:





Artist impression of the pop-up lab fit out.



## RESEARCH

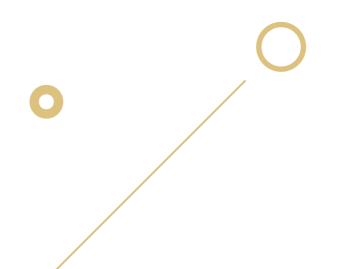
Research activities can be supported by FutureLab, either by securing a researcher at one of our university hubs or coordinating research with one of our partner organisations.

### Woodside has previously organised research in the fields of:

- Materials science
- Corrosion
- Pipelines
- Floating facilities
- Machine learning
- Bayesian networks
- Construction management
- Geophysics
- Computation geoscience

### Forms of research FutureLab can organise:

- Industry-led research
- PhD research
- Research fellowship
- Research-based internships





Additive manufacturing prototype produced by Monash University through the FutureLab Innovation Centre.



Collaborating on real-world challenges in a team-based environment not only creates solutions, it drives learning and skill development simultaneously.

Action-learning exposes you to diverse perspectives and new ways of thinking, helping you develop your professional competencies, leadership skills, and expanding your professional networks.

We facilitate action-learning through co-hosting events at Mia Yellagonga, across our FutureLab hubs, and in our pop-up lab.





## ENGAGEMENT

The reputations of the institutions we collaborate with provide excellent platforms to participate in constructive debate, high-profile discussions and teaching opportunities.

Through these relationships, we have a unique opportunity to engage and influence with peers across industry, academia and today's youth, sharing new ideas, and championing technical progress.

FutureLab supports a range of engagements promoting youth interest in STEM, technological innovation in Western Australia and women's professional involvement in academia and the oil

Engagements include but aren't limited to:





Girls in Engineering Engagement Program, facilitated by University of Western Australia and FutureLab.



Vice Chancellor keynote and network event, facilitated by Women of Indian Ocean Marine Research Centre (IOMRC) Network and FutureLab.

## • o Campaigns

FutureLab campaigns generate new ideas and workable solutions.

There are no constraints on size, discipline, or location.

You can select the most appropriate event that suits your challenge and your desired outcome.

## Campfire chats Information-sharing sessions intended to either teach a new skill, share new insights, provide updates, or increase awareness on a topic that is relevant to you or your challenge.

#### **Hackathons and Data Hackathons**

Sprint-style problem-solving events that use decision-gate checkpoints and the 40:20:40 rule to drive intensive ideation and solution selection.

Hackathons can be incorporated into events like conferences and workshops to build upon learnings and navigate new ways to implement new information into current challenges.

#### Site Visit

Intended to take innovators to where the problem is occurring, to gain a fresh perspective and engage practitioners.

#### **Grand Challenge**

A virtual event similar to a hackathon, but suited to more complex problems that require more than a day to solve. FutureLab Exchange is used to facilitate these events, and they are usually more widely communicated across the FutureLab community to create momentum and increase participation.

### FutureLab Exchange



FLEX is our online platform dedicated to crowd-sourcing solutions. It connects you with new and existing FLEX users to come together and workshop a challenge, while tracking the thought processes of your contributers.

Events like hackathons can be facilitated through FLEX, and can be tailored to suit your timing and scope requirements.

We have previously run FLEX campaigns on health and safety performance, carbon management and digital operations optimisation.

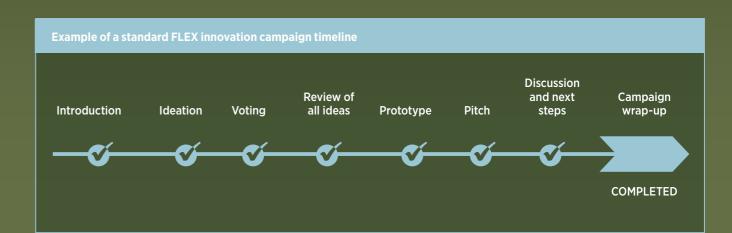
You can reach FLEX at crowdicity.woodside.com.au

1 - 3 days

1 day -2 weeks

Up to 30

) days





- Collaborate with each other to solve FLEX challenges.
- Submit and vote on ideas.
- Provide feedback to challenge owners.

#### Challenge owners

- Champion the challenges they submit into FLEX.
- Monitor ideas and feedback provided by the community.
- Drive their challenge's social innovation process.

### FutureLab ECOSYSTEM

Through our technology strategy, we are taking our industry to new frontiers by adopting and developing innovations that build on our strengths - yet challenge our thinking.

As a world-class oil and gas company, we pride ourselves on the strength of our own expertise. But we also understand the importance of collaborating with external networks to problem-solve and provide alternative and complimentary expertise.

We continuously establish relationships across industry peers, service providers, academia, government and advocacy bodies to drive technological advancements We call this our FutureLab Ecosytem. With support from FutureLab, Woodside has secured Memorandums of Understandings on technology cooperation with major companies in Korea, China, Japan, Germany, Norway, UK, Italy, Indonesia and USA to drive growth.

FutureLab has also opened unique channels for strategic research with universities and industry partners, providing opportunities to work across each other's ecosystems. We have significant partnerships with Monash University, the University of Western Australia and Curtin University where we collectively draw upon each other's subject-matter experts to innovate. We proudly support initiatives that leverage start-up companies and dynamic new players across industries to share work and upscale their outreach. In recent years, we have supported programs like Western Australia Innovator of the Year, KPMG Energise, Offshore Technology Conference Asia Research and Development Showcase, and help fund the build of Innovation Central Perth at Curtin University, designed to support innovative start-ups in the field of Internet of Things.

Our FutureLab Ecosystem helps our partners reach their goals by working together with Woodside, and helps us become more resilient and creative in our innovation journey.

#### Woodside Subject-Matter Experts

- Engineering
- Geoscience
- Environmental Science
- Logistics
- Data Science
- Project Management

#### FutureLab University Hubs

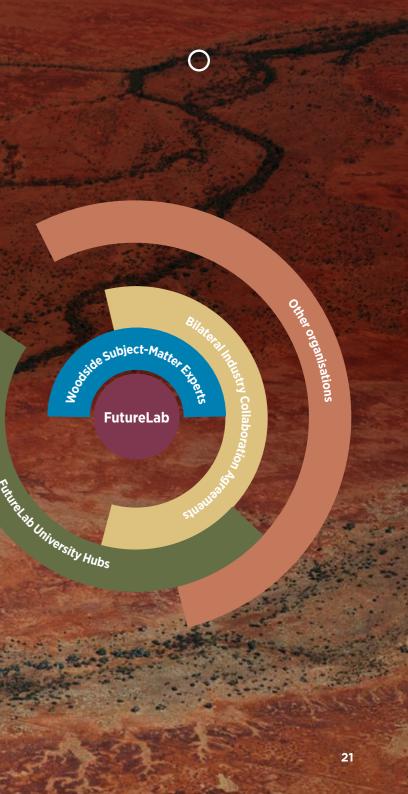
- Monash University
- University of Western Australia
- Curtin University

#### Bilateral Industry Collaboration Agreements

- Strategic service providers and vendors
- Industry peers
- Unconventional technologies

#### Other organisations

- Department of Jobs, Tourism, Science and Innovation
- National Aeronautics and Space Administration
- Committee for Economic Development
   of Australia
- Massachusetts Institute of Technology



# FutureLab

Our university partnerships help us collaborate with academics and experts across a range of technical fields. We can create shared value by supporting long-term research and prototyping activities, growing excellence in academia and industry practices.



- Additive manufacturing facilities
- Materials engineering expertise
- Data science expertise
- New energy research



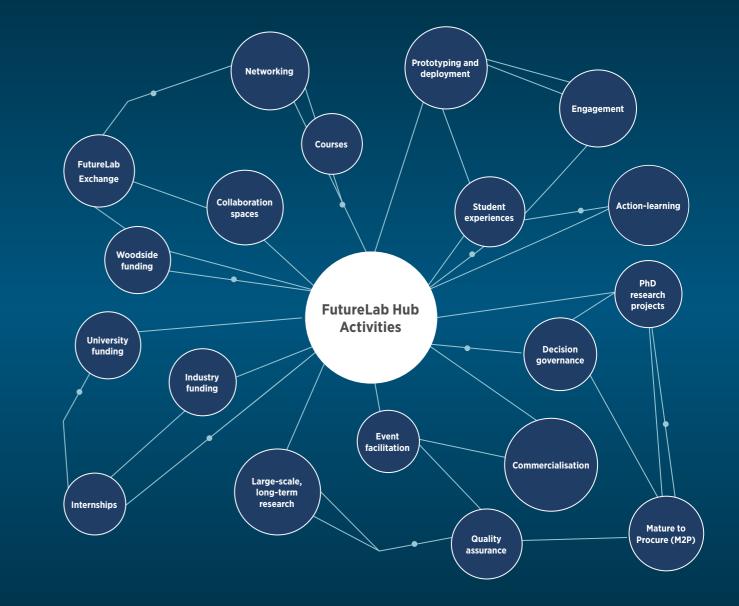
#### University of Western Australia

- OceanWorks
- RiverLab
- EZONE UWA
- Centre for Long Subsea Tiebacks
- LNG Futures Facility
- Ocean engineering
- Biological science expertise



#### **Curtin University**

- Corrosion Engineering Centre
- Innovation Central Perth
- Chemical engineering lab
- Digital Internet of Everything
   expertise
- Construction technology
   expertise



### FutureLab at Monash University



Interns working out of the Woodside Innovation Centre, Monash University.

Monash University is Australia's largest technical university and the top Australian university for material engineering. The department is one of the oldest of its kind globally, established in 1970.

#### FutureLab and Monash

Our Woodside Innovation Centre is located at Monash's Clayton campus, combining superb facilities and equipment with talent.

We have experts and support staff available to facilitate problem-solving, including an Innovation Centre manager, a full-time post-doctoral researcher, PhD researchers, undergraduates and interns.

#### The Centre has a dedicated boardroom, materials engineering space, a proof of concept laboratory and a prototyping lab specialising in additive manufacturing (metals and non-metals) and software development.

We also fund a Professorial Chair of Material Science at the university.

#### Expertise

The Innovation Centre can provide access to researchers, experts, students, interns or equipment available through our partnership and beyond.

#### Construction

Our prototyping lab has created additive manufacturing and software prototypes that have capacity to be implemented into our business in the near-term.

#### Research

We have previously commissioned long-term research at Monash in corrosion, additive manufacturing, machine learning and autonomous design. New research can be organised under our Multi-Project Framework Agreement.

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#### Auto-layout Visualisation Tool

Woodside was looking for ways to optimise the design and layout capabilities of piping infrastructure that traditionally relies on judgement of expert piping engineers.

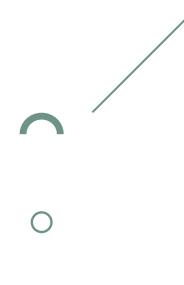
Through our partnership with Monash, we were connected with research fellows in optimisation and visualisation that worked on developing a piece of software that could leverage machine learning to identify and manoeuvre around common design challenges. While initially focusing on pipeline rerouting optimisation, the auto-layout tool expanded to encompass acid-gas removal units, and we eventually began testing the tool's intuitiveness against our existing Pluto LNG Plant layout, yielding encouraging and positive results.

Currently, the tool can model high-level design possibilities and suggest alternative layouts for infrastructure and equipment locations for small-scale LNG plants, allowing engineers to focus their time and expertise on more complex plant



design elements. The tool has the ability to reduce 3D modelling design times from eight weeks down to just one, and is currently in its beta testing phase.

Auto-layout prototype in beta phase.



### FutureLab at the University of Western Australia

FutureLab's involvement with the University of Western Australia (UWA) is wide-reaching, offering various spaces and expertise.

Recognised as Australia's top university for ocean engineering, UWA offers expert knowledge and intensive-research capabilities.

#### FutureLab and UWA

Our OceanWorks hub, located in the Indian Ocean Marine Research Centre at the UWA Crawley campus is designed to bring collaborators interested in ocean engineering together to network and develop solutions to new and existing challenges. Events including technical presentations professional networking sessions led by both industry and researchers take place at the hub to promote learning across disciplines and community.

#### Expertise

The Centre for Long Subsea Tiebacks, a joint initiative between industry and UWA, and supported by Woodside, drives research into new subsea engineering technologies for offshore oil and gas production and creating solutions to enhance the economic feasibility of remote offshore gas production.

iverLab is a joint initiative between /oodside and UWA, aiming at developing nnovations in offshore engineering and biological sciences through research, education and outreach. The program utilises Perth's Swan River and its steady supply of wind power to understand wave-structure interaction, and explore geomechanics and biomonitoring.

Noodside is also a proud foundation bartner for EZONE UWA, a world-class earning space designed for engineering and mathematical science disciplines to co-locate with industry and undertake oint-value research. It includes three science aboratories, 11 teaching rooms, a café, and office space for 150 higher degree students.

he Offshore Floating Facilities and the NG Futures Facility on campus also rovide state-of-the-art research bases.

#### Construction

UWA has extensive prototyping capabilities in flow assurance, geotechnical centrifuge testing, gas absorption treatment, floating basin testing and pipeline stability.

#### Research

We have previously commissioned long-term research in weight coating stablisation of submarine structures, and pipeline impacts during rough weather conditions. New research can be organised under our R2D3 Alliance Framework Agreement.



The RiverLab team deploying a model of a Floating Production, Storage and Offloading vessel in the Swan River, Western Australia.



CeanWorks hub, University of Western Australia.



#### Vessel Operability Positioning Analysis Tool

Woodside was looking at improving methods of estimating the unique operability and response of different vessels we often use for offshore activities, in order to improve accuracy of our vessel impact and response estimations.

Through our partnership with UWA, we connected with academics in hydrodynamics that began creating software that modelled the interplay between ocean and vessel behaviours using state-of-the-art theories. In less than three months, a generic analysis tool was developed that could predict how different vessels and platforms would respond in varying conditions. The tool was thoroughly verified, including industry peer-review, enabling critical decision-making related to drilling plans.

The tool has been distributed across the business and has been used successfully in rig selection and scheduling for a number of our offshore exploration activities. It has created a step change in the quality of engineering information used to inform decision-making, providing significant commercial value to Woodside.

### FutureLab at **Curtin University**

Curtin University is ranked within the top one per cent of universities worldwide, known for their technical excellence in science studies. and places second in the world for mineral and mining engineering.

#### FutureLab and Curtin

Curtin offers a number of spaces to pursue technical innovation.

Innovation Central Perth is a digital technology and design space co-funded by Woodside, leveraging cloud, analytics and Internet of Everything (IoE) network platforms to create tech solutions.

The Corrosion Engineering Centre is dedicated to corrosion research and shortterm development related to the petroleum, mining and chemical processing industries. The Centre holds test chambers for simulated corrosion, high temperature and pressure autoclaves and a LNG ambient vaporisation experimental rig among other research and

We also co-sponsor a Chair in Corrosion Engineering, located at the Corrosion Engineering Centre.

#### Expertise

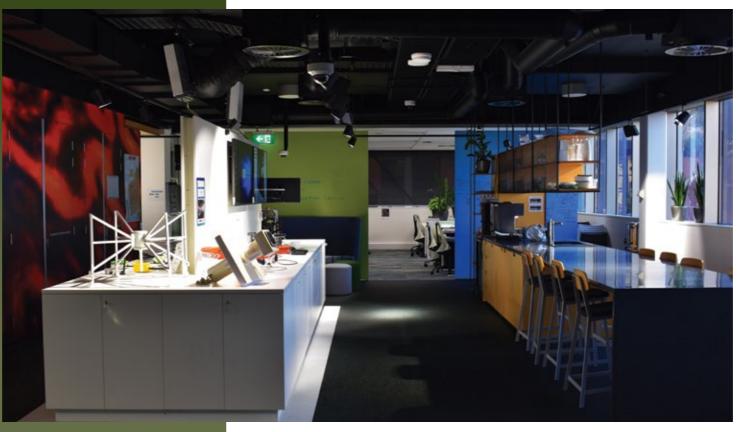
Curtin can provide access to experts in areas such as corrosion, information and communications technology, construction technology, and beyond if required.

#### Construction

Curtin has prototyping capabilities in wet corrosion testing, information and communication technology interfaces, building information modelling (construction technology), cryogenic flow testing and LNG vaporisation.

#### Research

We have previously commissioned long-term research in corrosion and across the chemical engineering discipline. New research can be organised under our R2D3 Alliance Frame



Innovation Central Perth, Curtin University.

#### **3D-Printed Packing Improvements**

Woodside was interested in understanding the performance of the traditional internal surface and packing features of absorption and distillation columns, to then create novel internals for improved performance.

Through our partnership with Curtin, we engaged a set of chemical engineering interns who used hydrodynamic simulations to identify shortcomings of standard packings.

Throughout the project, our interns assisted the research team to develop a packing design that minimised gas flow resistance and pressure drops. By using additive manufacturing techniques, they strongly contributed in fast-tracking the conceptualisation and testing of their prototypes.

Curtin is currently progressing commercialisation activities for these inventions, which is likely to be a major breakthrough in this area over the past 30 years.

## Let's get STARTED

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FutureLab at Woodside	Woodside FutureLab team E: futurelab@woodside.com.au						
FutureLab at Monash	Woodside Innovation Centre E: woodsideic@monash.edu						
FutureLab at UWA	OceanWorks E: oceanworks@uwa.edu.au						
FutureLab at Curtin	Director of Research Partnerships						





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Head Office: Woodside Energy Ltd Mia Yellagonga 11 Mount Street Perth WA 6000 **Postal Address:** GPO Box D188 Perth WA 6840 Follow us: