



Standing Committee on Public Administration
Parliament House
4 Harvest Tce
West Perth WA 6005

30th January 2024

RE: Submission regarding the Inquiry into innovation in Western Australia (the “Submission”)

Dear Members of the Standing Committee on Public Administration (“**Committee**”),

Future Energy Export CRC Limited (“**FEnEx CRC**”) welcomes the opportunity to provide comment and input for consideration by the Parliament of Western Australia (“**Parliament**”) regarding the Inquiry into Innovation in Western Australia (the “**Inquiry**”)¹.

FEnEx CRC is firmly committed to supporting the State Government of Western Australia (“**WA Government**”) achieve the aims articulated with its *Western Australian Innovation Strategy and Action Plan*² as well as its *Diversify WA: Future State*³. FEnEx CRC concurs with the WA Government’s views that “innovation will be a key enabler for the future growth and diversification of the WA economy⁴,” which would also “turn into high quality jobs, greater investment and broader community benefits⁵.”

1. Executive Summary of our Submission

FEnEx CRC believes there are several recommendations that the WA Government should consider to enhance the opportunity for building greater economic resilience, assist the diversification of its economy, open up new markets and upskill its workforce.

As articulated in this submission and others FEnEx CRC has made on State and Federal matters, **a key issue for WA and Australian innovation – and particularly for energy related innovation – is being caught within the “2 Valleys of Death”** where many promising innovations struggle to bridge the gap between research and full commercialisation. Numerous barriers exist that exacerbate this – but two fundamental issues at a Western Australia (“**WA**”) level are:

- (1) Extremely low level of Research and Development (“**R&D**”) investment (by government, private non-profit, business, and higher education) in WA when compared to WA’s Gross State Product (“**GSP**”). Despite a recommendation by a former State Parliamentary Inquiry in 2016 to raise the WA expenditure on R&D to 3% of GSP (which would match the average spend by OECD members), it continues to languish at less than 1%. **FEnEx CRC strongly recommends that the WA Government implement policies that increase total annual investment for innovation and R&D in WA (by government, private non-profit, business, and higher education) to 3% of WA’s GSP.**

¹ Parliament of Western Australia (2023) “Inquiry into innovation in Western Australia.” More information available at <https://www.parliament.wa.gov.au/parliament/commit.nsf/0/0044E590EAF695548258A770014AE58?OpenDocument#Details>

² Government of Western Australia (2022) “WA Innovation Strategy” and “WA Innovation Strategy - Action Plan” More information available at <https://www.wa.gov.au/government/publications/western-australias-innovation-strategy>

³ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

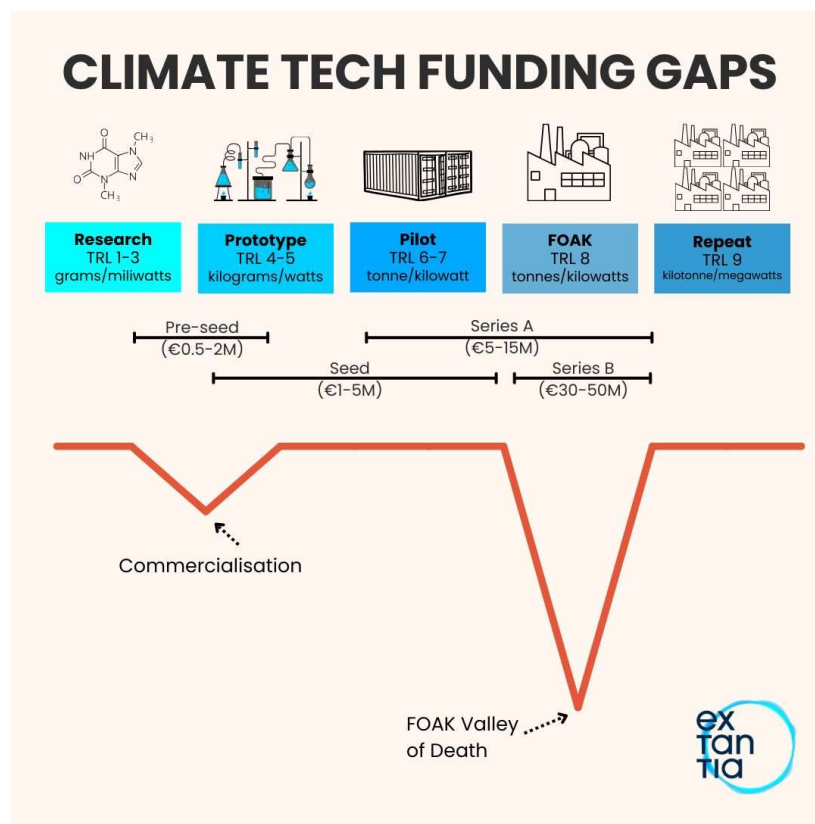
⁴ Government of Western Australia (2022) “WA Innovation Strategy” page 4 (Forewords - Hon Stephen Dawson MLC). Available at <https://www.wa.gov.au/system/files/2022-12/Innovation%20Strategy.pdf>

⁵ Government of Western Australia (2022) “WA Innovation Strategy” page 4 (Forewords - Professor Peter Klinken, AC). Available at <https://www.wa.gov.au/system/files/2022-12/Innovation%20Strategy.pdf>

Quite simply – if fewer dollars are available, WA can only expect a lower level of innovation compared to its Australian and international peers.

- (2) Lack of funding support for First Of A Kind (“**FOAK**”) products and facilities being developed in WA and seeking between AU\$10 million to AU\$100 million that are in a caught in the ‘Second Valley of Death’ dilemma where:
- a. On one side, the technology is not de-risked enough for infrastructure investors and other institutional investors (who have funds but not enough risk appetite); and
 - b. On the other side, the funding amount is:
 - i. Too big for early-stage technology venture capital funds to finance the required equity-portion, and
 - ii. Too small for late-stage technology venture capital funds who tend to invest at ~AU\$100m million.

See image below⁶ for a visual representation of the ‘Second Valley of Death’ dilemma.



FEnEx CRC strongly recommends that the WA Government provide subsidies for enabling FOAK products and facilities that directly align with the objectives of strategic development for the nine priority sectors as identified in the Diversify WA: Future State⁷.

Another barrier for enabling innovation relates to risk aversion for implementing policies for innovation. Government policies for innovation and research often have good ambitions which are not realised due to the

⁶ Reem Yair (Partner at Extantia Capital) (2023), LinkedIn post on Climate Tech Innovation’s “FOAK Valley of Death.” Image available at https://www.linkedin.com/posts/yairreem_climatetech-cleantechcapitalday-venturecapital-activity-7119928519987486720-0u3i/

⁷ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

culture of risk aversion that often exists within the government agencies that are tasked to implement such policies.

FEnEx CRC recommends that the WA Government recognise the fact that most potential innovations fail, and incorporate this fact into the design and implementation of its policies so that the organisational culture of risk aversion that is often seen by the implementers does not hamper the process and development of innovation.

A further key recommendation in this submission is for the WA Government to **facilitate greater collaboration among innovators, research institutions and industry participants and facilitate knowledge transfer through:**

- (3) **Ongoing creation of specialised innovation hubs and accelerators that offer tailored support for technology development and market entry.** One of FEnEx CRC's flagship projects – the Kwinana Energy Transformation Hub (KETH) is poised to offer a shovel-ready facility that can provide a bridge between innovators as well as research institutions and industry, facilitating knowledge transfer, fostering collaboration, and ensuring that innovative solutions are not left stranded in the transitional phase. Additionally, FEnEx CRC highlights the recent launch of its low pressure LCO₂ transportation R&D project among major Australian and Japanese partners ("**LCO₂ Technology R&D Project**") as an example of how innovation can be originated and effectively pursued for one of the priority sectors as identified by "Diversify WA: Future State."
- (4) **Requiring or at least facilitating open access for WA Government funded research** (while allowing for commercially sensitive information to be kept confidential) in journals, papers and publications that is currently locked behind paywalls.
- (5) **Partnering with intermediaries, such as industry associations and other advisory or network bodies, that have existing connections between industry, government, researchers, and markets** when implementing programs to support diffusion (such as capability development initiatives and extension services).

Finally, FEnEx CRC also recommends that the WA Government **replaces the priority sectors of "renewable hydrogen" and "CCUS" technologies, as identified by the 'Diversify WA: Future State'⁸, with a broader priority of "decarbonisation"** (with "renewable hydrogen" and "CCUS" technologies forming part of the "decarbonisation" priority).

2. Overview of FEnEx CRC

FEnEx CRC is an Australian not-for-profit organisation striving to decarbonise liquefied natural gas ("**LNG**") exports and grow clean hydrogen production. FEnEx CRC brings together thirty-seven (37) industry, government, and university partners with resources of approximately AU\$166 million to conduct industrial-scale research that supports LNG and hydrogen exports from Australia.

For more information on FEnEx CRC, see Appendix 1 of this document.

3. Detail regarding our Submission

As per the Terms of Reference of the inquiry, FEnEx CRC provides the following contributions in relation to the Inquiry:

⁸ Government of Western Australia (2023) "Diversify WA: Future State." Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

(1) Regarding our assessment of the current state of the innovation ecosystem

a. FEnEx CRC commends the WA Government for:

- i. Developing and commencing implementation of its WA Innovation Strategy and Action Plan⁹;
- ii. Committing more than AU\$30 million since 2017 through the New Industries Fund (“NIF”)¹⁰ and supporting key initiatives to support the growth of WA’s innovation ecosystem
- iii. Developing the Diversify WA economic framework¹¹ and the Diversify WA: Future State¹² to identify nine priority sectors for strategic development that match WA’s unique strengths with global trends for achieving growth across the WA economy and outlining its 2035 aspirations for the priority sectors.

b. FEnEx CRC observes the following key barriers that hamper Western Australia (“WA”) to grow its innovation ecosystem

i. Barriers related to the economic structure of WA

1. WA is dominated by the mining, petroleum, and primary industries; Out of the nine priority sectors as identified by “Diversify WA: Future State,” five sectors (renewable H2, critical minerals, Carbon, Capture, Usage and Storage (“CCUS”), LNG decommissioning, high-value food and beverages) are expected to be developed through investment and capability provided by the said industries. However, operations in these industries are “exposed to high levels of risk in terms of safety and regulatory compliance, capital intensity, weather dependency and workforce variability. Risk saturation and a regulatory environment that imposes high penalties for non-compliance constrain the appetite for innovation.”¹³
2. Small businesses represent 97% of all businesses in Western Australia¹⁴. The characteristics of small businesses having low levels of free cash flow and human resources “limit the capacity to invest in adopting and scaling innovation. The ‘missing middle’ (low number of medium-sized businesses) means that the scaling of innovation and realisation of commercial benefits either fails or is taken offshore.”¹⁵
3. Not all businesses have the need or risk appetite to innovate to achieve their objectives. “Research shows that only 5% to 15% of business leaders of small and medium enterprises (“SMEs”) have the desire to grow to be multinational businesses; the majority are lifestyle businesses.”¹⁶

⁹ Government of Western Australia (2022) “WA Innovation Strategy” and “WA Innovation Strategy - Action Plan” More information available at <https://www.wa.gov.au/government/publications/western-australias-innovation-strategy>

¹⁰ Government of Western Australia (2022) “Innovation Strategy Western Australia – the place to innovate” page 14. More information available at <https://www.wa.gov.au/system/files/2022-12/Innovation%20Strategy.pdf>

¹¹ Government of Western Australia (2023) “Diversify WA economic development framework.” Available at <https://www.wa.gov.au/organisation/department-of-jobs-tourism-science-and-innovation/diversify-wa-economic-development-framework>

¹² Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

¹³ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 10. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

¹⁴ Government of WA (2023), “Small business facts and statistics.” Information available at <https://www.wa.gov.au/service/business-support/small-business-services/small-business-facts-and-statistics>

¹⁵ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 11. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

¹⁶ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 10. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

4. Since the domestic WA (and broader Australian) market for innovative enterprises is perceived to be small, this represents subscale reward relative to the risk profile for pursuing innovation. “Businesses seeking to service global markets from Australia face barriers such as accessibility and cost competitiveness that render these markets unobtainable¹⁷.”

ii. Barriers related to funding access for innovation in WA

1. The estimated R&D expenditure across the WA economy is approximately AU\$2,751 million¹⁸. Assuming that WA’s Gross State Product (“GSP”) is AU\$320,653 million¹⁹, WA’s estimated R&D expenditure is only ~0.86% of WA’s GSP. This is low relative to:
 - a. Average R&D expenditure of 3.01% (% of GDP) spent by OECD members²⁰; and
 - b. WA’s aspirational R&D expenditure target of 3% (% of GSP) as recommended by a 2016 inquiry into technological and service innovation in Western Australia by the Parliament’s Economic and Industry Standing Committee²¹.

A related point to highlight is that WA’s estimated R&D expenditure (AU\$2,751 million, as stated above) only constitutes 7.7% of the gross expenditure on R&D (GERD) for Australia of AU\$35,602 million²². Assuming that WA’s GSP of AU\$320,653 million (as stated above) constitutes 16.0% of Australia’s Gross Domestic Product of AU\$ 2,010,087 million, the R&D expenditure incurred in WA appears low relative to that which is incurred across the rest of Australia.

¹⁷ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 10. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

¹⁸ AU\$2,751 million is based on a sum of (1) 2020-2021 Government expenditure on R&D (GOVERD) spent in WA of AU\$ 245 million; (2) 2020-2021 Private non-profit expenditure on R&D (PNPERD) spent in WA of AU\$ 104 million; (3) 2020-2021 Business expenditure on R&D (BERD) spent in WA of AU\$1,347 million; and (4) 2020 Higher education expenditure on R&D (HERD) spent in WA of AU\$1,055 million.

- Information for WA’s GOVERD (AU\$ 245 million) and PNPERD (AU\$ 104 million) available at Australian Bureau of Statistics (2022) “Research and Experimental Development, Government and Private Non-Profit Organisations, Australia”

<https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-government-and-private-non-profit-organisations-australia/latest-release>

- WA’s BERD (AU\$1,347 million) derived from (1) “BERD, by location of expenditure - proportion of GSP” for WA 2021-22 being 0.42% (information available at Australian Bureau of Statistics (2023) “BERD and GSP” <https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-businesses-australia/latest-release>); and (2) GSP for WA 2021-22 being AU\$320,653 million (information available at Australian Bureau of Statistics (2021) “Table 1. Gross State Product, Chain volume measures and current prices” of “Australian National Accounts: State Accounts” <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/2020-21>)

- WA’s HERD (AU\$1,055 million) available at Australian Bureau of Statistics (2022) “Research and Experimental Development, Higher Education Organisations, Australia” <https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-higher-education-organisations-australia/latest-release>

¹⁹ Australian Bureau of Statistics (2021) “Table 1. Gross State Product, Chain volume measures and current prices” of “Australian National Accounts: State Accounts,” June 2021 data for “Western Australia; Gross state product: Chain volume measures.” Information available at <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/2020-21>

²⁰ UNESCO Institute for Statistics (2023), “Research and development expenditure (% of GDP)” for OECD members in 2021. Research and development expenditure include both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development. Information available at <https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?end=2021&start=1996&view=chart>

²¹ Parliament of Western Australia (2016) “Economic and Industry Standing Committee – Growing WA through Innovation – The Western Australian Government’s role in fostering innovation to expand and diversify the economy” pages ix and 61. More information available at [https://www.parliament.wa.gov.au/Parliament/commit.nsf/\(Report+Lookup+by+Com+ID\)/F0D11EBF044B3B4B48257FE20005D8E2/\\$file/20160630%20EISC%20Report%207.pdf](https://www.parliament.wa.gov.au/Parliament/commit.nsf/(Report+Lookup+by+Com+ID)/F0D11EBF044B3B4B48257FE20005D8E2/$file/20160630%20EISC%20Report%207.pdf)

²² Australian Bureau of Statistics (2021) “Table 1. Gross State Product, Chain volume measures and current prices” of “Australian National Accounts: State Accounts.” Available at <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/2020-21>

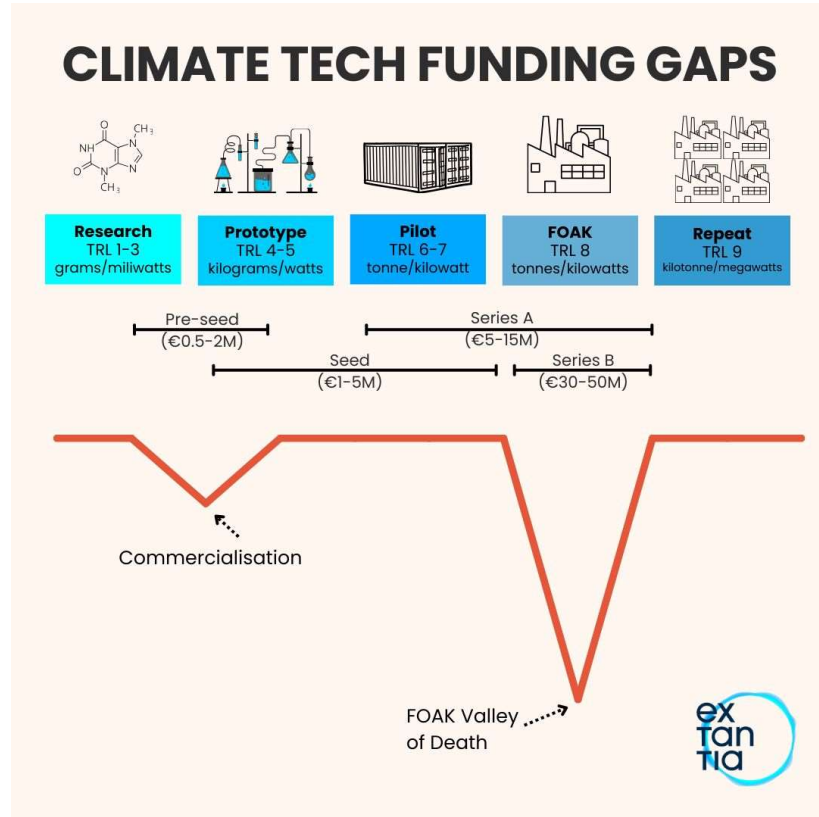
2. When introducing First Of A Kind (“**FOAK**”) products and facilities into market, there are actually two funding gaps:
 - a. The first gap is experienced when innovators/startups have successfully tested the FOAK technology in a laboratory setting and are ready to demonstrate the technology at small/pilot scale (pre-seed rounds); and
 - b. The second gap is experienced when innovators/startups need substantial investments to deliver a commercial-scale project that utilises the FOAK technology (usually Series A / B rounds).

While many of WA Government’s grant programs for innovation, ranging between ~AU\$50,000 to ~AU\$500,000, assist innovators/startups to address the first funding gap, innovators/startups are challenged to raise funds for addressing the second funding gap of ~AU\$10 million to ~AU\$100 million. Innovators/startups are in a ‘caught in between’ dilemma where:

- c. On one side, the technology is not de-risked enough for infrastructure investors and other institutional investors (who have funds but not enough risk appetite). As mentioned above, appetite for innovation by the mining, petroleum, and primary industries of WA (who also have funds) tend to also be constrained due to risk saturation and regulatory environment that imposes high penalties for non-compliance; and
- d. On the other side, the funding amount is:
 - i. Too big for early-stage technology venture capital funds to finance the required equity-portion, and
 - ii. Too small for late-stage technology venture capital funds who tend to invest at ~AU\$100m million.

See image below²³ for a visual representation of this ‘caught in between’ dilemma.

²³ Reem Yair (Partner at Extantia Capital) (2023), LinkedIn post on Climate Tech Innovation’s “FOAK Valley of Death.” Image available at https://www.linkedin.com/posts/yairreem_climatetech-cleantechcapitalday-venturecapital-activity-7119928519987486720-0u3i/



iii. Barriers related to lack of focus for “non-tech” innovation in WA

1. “Government policy directs most resources to physical sciences and tangible product innovation. Limited support is available for de-risking innovation in services, business model or market adoption and growth.²⁴” There is an absence of government intervention that focuses on “building capabilities to de-risk market adoption and develop innovative business models. Programs currently focus primarily on technical readiness and product feasibility risk, while neglecting crucial elements of building competitive businesses²⁵.”
2. As highlighted by the Australian Government Productivity Commissions:
 - a. “Government policy needs to play more emphasis on the 98% of businesses that benefit from diffusion of existing good ideas and effective business models²⁶.” It is noted that the World Intellectual Property Organisation ranks Australia at 78th in the world in knowledge diffusion and 52nd in knowledge absorption²⁷.

²⁴ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 14. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

²⁵ Office of Industry Innovation and Science Australia for the Australian Government (2023) “Barriers to collaboration and commercialisation” page 13. Information available at <https://www.industry.gov.au/publications/barriers-collaboration-and-commercialisation>

²⁶ Australian Government Productivity Commission (2023), “Factsheet #3 for 5-year Productivity Inquiry - Advancing Prosperity Volume 5 (Innovation for the 98%)” page 1. Available at <https://www.pc.gov.au/inquiries/completed/productivity/report/productivity-factsheet3-innovation-diffusion.pdf>

²⁷ World Intellectual Property Organisation (2021) “Global Innovation Index 2021” page 6 and 7. Available at https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021/au.pdf

- b. “Obstacles to the diffusion of already known innovations and the policy levers to address these obstacles generally take a different form to those widely used to stimulate new-to-the-world innovation. In particular, the policies that promote diffusion of established technologies and practices in an economy tend to be more general and broad-based. They aim to affect all firms in all industries, not just those creating and commercialising new-to-the-world innovations. These policies include:
- i. Broad conditions that maximise the incentives for firms to experiment and adopt innovations
 - ii. Facilitating the transfer of knowledge, skills, and technologies from overseas
 - iii. Building critical skills for firm-level innovation – management capabilities in particular
 - iv. Enabling the flows of information that support good decision making”²⁸

iv. **Barriers related to risk aversion for implementing policies for innovation**

Government policies for innovation and research often have good ambitions which are not realised due to the culture of risk aversion that often exists within the government agencies that are tasked to implement such policies. Causes of the said organisational culture of risk aversion include “difficulties of achieving (and measuring) innovation success, bureaucratic norms that emphasize rules over results and processes over outcomes, and the asymmetric relationship between those bearing the risk involved in innovation and those garnering the reward or incentive²⁹.” Hence, the time taken to approve minor changes or assess technical details which do not actually matter greatly erodes the potential impact of the policy and associated funding, and often causes the failure such risk aversion was intended to avoid.

(2) Regarding our recommendation on the roles of the WA Government in supporting entrepreneurship, start-ups, and SMEs

- a. The WA Government improves its total annual spend on R&D across the WA economy for achieving its aspirational R&D expenditure target of 3% (% of GSP). The WA Government also monitor and report on the progress in reaching this goal.
- b. While working to achieve an aspirational R&D expenditure target of 3% (% of GSP), the WA Government should engage with the Australian Commonwealth Government to explore ways to allocate more of Australia’s total annual spend on R&D to WA. The WA Government can highlight to the Australian Commonwealth Government that WA’s GSP contribution to Australia’s Gross Domestic Product is ~16.0%, while WA’s estimated R&D expenditure only constitutes ~7.7% of the gross expenditure on R&D (GERD) for Australia.
- c. The WA Government designs and implements grant programs for innovation that specifically address the following barriers:
 - i. Five out of the nine priority sectors as identified by “Diversify WA: Future State” (renewable H2, critical minerals, CCUS, LNG decommissioning, high-value food and beverages) are expected to be developed through investment and capability provided by the mining, petroleum, and primary

²⁸ Australian Government Productivity Commission (2023), “5-year Productivity Inquiry - Innovation for the 98% - Inquiry Report Volume 5” page 20. Available at <https://www.pc.gov.au/inquiries/completed/productivity/report/productivity-volume5-innovation-diffusion.pdf>

²⁹ (2017), “Rethinking the effect of risk aversion on the benefits of service innovations in public administration agencies.” Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0048733317300598>

- industries; appetite for innovation by these industries tend to be constrained due to risk saturation and regulatory environment that imposes high penalties for non-compliance;
- ii. The second funding gap for introducing FOAK products and facilities into market is experienced when innovators/startups need substantial investments (~AU\$10 million to ~AU\$100 million) to deliver a commercial-scale project that utilises the FOAK technology (usually Series A / B rounds). While many of WA Government's grant programs for innovation, ranging between ~AU\$50,000 to ~AU\$500,000, assist innovators/startups to address the first funding gap, innovators/startups are challenged to raise funds for addressing the second funding.
 - iii. Limited support is available for de-risking innovation in services, business model or market adoption and growth. There is an absence of government intervention that focuses on building capabilities to de-risk market adoption and develop innovative business models.
 - iv. Government policies needs to place more emphasis on the 98% of businesses that benefit from diffusion of existing good ideas and effective business models.
 - v. Government policies needs to explicitly require the implementers (relevant government agencies) of the said policies to take an approach more analogous to venture capital investors. Most potential innovations fail; this fact should be factored into the design and implementation of the said policies so that the organisational culture of risk aversion that is often seen by the implementers does not hamper the process and development of innovation.
- d. The WA Government strengthen collaborative networks for diffusion and facilitate knowledge transfer through:
- i. Requiring open access for government funded research (while allowing for commercially sensitive information to be kept confidential) in journals, papers and publications that is currently locked behind paywalls.
 - ii. Partnering with intermediaries, such as industry associations and other advisory or network bodies, that have existing connections between industry, government, researchers, and markets when implementing programs to support diffusion (such as capability development initiatives and extension services).

(3) Any other matters that the Committee considers relevant

- a. FEnEx CRC recommends that the WA Government **facilitate greater collaboration among innovators research institutions and industry participants and facilitate knowledge transfer through ongoing creation of specialised innovation hubs and accelerators that offer tailored support for technology development and market entry.**

- i. **FEnEx CRC's flagship projects, the Kwinana Energy Transformation Hub (KETH), is poised to offer a shovel-ready facility that can bridge innovators as well as research institutions and industry, facilitating knowledge transfer, fostering collaboration, and ensuring that innovative solutions are not left stranded in the transitional phase.**

The KETH will deliver a multi-user, open-access technology testbed that provides low-risk live environment for demonstrating new technologies and processes as well as a training facility for hydrogen, LNG related decarbonisation, and energy transition sectors.

The KETH received an AU\$15 million investment attraction fund grant from the WA Government in 2023 and plans for a Final Investment Decision in 2024.

FEnEx CRC will utilise KETH to encourage collaboration among innovators, research institutions and industry, and accelerate research and development activities for enabling commercial-scale

deployment of innovative decarbonisation technologies that would assist the world to achieve its Net-Zero aspirations.

- ii. FEnEx CRC highlights the recent launch of **its low pressure LCO₂ transportation R&D project among major Australian and Japanese partners (“LCO₂ Technology R&D Project”) as an example of how innovation can be originated and effectively pursued for one of the priority sectors as identified by “Diversify WA: Future State.”**

1. Overview of the LCO₂ Technology R&D Project

On 23 August 2023, FEnEx CRC, JX Nippon Oil & Gas Exploration Corporation (“**JX NOEX**”), Low Emission Technology Australia (“**LETA**”), Mitsui O.S.K. Lines, Ltd. (“**MOL**”), and Osaka Gas Co., Ltd. (“**Osaka Gas**”) jointly announced the launch of the LP Technology R&D Project to conduct research and development to demonstrate the technical feasibility and operability of low-pressure and low temperature solutions for the bulk transport of CO₂ by ships³⁰.

The LCO₂Technology R&D Project will consist of a series of laboratory-based experiments and engineering modelling to study behaviour and boil off characteristics of liquid CO₂ under dynamic operating conditions and the impact of non- CO₂ components.

This LCO₂Technology R&D Project will be executed by FEnEx CRC, University of Western Australia, Curtin University, Seoul National University and deepC Store Pty Ltd (“**deepC Store**”).

2. Context of project origination

In March 2023, FEnEx CRC was approached by deepC Store, a CCS project developer and operator headquartered in Perth WA, regarding a key CCS industry need to demonstrate the technical feasibility and operability for large-scale liquefied CO₂ shipping based on “low temperature and low pressure” conditions. See below for the context regarding this key CCS industry need.

- a. Australia has large potential CO₂ sequestration capacity of 434 billion tonnes³¹ (equivalent to ~870 years of Australia’s current greenhouse gas emissions³²), of which 316 billion tonnes (~73%) resides in offshore Australia. This geological CO₂ storage capacity suggests that significant CO₂ reduction contributions can be expected via CCS for the hard-to-abate industrial sectors of Australia.
- b. Australia can also play a central role in the decarbonisation of the Asia Pacific region by providing its abundant geological CO₂ storage capacity to international hard-to-abate industrial sectors that lack suitable storage sites within their jurisdiction. In doing so this would maximise economic opportunities for Australian businesses and employment as well as forge increased international

³⁰ More information on FEnEx CRC’s launch of the low pressure LCO₂ transportation R&D project available at: <https://www.fenex.org.au/australian-japanese-partners-execute-rd-project-agreement-to-develop-safe-and-efficient-solutions-for-industrial-scale-shipping-of-co2/>

³¹ Carbon Storage Taskforce (2009) “National Carbon Mapping and Infrastructure Plan – Australia” pages 28 and 31. Available at [https://www.parliament.wa.gov.au/parliament/commit.nsf/\(\\$lookupRelatedDocsByID\)/518FAC2BBA6C246648257C29002DB8E6/\\$file/NCM_Full_Report.pdf](https://www.parliament.wa.gov.au/parliament/commit.nsf/($lookupRelatedDocsByID)/518FAC2BBA6C246648257C29002DB8E6/$file/NCM_Full_Report.pdf)

³² Australian Government (2022) “Australia’s Nationally Determined Contribution – Communication 2022” Page 7. Available at <https://unfccc.int/sites/default/files/NDC/2022-06/Australias%20NDC%20June%202022%20Update%20%283%29.pdf>

collaboration and cooperation and assist nations accelerate global progress towards meeting their Paris Agreement goals.

- c. The key challenge for offering CCS to all hard-to-abate industrial sectors in Australia and overseas is that many of the major CO₂ emission sources are located hundreds of kilometres away from prospective geological CO₂ storage sites. Upon exceeding 200km of transportation distance, CO₂ liquefaction and shipping can be lower cost than pipelines³³. It is noted that the technical capability to manage “low temperature and low pressure” conditions for large volume transportation via CO₂ ships is essential³⁴.
- d. The technology maturity for large-scale liquefied CO₂ shipping based on “low temperature and low pressure” conditions is low (currently TRL 3³⁵). R&D activities for this technology are needed now for having the technology ready to assist Australia’s hard-to-abate industrial sectors in their efforts for meeting their interim 2030 targets and their statutory requirements under the Safeguard Mechanism reform.

3. Process for launching the project

Based on the following provided by FEnEx CRC and deepC Store (together the “Parties”), the Parties successfully launched the LCO₂ Technology R&D Project within five months after the Parties mutually identified a collaboration opportunity:

- a. Industry need and major capital project management capabilities, provided by deepC Store;
- b. World class R&D capabilities (researchers and facilities), low overhead R&D execution model, and strong governance model, provided by FEnEx CRC
- c. Connections and processes to engage with an extensive network of industry participants for identifying benefactors, provided jointly by the Parties.

More specifically, the Parties delivered on the following process to enable an accelerated launch of the LCO₂ Technology R&D Project.

- d. In March 2023, FEnEx CRC was approached by deepC Store regarding its key CCS industry need and deepC Store’s desire to conduct R&D activities.
- e. By April 2023, the Parties completed the development of the scope of work and the team to deliver the LCO₂Technology R&D Project (team consisting of FEnEx CRC, University of Western Australia, Curtin University, Seoul National University and deepC Store), and commenced a joint solicitation of interest process among 25 Australian and international industry participants for identifying benefactors.
- f. By June 2023, the Parties obtained confirmation of intent from JX NOEX, LETA, MOL, and Osaka Gas to participate in and fund the LCO₂Technology R&D Project, and commenced negotiation of a definitive agreement (utilising FEnEx CRC’s existing R&D agreement template) to conduct the LCO₂Technology R&D Project.

³³ Japan’s Ministry of Economy, Trade & Industry (METI) (2022), “CCS Long-term CCS Roadmap Investigative Commission Interim Summary” report (page 17). Available (in Japanese) at https://www.meti.go.jp/shingikai/energy_environment/ccs_choki_roadmap/20220527_report.html

³⁴ Same as above.

³⁵ At TRL 3, R&D work is deemed to have moved beyond the paper phase to experimental work that verifies that the concept works as expected on simulants. Components of the technology are validated, but there is no attempt to integrate the components into a complete system.

- g. By August 2023, FEnEx CRC, JX NOEX, LETA, MOL, and Osaka Gas executed a multi-party Project Agreement to conduct the LCO₂ Technology R&D Project.

The LCO₂ Technology R&D Project will be conducted over 12 months, with aim to transition into a to launch a full value chain small scale carbon capture and utilisation project for further demonstrating the technical and operational feasibility of low-pressure and low temperature solutions for the bulk transport of CO₂ (aim to achieve TRL 7+).

4. Key takeaways

Key takeaways from the pursuit of the LCO₂ Technology R&D Project for addressing key barriers and growing the WA innovation ecosystem are:

- a. FEnEx CRC offers world class R&D capabilities (researchers and facilities), low overhead R&D execution model, and a strong governance model to enable commercialisation of WA's innovation
- b. FEnEx CRC can offer innovators with connections and processes to engage with an extensive network of industry participants for identifying benefactors
- c. For innovators to accelerate their access to funding and capabilities, it is essential that the innovators clearly articulate their rationale, supported by key industry needs, for pursuing R&D and commercialisation.

- b. FEnEx CRC recommends that the WA Government **replace the priority sectors of “renewable hydrogen” and “CCUS” technologies, as identified by the ‘Diversify WA: Future State’³⁶, with a broader priority of “decarbonisation”**

i. Context

The Federal Government is currently reviewing its National Science Priorities. As part of the consultation phase for this process, FEnEx CRC submitted the following five key reasons to establish “decarbonisation” as a national science and research priority:

1. The energy transition is gaining momentum – but not fast enough. Despite encouraging signs of progress across a number of sectors, greater efforts are needed to put the world on track to reach net zero emissions by 2050. This has been underlined by the annual Tracking Clean Energy Progress (TCEP) report conducted by the International Energy Agency (IEA) that assesses fifty-five (55) components of the energy system – sectors, technologies, infrastructures, and cross-cutting CO₂ mitigation strategies – and evaluates their progress. As of September 2022, only two components were on track with more required in all other areas especially in the arena of clean energy technologies.
2. Many of the technologies needed to reach Net Zero by 2050 do not exist. It is recognised – including by the IEA – that the adoption of low emissions (and decarbonisation) technologies will be vital for any significant emission reduction. However, it is equally acknowledged that the availability, timing, and readiness of technology solutions remains uncertain and that the deployment of significant abatement technologies is unlikely before 2030 and that our 2050 aspirations will require significant investment in a diversity of still emerging technologies and fuels across all parts of the energy system. The IEA within its World Energy Outlook 2021 and Net Zero by 2050 (NZE) scenarios highlights that half of the emissions reductions that will need to be achieved by 2050 will need to come

³⁶ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

from technologies that are still be developed (or at best at the demonstration or prototype stage today). To highlight the scale of the task ahead, the IEA also predicts 18% of decarbonisation by 2030 will happen from new technologies and change behaviour vs 50% by 2050.

3. There are many promising decarbonisation technologies – but they are costly and unproven. Most new technologies aimed at assisting industry meet the challenge of a net zero future have not been tested at industrial-scale nor been able to push their cost curves down for commercial-scale production (an example is reducing the energy required to liquefy hydrogen and produce synthetic fuels).
4. No company or nation can figure this out alone. Reducing emissions is not just about science and technology, it also needs increased collaboration to pool expertise and think and work differently to lower the carbon intensity of our energy requirements.
5. There is an enormous amount of work underway – but it needs to be better coordinated. Australia’s Cooperative Research Centre (CRC) program is an Australia’s innovation success story but a case in point. For over 30 years CRC’s have provided an outstanding return on investment for the Australian community and currently over 80% of the current CRC cohort have direct relevance to Australia’s decarbonisation mission; either mitigating, informing, or adapting to climate change or driving low emissions and alternative energies. CRCs have an enviable track record in providing direct, material and prompt responses to Government priorities but it is recommended that this work could be greater leveraged by the Australian Government and increased coordination could be achieved via recognition of the CRC network and relevance within the emerging National Science Statement.

FEnEx CRC believes these points and many others made in its submission (see Appendix 2) are relevant for consideration by this Parliamentary Committee as WA’s ability to maintain a strong economy and an internationally competitive energy export industry – as well as achieve Net Zero by 2050 – will rely on the development of a range of emerging technologies and innovations.

ii. **Recommendation**

Upon viewing the ‘Diversify WA: Future State’³⁷ and the nine priority sectors that have been identified for WA’s strategic development, FEnEx CRC highlights that

1. “Renewable hydrogen” and “CCUS” technologies are certainly key tools within the ‘Swiss Army Knife’ kit of decarbonisation, but excludes other key technologies such as those related to energy efficiency, batteries for electric vehicles, and renewable fuels such as ammonia;
2. Tzhe following WA Government-led initiatives as announced in December 2023 by the WA Government, recognises this issue of ‘Diversify WA: Future State’³⁸ only positioning “renewable hydrogen” and “CCUS” technologies as priority sectors, and have expanded the remit for WA Government funding to include other decarbonisation technologies and activities as eligible for funding.

³⁷ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

³⁸ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

- a. Expressions of Interest (EOI) to undertake the role of GreenTech Hub (“GTH”) Operator³⁹
- b. Feasibility study of establishing a Fraunhofer Innovation Platform in WA⁴⁰

FEnEx CRC therefore proposes that the **WA Government replace the priority sectors of “renewable hydrogen” and “CCUS” technologies, as identified by the “Diversify WA: Future State”⁴¹, with a broader priority of “decarbonisation”** (with “renewable hydrogen” and “CCUS” technologies forming part of the “decarbonisation” priority).

4. Conclusion and next steps

FEnEx CRC fully supports the WA Government to increase the focus on and delivery of innovations and new technologies that can be a key enabler for the future growth and diversification of the WA economy⁴²,” which would also “turn into high quality jobs, greater investment and broader community benefits⁴³.”

As the WA Government examines the complexities of fostering innovation, FEnEx CRC firmly advocates for extensive implementation of policies and support that recognises and addresses the challenges posed by the “2 Valleys of Death” and a commitment to increase total annual investment for innovation and R&D in WA (by government, private non-profit, business and higher education) to 3% of WA’s GSP.

Assisting projects navigate the “2 Valleys of Death” and allocating a higher percentage of resources to innovation and R&D will significantly fuel technological advancements and also enhance WA’s global competitiveness.

FenEx CRC also recommends that the WA Government recognise the fact that most potential innovations fail, and incorporate this fact into the design and implementation of its policies so that the organisational culture of risk aversion that is often seen by the implementers does not hamper the process and development of innovation.

FEnEx CRC can assist the WA Government to facilitate greater collaboration among innovators, research institutions and industry participants through ongoing creation of specialised innovation hubs and accelerators that offer tailored support for technology development and market entry. FEnEx CRC can offer its KETH facilities to enable such collaboration, and the LCO2 Technology R&D Project as its latest example of how innovation can be originated and effectively pursued for one of the priority sectors as identified by “Diversify WA: Future State.”

The WA Government can also strengthen collaborative networks for diffusion and facilitate knowledge transfer by requiring open access for government funded research, and partnering with intermediaries that have existing connections between industry, government, researchers, and markets.

³⁹ Government of Western Australia (2023) “EXPRESSION OF INTEREST - LOWER CARBON GRANTS PROGRAM – GORGON FUND AND GREENTECH HUB - OPERATOR GREENTECH HUB” pages 1 and 2. Available at https://www.wa.gov.au/system/files/2023-12/greentech_hub_expression_of_interest_information_0.pdf

⁴⁰ Government of Western Australia (2024) “Invitation to help shape a Fraunhofer Innovation Platform for Western Australia – 23 January 2024” Email and presentation pack made available at the public event can be made available upon request.

⁴¹ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>

⁴² Government of Western Australia (2022) “WA Innovation Strategy” page 4 (Forewords - Hon Stephen Dawson MLC). Available at <https://www.wa.gov.au/system/files/2022-12/Innovation%20Strategy.pdf>

⁴³ Government of Western Australia (2022) “WA Innovation Strategy” page 4 (Forewords - Professor Peter Klinken, AC). Available at <https://www.wa.gov.au/system/files/2022-12/Innovation%20Strategy.pdf>



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Finally, FEnEx CRC recommends that the WA Government replace the priority sectors of “renewable hydrogen” and “CCUS” technologies, as identified by the ‘Diversify WA: Future State’⁴⁴, with a broader priority of “decarbonisation” (with “renewable hydrogen” and “CCUS” technologies forming part of the “decarbonisation” priority).

FEnEx CRC looks forward to participating and supporting the WA Government in its efforts to grow WA’s innovation ecosystem and support the commercialisation of WA’s innovations.

For any questions or comments on the matters covered above, please contact Daein Cha at Daein.Cha@fenex.org.au.

Name: Professor Eric May
Title: Managing Director and CEO
Future Energy Export CRC

⁴⁴ Government of Western Australia (2023) “Diversify WA: Future State.” Available at <https://www.wa.gov.au/government/publications/diversify-wa-future-state>



Appendix 1 – Overview of FEnEx CRC

ABOUT FEnEx CRC

Driving towards energy export decarbonisation through industrially relevant research and innovation.

The Future Energy Exports Cooperative Research Centre (FEnEx CRC) is an Australian not-for-profit organisation striving to future-proof energy exports through industrial-scale research and innovation. Established in 2020 as a research-driven organisation, it also delivers education and training, evidence-based advice to inform the development of government policies, testing facilities and PhD scholarship opportunities.

Through research and innovation in liquefied natural gas (LNG) and hydrogen, the FEnEx CRC will help Australia remain at the forefront of energy provision internationally.

FEnEx CRC brings together industry partners spanning the entire supply chain, innovative research universities and international participants to collaborate on the development of a sustainable energy export industry. It works to bridge the gap between industry and academia to facilitate and fund, cutting-edge industry-led research. The CRC aims to help industry deliver energy cost effectively while also addressing the need for emission reductions.

The CRC's network shares knowledge, exchanges ideas and describes common challenges at monthly colloquiums, offers micro-credentials and professional development, and participates in public forums, webinars and panels.

Vision

Chart a path to decarbonised energy export from cleaner LNG to green hydrogen.

Mission

Driving towards energy export decarbonisation through industrially relevant research and innovation.

Values

Collaborative
Innovative
National thought-leader
Commercial focus
Respected



At a glance



\$40m

Commonwealth
contributions



\$166m

Total cash and in-kind
contributions



10

Years of funding



30

PhDs underway



53

Projects



321

Project team members



11

Commonwealth
milestones achieved



37

Partners



10

Foundation Fellows &
Strategic Research Fellows



1000+

Attendees in webinars,
workshops, annual conference
& monthly colloquiums



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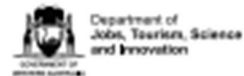
Cooperative Research Centre

Participants

Industry



Government Agencies



Universities



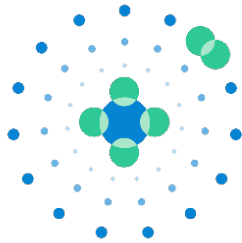
End of Appendix 1



Appendix 2 – FEnEx CRC’s National Science and Research Priorities submission

(See attached “FEnEx CRC National Science Research Priorities submission FINAL” document)

End of Appendix 2



FUTURE ENERGY EXPORTS

Cooperative Research Centre

National Science and Research Priorities submission

The Future Energy Exports Co-operative Research Centre (FEnEx CRC) welcomes the opportunity to comment on the Australian Government's plans to revitalise the *2015 National Science and Research Priorities* and *2017 National Science Statement*.

FEnEx CRC is an Australian not-for-profit organisation striving to help decarbonise energy exports and hard-to-abate heavy industry through industrial-scale research and innovation.

Through research and innovation targeting the decarbonisation of Liquefied Natural Gas (LNG) production, and growing the use and export of lower-emission energies including renewably produced hydrogen and ammonia, the FEnEx CRC's aim is to help Australia to remain a key energy exporter.

Established in 2020 as a research and education-driven charity, FEnEx CRC brings together industry participants, governments, innovative research universities and international affiliates to collaborate on projects that address the key challenges now facing Australia's energy exports. More details about the FEnEx CRC are available at www.fenex.org.au

RECOMMENDATION – INCLUDE “DECARBONISATION” AS A NATIONAL PRIORITY

The main objective of this submission is to highlight that “decarbonisation” should be explicitly listed as a science and research priority to galvanise more strategic and coordinated research across academia, industry and government with the goal of assisting Australia – and its energy export customers – to achieve Net Zero by 2050.

In addition this submission is also aimed at raising awareness of the FEnEx CRC's potential to:

- Accelerate the development of decarbonisation and low emission technologies for a number of Australia's emissions-intensive, trade-exposed (EITE) businesses
- Deliver tangible industrial-scale pilot demonstration projects such as the Kwinana Energy Transformation Hub (KETH) that can assist decarbonisation of hard-to-abate sectors (particularly those using gas as a primary source of energy)
- Assist with coordinating international research and development co-operation aimed at accelerating decarbonisation and the energy transition across Australia's energy customers and the broader Asia Pacific

Science and research to set the foundations for a successful Net Zero

Australia has committed to achieve net zero emissions by 2050 and reduce greenhouse gas emissions by 43% below 2005 levels by 2030.

Decarbonising Australia's energy system is a significant challenge and urgent action is required on multiple fronts if these targets are to be achieved while also maximising a thriving resources and energy-exports based economy.

Timing is critical and driving innovation through increased science and research will be key to:

- Increase efficiencies across the Australian economy to make the best use of our energy and resources

- Drive improvements in new technologies such as carbon capture and storage (CCS) and carbon capture usage and storage (CCUS)
- Accelerate the switch to fuels with lower carbon intensity and/or derived from renewables

By setting “decarbonisation” as a priority, the Australian Government can send a clear signal that it will support policy and develop incentives to close the gaps that exist in the above areas and set a strong foundation to reduce emissions through improvements in science and technology.

Five key reasons to establish “decarbonisation” as a national science and research priority

The FEnEx CRC believes there are five key reasons to establish “decarbonisation” as a national science and research priority:

1. The energy transition is gaining momentum – but not fast enough. Despite encouraging signs of progress across a number of sectors, greater efforts are needed to put the world on track to reach net zero emissions by 2050. This has been underlined by the annual Tracking Clean Energy Progress (TCEP) report conducted by the International Energy Agency (IEA) that assesses 55 components of the energy system – sectors, technologies, infrastructures and cross-cutting CO₂ mitigation strategies – and evaluates their progress. As of September last year, only two components were on track with more required in all other areas especially in the arena of clean energy technologies.
2. Many of the technologies needed to reach Net Zero by 2050 do not exist. It is recognised – including by the IEA – that the adoption of low emissions (and decarbonisation) technologies will be vital for any significant emission reduction. However, it is equally acknowledged that the availability, timing, and readiness of technology solutions remains uncertain and that the deployment of significant abatement technologies is unlikely before 2030 and that our 2050 aspirations will require significant investment in a diversity of still emerging technologies and fuels across all parts of the energy system. The IEA within its *World Energy Outlook 2021* and *Net Zero by 2050* (NZE) scenarios highlights that half of the emissions reductions that will need to be achieved by 2050 will need to come from technologies that are still be developed (or at best at the demonstration or prototype stage today). To highlight the scale of the task ahead, the IEA also predicts 18% of decarbonisation by 2030 will happen from new technologies and change behaviour vs 50% by 2050.
3. There are many promising decarbonisation technologies – but they are costly and unproven. Most new technologies aimed at assisting industry meet the challenge of a net zero future have not been tested at industrial-scale nor been able to push their cost curves down for commercial-scale production (an example is reducing the energy required to liquefy hydrogen and produce synthetic fuels).
4. No company or nation can figure this out alone. Reducing emissions isn’t just about science and technology, it also needs increased collaboration to pool expertise and think and work differently to lower the carbon intensity of our energy requirements.
5. There is an enormous amount of work underway – but it needs to be better coordinated. Australia’s Cooperative Research Centre (CRC) program is an Australia’s innovation success story but a case in point. For over 30 years CRC’s have provided an outstanding return on investment for the Australian community and currently over 80% of the current CRC cohort have direct relevance to Australia’s decarbonisation mission; either mitigating, informing or adapting to climate change or driving low emissions and alternative energies. CRCs have an

enviable track record in providing direct, material and prompt responses to Government priorities but it is recommended that this work could be greater leveraged by the Australian Government and increased coordination could be achieved via recognition of the CRC network and relevance within the emerging *National Science Statement*.

Clearly, Australia's ability to maintain a strong economy and an internationally competitive Australian energy export industry – and also achieve Net Zero by 2050 – will rely on the development of a range of emerging technologies.

By enshrining “decarbonisation” in the national science and research priorities, the Federal Government can ensure increased focus is given to improving the near-term availability of commercial-scale abatement technology, without which there is a risk it will becoming a significant constraint for Australian industry.

Global race for research and development capability

Currently Australian research and development is facing a significant drain to other parts of the globe which is being attracted elsewhere in the face of initiatives including:

- The USA's USD\$369 billion investment in clean technology through the Inflation Reduction Act
- The 'France 2030' €100 billion investment plan
- The European Union's 'Fit for 55' programme
- Germany's €200 billion funding for industrial transformation

Given it is clear Australia is in an international race for capital, skills and the industries of the future it reinforces the importance of ensuring the new science and research priorities are sufficiently focussed on discrete topics of importance to our local economy to ensure the success of Australian efforts.

Pilot projects to demonstrate tangible progress in decarbonisation

To accelerate the successful development of a lower-carbon future, FEnEx CRC recommends the Federal Government prioritise the establishment of tangible pilot projects and facilities to demonstrate, test and de-risk decarbonisation technology solutions.

An example of a global-first test-bed for innovative technologies with real-life application is the FEnEx CRC's flagship project – the Kwinana Energy Transformation Hub (KETH).

The KETH is a hydrogen and small-scale LNG test facility located in Western Australia that is being advanced (subject to support from the Western Australian and Australian Federal Governments and industry) to a Final Investment Decision in 2023. The KETH will be a multi-user, open-access facility that enables collaboration between industry, government, training and research organisations and will provide a unique low-risk live environment for demonstrating new technologies and processes as well as a training facility for the hydrogen and LNG sectors.

Accelerating industrial-scale innovation via facilities such as the KETH can assist increase regional energy security by decarbonising LNG and accelerating the development of commercial-scale hydrogen production. Pilot projects such as the KETH will also help de-risk energy transition strategies before the next wave of investments targeting Net-Zero. More information is available at www.keth.com.au

FEnEx CRC recommends the Federal Government support the KETH as a potential “shovel ready” pilot project and its use to accelerate initiatives developed under the new science and research priorities and *National Science Statement*.

Capitalising on our international leadership

FEnEx CRC encourages the Australian Government to include in its revised *National Science Statement* a stronger focus on the key role Australia can play building research capacity, capability and demonstration within the region with respect to improving energy security and decarbonisation.

Since the 2017 Statement was issued Australia has established a number of international partnerships including the *Australia and Republic of Korea Low and Zero Emissions Technology Partnership* and the *Memorandum between Australia and Singapore for Cooperation on Low-Emissions Solutions*. In addition Australia also has the *Australia and United States Net-Zero Technology Acceleration Partnership* and the *Japan and Australia Partnership on Decarbonisation*. The Australian Government is also now participating in the Government of Japan’s *Asia Zero Emission Community (AZEC)* concept which aims to promote decarbonisation across the Asian region.

FEnEx CRC encourages the revised *National Science Statement* expands its focus on international science engagement and show its leadership in assisting its Asian neighbours and key export customers achieve their net zero targets.

Trends identified in Future Battery Industries Cooperative Research Centre submission

This FEnEx CRC submission is fully aligned with the one made by the Future Battery Industries Cooperative Research Centre (FBICRC). As highlighted by FBICRC, a priority should only set if it can pass the tests of:

- Potential to build and sustain a competitive advantage
- Essential for our national security or social cohesion
- Provide outsized economic benefits

The way forward

The Future Energy Exports Co-operative Research Centre is available to meet and discuss any aspects of this submission and assist with developing practical recommendations relating to the development of new *National Science and Research Priorities* as well as a revised *National Science Statement*.

We would also like to offer our expertise to assist development of the Taskforce we note is intended to be created to help deliver the new priorities and statement.

At FEnEx CRC we appreciate the opportunity to raise these matters and look forward to continuing to work collaboratively with the Australian Government, as well as private industry, to future-proof our nation’s energy needs through industrial-scale innovation.

Yours sincerely



Professor Eric F. May FTSE, FIChemE

CEO, Future Energy Exports Co-operative Research Centre