

**Peter Coleman – the Next Wave of LNG Growth**  
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Can I start by commending APPEA on the composition of this panel? If you'll forgive me, Nigel, I'm not really referring to you and me. You would expect to hear from us at an APPEA conference.

I'm talking about Amy and Larry. It was terrific to hear Amy's comments about the global context and to hear from Larry about the role of the CSIRO. The CSIRO has a wealth of expertise. If we are not tapping into this fantastic resource, we are missing out.

That's a theme I want to draw out today as I discuss how we are preparing for the next wave of LNG growth. We are forging relationships beyond our industry to help us do things better – whether it's the scientists at the CSIRO, universities and NASA or the innovators and inventors in other industries.

We welcome disruptors and are open to new ideas.

At Woodside, we love tech geeks, but innovation is much broader than that. It's the ability to discover, develop and test ideas and solutions that can improve the way we do things across our entire business.

Innovative thinking should shape everything we do: from the design of our facilities, to the commercial arrangements that underpin them, to how we and our partners interact with others in resource development.

We can achieve the best outcomes if we combine innovative thinking by our own people with fresh ideas from outside our industry.

Those external perspectives can save us from the complacency that is a real risk if we just talk to each other, in our own echo chamber.

We should not take for granted our role in the future energy mix. There's opportunity on the horizon, but there's stiff competition – from other gas producers and other energy sources.

Business as usual is just not going to cut it these days. The world has moved on. We need to reshape what we do and how we do it.

As we prepare to expand production to meet emerging global demand for LNG, we need to learn from the last construction boom and take the complexity out of development. We also need to think about how things are changing.

I'll talk today about three transitions:

- in the design of our facilities;
- in our commercial and marketing arrangements;
- and in the longer-term energy mix.

These transitions are shaping our plans as Woodside enters a growth and construction phase on the Burrup Hub, which will support thousands of jobs as we invest billions of dollars in developing gas for domestic and export markets.

We've described our plan to process the Scarborough and Browse resources through the Pluto and North West Shelf facilities as "bold but simple".

Bold because it involves the development of some 20 to 25 trillion cubic feet of gross dry gas resources. Simple because we are relying on proven facilities. We can add “smart” to that description: bold, simple and smart.

Our plans to upgrade the Pluto and North West Shelf facilities give us an opportunity to integrate advanced technologies that were not available when these plants were built. We have proven, reliable plants that we can now transform into smart plants.

We are making sure that the design of our facilities allows for the capture, transmission and analysis of data. We are not giving our plants a mere facelift – we intend to install a whole new data-driven nerve system.

Let me explain by talking about our smart sensors: a small magnetic device, 12cm by 7cm, which can sense and transmit data about how equipment is performing.

The smart sensors started as a tech project, exploring the potential for wireless data-streaming, but the team very quickly went out to our facilities to ask what problem needed solving.

The answer came back that we wanted to improve monitoring of machine health.

To do this, we designed the smart sensors in-house, reducing the cost from around \$30,000 to purchase and install a device to less than \$300 - and we may even be able to get this down to \$30, if not \$3.

This is significant because we intend to deploy thousands per facility to give us a wealth of data that we have not had before.

The sensors can detect and identify problems with a machine's performance by a change in vibrations and temperature. That data can be updated continually. With the right algorithms, we can analyse it and improve how our facilities operate.

This builds on previous work with the CSIRO on wireless technology. We also reached agreement just last week with CSIRO to collaborate on transforming existing off-the-shelf vehicles into autonomous robotic systems. Separately, we are working with NASA to understand how the latest developments in robotics can be applied in remote locations where we work.

Together, these technologies will give us the ability to detect and respond to emerging issues in our facilities before they disrupt operations.

We are harnessing technologies that have developed outside of oil and gas – data science was pioneered by the finance sector looking for trading algorithms; digitization is being driven by the development of smart home appliances; and progress on robotics has arguably been propelled by the push for autonomous vehicles.

These technologies have been matured for other purposes, but can now be deployed to improve our operations.

We recognize that we need to tap into expertise across different disciplines and that the experts won't always come to us – sometimes we need to go to them. That's the reasoning behind our FutureLab collaboration hubs at the University of Western Australia and Monash and Curtin Universities, recruiting some of the brightest minds to work on solving our problems.

The FutureLab concept is as much a way of thinking as a physical space. It's a mindset that can apply more broadly across our business.

Shaun Gregory, our EVP Exploration and Chief Technology Officer, will talk later in the week about our approach to innovation, explaining that it's very structured and focused on solving problems. Shaun describes it as: think big, prototype small, scale fast.

That's an approach that can also be applied to other challenges, including those of a commercial nature.

As an industry, we need to think fundamentally differently about how we do negotiations.

As we plot the development of the Burrup Hub, we are talking with our joint venture partners about new approaches, leveraging infrastructure for maximum value. The nature of our commercial arrangements is changing and so is our approach to marketing our product.

We need to be prepared to step outside our comfort zone. That was the case for Woodside as we planned the LNG truck-loading facility we are building at the Pluto Plant, giving miners in the Pilbara the option of using a cleaner and local fuel, rather than imported diesel, to power their operations and run their trucks and trains.

It's different to anything we've done before. It's of a much smaller scale. But we were able to think big and see the benefits - reducing emissions and building a new market for our product in our own backyard.

So we made the call that it was an opportunity worth pursuing, unlocking commercial and environmental value. That facility will be ready for customers later this year.

In tandem, we've been preparing for what we described last year as a "quiet revolution" in global shipping ahead of the International Maritime Organisation's 2020 deadline for tighter controls on the Sulphur content of marine fuel.

We are working with the shipping and mining industries on the transition from heavy fuel oil to LNG for bulk carriers shipping Australia's biggest mining exports on the busy trade routes to north Asia.

Through the Green Corridor Joint Industry Project, we've developed a vessel design that will support LNG bunkering in northern Western Australia for two round-trips between Australia and Asia. Woodside is now designing the supply chain to provide LNG fuel from our existing operations to these vessels.

There are mounting signs globally that LNG is cracking the bunker market, including new orders for LNG-fueled ships by one of the world's largest container lines, CMA CGM, and by leading cruise companies.

The quiet revolution is gaining momentum.

That leads into the third transition I want to talk about: the transition in the energy mix. This is shaping how we think about our facilities, given our own power needs and our role in the supply of energy.

It also opens up commercial opportunities as gas displaces coal in power generation and as new demand for LNG emerges in China, India and other parts of Asia.

To capture these opportunities, we'll need innovative approaches. This may include extending our offering from the provision of LNG into the provision of gas-fired power in some emerging markets, if that is what is required to displace coal and increase our market share.

By establishing the truck-loading facility at Pluto, we are laying the groundwork for gas-fired industrial power generation in the Pilibara, preparing to showcase energy solutions that may also be exportable.

And if the best option is flexible, reliable gas-fired power complemented by renewables, we are keen to explore how we can support that.

We can start with our own facilities. When they were first designed, it made sense to use our gas to generate power to run our plants. Now, as we upgrade those plants and extend their lives, we are considering if that is the most efficient use of gas, or if we could use the sunlight that is so abundant in the Pilbara and integrate solar into our power generation.

The fuel we use to run the Karratha Gas Plant accounts for around 70% of the facility's emissions. We use around 7% of our production to generate power and run our compressors - and that's fuel we could otherwise be selling as LNG. So there are commercial as well as environmental reasons to consider other energy options.

This may include batteries. Woodside is pioneering the use of a 1MWh battery on the offshore Goodwyn A Platform, cutting emissions by reducing the need for back-up power generation, known as spinning reserve. Similar solutions may be able to be deployed in our onshore facilities to manage short-term disruptions and improve efficiency.

These are decisions we'll weigh up in the next few years - and I expect we'll see significant change in power generation at our facilities by the mid-2020s.

We are also thinking beyond that and taking a keen interest in the development of hydrogen as an energy source, driven largely by Japan. Our foundation customers were Japanese and they remain very important partners for us.

We don't know what Japan will be ready to showcase at the Tokyo Olympics, but by the 2030s I expect we will see at-scale hydrogen production around the world - and we're looking to be part of that.

The Pilbara's abundant sunlight may be useful in that context - and it's worth remembering that LNG is predominantly methane, containing four hydrogen molecules. Japan is already using our LNG to generate hydrogen. If Japan wants its future energy needs to be met through a combination of LNG and hydrogen, we are well-placed to deliver both.

It is fitting that we are having this discussion in South Australia. Power outages here in 2016 unleashed a national debate on energy that ultimately led to federal government intervention to shore up domestic gas supply in the eastern states.

In Western Australia, we already factor in domestic supply. One of the first steps in realizing Woodside's vision for the Burrup Hub has been reaching agreement to negotiate the supply of gas to a domestic industrial customer.

This reflects our thinking that you achieve a licence to export through agreeing to reliable and affordable supply to the domestic market. It's a fool's folly to think it's the other way around.

The topic for this panel is *Energy Transformation: the Future is Now*. When you're planning LNG developments, that's certainly true: you have to imagine future conditions in order to support progress on developments.

To do this, we are planning for transitions in the technology of our facilities; in our industry's commercial and marketing arrangements; and in the energy mix.

Our industry has decades of experience to draw on and learn from, but the world is changing fast - and we need to be prepared to change with it. As we embark on a new phase of growth, we are focused on the future and our role in it.

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