HySupply Australian Project Update

Prof. Iain Macgill

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

HySupply - German Delegation Visit to Australia
UNSW Sydney
May 26, 2022

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
A collaboration

Joint Feasibility Study of Renewable Hydrogen

German-Australian Hydrogen Supply Chain

Module 1: Production
- Renewable energy
- Hydrogen (H₂)

Module 2: Transport
- Export of hydrogen-based energy carriers

Module 3: Recovery
- Import
- Recovery and distribution

Module 4: End use
- Steel industry
- Refineries
- Chemical industry

Source: BDI/acatech

Logos:
- GlobH2E
- UNSW
- Bundesverband der Deutschen Industrie e.V.
- DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN
... a collaboration of many parts
Growing numbers of export oriented projects in development

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

...and some key shared experiences

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

Wind and solar are replacing fossil fuels’ market share

<table>
<thead>
<tr>
<th>Country</th>
<th>Fossil Fuels</th>
<th>Wind and Solar</th>
<th>Other clean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>-</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>50%</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>Chile</td>
<td>30%</td>
<td>15%</td>
<td>25%</td>
</tr>
<tr>
<td>Spain</td>
<td>20%</td>
<td>30%</td>
<td>2%</td>
</tr>
<tr>
<td>Argentina</td>
<td>30%</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>Kenya</td>
<td>40%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>20%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>Greece</td>
<td>10%</td>
<td>40%</td>
<td>10%</td>
</tr>
<tr>
<td>Hungary</td>
<td>25%</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>Portugal</td>
<td>30%</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Estonia</td>
<td>20%</td>
<td>25%</td>
<td>15%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>15%</td>
<td>30%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Source: EMBER’s Global Electricity Review 2020
Note: Countries selected by the biggest increases in wind and solar share.

Wind and solar have taken off across the world

Wind and solar as a percentage share of electricity generation in 2011 (also 2020).

Seats won

<table>
<thead>
<tr>
<th>Party</th>
<th>Seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALP</td>
<td>75</td>
</tr>
<tr>
<td>LNP</td>
<td>57</td>
</tr>
<tr>
<td>IND</td>
<td>10</td>
</tr>
<tr>
<td>GRN</td>
<td>3</td>
</tr>
<tr>
<td>OTH</td>
<td>2</td>
</tr>
</tbody>
</table>

Last updated May 25, 2023, 9:15pm

76 seats needed for a majority

75.41% counted

4 still to call
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 analysis

• 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.

**Project Description**

**Project Statement**

The HySupply Shipping Analysis Tool has been developed to evaluate the levelised cost of transporting 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 industrial collaborators.

**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 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/](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.
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Full details on the assumptions and values used are contained in the documentation provided.
‘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)

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

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

Supply-side Roadmapping (with Deloitte)
Much to be optimistic about... but much more still to be done.

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
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.
# Certification Scheme Roles

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

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scheme owner</strong></td>
<td>Develops and maintains the certification scheme and owns “mark of conformity”</td>
</tr>
<tr>
<td><strong>Certification body</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Certification body</strong></td>
<td>Performs an assessment of a product, process, or service to demonstrate that requirements specified in the certification scheme have been fulfilled</td>
</tr>
<tr>
<td><strong>Accreditation body</strong></td>
<td>Checks that the certification body is independent and impartial, and is employing people with the right training</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Scheme type</th>
<th>CertifHy</th>
<th>Australian GO</th>
<th>AEA</th>
<th>Smart Energy Council</th>
<th>GH2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification type</td>
<td>Certification of low-emissions hydrogen</td>
<td>Certification of quality of information about hydrogen emissions and production</td>
<td>Certification of quality of information about ammonia emissions and production</td>
<td>Certification of renewable hydrogen</td>
<td>Certification of green hydrogen</td>
</tr>
<tr>
<td>Scheme owner type</td>
<td>Public-private partnership</td>
<td>Public</td>
<td>TBD</td>
<td>Private</td>
<td>Private</td>
</tr>
<tr>
<td>Certification type</td>
<td>Third-party conformity assessment</td>
<td>TBD</td>
<td>TBD</td>
<td>Third-party conformity assessment</td>
<td>Third-party conformity assessment</td>
</tr>
<tr>
<td>Intended geographic coverage</td>
<td>EU focused at present but expanding</td>
<td>Initially Australian, intended to be international</td>
<td>International</td>
<td>International</td>
<td>International</td>
</tr>
<tr>
<td>Owns a mark of conformity as of May 2022</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Agency</td>
<td>Status</td>
<td>Scheme boundaries</td>
<td>Emissions scope</td>
<td>Grid electricity eligibility</td>
<td>Offset treatment (not CCS)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------</td>
<td>----------------------------</td>
<td>----------------------------------------</td>
<td>------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CertifHy Phase II</td>
<td>Completed pilot program</td>
<td>Well-to-gate (factory)</td>
<td>Scope 1, 2, upstream 3 (feedstock)</td>
<td>With surrender of renewable energy certificate</td>
<td>Not mentioned directly, but description of certificate requirements suggests offsets not acceptable</td>
</tr>
<tr>
<td>CertifHy Phase III</td>
<td>Press release</td>
<td>Assumed same as Phase 2</td>
<td>Assumed same as Phase 2</td>
<td>Expected to align with RED II requirements (if including pending Article 27 this would mean additionality, geographic match, temporal match)</td>
<td>Assumed same as Phase 2</td>
</tr>
<tr>
<td>Australian Government GOO</td>
<td>Trials proceeding</td>
<td>Well-to-gate (factory)</td>
<td>Scope 1, 2, upstream 3 (feedstock)</td>
<td>Via location-based and/or market-based mechanisms</td>
<td>Possible that offsets will be permitted; if so, recommendation is to include tracking of source of offset</td>
</tr>
<tr>
<td>AEA</td>
<td>Discussion paper</td>
<td>Well-to-gate (factory)</td>
<td>Scope 1, 2, upstream 3 (feedstock)</td>
<td>With or without PPA (non-exhaustive)</td>
<td>Not mentioned directly, but likely to receive similar treatment to IPHE recommendation</td>
</tr>
<tr>
<td>IPHE</td>
<td>Methodology draft</td>
<td>Well-to-gate (factory)</td>
<td>Scope 1, 2, upstream 3 (feedstock &amp; capital)</td>
<td>Via location-based and/or market-based mechanisms</td>
<td>Recommendation against using offsets; where used, report type and quantity</td>
</tr>
<tr>
<td>Smart Energy Council</td>
<td>First pilot facility has been certified</td>
<td>Well-to-gate (factory)</td>
<td>Scope 1, 2, upstream 3 (feedstock), planned expansion for downstream (well-to-wheel)</td>
<td>Australian Government renewable energy definition</td>
<td>Offsets under consideration in order to enable ‘zero carbon’ certification</td>
</tr>
<tr>
<td>GH2 Scheme</td>
<td>Standard draft (March 2022)</td>
<td>As per IPHE although proposed extensions to storage, transport and use</td>
<td>As per IPHE with some modification</td>
<td>Via location-based and/or market-based mechanisms</td>
<td>Offsets not discussed in Draft Standard but note application of IPHE draft method</td>
</tr>
</tbody>
</table>
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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Associate Director (Research)
Zero-Carbon Energy for the Asia-Pacific Grand Challenge
W www.anu.edu.au/zerocarbon
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 required 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.