Ammonia's Promise

Presentation to the 2nd Ammonia = Hydrogen 2.0 Conference
Hosted by the Australian Chapter of the Ammonia Energy Association
28 July 2020

Penelope Howarth
Research Fellow
Grand Challenge: Zero Carbon Energy for the Asia Pacific (ZCEAP)
Australian National University

penelope.howarth[at]anu.edu.au

Research project in collaboration with the ZCEAP Hydrogen Fuels Team (including Dr Lee White and Dr Emma Aisbett)

Australian National University

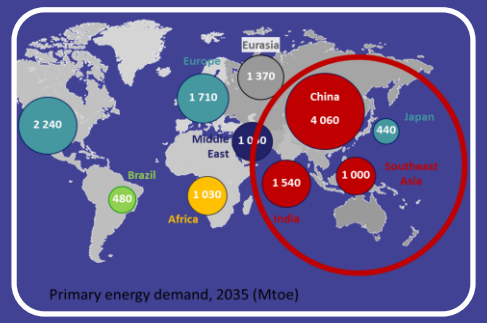
ANU Grand Challenge –
Zero-Carbon Energy for the Asia-Pacific

ANU investment: $10m over 5yrs, ~ 40 people

Director: Professor Ken Baldwin

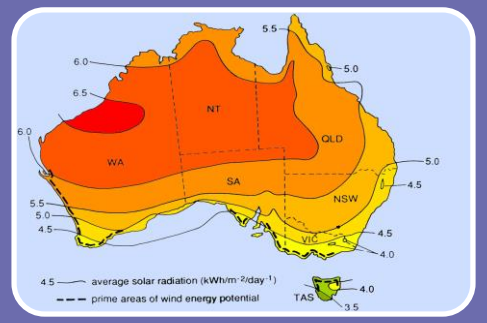
Kenneth.Baldwin[at]anu.edu.au

Why *Zero-Carbon Energy for the Asia-Pacific*?



Asia-Pacific is pivotal

- 65% of projected energy growth in coming decades
- Global GHG reductions thus depend crucially on decarbonizing A-P energy
- Australia's traditional energy exports are therefore time-limited



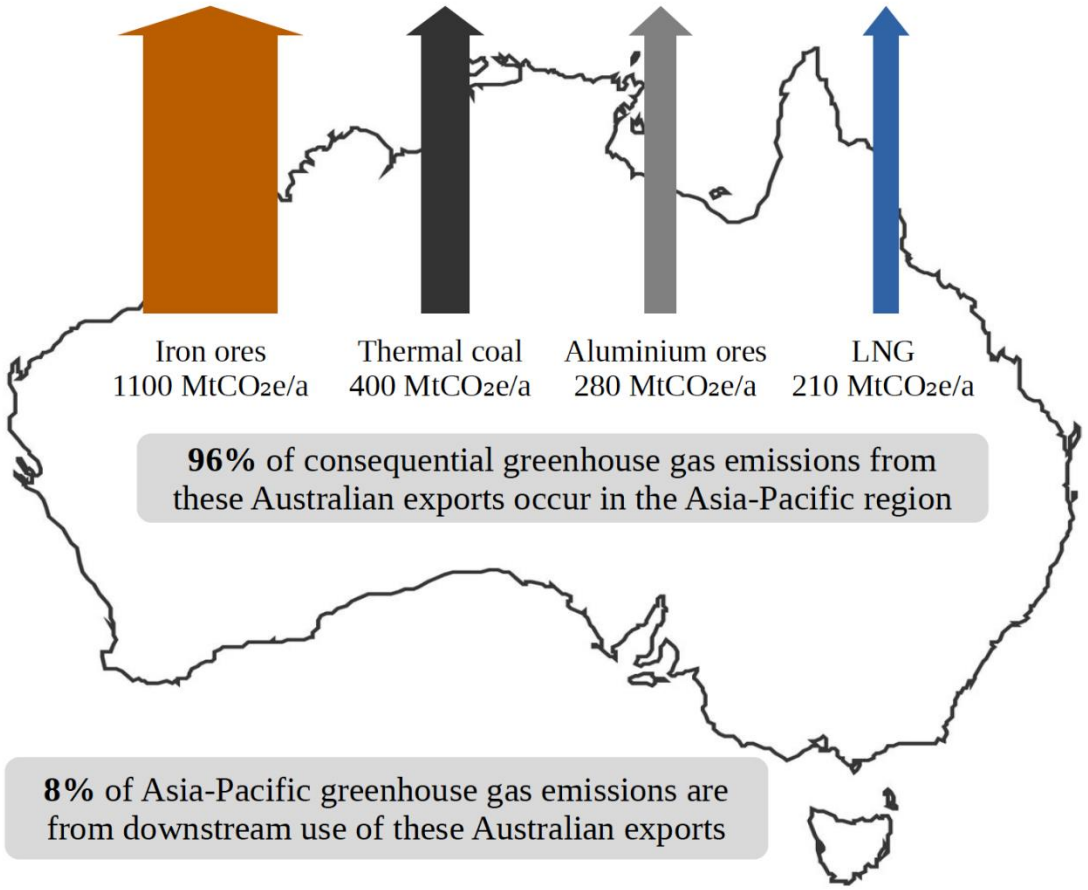
Australia is well-placed to support an efficient energy transition in the region

- geographic proximity & world-leading renewable and mineral resources
- human capital & good governance
- experience with global scale energy trade & investment

Sustainable growth and high-quality jobs

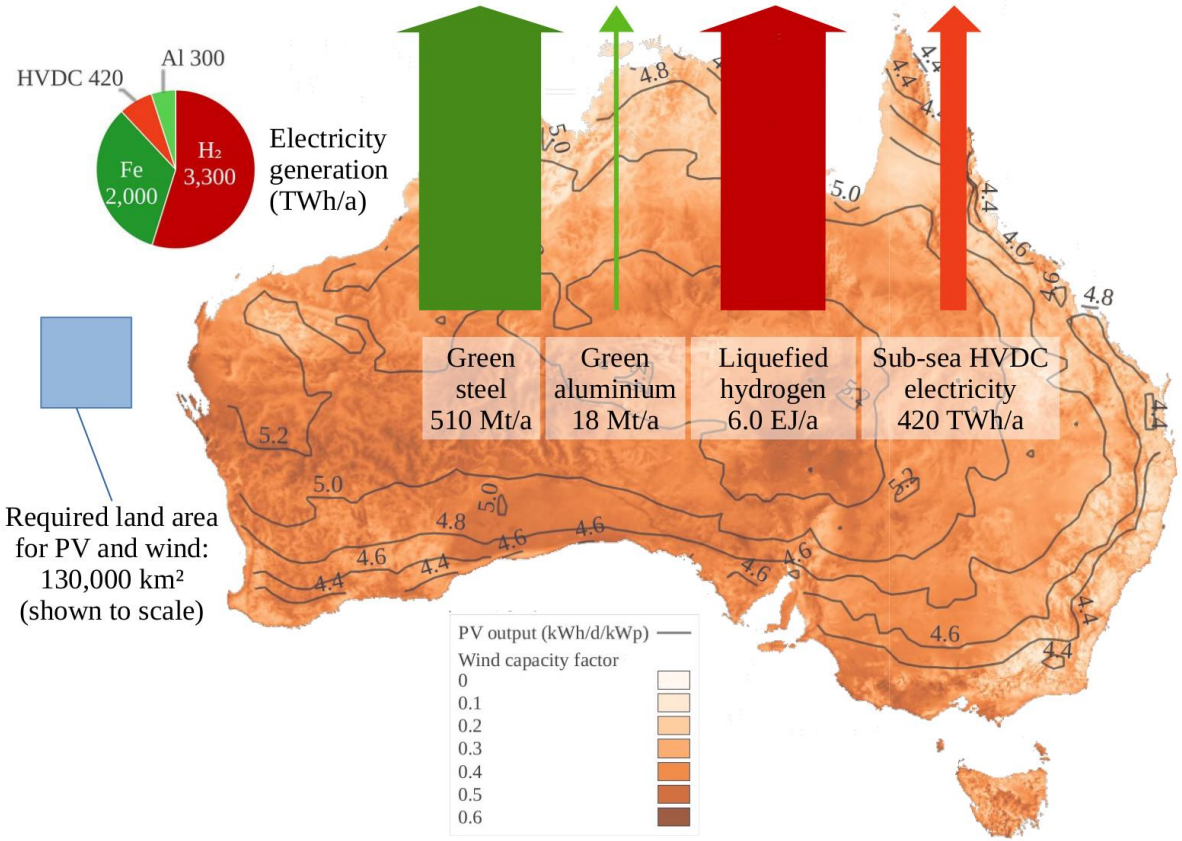
- including in rural and remote areas
- opportunities for Indigenous communities
- future-proofing Australia's energy exports for the long term

Zero-Carbon Energy for the Asia-Pacific



23 x the NEM's

261 TWh/a !



Zero-Carbon Energy for the Asia-Pacific

The ZCEAP research program consists of **five interrelated projects**:

- Renewable Electricity Systems
- **Hydrogen Fuels**
- Energy Policy and Governance in the Asia-Pacific
- Renewable Refining of Metal Ores
- Indigenous Community Engagement.

Objectives

We will use research and engagement to help:

- Transform the way Australia trades with the world through the development of zero-carbon export industries
- Create new paradigms in benefit sharing
- Develop technologies, policies and approaches that can be applied in the Asia-Pacific and beyond.

Ammonia = Hydrogen 2.0

‘Ammonia certification to support decarbonisation and international trade - challenges and opportunities’

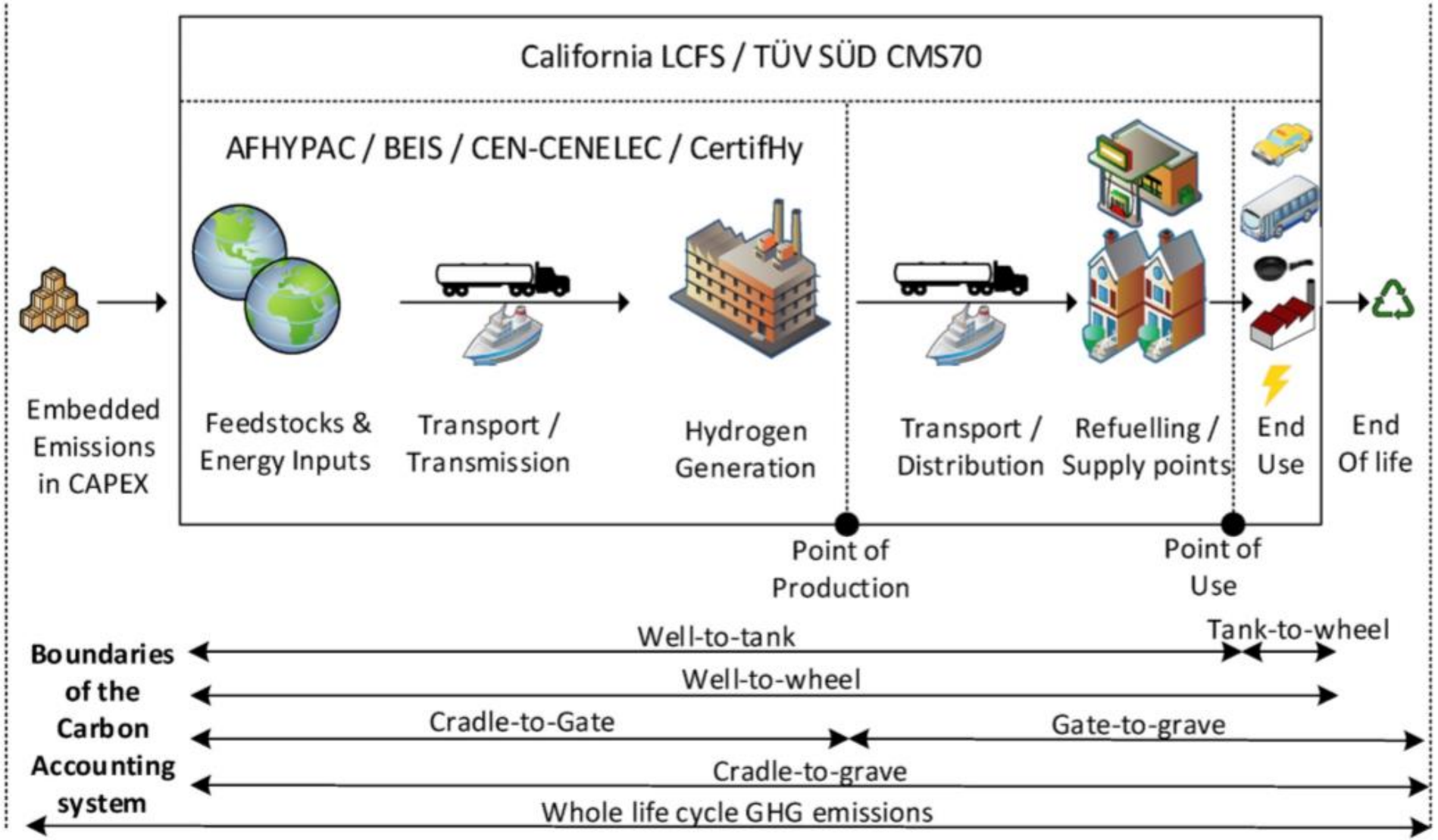
- Ammonia and hydrogen – drivers for new fuels
- ‘Clean’, ‘Green’, ‘Blue’, ‘Grey’, ‘Turquoise’ etc etc…
- Price and emissions profiles – the global playing field
- An efficient international ammonia energy market
- How do we get there?

Ammonia certification: Why?

- Corrects an “asymmetry of information” market failure – without certification, buyers cannot know how “clean” the ammonia is
- This facilitates international trade – buyers of low embedded emissions ammonia know that sellers are providing what is promised
- Supports potential premium pricing of ammonia generated by electrolysis powered by renewable generation – a comparative advantage for Australia
- Key feature will be for certifications in Australia to be accepted by potential importers

Reference: White, L. V., Fazeli, R., Cheng, W., Aisbett, E., Beck, F. J., Baldwin, K. G. H., Howarth, P., O’Neill, L., (forthcoming) *Towards emissions certification systems for international trade in hydrogen: the policy challenge of defining boundaries for emissions accounting*

Certification Boundaries (Hydrogen)



Reference: Abad and Dodds (2020), *Green hydrogen characterisation initiatives: Definitions, standards, guarantees of origin, and challenges'*

Ammonia certification: How?

From Australia's National Hydrogen Strategy

'Australia does not want to see any international disagreement about certification delaying investment in hydrogen production. One way to avoid this would be to **quickly establish** a minimal certification scheme that verifies and tracks

- **production technology**
- **scope 1 and scope 2 carbon emissions**
- **and production location**

The scheme could be expanded later to include water consumption and other factors'.

Ammonia certification: How?

- Ammonia (NH_3) is emerging as a low embedded emissions energy product in its own right (not just a H_2 carrier)
- Large scale NH3 international trade may happen sooner (by late-2020s) than for hydrogen – coal co-firing, shipping fuel
- Ammonia has similar certification system issues with H_2 but differences too – production process, demand markets, corporate stakeholders, political momentum, governance
- What are the alternatives for ammonia certification – treat as an extension of H_2 certification or separate/parallel certification?

Conclusions

- Low embedded emissions ammonia certification system timing – urgent!!
- Leveraging ammonia focussed forums in shaping ammonia governance (Ammonia Energy Association, Green Ammonia Consortium. Others?)
- Ammonia energy trade governance negotiations - dedicated ammonia forum(s), or parallel track within existing H_2 forums? Other?
- Geo-political implications of Australia's place supplying ammonia to potentially huge Asian markets - IMO, IPHE and others
- Emissions accounting for ammonia production boundary – what are the implications for certification of integrated H2/NH3 plants?
- Inclusion of transportation stage boundary in emissions calculations can strengthen ammonia's clean credentials vis à vis hydrogen

Contact me on Penelope.Howarth[at]anu.edu.au