**Project Title: Technoeconomic Analysis of Power to X Value Chains**

***Project Summary:***

Commercial maturity of Power-to-X (P2X) technologies to utilise renewable energy resources for electrochemical conversion of abundant molecules like water, CO2, and N2, into green renewable energy-carriers, fuels and chemical feedstocks have opened new avenues for deep-rooted decarbonisation.1 A transition that is well underway, with 41 governments (accounting for ~80% of global CO2 footprint from energy use) having introducing policies and incentives to kick start the P2X economies, leading to expectations that H2 and derivatives could supply upto about a fifth of global energy needs.2,3,4

However, only 10% of the committed projects have reached an FID decision.3 A key challenge is establishing viable supply and offtake opportunities for H2 and derivatives.5 Here at GlobH2E we have developed modelling tools and assessment frameworks that have the capability to simulate, evaluate and establish cost optimised mix of P2X technologies and renewable energy resources for a wide range of products including green hydrogen, ammonia, methanol, SAF etc.6-9 This PhD project will focus on building further capability and functionality of these existing resources and establishing new tools/frameworks for offtake of these pathways including their storage, transport and end use across the power sector and industry particularly the mining sector, heavy duty transportation including maritime and aviation as well as emerging export opportunities. The tools will be used for analysis within the context of Australia’s emerging H2 economy as well as globally, including opportunities to contribute to government and industry led feasibility studies. As such, prior knowledge in technoeconomic analysis, financial modelling, renewable energy modelling (solar/wind energy data modelling), process design and engineering along with software skills like Aspen/DWSIM, Excel VBA modelling, python and web code development would be beneficial.

***Key Techniques:***

Technoeconomic Analysis, Process Simulation, Open-Source Assessment Tool Coding and Development.

***Supervisors:***

Dr. Rahman Daiyan (School of Minerals and Energy Resource Engineering), Dr. Muhammad Haider Ali Khan (School of Chemical Engineering) and Prof Iain MacGill (School of Electrical Engineering).

Further information regarding the project, can be obtained by contacting Dr. Daiyan (r.daiyan@unsw.edu.au) or Dr. Haider ([muhammadhaiderali.khan@unsw.edu.au](mailto:muhammadhaiderali.khan@unsw.edu.au)) and for application process please contact: GlobH2E Centre Manager: mandalena@unsw.edu.au

***PhD Stipend:***

PhD Scholarship will be available for a period of 3.5 years. The HDR stipend rate is $ $37,684 per annum tax-free (for 2024 rate and indexed annually). International applications are encouraged to apply and maybe eligible for Tuition Fee Scholarships.

***Note*** *that Domestic Student maybe eligible for Engineering Top Up (to maximum of $10,000 per annum.)*

***Research Environment:***

The GlobHE Training Centre is offering PhD Scholarship that will provide a unique training opportunity through:

* World-class and state-of-the-art facilities and experts across the participating universities, research institutions, industry partners and other organisations
* An integrated Training Centre research agenda with inter-disciplinary projects across 5 themes area
* Opportunity to work or placement with partner organisations and industry partners.
* Research skills, career development workshops and relevant industrial training.
* Competitive support for national and international conference travel and networking opportunity
* Generous project support and excellent mentorship
* Delivering the next generation of highly skilled workforce to give Australia the ability to build home-grown hydrogen solutions and economic models.

***Eligibility and Process:***

If you are interested to apply for PhD admission and scholarship at UNSW, please go to UNSW Graduate Research Website outlining eligibility requirement and application step by step process: https://research.unsw.edu.au/submit-application

***Key Dates:***

Applications must be submitted by the application deadline for the intended study period (Term) to ensure acceptance and enrolment processes are completed by the Term Start Dates. Please check the key dates for application deadlines: <https://www.unsw.edu.au/research/hdr/application>

***References:***

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2. Hydrogen Council; McKinsey & Company. *Hydrogen Insights 2023:* 2023. <https://hydrogencouncil.com/en/hydrogen-insights-2023/>.
3. IEA. *Global Hydrogen Review 2023*; International Energy Agency, 2023. <https://www.iea.org/reports/global-hydrogen-review-2023>.
4. IRENA (2023), *World Energy Transitions Outlook 2023: 1.5°C Pathway*, Volume 1, International Renewable Energy Agency, Abu Dhabi. <https://www.irena.org/Publications/2023/Jun/World-Energy-Transitions-Outlook-2023>
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6. Khan, M.H.A.; Heywood, P.; Kuswara, A.; Daiyan, R.; MacGill, I.; Amal, R. *An integrated framework of open-source tools for designing and evaluating green hydrogen production opportunities*. Commun Earth Environ **3**, 309 (2022). <https://doi.org/10.1038/s43247-022-00640-1>
7. Shepherd, J.; Khan, M.H.A., Amal, R.; Daiyan, R.; MacGill, I. *Open-source project feasibility tools for supporting development of the green ammonia value chain.* Energy Conversion and Management, Volume 274, 2022, 116413, <https://doi.org/10.1016/j.enconman.2022.116413>
8. Van Antwerpen, J.; Khan, M.H.A.; Shepherd, J.; Hao Tan, Z.; Grundy, S.; MacGill, I.; Amal, R.; Daiyan. R. *A model for assessing pathways to integrate intermittent renewable energy for e-methanol production*. International Journal of Hydrogen Energy, Volume 48, Issue 78, 2023. <https://doi.org/10.1016/j.ijhydene.2023.04.177>
9. Johnstone, C.; Khan, M.H.A.; Amal, R. Daiyan, R.; MacGill, I. *Shipping the sunshine: An open-source model for costing renewable hydrogen transport from Australia.* International Journal of Hydrogen Energy, Volume 47, Issue 47, 2022. <https://doi.org/10.1016/j.ijhydene.2022.04.156>