



AUSTRALIA Petroleum

Investing in Australia's journey to a low emission economy

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with contributions from:

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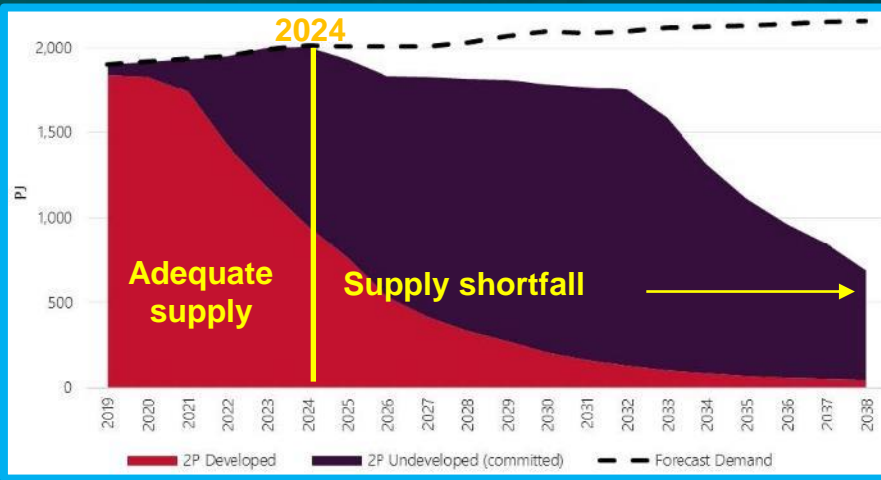
The future of Australia's energy resources



- Post-Covid 19 response to stimulate economy
- Secure and stable energy supply to enable expansion of domestic manufacturing
- Accelerate the transition to a low carbon economy
- Establish a world class hydrogen export industry

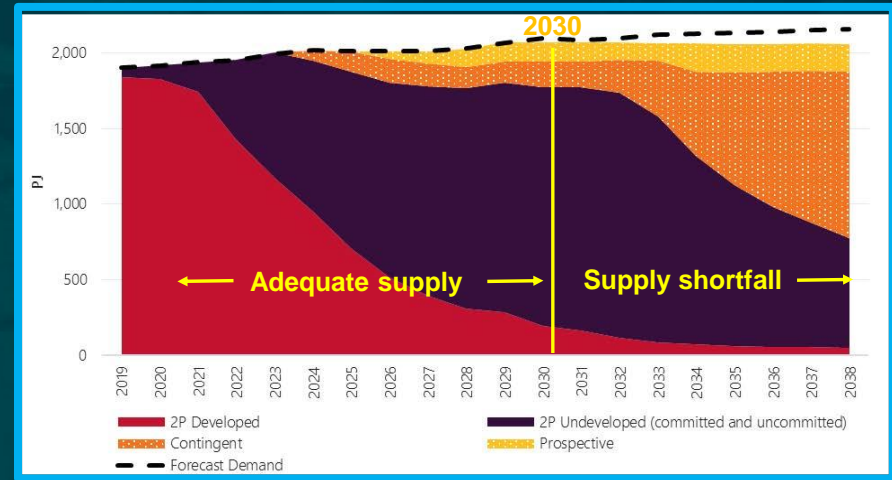


The Challenge: energy security and post-COVID economic recovery



**Projected eastern and SE- Australia gas production
(export LNG and domestic)**

**supply from existing projects and committed
developments**



**Projected eastern and south-eastern Australia gas
production (export LNG and domestic), 2019–38;
supply from all available resources
(including uncertain and developed projects)**

AEMO Gas Statement of Opportunities, March 2019

Strategic Basins Plans



Australia's identified non-renewable energy resources (2018)

- Part of “gas-fired economic recovery”
- Focus on gas-supply for eastern Australia
- Natural gas as the “enabler” for rapid expansion of renewable energy
- Selection criteria based around resource availability and proximity to infrastructure
- First two of five basins announced
 - Beetaloo Sub-basin
 - North Bowen/Galilee Basin
- Assessment of possible impediments to development
- Job creation to expand existing infrastructure and manufacturing capabilities
- Remaining three basins to be announced in due course

Cost of hydrogen production is coming down ...



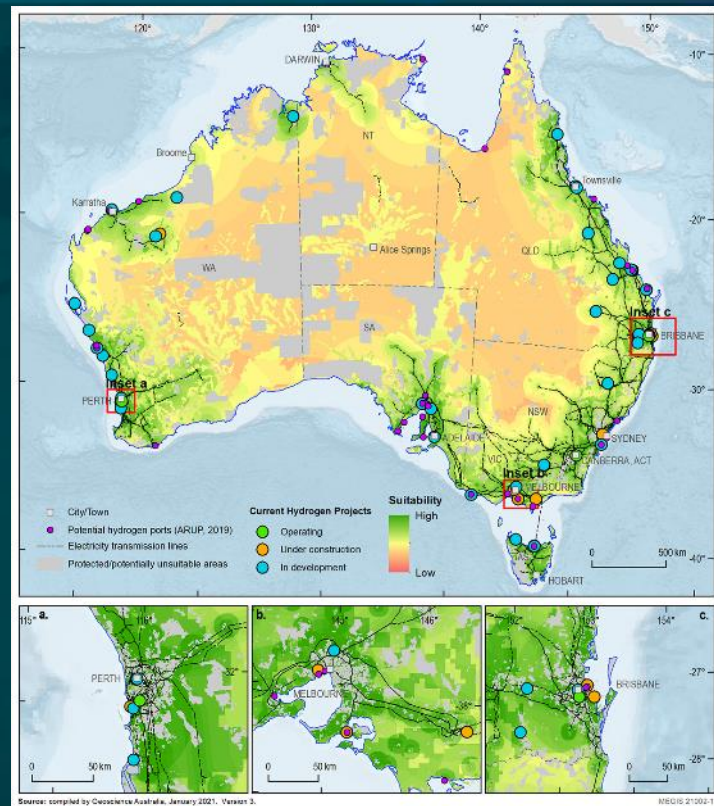
	Cost 2018 est. US\$/kg (CSIRO)	Cost 2020 est. US\$/kg (BNEF)	Cost 2030 est. US\$/kg (BNEF)	Cost 2050 est. US\$/kg (BNEF)
Natural gas + CCS	1.61 – 1.96	1.34 - 2.91		1.25 - 2.82
Coal + CCS	1.82 – 2.17	2.51 - 3.30		2.22 - 3.05
Renewable H ₂	3.36 – 5.18	2.53 – 4.57	1.14 - 2.71	0.73 - 1.64

Sources: BloombergNEF Hydrogen: the Economics of Production from Fossil Fuels with CCS, 2020
BloombergNEF Hydrogen Economy Outlook, 2020
CSIRO Hydrogen Strategy, 2018

Hydrogen projects in Australia (as of Jan 2021)



- GA with Future Fuels CRC tracks hydrogen projects around Australia
- Rapidly growing
- Updated quarterly
- Shows where natural hubs are forming
- Location of projects consistent with renewable energy constrained by existing infrastructure scenario (*green shading on map*)



Hydrogen Economics Fairway Tool (with Monash University)



AusH2 - Australia's Hydrogen Opportunities Tool

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Combines large-scale infrastructure and hydrogen-based datasets to conduct geospatial analysis of the economic-viability of hydrogen operations across Australia

- In development
- Under construction
- Operating
- H2 Research Centre

Inspection Tool

Click on the map to query a point, you may click again to select a different point.

Hydrogen Projects

General

ID	25
PROJECT_NAME	Hydrogen Energy Supply Chain (HESC) - Hydrogen Production Location
STATE	VIC
LOCATION	Loy Yang
LATITUDE	-38.250755
LONGITUDE	146.576657
ORGANISATION	Kawasaki Heavy Industries, J-POWER, Iwatani Corporation, Marubeni Corporation, AGL, Sumitomo Corporation
STATUS	Under construction
ENERGY_SOURCE	Brown coal
PRODUCTION_METHOD	Coal gasification
EXPECTED_START_DATE	Pilot phase: 2020-2021; Commercial phase 2030s
ELECTROLYSER_SIZE_MW	n/a
HYDROGEN_PRODUCED_T_PER_YEAR	3
DESCRIPTION	The Hydrogen Energy Supply Chain (HESC) is a world-first pilot project that aims to safely and efficiently produce clean hydrogen from brown coal and transport it to Japan. During the pilot phase, brown coal from the Latrobe Valley will be gasified at the AGL Loy Yang Complex to produce hydrogen-rich syngas. The syngas will subsequently be purified and the produced hydrogen will be transported to the Port of Hastings where it will be liquefied and loaded onto a specialised carrier for export to Japan. This project is the first initiative in Victoria to transport mass quantities of hydrogen across open waters. Up to 3 tonnes of hydrogen gas will be produced over the year of pilot operations. If the pilot phase is successful, hydrogen production is likely to be commercialised in the 2030s. The HESC project is committed to sustainability and has announced that the carbon offset arrangements for the pilot have now been finalised. Should the project proceed to

Preliminary Regional Calculations: Renewables



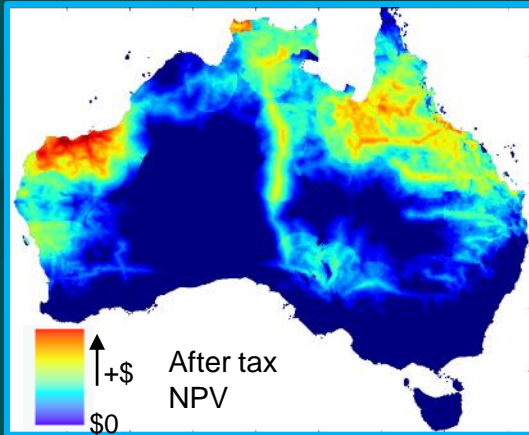
- Assuming **0.5 Mt/a H2 plant** - large/export scale
- Maps of Net Present Value for a target \$H2/kg
- Hybrid wind and solar => higher capacity factors

Aiming for 'H2 Under \$2/kg'

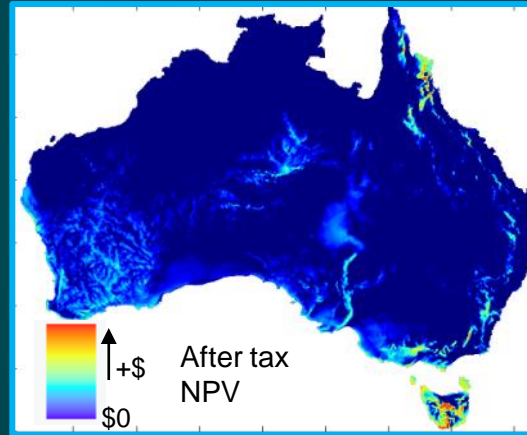


*Slide from S. Walsh
(Monash University)*

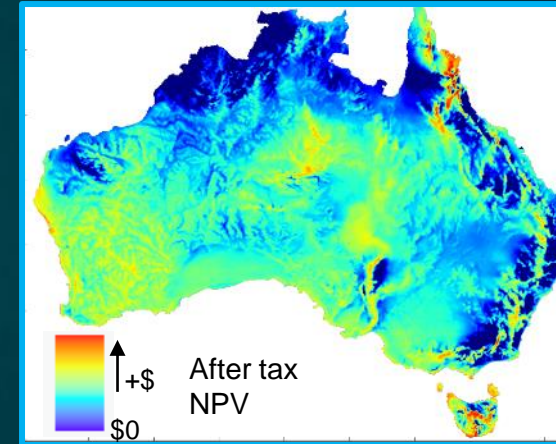
Solar PV



Onshore Wind



Hybrid wind and solar



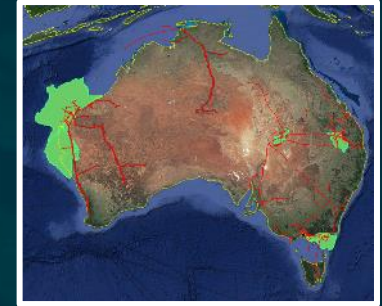
Preliminary Regional Calculations: “Blue” Hydrogen



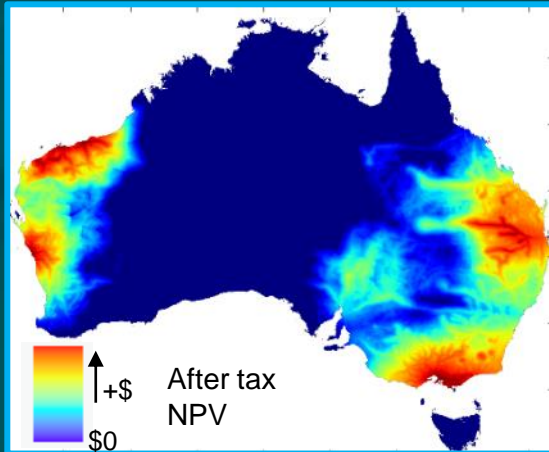
Slide from S. Walsh (Monash University)



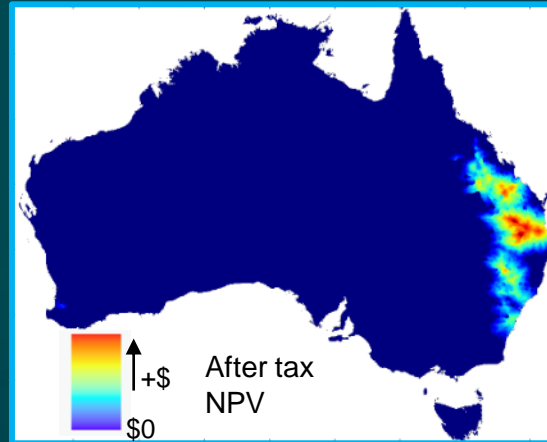
- Assuming **0.5 Mt/a H₂ plant** – large/export scale
- Cost strong affected by proximity to geological storage sites



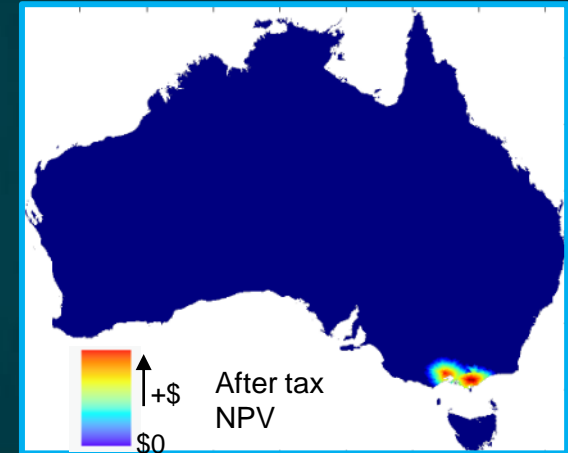
Steam Methane + CCS



Black coal + CCS



Brown coal + CCS



Conclusion

- Australia has a vast energy resources base offering wide-ranging investment opportunities
- The readily available energy resources can be utilised to increase the nation's manufacturing capabilities
- The development and application of new technologies can drive the post-COVID economic recovery
- Australia is on track to transition to a low carbon economy in the not too distant future

