

APPEA 2021: The Road to Net Zero

The 2021 Australian Petroleum Production & Exploration Association (APPEA) conference was dominated by the net zero recommendations of the recent International Energy Agency (IEA) report, although a new offshore acreage round was released, and the LNG export market is expected to grow substantially.

I discuss the implications of the net zero goals for decarbonization of a global-scale natural gas and coal exporter, the opportunities and challenges to developing a hydrogen economy, perspectives on carbon capture and storage (CCS), the ever-present specter of environmental approvals for all energy suppliers, and the economic implications to petroleum companies of all scales from the responsibilities of infrastructure decommissioning.

New Energy Focus for a Resources-Rich Nation

In 2020, Australia's nominal GDP of \$1.33 trillion was 13th in the world, comparable to Brazil, and ahead of Spain. The largest export products by value were iron, coal, petroleum gases, gold and aluminum. In aggregate, those major exports account for 63.1% of overall exports sales. Beyond a dependence upon resources for export income, Australia is a vast and remote island, so it is no surprise that historical economics made the unloved energy trika of oil (39%), natural gas (26%) and coal (29%) the most practical sources of energy supply. Looking forwards to a future based upon the export and use of renewable energy, Australia represents a melting pot of challenges and opportunities: The economy must shift away from fossil fuels in an economically-manageable manner, is uniquely able to exploit an established mining industry to supply metals and other minerals that support the transition to renewables, has vast open and sun-drenched spaces for solar and wind farms, but also suffers from limited access to skilled labour and the logistical challenges of building infrastructure in remote and undeveloped regions.

The recent 2021 Australian Petroleum Production & Exploration Association (APPEA) conference, the 60th such annual event, was very clearly focused on energy transition; driven by the recent International Energy Agency (IEA) report titled 'Net Zero by 2050: a Roadmap for the Global Energy Sector'. APPEA events traditionally promote opportunities to develop the Australian petroleum industry at the corporate, government and environmental level; with the geoscience element of the technical program designed to promote undeveloped basins, present new exploration perspectives, and share insights from recent discoveries. Given the quite significant change in conference themes, the APPEA 2021 program serves as a useful insight into the changes faced by the world as it attempts to steer a new energy course.

After summarizing the status of new exploration acreage releases, I will move to the four key themes relevant to an energy industry seeking new directions, as well as cleaning up some of its older legacy.

Conventional Hydrocarbons and a New Offshore Acreage Model

Australia remains an active exploration region, with the [2020 Offshore Petroleum Exploration Acreage Release](#) recently closing, and the [2021 Offshore Petroleum Exploration Acreage Release](#) recently released. One of Australia's largest in several years, the 2020 license round included 100,000 square kilometres of open acreage across offshore Western Australia, Ashmore-Cartier Islands, the Northern Territory and Victoria. Successful bidders are granted a work bid exploration permit; a six-year title that can be renewed for a further two periods of five years. Of the 42 blocks for offer, just 15 were bid on, continuing a recent investment preference towards established petroleum fairways. Areas that did not receive a bid have reverted to vacant acreage. The new 2021 license round includes 21 blocks across Western Australia, Victoria, Tasmania and the Ashmore and Cartier Islands, and concentrates on proven oil and gas areas close to existing infrastructure in the north west and largely deepwater frontier areas of the Gippsland and Otway basins. Bidding is open and ends March 3 next year.

The bias to proven petroleum fairways must be frustrating for the many geoscientists who continue to champion petroleum systems in the vast undeveloped areas of onshore Australia—which the APPEA technical program continues to support and put a spotlight on each year—and one wonders whether a sustained supply crisis in imported petroleum liquids might be the only catalyst likely to change the status quo.

Nevertheless, the North West Shelf clearly retains most attention, driven by the external LNG market illustrated in Figure 1, and interest seems to be transitioning northwards from the mature Carnarvon Basin to the (offshore) Browse and Bonaparte Basins.

An entirely new acreage release development is the subject of a separate carbon capture and storage (CCS) nominations round this year. The call for nominations of areas for the 2021 Greenhouse Gas Acreage Release, covering Commonwealth waters across Australia, will provide companies the opportunity to obtain acreage to explore for offshore greenhouse gas injection and storage locations. Nominations are open until 5pm Wednesday 14 July 2021.

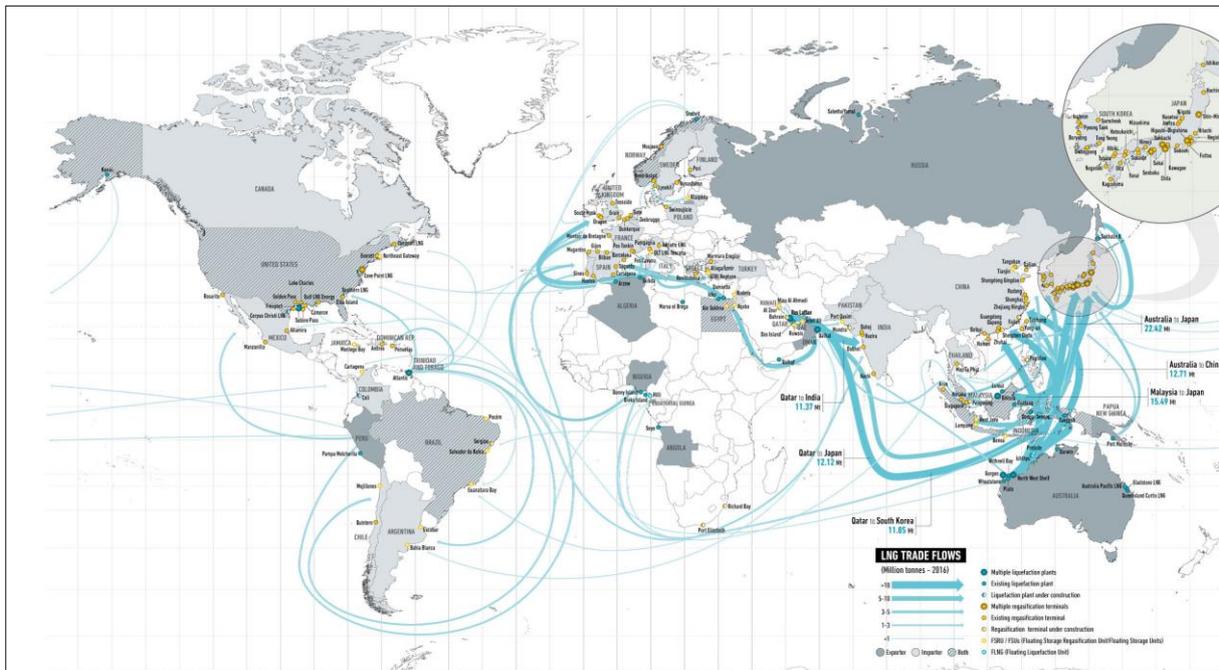


Figure 1: 2016 global LNG market by millions of tons (Source:Snam).

‘Energy for a Better Australia’

The 2021 APPEA Conference Program was notable for several themes developed in the sections below:

- Net zero carbon mmissions
- Decarbonizing the industry
- Hydrogen
- Decommissioning old facilities

The latter three activities have been high profile for several years now, but have taken on new urgency in light of new focus upon the target for net zero emissions.

Net Zero Carbon Emissions

Unsurprisingly, the recent International Energy Agency (IEA) report titled ‘Net Zero by 2050: a Roadmap for the Global Energy Sector’ generated much discussion, and in the minds of many, has already lead to unworkable expectations. For those on the petroleum side, oil exploration and project development can only end when there is sufficient power from alternative sources such as hydrogen and renewables to drive the global economy, and the latter growth will require vast supplies of minerals and metals not yet discovered or mined. But conservation movements and activists believe that with enough pressure, these goals can be realized as soon as 2030.

The IEA report stated "There is no need for investment in new fossil fuel supply in our net zero pathway. Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required." Re-phrased, the IEA envisages an historic surge in clean



energy investment driven by strong and credible policy actions from governments and underpinned by far greater international cooperation than that seen to date (refer also to Figure 2). As well as an immediate cessation in fossil fuel projects, it assumes that by 2035 all sales of new internal combustion engine (ICE) passenger cars will have ceased and that by 2040, the global electricity sector will have reached net zero emissions. From an Australian perspective, about 20 000 square kilometers of solar panels would be required to support the domestic power usage of 2 250 TWh. This will translate to large construction efforts, and large landfill projects after each solar panel needs replacement

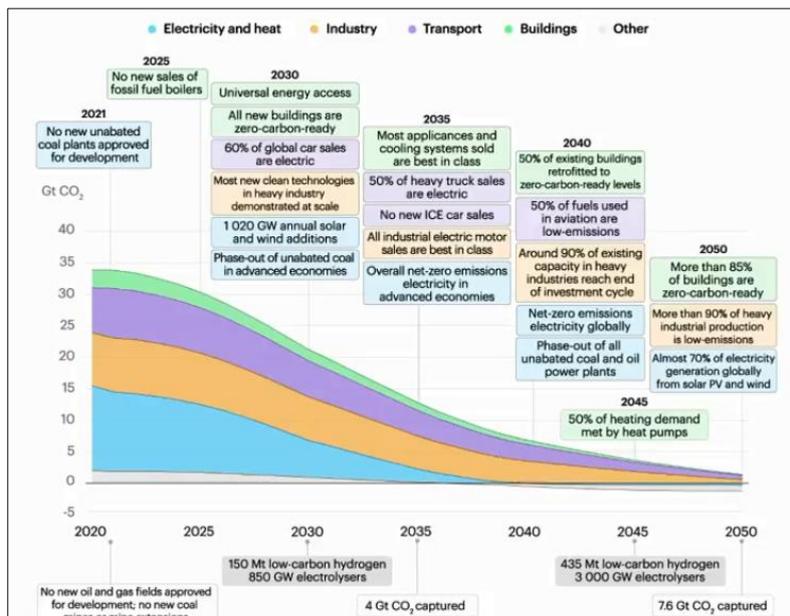


Figure 2: IEA Net Zero 2050 Roadmap (Source: IEA).

Public Perception

The greatest battle ahead for the oil and gas industry is that of public perception. APPEA’s first social license report showed only 19% opposed the Australian oil and gas industry, and 7% strongly opposed it. However it has been shareholders, both activist and otherwise, that have been front and center of oil and gas company annual general meetings in recent years—presenting resolutions demanding they articulate how they will reduce emissions, wind down operations and decommission assets.

Plenary session Is the Oil and Gas Industry Part of a Net Zero Emissions Future?, addressed the question with

a panel of global experts that notably included two leading conservation movements. This was no mean feat by APPEA, and although the demands to achieve net zero by 2030 and accelerate emissions reductions by selling down all ‘high emissions assets’ seems highly ambitious, kudos have to go to the conservation speakers for appearing, and one hopes our future will not see net zero as a zero sum game where one side feels they have to win, while the other side must lose. Or indeed, that there are any ‘sides’ taken at all, and instead all stakeholders can conduct a productive long-term working relationship.

University of Texas bureau of economic geology director Scott Tinker argued that activists and investors needed to take a holistic approach, given the nature of growing energy demand in countries that are only beginning to develop. He also claimed there needed to be more awareness around the trade-offs renewables represented, such as the impacts of mining and water usage in green hydrogen.

It was interesting to hear argument against investment dominated by CCS/CCUS and blue hydrogen markets; partly because burning gas as part of blue hydrogen (refer to Figure 4) is viewed by some environmental activists as unnecessary and harmful, and partly because investment should be driven towards ‘known’ renewable technologies under strict timelines.

Australia will find it economically challenging to wind down natural gas production and LNG export when Southeast Asian demand alone is set to double by 2040, even in scenarios where global net zero emissions by 2050 are considered, and when LNG is seen to reduce emissions as a ‘transition fuel’ in importing countries by about 170 million tonnes each year.

Discussing what role the oil and gas sector could play beyond its focus on CCUS and hydrogen, McKinsey & Company partner Kassia Yanosek noted there were spaces for downstream players to turn to biofuels and green diesel for refiners, however she noted offshore wind had the most compelling argument for transferable skill sets.

Challenges for CCS

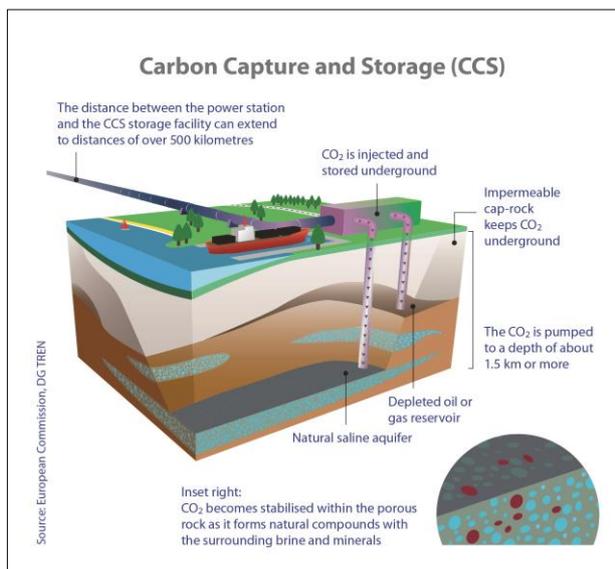
In the early 2000s, a surge of new CCS projects that permanently captured CO2 from stationary sources such as power generation, industry and LNG facilities have since been cancelled. According to a paper by Jerome Paz from Xodus titled ‘The Australian CCS roadmap—a reflection on lessons learned and considerations for future success’,



concluded that the large cost of infrastructure to link capture sites to distant CO2 storage sites was the primary reason for the cancellation of projects. A carbon market that attracts investment such as carbon tax credits or a carbon price is the most obvious way forwards, and pragmatically, new project designs need to consider future saleable products from captured emissions—such as being used in blue hydrogen projects.

Australia's lone CCS project, and aiming to bury 3.4 to 4 million tons of CO2 each year, is the massive Gorgon project operated by Chevron. Sequestration started 3 years late, and is now beset by rock frame problems that have reduced the rate of CO2 storage—and an insight into some of the practical challenges that must be understood for successful carbon storage. For some, CCS is viewed as unproven, difficult, and expensive.

Figure 3: Principles of CCS (Source: European Commission, DG TREN).



Australia's two largest oil companies provided contrasting CCS perspectives. Santos CEO Kevin Gallagher used most of his keynote speech in the opening plenary session Powering Australia's Recovery to state that decarbonisation was an opportunity and not a brake on business. In addition to its Moomba CCS project in the onshore Cooper Basin, planned for FID later this year, which has an initial capacity of 1.7 million tonnes per annum but with eventual storage capacity of 20MMtpa, Santos is also looking at repurposing its depleting offshore Bayu-Undan field as a CCS site.

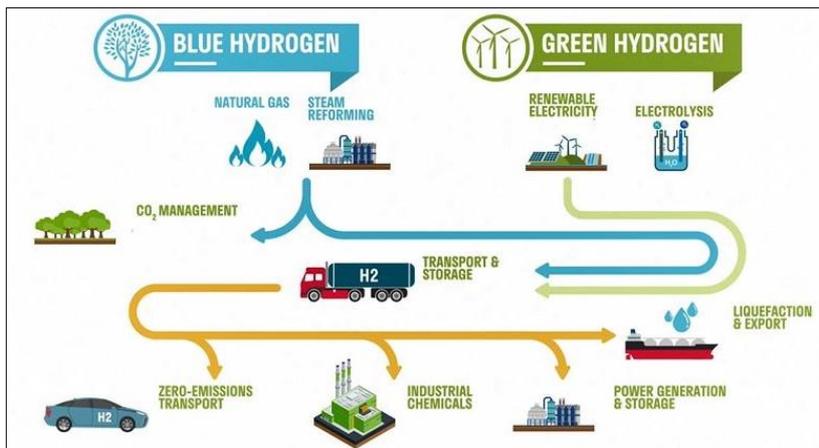
Offshore CCS has struggled thanks to much higher economic barriers. Last year, TotalEnergies CEO Patrick Pouyanne said the only thing that made Norway's large scale CCS project (and potential analogue) Northern Lights economic was the support from the government. Indeed, Woodside Energy told the federal government last year that offshore CCS for its proposed Browse Browse development was too expensive and technically difficult. Time will tell.

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Hydrogen the Great Hope

Unquestionably the highest-profile energy topic in the Australian media, hydrogen is proposed as a viable option to power both oil and gas infrastructure operations, as well as those of mining and metals production. But the question remains open of whether hydrogen has a 'clean' environmental footprint. An panel event titled 'Australia's Hydrogen Future – Turning Promise into Reality' considered the steps necessary to bring hydrogen into the energy mix.

Figure 4: Blue vs. Green Hydrogen (Source: Woodside).



According to modeling by the Australian Energy Market Operator (AEMO), hydrogen could completely replace natural gas in the Australian National Electricity Market (NEM) by 2040. AEMO modelled a hydrogen scenario for the first time, which considers a future with a thriving green hydrogen economy helping strong economic and population growth while taking stronger action to address climate change risks.

Hydrogen is expected to replace up to 20% of domestic gas demand by 2040, green hydrogen consumption would grow beyond that date, and the hydrogen is assumed to be produced from grid-connected electrolyzers. Under this scenario, residential and commercial annual gas consumption would rise over the next five years due to assumed



stronger economic conditions, but would fall over the following decade as hydrogen blending, combined with stronger energy efficiency and fuel switching is forecast to, relatively, flatten gas consumption.

On the industrial side hydrogen fuel-switching would occur for ammonia, steel production and oil refineries. Hydrogen blending within the distribution networks for smaller industrial loads may also reduce gas consumption.

Where will the hydrogen come from?

Hydrogen sources come in three forms: Natural hydrogen produced within the earth, green hydrogen from electrolysis of water using renewable electricity sources, and blue hydrogen using natural gas.

Onshore Australia's total natural hydrogen production rate is estimated to be between ~1.6 and ~58 MMm³/year, but no commercial facilities yet exist. Australia is the second largest owner of hydrogen projects after the Netherlands, according to Wood Mackenzie, and the globally traded market for low-carbon hydrogen or its derivatives could reach 25-45 million tonnes by 2050, equivalent to US\$50-90 billion in potential export revenue.

Hydrogen production has its own environmental challenges

Nevertheless, it is not all smooth sailing for hydrogen. A consortium of developers behind the giant Asian Renewable Energy Hub that was to cover 6 500 square kilometres in the East Pilbara region of northwestern Australia, had received approval from the federal government for the A\$22 billion development in 2020. Designed to export renewable electricity to Singapore, and having support from the Nyangumarta People owners of Native Title, the project was recently deemed too environmentally destructive by the federal government.

Figure 5. Proposed Asia Renewable Energy Hub based in the remote East Pilbara region of Australia. (Source: AREH).

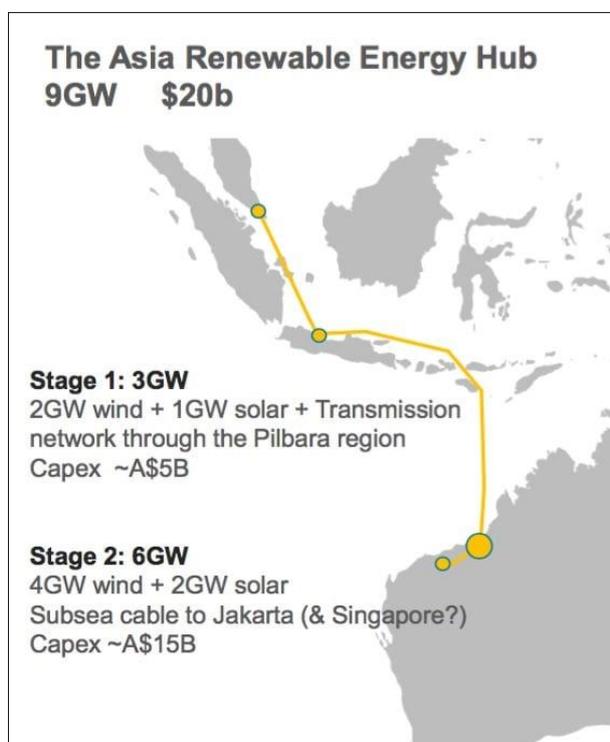
The project was expected to create 7 000 full time jobs and about 20 000 indirect jobs during construction and its 50-year operational life. It would also provide mining companies and fertilizer producers in the north with cheap hydrogen for industrial purposes. However, the federal minister for the environment refused to sign off on the project as "The proposed action will have clearly unacceptable impacts on matters protected by Part 3 of the Environment Protection and Biodiversity Conservation Act (EPBC Act); related to potential ammonia spillage. This decision means the operator will have to withdraw its proposal, provide a response, and then resubmit another proposal explaining how they will mitigate environmental risks associated with the development.

Whatever the outcome, it is clear that the environmental impact of the vast renewables developments necessary to replace hydrocarbons and coal is complex, and this case example is a reminder that energy transition before 2030, or 2050 (the most common net zero target), will require transformative effort to achieve.

Decommissioning Old Facilities

The obligations of the oil and gas industry to decommission ageing facilities has been accelerated in recent times by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), Australia's independent offshore regulator. Trouble began when Woodside Energy (legally) sold the Northern Endeavour oil production vessel in the Timor Sea, with its A\$144 million decommissioning liability to unlisted Northern Oil and Gas Australia, who later entered voluntary administration in 2019, and responsibility for the decommissioning fell to the Australian government.

Fast forward to 2021, and NOPSEMA ordered ExxonMobil to plug 180 wells and start dismantling ten platforms from its vast Bass Strait operation by September 2027. Exxon and its 50 per cent partner BHP have produced oil



and gas from the Bass Strait since 1969 and now, after 42 years, must begin a gigantic clean-up. Over four decades, Exxon drilled 421 wells, installed 19 platforms and laid about 600 km of pipeline on the seabed. Ten platforms, six pipelines and more than half the wells are no longer used for production. Another six platforms will cease production by 2025.

Australia's offshore oil and gas producers are estimated to have a A\$52 billion clean-up bill over the next three decades, with half of that to come this decade. Whilst such activities will create many new offshore employment opportunities, the vast decommissioning costs must inevitably eat into already-declining global exploration budgets. Two dedicated sessions at APPEA 2021 titled Decommissioning's Environment and The Business of Decommissioning were a sign of a high-profile topic in years ahead.

The decommissioning of expired assets is equally applicable to renewables, as every energy pathway forwards will have a 'polluting tail', and the scale of investment needed to rehabilitate mining sites, and safely and cleanly dispose of batteries, wind turbines and solar panels will be a large challenge in itself.

Summary

APPEA 2021 was a welcome return to face-to-face conferencing after the most transformative global event in living memory. The future ahead for the oil and gas industry is similarly confronted by the most transformative social, environmental and economic challenges in its history, and cool heads are required. In Australia's case, it has an abundance of space, mining opportunities and natural energy sources necessary to not only meet net zero targets, but also develop sustainable new global export markets. How quickly such ambitions can be realized, and under what regulatory conditions, is clearly beyond the scope of one highly ambitious report.

