HySupply - German Delegation Visit to Australia

HySupply Project Meeting

UNSW Sydney

May 26, 2022

GlobH2E UNSW SYDNEY BDI Bundesverband der Deutschen Industrie e.V. acatech DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN

WELCOME

HySupply Australian Project Update

Prof. Iain Macgill

HySupply Team Lead - Australia

An update on HySupply Australia – work to date, underway and to come

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Professor Iain MacGill

and the HySupply/GlobH2e team including Dr Daiyan Rahman, Prof. Rose Amal, Prof. Sami Kara, Prof. Francois Aguey-Zinsou, *as well as partners including Deloitte, Australian National University, Baringa Partners, Scimita….*

In Collaboration with HySupply German Consortium led jointly by BDI and acatech

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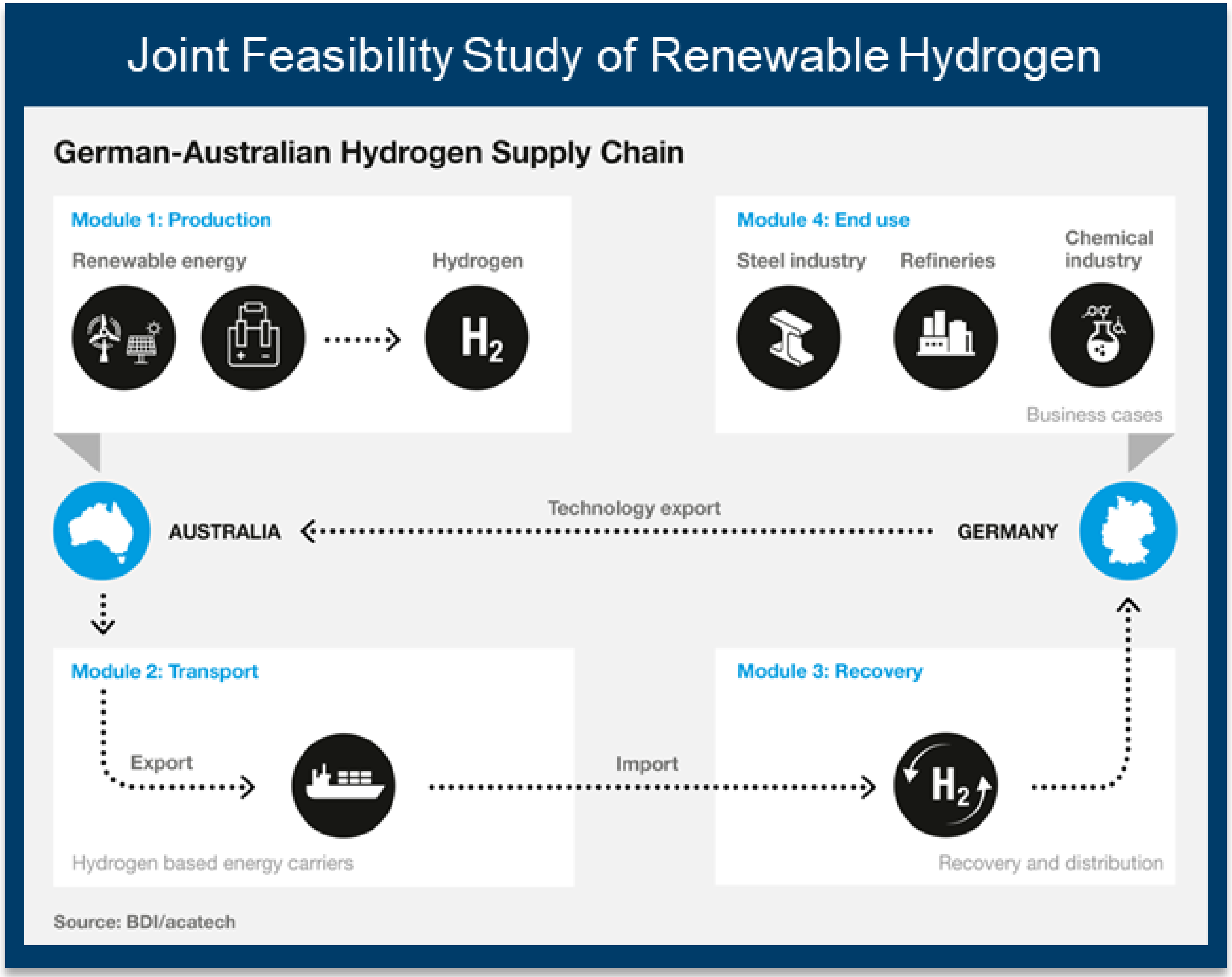
A collaboration



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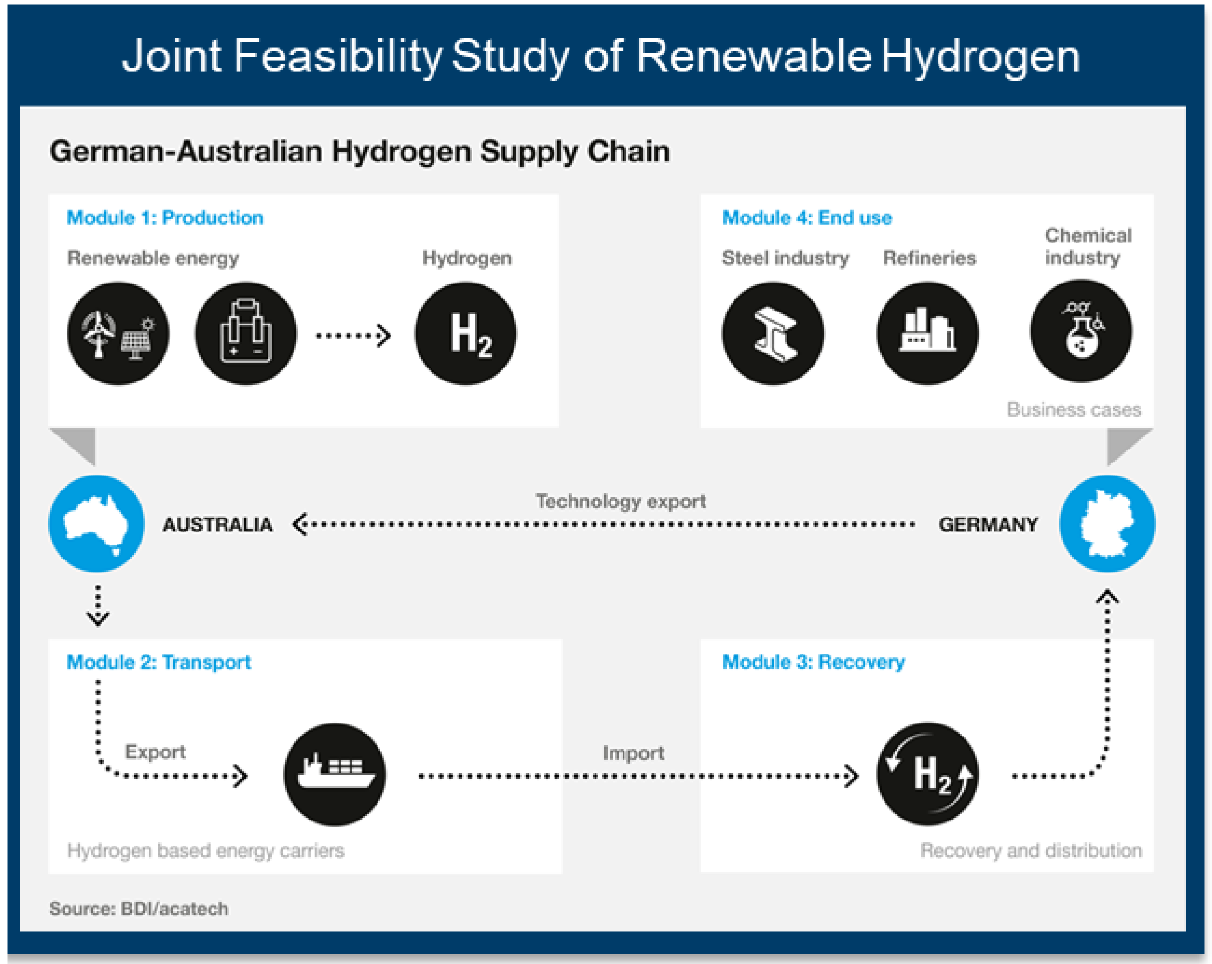
BDI Bundesverband der Deutschen Industrie e.V.

acatech DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN

… a collaboration of many parts



German Project Group

Note: We seek and welcome new consortium members across Australia's emerging green hydrogen value chain. Please feel free to contact either Dr Rahman Daiyan (r.daiyan@unsw.edu.au) or Associate Professor Iain MacGill (i.macgill@unsw.edu.au) to explore this further.

Since HySupply inception in late 2020

Expanded Australia-Germany collaborations

Hydrogen Accord (June 2021)

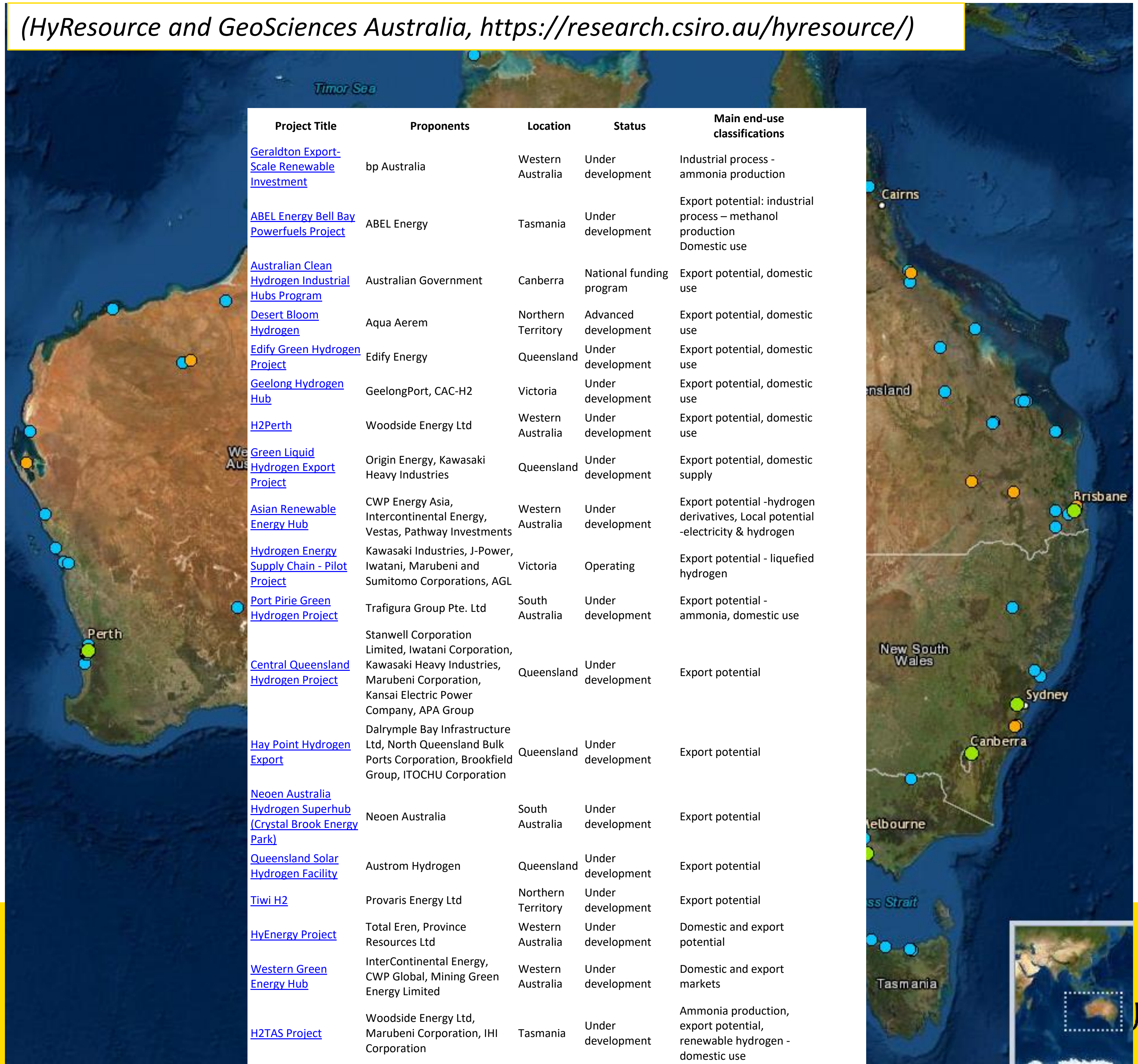
- German-Australian Hydrogen Innovation & Technology Incubator (HyGATE) to support real-world pilot, trial, demonstration & research projects along the hydrogen supply chain. Up to A$50 million and €50 million
- Facilitating industry-to-industry cooperation on demonstration projects in Australian hydrogen hubs.
- Exploring options to facilitate the trade of hydrogen and its derivatives produced from renewables (such as ammonia) from Australia to Germany, including through Germany's H2Global Initiative, which supports long-term supply agreements with German industry.

State Government partnerships

Industry partnerships

Growing numbers of export oriented projects in development

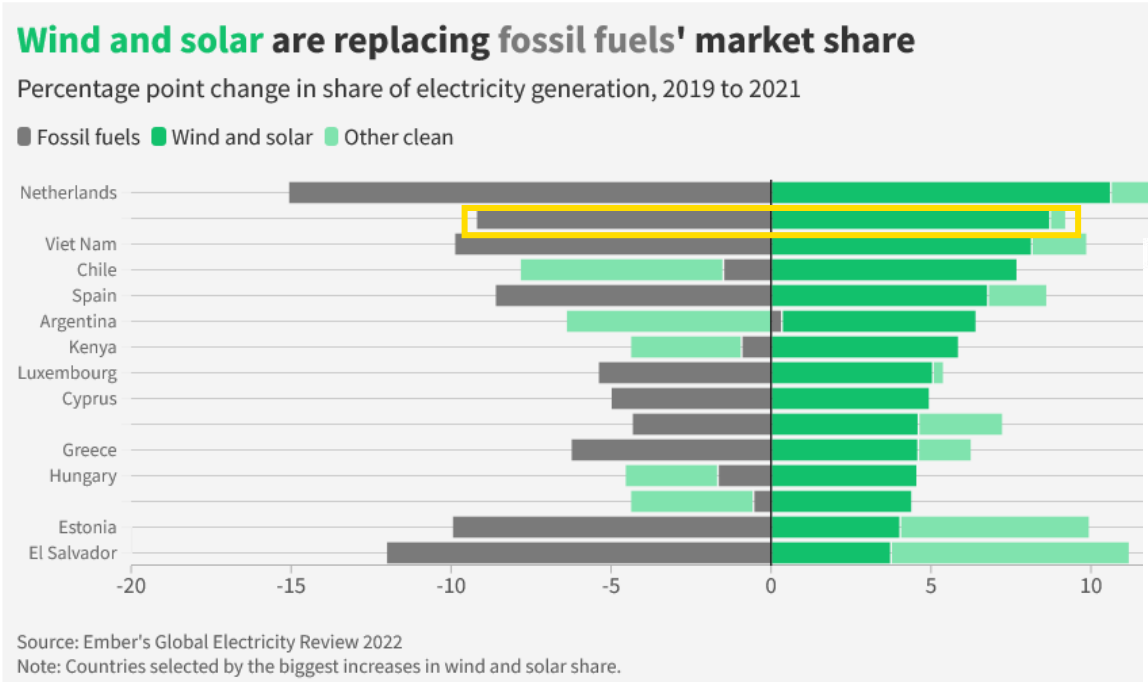
(HyResource and GeoSciences Australia, https://research.csiro.au/hyresource/)

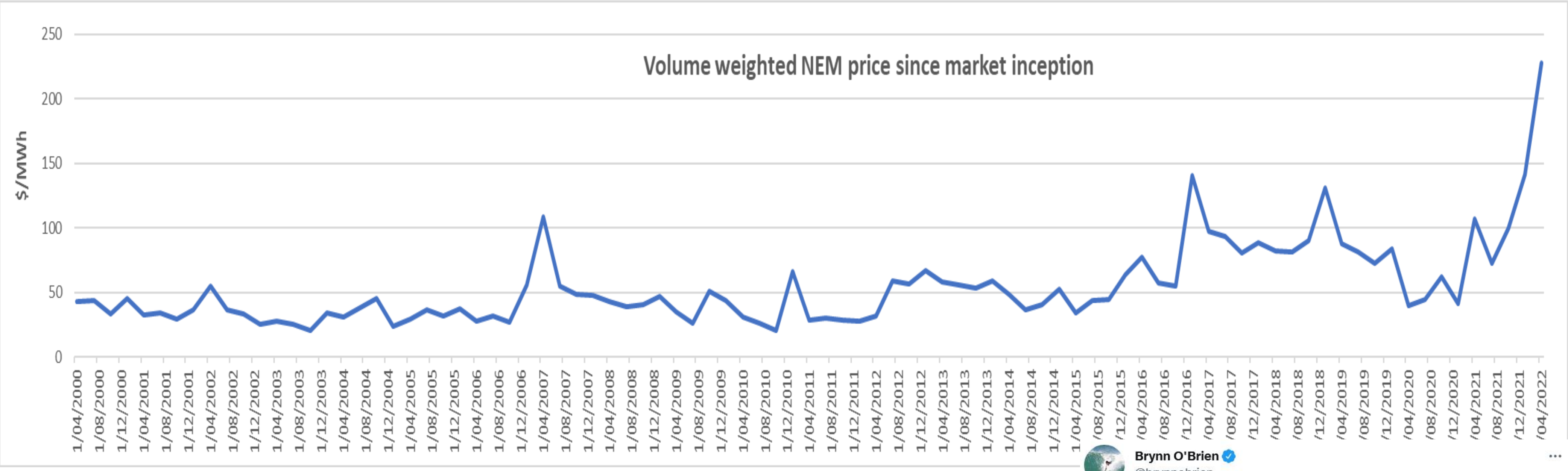


Project Title	Proponents	Location	Status	Main end-use classifications
Geraldton Export-Scale Renewable Investment	bp Australia	Western Australia	Under development	Industrial process - ammonia production
ABEL Energy Bell Bay Powerfuels Project	ABEL Energy	Tasmania	Under development	Export potential: industrial process – methanol production Domestic use
Australian Clean Hydrogen Industrial Hubs Program	Australian Government	Canberra	National funding program	Export potential, domestic use
Desert Bloom Hydrogen	Aqua Aerem	Northern Territory	Advanced development	Export potential, domestic use
Edify Green Hydrogen Project	Edify Energy	Queensland	Under development	Export potential, domestic use
Geelong Hydrogen Hub	GeelongPort, CAC-H2	Victoria	Under development	Export potential, domestic use
H2Perth	Woodside Energy Ltd	Western Australia	Under development	Export potential, domestic use
Green Liquid Hydrogen Export Project	Origin Energy, Kawasaki Heavy Industries	Queensland	Under development	Export potential, domestic supply
Asian Renewable Energy Hub	CWP Energy Asia, Intercontinental Energy, Vestas, Pathway Investments	Western Australia	Under development	Export potential -hydrogen derivatives, Local potential -electricity & hydrogen
Hydrogen Energy Supply Chain - Pilot Project	Kawasaki Industries, J-Power, Iwatani, Marubeni and Sumitomo Corporations, AGL	Victoria	Operating	Export potential - liquefied hydrogen
Port Pirie Green Hydrogen Project	Trafigura Group Pte. Ltd	South Australia	Under development	Export potential - ammonia, domestic use
Central Queensland Hydrogen Project	Stanwell Corporation Limited, Iwatani Corporation, Kawasaki Heavy Industries, Marubeni Corporation, Kansai Electric Power Company, APA Group	Queensland	Under development	Export potential
Hay Point Hydrogen Export	Dalrymple Bay Infrastructure Ltd, North Queensland Bulk Ports Corporation, Brookfield Group, ITOCHU Corporation	Queensland	Under development	Export potential
Neoen Australia Hydrogen Superhub (Crystal Brook Energy Park)	Neoen Australia	South Australia	Under development	Export potential
Queensland Solar Hydrogen Facility	Austrom Hydrogen	Queensland	Under development	Export potential
Tiwi H2	Provaris Energy Ltd	Northern Territory	Under development	Export potential
HyEnergy Project	Total Eren, Province Resources Ltd	Western Australia	Under development	Domestic and export potential
Western Green Energy Hub	InterContinental Energy, CWP Global, Mining Green Energy Limited	Western Australia	Under development	Domestic and export markets
H2TAS Project	Woodside Energy Ltd, Marubeni Corporation, IHI Corporation	Tasmania	Under development	Ammonia production, export potential, renewable hydrogen - domestic use

...and some key shared experiences

- Growing renewables deployment
- Recent energy price shocks
- Federal elections

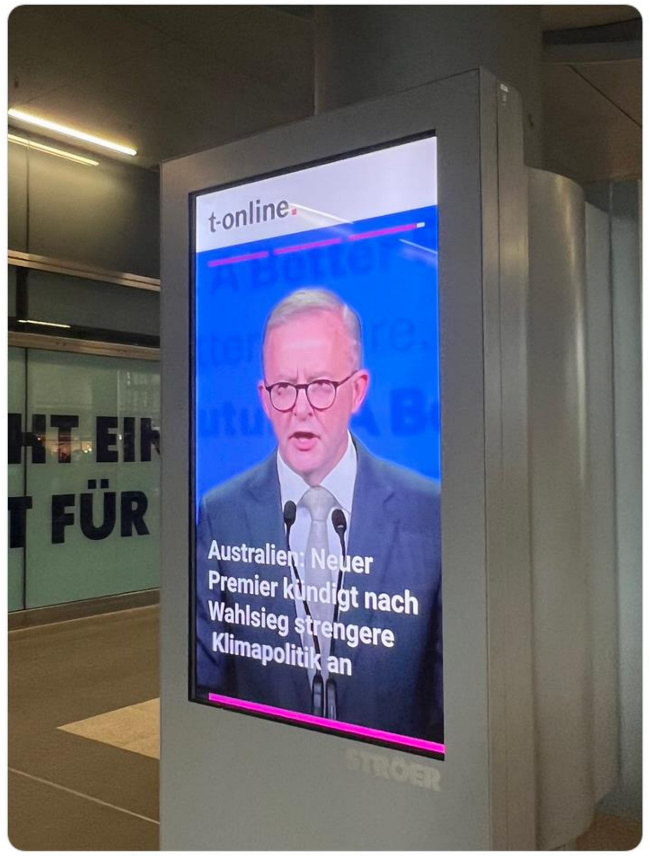




Brynn O'Brien
@brynnobrien

Berlin Hauptbahnhof (central station) just now!

Translate Tweet



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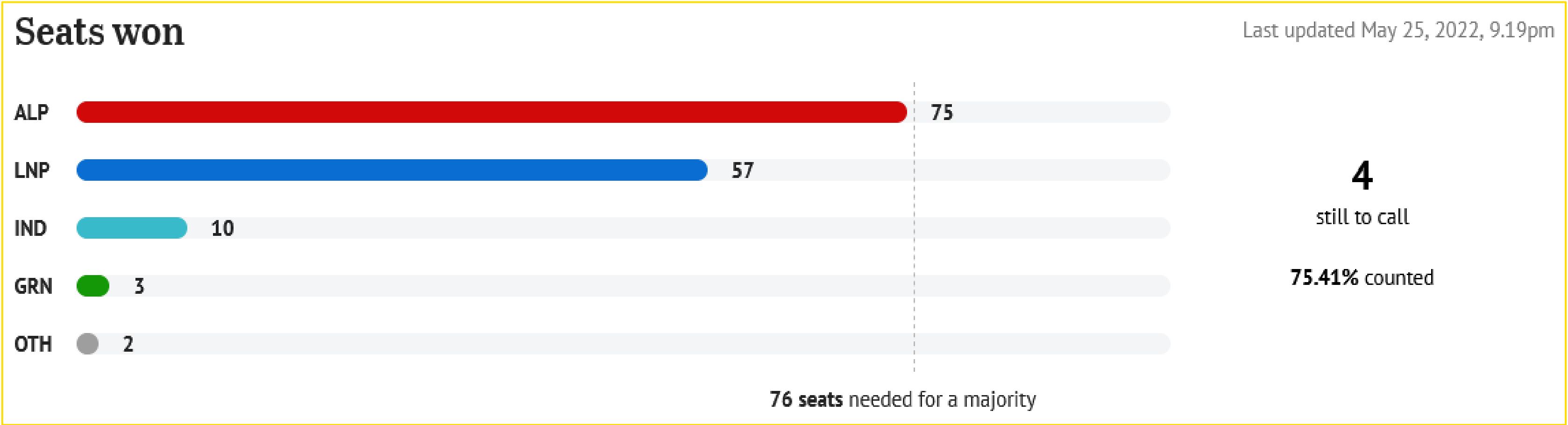


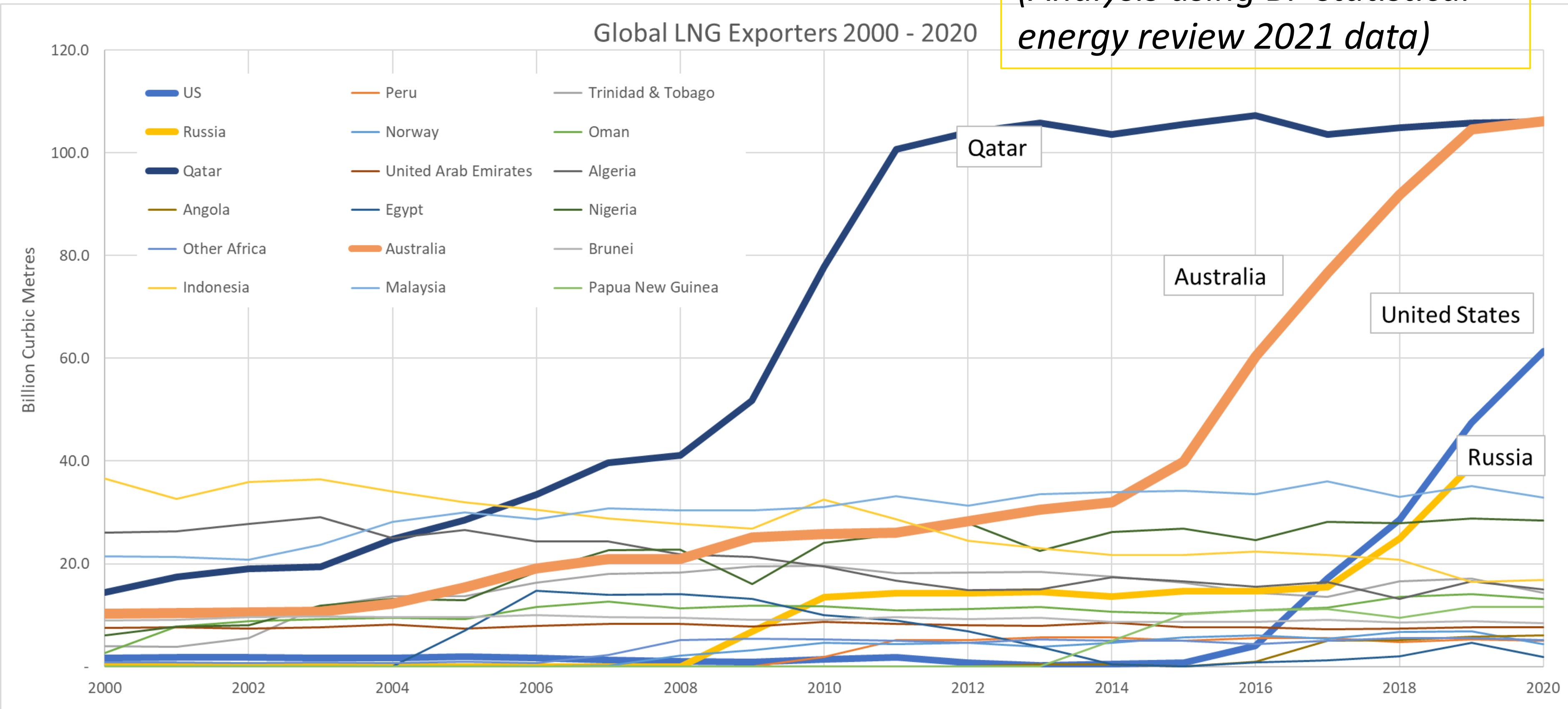
State of Play Report

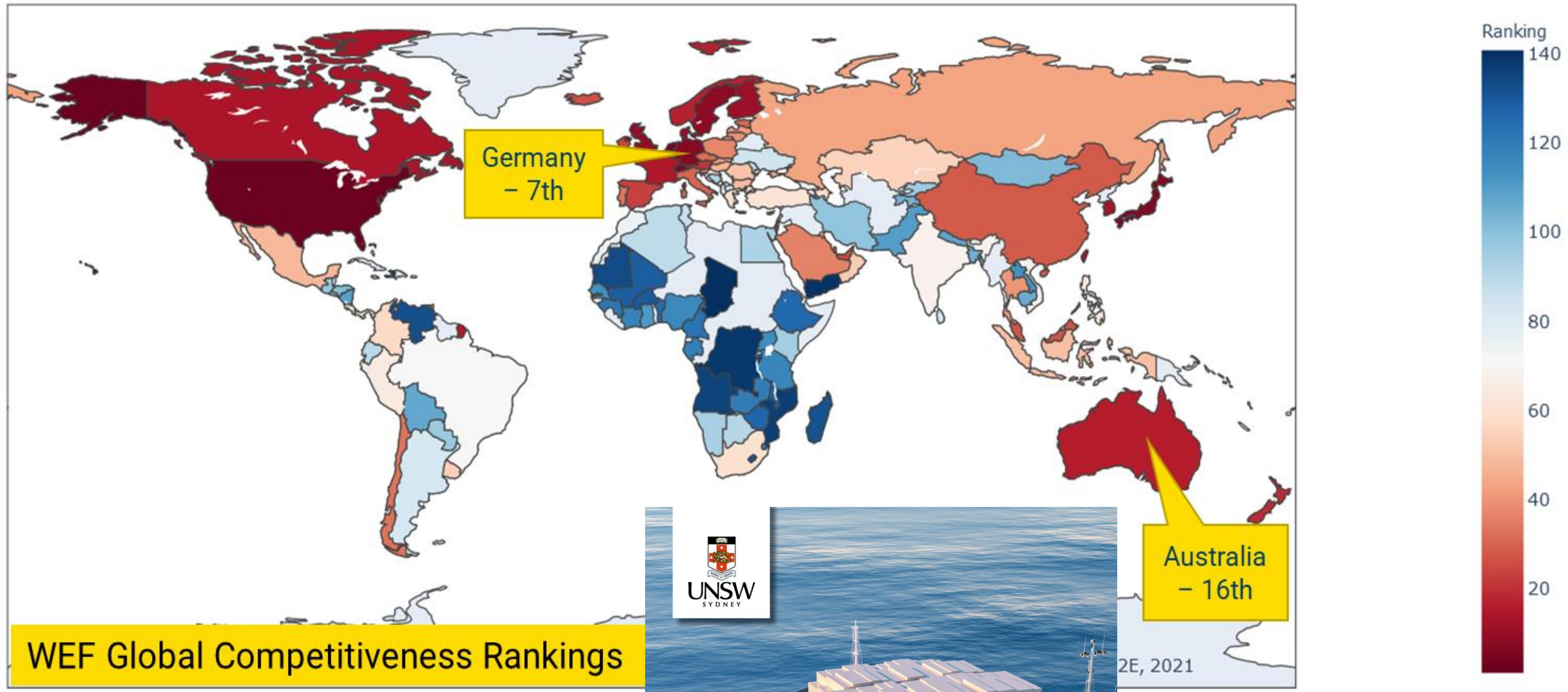
Assessing the case for a renewable supply chain between Germany and Australia

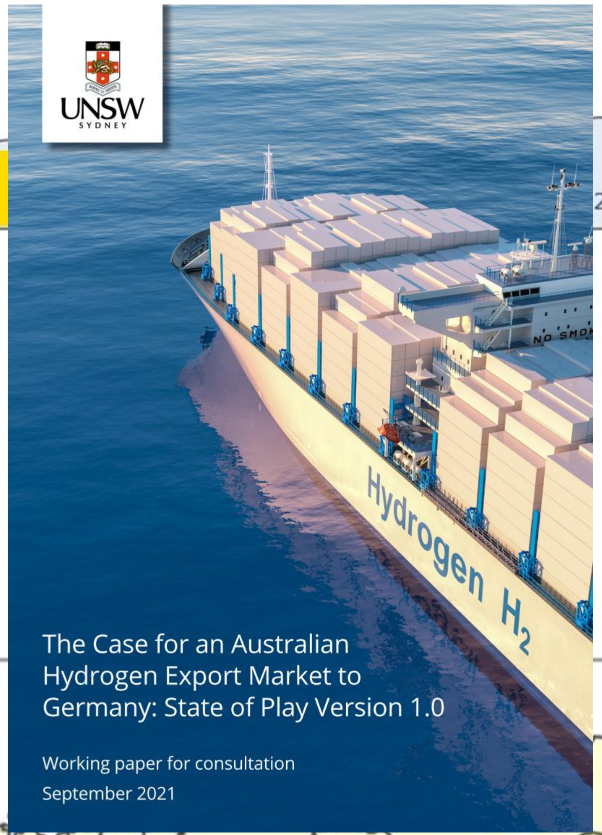
Global energy trade at present largely an outcome of availability of easily extracted low-cost fossil fuels. A more renewable energy world a more self reliant world but still a need for clean energy trade

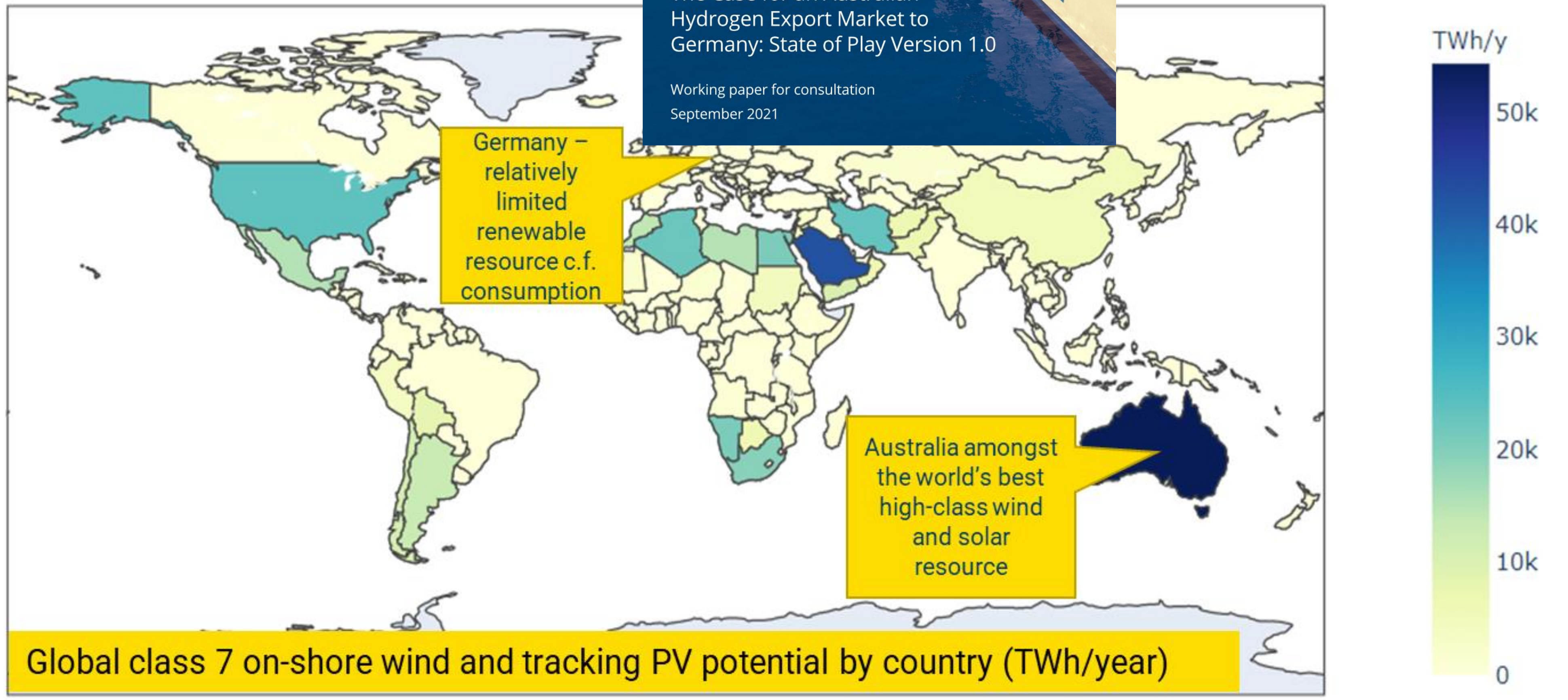
Who might trade with who – complex considerations from resources potential to existing partnerships to ease of doing business to demonstrated capabilities, to infrastructure, to government facilitation efforts, to value chains and transport considerations

(Analysis using BP statistical energy review 2021 data)



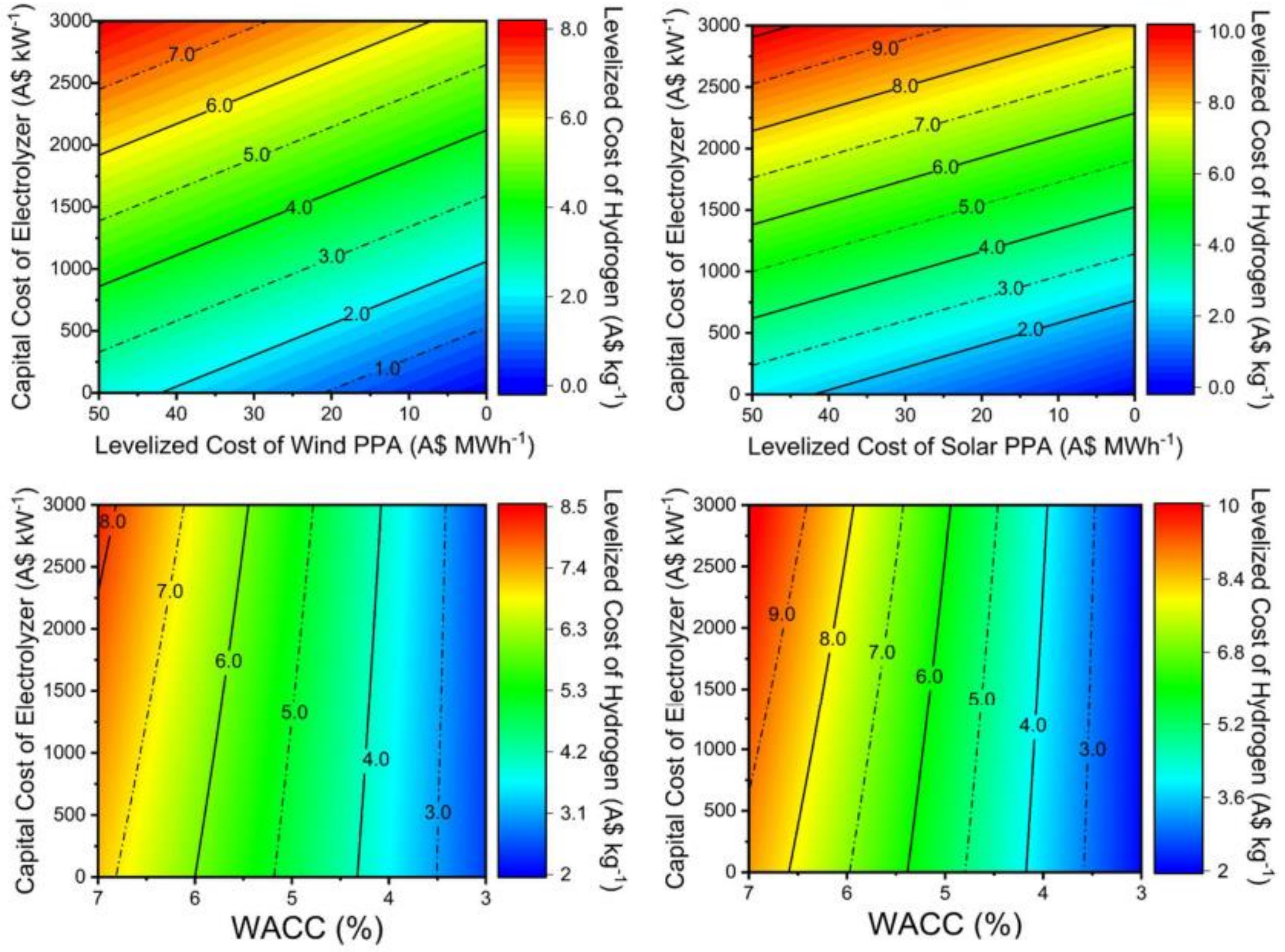


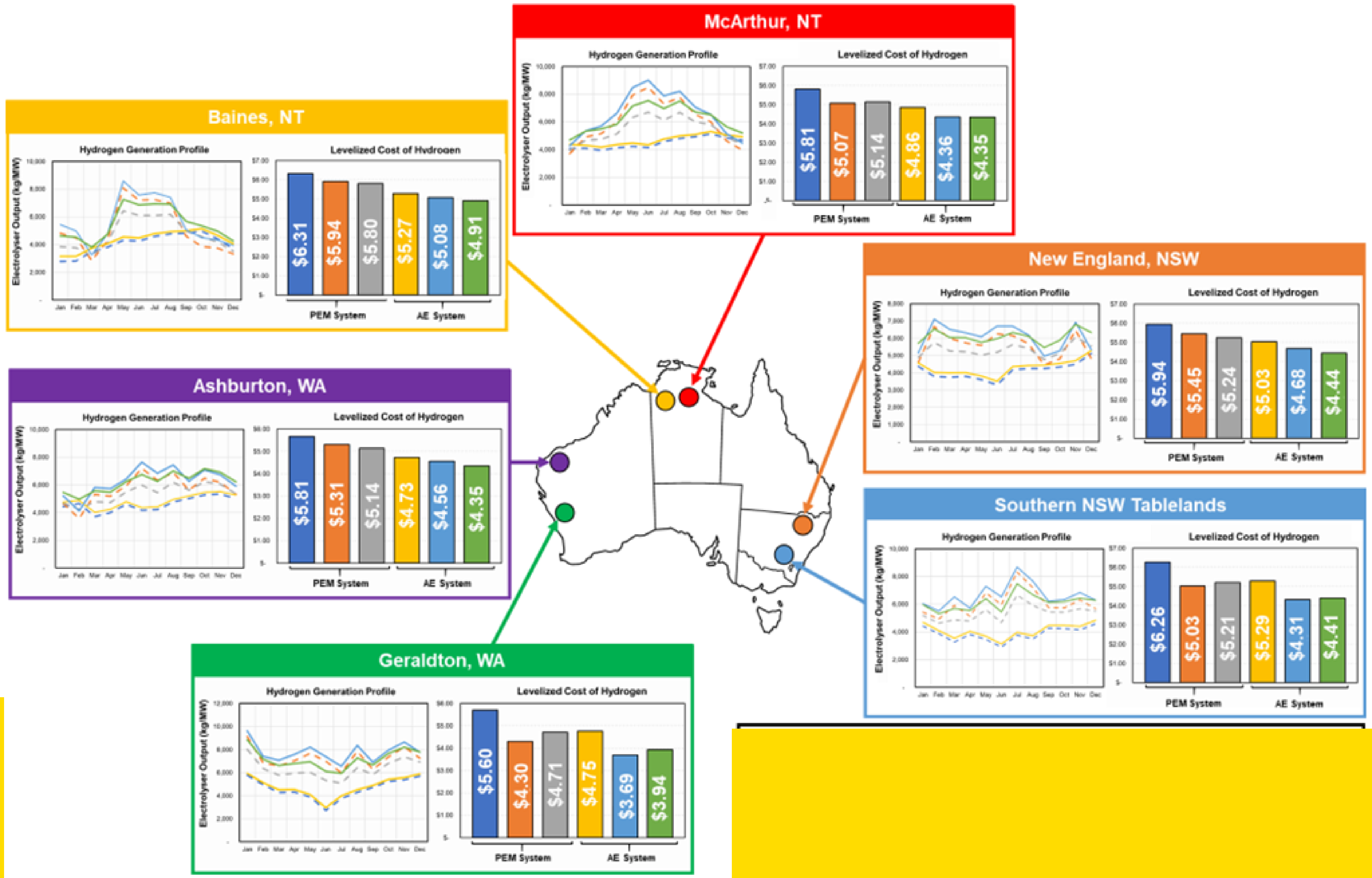


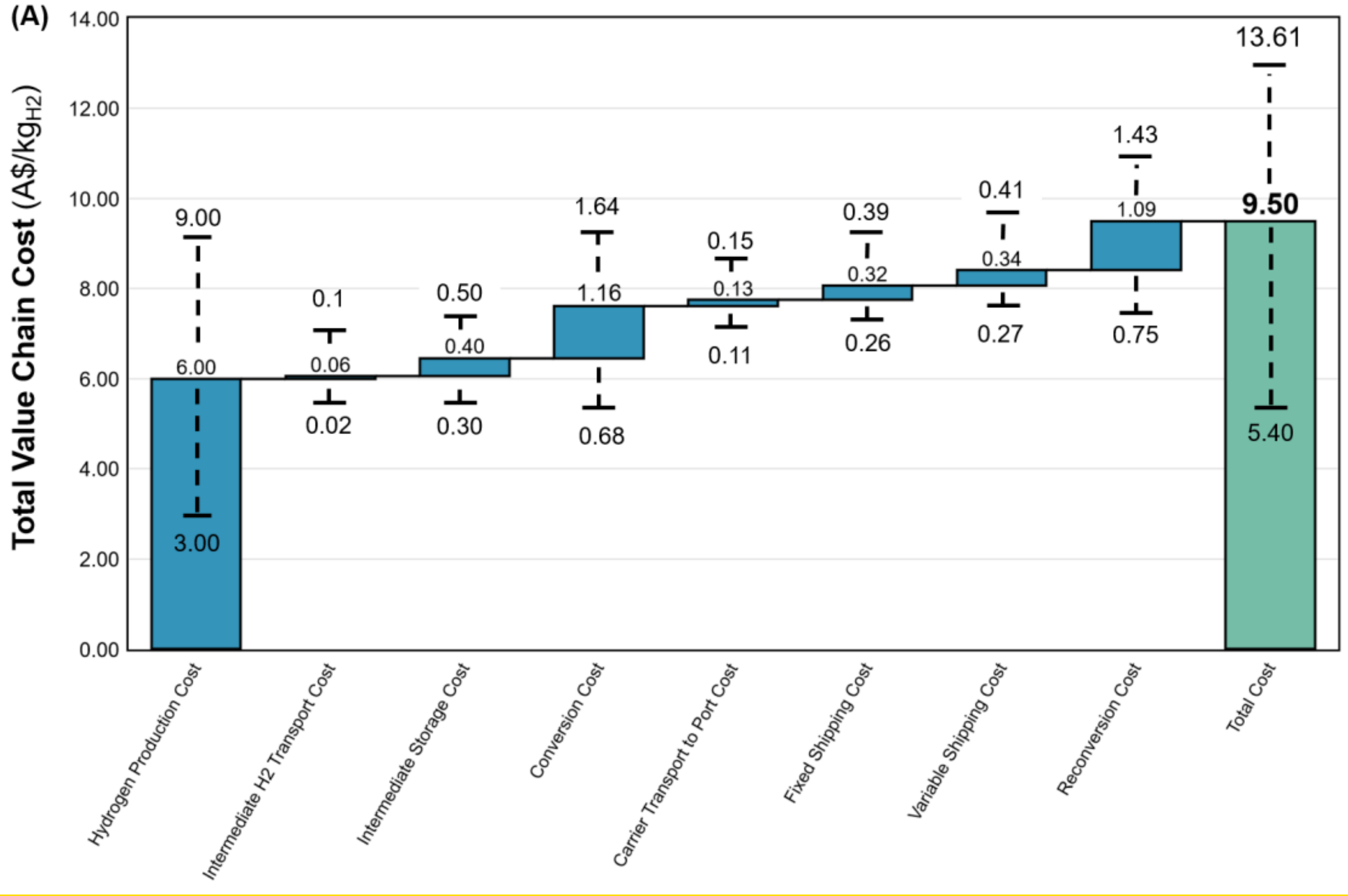


Preliminary value chain anal

- Locational and temporal renewable hydrogen production costs
- Challenges, opportunities in reducing these
- Preliminary integrated supply chain analysis from production, conversion to transport







Modelling renewable hydrogen supply and value chains – open-source tools to assist a potentially wide range of stakeholders to better understand and evaluate a range of possible supply chains, including key uncertainties – e.g. scale effects, technology progress

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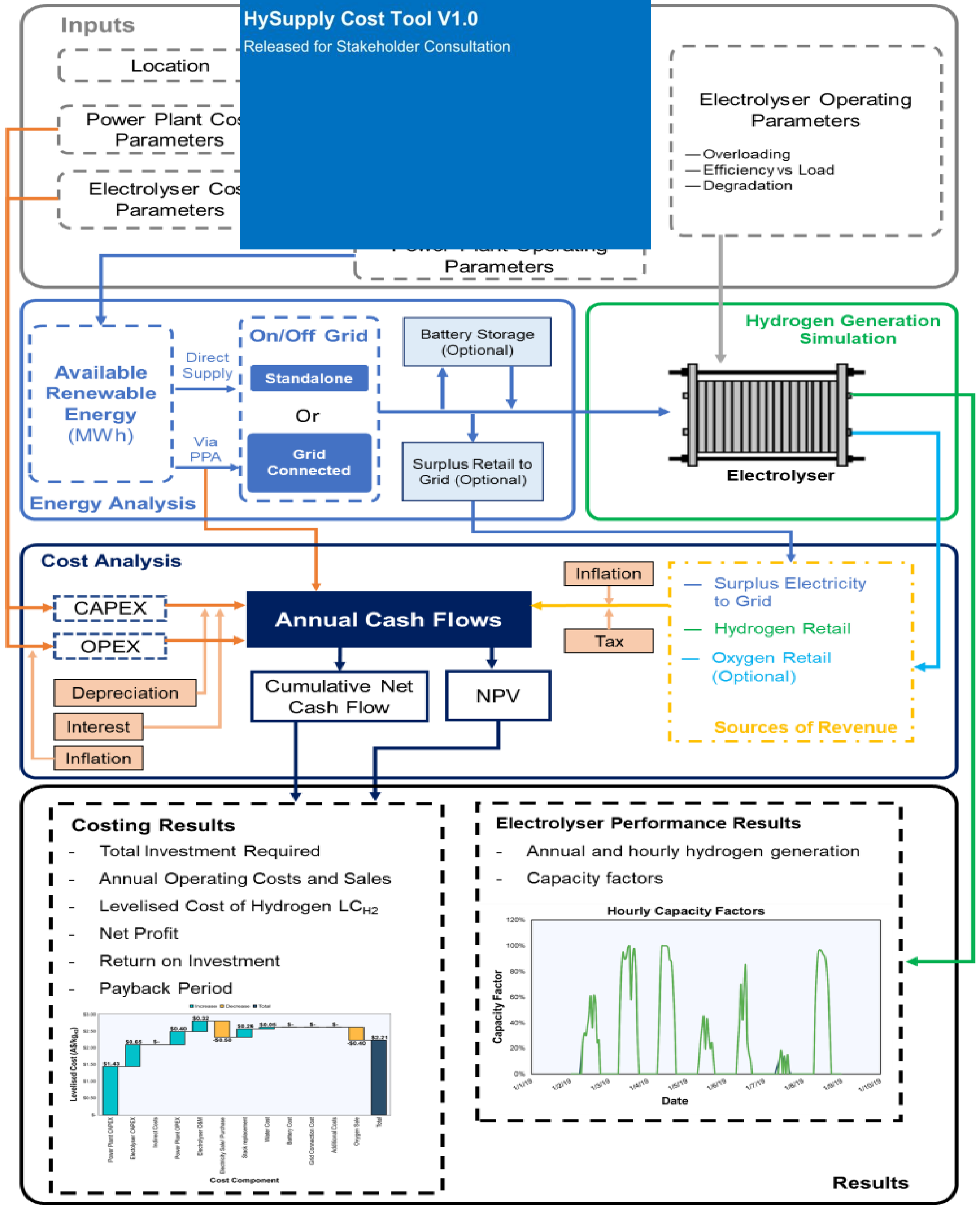
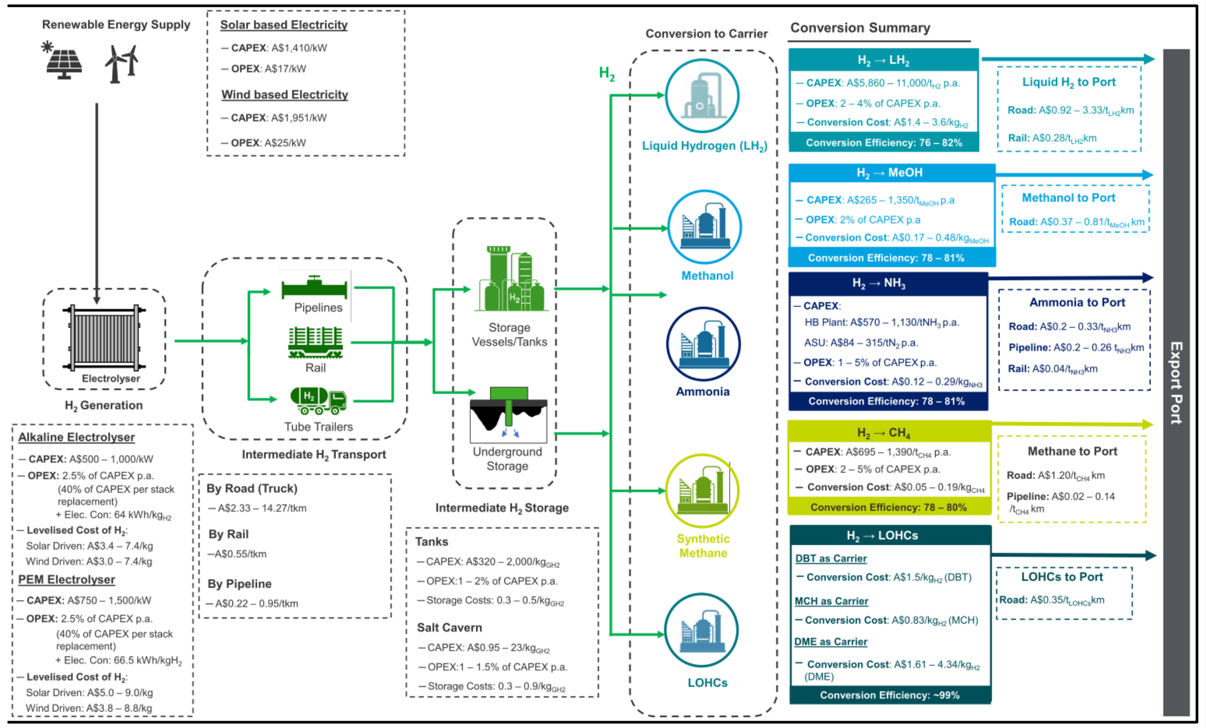
HySupply Cost Tool V1.0

Released for Stakeholder Consultation





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HySupply Shipping Tool V1.1

Pending release for Stakeholder Consultation

Project Description

Project Statement

The HySupply Shipping Analysis To[...] ...ng hydrogen (and hydrogen carriers) via shipping.

Project Scope

The tool allows the user to analyse the shipping cost of hydrogen, ammonia, methanol, methane and LOHC (DME) on shipping routes of their choice, with the individual system performance parameters adopted from literature and advice from

Tool Competencies

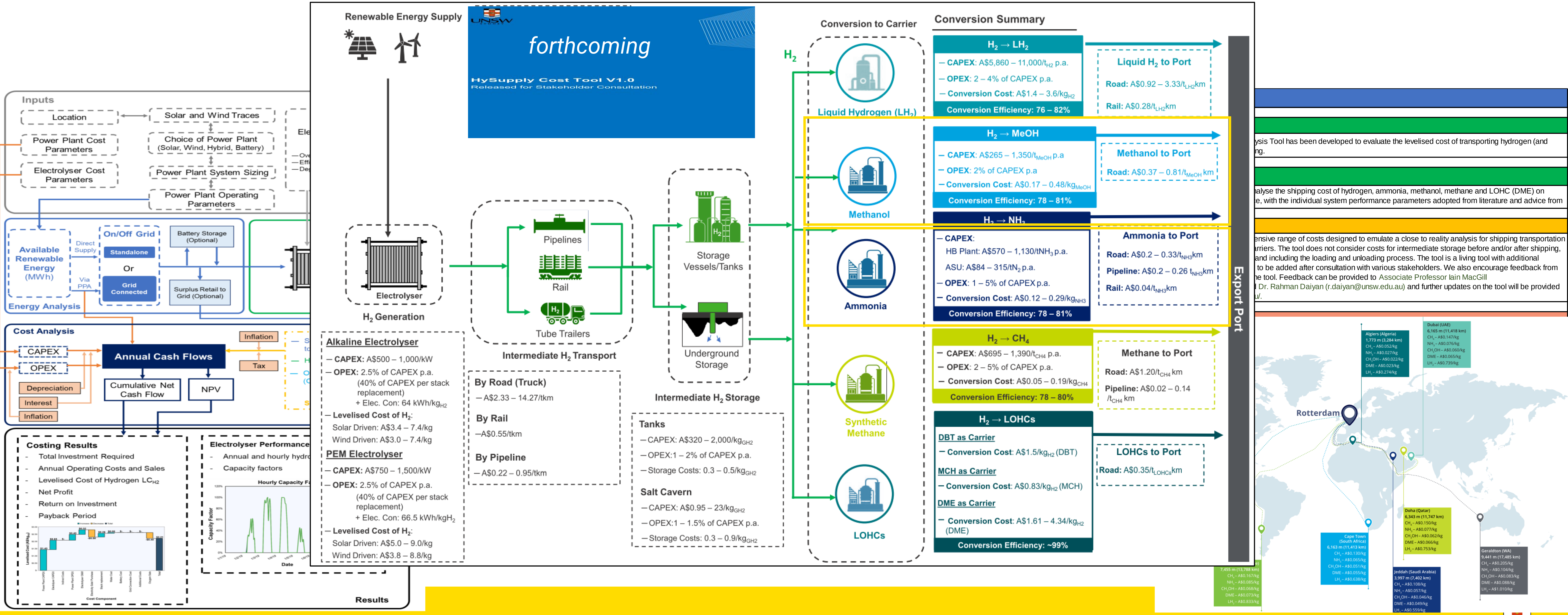
The tool includes a comprehensive range of costs designed to emulate a close to reality analysis for shipping transportation of hydrogen and hydrogen carriers. The tool does not consider costs for intermediate storage before and/or after shipping, analysing only the cost up to and including the loading and unloading process. The tool is a living tool with additional features being and expected to be added after consultation with various stakeholders. We also encourage feedback from the user to help us improve the tool. Feedback can be provided to Associate Professor Iain MacGill (i.macgill@unsw.edu.au) and Dr. Rahman Daiyan (r.daiyan@unsw.edu.au) and further updates on the tool will be provided at https://www.globh2e.org.au/.

Analysis Methodology

The model calculates the levelised cost of transport via shipping for LNG, ammonia, methanol, LOHCs (with DME the LOHC costed) and liquefied hydrogen. The levelised cost is calculated by adding the total annual costs and dividing by the annual total energy delivered.

Total energy delivered is dependent on the ship speed, shipping route length, time at port and days per year the ship is available for operation. Total annual costs are a summation of capital and operating costs. Annual capital costs were calculated using a capital recovery factor for the ship capital costs. Annual operating costs were given through the addition of fuel, labour, canal, port, maintenance, miscellaneous, insurance and boil-off gas (BOG) costs. Users are also given the option to incorporate additional capital and operating costs into the model.

An expanding suite of open-source tools



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Other work in progress, and still to come

‘deeper dives’ on key issues

- Standards and regulatory gaps for the hydrogen value chain *(with Standards Australia)*

- Grid connection issues for renewable hydrogen plants *(with Baringa)*

Baringa

- Green ‘carbon’ potential in Australia for renewable / zero-emission fuels *(with Scimita Ventures)*

Scimita VENTURES
Cutting edge science.
Leading edge innovation.

RE hydrogen certification issues, challenges, options *(led by ANU)*

Australian National University

Supply-side Roadmapping *(with Deloitte)*

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Much to be optimistic about… but much more still to be done

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Questions, comments, suggestions all welcome

Iain MacGill – i.macgill@unsw.edu.au or any of the HySupply Australia Team

HySupply Certification Update

Associate Prof. Emma Aisbett

Australian National University (ANU)

CERTIFYING AUSTRALIA-GERMANY GREEN HYDROGEN SUPPLY CHAINS

A/PROF. EMMA AISBETT

Australian National University

Report Aim and Objectives

Aim

To help stakeholders make informed choices, facilitate collaboration and avoid unnecessary costs and complexity.

Objectives

- Providing a common ‘language’ by defining and explaining technical terminology.
- Identifying desirable characteristics for schemes.
- Summarising key hydrogen product certification schemes for Australia-Germany hydrogen product trade.

Image credit here

Certification Scheme Roles

Scheme owner and certification body can be same organisation, e.g. TÜV SÜD

Role	Description
Scheme owner (alt. Standard Developing Organisation)	Develops and maintains the certification scheme and owns "mark of conformity" Develops a set of rules and procedures that describes the product, process, or service to be certified, identifies the specified requirements that must be met, and provides the methodology for providing assessment
Certification body (alt. auditor, verifier, certifier)	Performs an assessment of a product, process, or service to demonstrate that requirements specified in the certification scheme have been fulfilled
Accreditation body	Checks that the certification body is independent and impartial, and is employing people with the right training

Desirable characteristics

for certification schemes supporting AU-DE trade are identified and explained

Interoperability

Trustworthiness

Non-discrimination

Accuracy

Transparency

Low regulatory burden

Completeness

Desirable characteristics

for certification schemes supporting AU-DE trade are identified and explained

Definition of renewable energy in schemes will be key to balancing these objectives.

Interoperability

Trustworthiness

Non-discrimination

Accuracy

Transparency

Low regulatory burden

Completeness

Scheme summaries

	CertifHy	Australian GO	AEA	Smart Energy Council	GH2
Scheme type	Certification of low-emissions hydrogen	Certification of quality of information about hydrogen emissions and production	Certification of quality of information about ammonia emissions and production	Certification of renewable hydrogen	Certification of green hydrogen
Scheme owner type	Public-private partnership	Public	TBD	Private	Private
Certification type	Third-party conformity assessment	TBD	TBD	Third-party conformity assessment	Third-party conformity assessment
Intended geographic coverage	EU focused at present but expanding	Initially Australian, intended to be international	International	International	International
Owns a mark of conformity as of May 2022	Yes	No	No	Yes	No

Scheme summaries

Agency	Status	Scheme boundaries	Emissions scope	Grid electricity eligibility	Offset treatment (not CCS)	Treatment of co-products
CertifHy Phase II	Completed pilot program	Well-to-gate (factory)	Scope 1, 2, upstream 3 (feedstock)	With surrender of renewable energy certificate	Not mentioned directly, but description of certificate requirements suggests offsets not acceptable	Not mentioned; is not recommended for report on certificates
CertifHy Phase III	Press release	Assumed same as Phase 2	Assumed same as Phase 2	Expected to align with RED II requirements (if including pending Article 27 this would mean additionality, geographic match, temporal match)	Assumed same as Phase 2	Assumed same as Phase 2
Australian Government GOO	Trials proceeding	Well-to-gate (factory)	Scope 1, 2, upstream 3 (feedstock)	Via location-based and/or market-based mechanisms	Possible that offsets will be permitted; if so, recommendation is to include tracking of source of offset	Discussed in detail; recommended for report on certificates
AEA	Discussion paper	Well-to-gate (factory)	Scope 1, 2, upstream 3 (feedstock)	With or without PPA (non-exhaustive)	Not mentioned directly, but likely to receive similar treatment to IPHE recommendation	Mentioned as a reporting metric
IPHE	Methodology draft	Well-to-gate (factory)	Scope 1, 2, upstream 3 (feedstock & capital)	Via location-based and/or market-based mechanisms	Recommendation against using offsets; where used, report type and quantity	Discussed in detail; recommended for report on certificates
Smart Energy Council	First pilot facility has been certified	Well-to-gate (factory)	Scope 1, 2, upstream 3 (feedstock), planned expansion for downstream (well-to-wheel)	Australian Government renewable energy definition	Offsets under consideration in order to enable 'zero carbon' certification	Treatment of these unclear based on public information. Anticipate these will be detailed in audit report
GH2 Scheme	Standard draft (March 2022)	As per IPHE although proposed extensions to storage, transport and use	As per IPHE with some modification	Via location-based and/or market-based mechanisms	Offsets not discussed in Draft Standard but note application of IPHE draft method	No specific mention of co-products

Image credit here

Conclusion

Report provides common language and basis for agreement of desirable characteristics.

It also identifies emerging interoperability issues

e.g. Offsets, treatment of co-products, CCS

Modular approaches to emissions accounting can address these

Definitions of renewable energy are hugely important for both environmental and trade outcomes

e.g. important to be thorough but non-discriminatory

THANK YOU

Contact Us

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Zero-Carbon Energy for the Asia-Pacific Grand Challenge

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Australian National University

HySupply Roadmapping Update

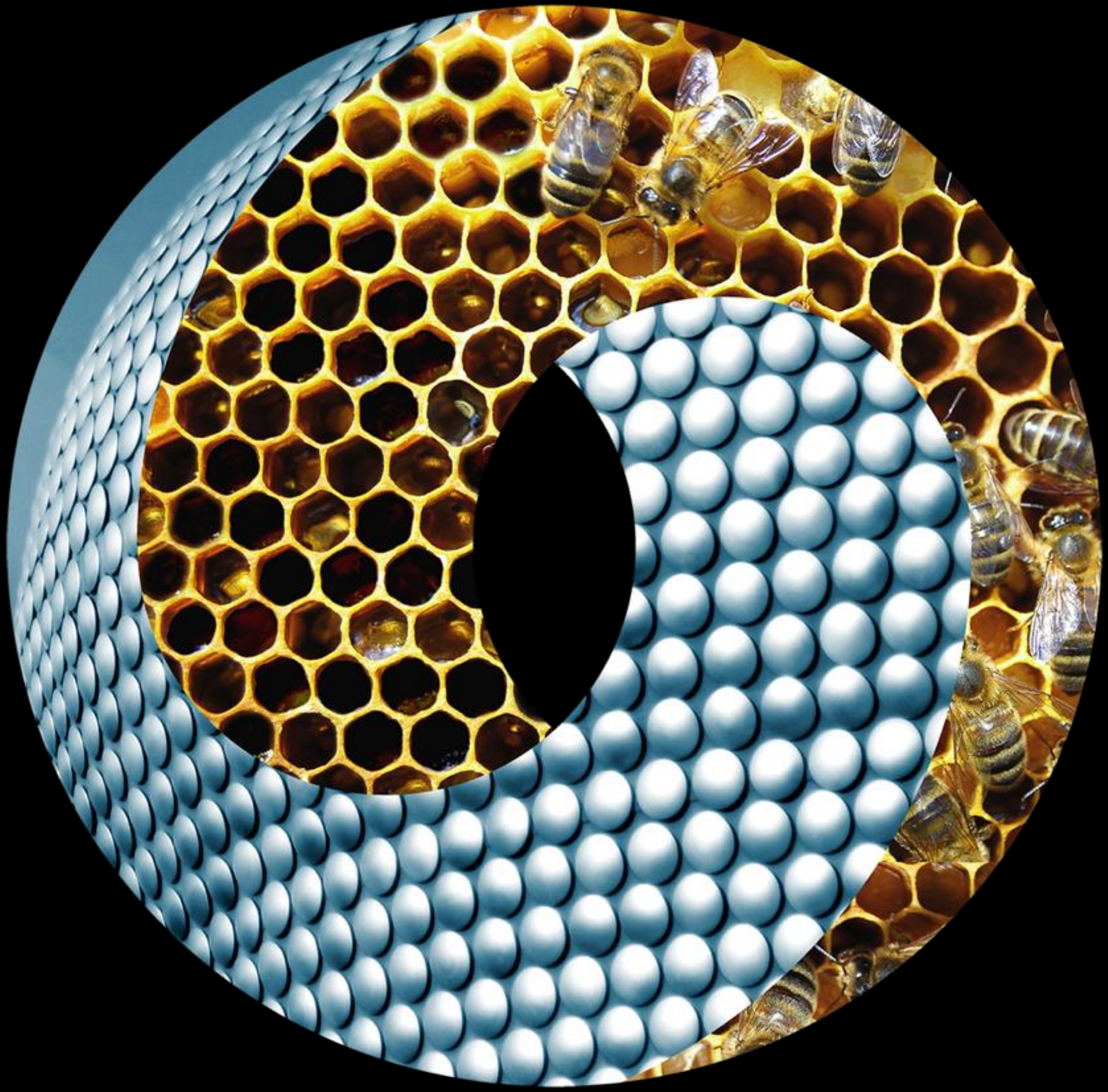
Dr. Will Rayward-Smith

Deloitte

HySupply Roadmapping Updates

26 May 2022

Dr. Will Rayward-Smith



Supply-side Roadmapping Exercise

HySupply Australia has performed a preliminary supply-side roadmapping exercise and is working together with HySupply Germany to perform a joint roadmapping exercise over the coming months

Key Objectives

1. Explore and build on the actions from other hydrogen related reports in Australia, including the National Hydrogen Strategy and CSIRO National Hydrogen Roadmap

2. Highlight the key barriers and opportunities for Australia in developing a hydrogen/hydrogen-derivatives export value chain

3. Provide an initial framework for realising these opportunities for Australia in the form of preliminary short-, medium- and long-term actions

Stakeholder Consultation

Over 50 stakeholders across industry, government agencies, and research organisations were consulted.

A draft copy of the supply-side roadmap report has been circulated for further stakeholder consultation.

Stakeholder Consultation

Key insights

01 **Willingness of international buyers** to pay for Australian exports

02 States and Territories must have **clear, harmonised and streamlined regulations.**

03 Government can best assist **'first-movers' by helping bridge the current price gap.**

04 Industry is growing **frustrated with repetitive hydrogen feasibility projects.**

05 **Hurdles from scaling** require a comprehensive effort across stakeholders to be overcome.

06 **Decarbonisation** of established chemical processes will **require a transitionary period.**

Roadmapping Actions

Six key action areas with actions over two time horizons

Harmonise Regulation

Collaboration between Stakeholders

Target Investment

Leverage a Hub Model

Build Social Acceptance

Learn from Current Export Industries

Now – 2025

2025 – 2030

Closing Remarks

Speed to action is critical if Australia is to become the market leader in hydrogen export.

Parallel development of the domestic and export market will be require for cost-competitive exports.

Investment on multiple fronts is required, as Australia needs to take a hydrogen carrier-agnostic investment approach**.**

Carrier ships, port upgrades, co-location of hydrogen infrastructure and access to spare capacity of renewable energy will be critical to ensure efficient hydrogen production, conversion and transport.