CCUSNA

Western Australia CCUS Hubs Workshop 19-20 February 2026

Full Final Report

What are the opportunities and challenges associated with developing a multi-user CCUS hub in Western Australia, for Kwinana, Mid West and the Pilbara regions?

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1 Executive Summary

Carbon Capture Utilisation and Storage (CCUS) is one of a suite of tools that will be necessary to fully decarbonise industry in Australia, especially for otherwise unavoidable process emissions. While a broad range of decarbonisation paths should be pursued concurrently, the insights generated from this project speak to the role of CCUS specifically. As highlighted in Western Australia's CCUS Action Plan (2024), CCUS holds an essential role in abating the state's hard-to-abate heavy industries.

Western Australia possesses all the foundational requirements for large-scale deployment: extensive CO_2 storage resources, a mature resource management history, established industrial emissions clusters, and deep technical expertise. Furthermore, our primary trading partners have ambitious net-zero targets but lack domestic storage capacity, creating a clear demand for transboundary CO_2 transport and secure sequestration.

Carbon Capture Utilisation and Storage Network Australia (CCUSNA) convened this two-day workshop to address a perceived impasse; despite interest from both government and industry regarding the potential for large–scale, low–cost decarbonisation via CCUS, planned projects are not progressing through to a Final Investment Decision stage.

Prior to the workshop, we hosted ten webinars featuring subject matter experts who provided insights into CCUS precincts, Australian CCUS policy, the local factors important for each proposed hub location (Kwinana, Pilbara and Mid West) alongside contributions from the operators and developers of successful international multi–user CCUS hubs. The workshop brought together 100 delegates from industry, government, and research to identify factors impeding multi-user hub development and propose low risk, immediate actions to build momentum, evaluate scalable future options or pivot as needed.

The take home message from this workshop is clear – the primary obstacle to large-scale CO_2 development is not technological or geographical, but the absence of an enabling State and Commonwealth policy framework. Australia faces a definitive choice: adopt integrated policy settings utilised by international peers, or accept that CO_2 will remain a niche option servicing only a subset of large oil and gas emitters.

While Australia positions itself as a global CCUS leader - citing early legislative frameworks like the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA) and the operational successes of Gorgon CCS and Moomba CCS - its current policy settings are, in practice, among the least enabling in the Organisation for Economic Co-operation and Development (OECD). This creates a disconnect between the nation's historically proactive stance and its present-day reliance on market-led development.

Compared to jurisdictions like China, Japan, Europe, the UK, and the US, Australia relies heavily on market mechanisms that fail to mitigate upfront commercial risk (see Figure 1).

Based on the workshop's preparatory webinars, CCUSNA's independent research, and the insights gathered during the two days of conversations, we can delineate four foundational elements currently missing in Australia, without which complex, 5-to-10-year multi-user hub projects will not proceed. Progress on any / all the elements would be a valuable step forward.

1. A National CCUS Strategy
2. A fit-for-purpose Emissions Trading Scheme (ETS)
3. A Carbon Border Adjustment Mechanism (CBAM)
4. A government-backed Business Model, notably a Carbon Contracts for Difference (CCfD) framework.

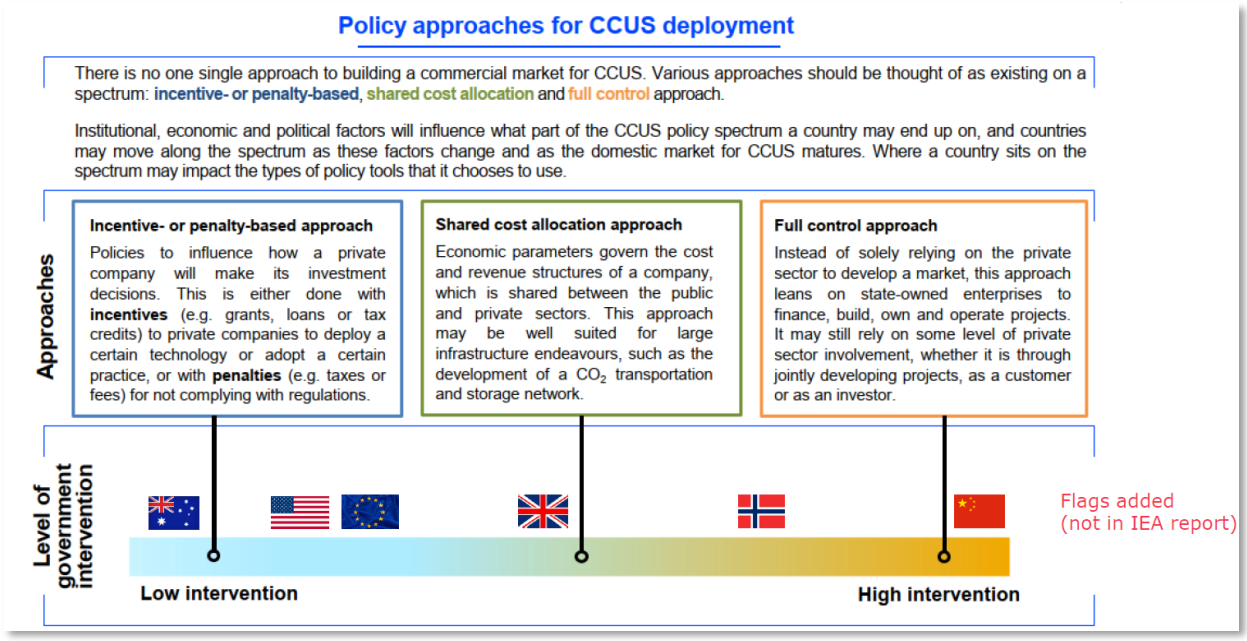

Figure 1: International Energy Agency (IEA) Summary of Policy Approaches for CCUS Deployment[1] (Flags added by CCUSNA to reflect 2026 status.)

Key Outcomes

All workshop delegates were invited to initiate or attend conversations over the two days of the workshop on any topic related to the convening theme "What are the opportunities and challenges in developing a multi-user CCUS hub in Western Australia (for Kwinana, Mid West and/or the Pilbara regions)". These conversations have formed the sections of this report and, by far, the three most discussed topics were:

- CCUS Policy – Safeguard Mechanism Review, a Pore Space Mandate, Carbon Contracts for Difference and the need for a National CCUS Strategy
- Government: The need for active, hub-scale coordination and policy support from Local, State, and Commonwealth governments starting with
- Community Support for CCUS

These topics are not unique to a Western Australia hub, and unless these were addressed, a large scale multi-user CCUS project would not proceed in Western Australia.

Because Kwinana, the Mid West, and the Pilbara each require distinct regional approaches, delegates stressed that a state-funded assessment, modelled on the CSIRO Northern Territory Low Emission Hub study, is vital. This work should commence immediately to provide the necessary framework for government and industry while broader policy and community coordination issues are resolved.

Acknowledgements

We thank our sponsors and attendees for their excellent contributions to this workshop. Thank you to all members of CCUSNA and to the CCUSNA Committee who worked together to conceive, prepare and co-ordinate the Western Australia CCUS Hubs Workshop.

[1] IEA CCUS Policies and Business Models

A Note on the Report Format

A Book of Proceedings has been provided to the participants for review and comprises the exact notes that each working group captured at the workshop. Discussions were wide ranging and often the conversations covered overlapping areas. (For a list of session topics see Section 21 Workshop Sessions). The Western Australia CCUS Hubs Workshop Final Report (this report) has grouped together all insights into common themes that emerged through these conversations.

Each section starts with a summary based on the notes taken at the workshop across various sessions – the original comments are then included to show the origin of the information (anonymised). To aid understanding the delegate comments are always shown verbatim and in this font. We have included the comments to show the diversity of opinion. Some points were raised only once while others were raised multiple times. Where a quantitative statement was made, we have endeavoured to fact check comments and additional information has been added for clarification where needed.

Section 4 "Policy Settings to Support CCUS in Australia" includes extra material which augments the delegates insights with additional research. Many of the workshop groups discussed policy needed to support a large scale CCUS Hub in Australia. In January 2026 CCUSNA was requested to submit a policy recommendation paper focused on CCUS to the Economics and Industry Standing Committee (EISC) of the Legislative Assembly, Parliament of Western Australia for their Inquiry Into the Role of Western Australia in the Global Effort on Decarbonisation. While the EISC submission paper was an in-depth research piece rather than a stakeholder engagement workshop, the two activities have informed one another. We have therefore decided to combine the EISC paper with this report. Consistent with the rest of this document, all delegate comments are included. This allows the reader, by referencing the raw feedback, to distinguish between the themes raised directly by workshop participants and the supplementary research added for completeness.

Otherwise this report is a collation of the qualitative findings of the two day workshop. The report captures a variety of views from participants and should not be attributed to any single company or organisation in attendance.

Unless otherwise stated all $ in this report refer to Australian Dollars (AUD).

2 Project Overview

- **Title:** Western Australia CCUS Hubs Workshop
- **Dates:** 19–20 February 2026
- **Venue:** Rosemary van den Berg Room, Boola Katitjin Building, Murdoch University, Perth, WA
- **Organiser:** Carbon Capture Utilisation and Storage Network Australia (**CCUSNA**)
- **Purpose:** A two-day collaborative workshop to explore the convening questions "**What are the opportunities and challenges in developing a multi-user CCUS hub in Western Australia (for Kwinana, Mid West and/or the Pilbara regions)**"

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MID WEST DEVELOPMENT COMMISSION

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Regional Development Australia

wood.

PILBARA DEVELOPMENT COMMISSION

3 List of Participants by Company / Organisation

Representing
Australian Gas Infrastructure Group (AGIG)
Airbridge
Alcoa Australia
Asia Natural Gas & Energy Association (ANGEA)
Bivios
Centre of Decommissioning Australia (CODA)
Chevron
Chamber of Minerals and Energy of Western Australia (CMEWA)
CO2CRC
Corrs Chambers Westgarth
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Curtin Institute for Energy Transition, Curtin University
Curtin University, Materials and Corrosion Engineering
deepC Store
Department of Climate Change, Energy, Environment & Water (DCCEEW)
Department of Energy and Economic Diversification (DEED)
Department of Mines, Petroleum and Exploration (DMPE)
Department of Planning, Lands and Heritage
Full Circle Carbon
Future Energy Exports CRC
Global CCS Institute
Heavy Industry Low-carbon Transition Cooperative Research Centre (HILT CRC)
InCapture
JERA Australia
Karratha and Districts Chamber of Commerce and Industry (KDCCI)
Kwinana Energy Recovery
Long Energy and Resources
Low Emission Technology Australia (LETA)
Mid West Development Commission
Minter Ellison
Mitsubishi Heavy Industries Australia
Mitsui E&P Australia
MRIWA
NH3 Clean Energy
Peel Development Commission
Pilbara Development Commission
Pilbara Ports
Pilot Energy
Regional Development Australia (RDA) Pilbara
Santos

Representing
School of Geography and the Environment, University of Oxford
SK Earthon
SpiroPak
Superpower Institute
Tactica
Tronox
VOPAK
Wesfarmers Chemicals, Energy & Fertilisers (WesCEF)
Wood
Woodside
Worley
Xodus
Yara Pilbara

4 Policy Settings to Support CCUS in Australia

4.1 Explanatory Notes

Explanatory Notes on this section (Policy Settings to Support CCUS in Australia) of the Western Australia CCUS Hubs Workshop Final Report.

In October 2025 CCUSNA made a submission to the Inquiry Into the Role of Western Australia in the Global Effort on Decarbonisation, under the Economics and Industry Standing Committee (EISC) of the Legislative Assembly, Parliament of Western Australia.

On 29 January 2026 members of the CCUSNA Committee were asked to appear before the EISC to provide further information on the role of carbon capture utilisation and storage in the decarbonisation of Western Australia trading partners.

The EISC requested that CCUSNA provide a supplementary submission detailing policy recommendations to facilitate the deployment of CCUS in Australia. We accepted this request, and indicated that we would prepare the submission following the Western Australia CCUS Hubs Workshop, so that we could include any insights arising.

"***Policy Settings to Support CCUS in Australia, A Review of Current Policies and Comparison to Successful Global Examples, April 2026***" by Rosie Johnstone (on behalf of CCUSNA) was submitted to the EISC in April 2026. The report outlines the integrated policy frameworks that both the Western Australian and Commonwealth Governments should evaluate to ensure CCUS remains a viable pathway for domestic sequestration and a service for our key international trading partners.

To bring the insights from the EISC submission into this report, we have adopted the same headings and where applicable we have included the Workshop Delegate Insights for each section. For readers who would like a copy of the full EISC submission report please contact info@ccusna.com.au

4.2 CCUS Policy Options

As stated by the International Energy Agency (IEA) [1] "Governments have several policy tools to address challenges to CCUS deployment. It is important that these tools work together to tackle economic viability, lead time, innovation and complexity challenges. Whatever tools a government chooses to employ will be unique to that country, but it is vital that the tools are effective and efficient, setting up a viable and sustainable commercial market for CCUS that attracts investment and retains it over the long term".

Policy measures to support CCUS roll out can be categorised into two distinct groups: Legislative (see Table 1 : Legislation and Regulation Policy Options for CCUS by Country) and Fiscal (see Table 2: Fiscal Policy Options for CCUS by Country). It is evident that Australia lags behind similar jurisdictions in policy breadth, having mostly limited actions to the enabling regulations and the formalisation of emissions targets.

In these tables abbreviations are as follows; (y) - a partial policy in place "dev." - a policy in development, "CCS" - Carbon Capture and Storage, "EOR" - Enhanced Oil Recovery, "NOC" - National Oil Company, "SGM" - Safeguard Mechanism, CBAM – Carbon Border Adjustment Mechanism, SOE – State Owned Entity, NZF - Net Zero Fund, CCfD – Carbon Contracts for Difference.

REGION	Country	Legislation and Regulation Policy Options									
		Legislation and Regulation	London Protocol	Emissions Reduction Targets	CCUS Roadmap	Carbon Price or Market	Pore Space Access / Mandate	Injection Targets	Pore space royalty	CBAM	International Cooperation
	Australia	y	y	y	n	(y)	n	n	n	dev.	(y)
EUROPE	Denmark	y	y	y	y	y	y	y	n	y	y
	Netherlands	y	y	y	y	y	y	y	n	y	y
	Norway	y	y	y	y	y	y	y	(y)	y	y
	Germany	y	y	y	y	y	y	y	y	y	y
	UK	y	y	y	y	y	n	y	n	y	y
ASIA-PAC	China	n	n	y	y	y	(y)	y	n	y	(y)
	Japan	y	y	y	y	y	dev.	y	n	(y)	y
	South Korea	y	y	y	y	y	n	y	n	y	y
	Malaysia	y	n	y	y	y	n	y	y	n	y
	Indonesia	y	n	y	y	y	y	y	y	dev.	(y)
N. AMERICA	USA	y	n	n	y	n	n	n	n	dev.	(y)
	Canada	y	y	y	y	y	n	(y)	y	dev.	(y)
MIDDLE EAST	Saudi Arabia	y	y	y	n	y	y	y	n	dev.	y
	Qatar	y	n	y	y	n	y	y	n	dev.	(y)

Table 1 : Legislation and Regulation Policy Options for CCUS by Country

REGION	Country	Fiscal Policy Options						Comments
		Grants	Financing	Project Equity / SOE	Tax Credits	CCfD	Government purchase of product	
	Australia	y	Maybe under NZF?	n	n	n	(y)	*Very little dedicated CCUS support - free market approach with SGM as main driver*
EUROPE	Denmark	y	y	y	(y)	y	(y)	*Denmark has rapidly accelerated CCUS with clear bi-partisan support. Nordsøfonden (NOC) is legislated to take a 20% participation in all storage licenses.*
	Netherlands	y	y	y	(y)	y	y	*EBN (Energie Beheer Nederland) acts as the state partner, holding 40% equity in storage projects to ensure public oversight and risk-sharing. SDE++ functions as a CCfD*
	Norway	y	y	y	n	y	y	*Often the first country in each of these policy categories has seen Norway as a key knowledge holder for CCUS*
	Germany	y	y	(y)	n	y	y	*Very large changes from a "no CCS" stance to strong practical support and legislation in just a few years*
	UK	y	y	n	n	y	y	*Support for CCUS remains strong and unchanged with change of government, through CCfD and injection targets*
ASIA-PAC	China	y	y	y	(y)	n	y	*Large scale CCUS underway through high level of state intervention*
	Japan	y	y	y	y	dev.	y	*Lack of local storage and very large industrial sector means international cooperation is fundamental*
	South Korea	y	y	y	y	dev.	y	*Lack of local storage and very large industrial sector means international cooperation is fundamental*
	Malaysia	y	y	y	y	dev.	dev.	*Emerging as the prime storage location for CO_2 from Korea and Japan as well as domestic emissions through NOC.*
	Indonesia	y	y	y	y	dev.	y	*Large emphasis on CCUS for domestic decarbonisation through NOC*
N. AMERICA	USA	(y)	y	n	y	n	(y)	*Even under Trump Administration 45Q tax credits are still in place in 2026. EOR also key enabler.*
	Canada	y	y	y	y	y	(y)	*Federal investment tax credits and provincial "carbon contracts" work in tandem. Focus has shifted to deployment of massive industrial hubs in Alberta and Saskatchewan.*
MIDDLE EAST	Saudi Arabia	y	y	y	(y)	dev.	y	*Saudi Aramco (NOC) is leading CCUS with injection target of 44Mtpa by 2035*
	Qatar	y	y	y	n	n	y	*Qatar Energy (NOC) is leading CCUS with injection target of 11Mtpa by 2035*

Table 2: Fiscal Policy Options for CCUS by Country

4.3 Policy - Legislation and Regulation Policy Options

In this section we will look at policy options that do not come at a cost for government and could in some cases be revenue generating.

4.3.1 Capture, Transport, and Storage Legislation and Regulation

4.3.1.1 Domestic

Developing a CCUS industry necessitates robust laws and regulations that span the entire value chain, including onshore and offshore projects and the logistics of moving CO_2 across state and international boundaries. Although this regulatory structure is the bedrock of the industry, it must be paired with other support mechanisms, as legislation alone will not drive industry growth. Despite the early introduction by Australia of the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGSA) in 2006, no CO_2 has been stored offshore under the Act in twenty years. States and Territories differ in their enabling legislation for storage onshore or in state waters. The only statewide legislation tested at scale is in South Australia (Moomba CCS). In Western Australia Gorgon CCS acts under its own bespoke State Agreement which only applies to the Barrow Island facility.

It should be noted that presence of legislation is not enough to guarantee that successive governments will support CCUS (as can be seen in Queensland's decision to cancel CO_2 storage titles and introduce a legislative ban within the Queensland part of the Great Artesian Basin ahead of the last election). Policy must enjoy bipartisan support for CCUS to be investable.

4.3.1.2 International

Australia is a signatory to The London Protocol which is the primary international treaty governing the protection of the marine environment from pollution caused by dumping. For Carbon Capture and Storage (CCS) it is the rulebook for how CO_2 can be stored under the seabed and moved across international borders.

Being joint signatories allows for the transboundary shipping of CO_2 under a framework that ensures the sequestration is permanent and safe. The process involves strict adherence to purity standards and a documented arrangement between the two governments to manage the risks and responsibilities of the storage project. A bi-lateral agreement between two countries is also required (and none are currently in place for Australia at the time of writing)

4.3.2 Strategic Signals

4.3.2.1 Legislated Emissions Reduction Targets

With the adoption of the 2015 Paris Agreement, Australia has since committed to Net Zero emissions by 2050 with a legislated target for 2030 of 43% and a 2035 target of 62-70% emissions reduction compared to 2005 levels.

Australia's Nationally Determined Contributions (NDCs) include "Accelerating zero- and low-emission technologies, including , inter alia, renewables, nuclear, abatement and removal technologies such as carbon capture and utilisation and storage, particularly in hard-to-abate sectors, and low-carbon hydrogen production." [2]

Workshop Delegate Insights - Legislated Emissions Reduction Targets

No WA Gov requirement to not vent CO_2 anymore.

Use of the stick by the govt as well as the carrot - look at all options (e.g. Gorgon - required to do CCS to carry out the development) - adds to certainty.

[2] https://unfccc.int/sites/default/files/2025-09/Australias%20Second%20NDC.pdf

Emissions currently to atmosphere and externality paid by third parties not part of the value chain (GHG Change impact; Coastal communities , farmers).

4.3.2.2 Dedicated CCUS Strategies, Roadmap, Plans

National CCUS Strategy

Unlike most comparable countries (see Table 1 : Legislation and Regulation Policy Options for CCUS by Country) the Commonwealth Government does not currently have a dedicated CCUS strategy or roadmap. There is a consultation process underway for general Carbon Management Technologies (CMT) which could include CCUS but a CMT plan or strategy has yet to be released at time of writing.

By contrast the Commonwealth has a target of 82% renewable electricity by 2030 [3] with a National Renewable Energy Priority List [4].

The National Hydrogen Strategy (2024) which sets a production target of 15 million tonnes per year by 2050, with intermediate five-yearly milestones. [5]

Some states have dedicated CCUS strategies.

Western Australia

The Western Australian Government identified CCUS as an economic diversification opportunity in Future State: Accelerating Diversify WA (2023) and was the first Australian jurisdiction to release a dedicated CCUS strategy, publishing the CCUS Action Plan in November 2024. The Action Plan outlines the role of CCUS in the State and sets out six action areas. The main area of progress has been the enactment, in May 2026, of regulations and associated legislation permitting the transport and storage of CO_2 within state jurisdiction.

Through these initiatives, the Western Australian Government has provided a welcome statement of support. The next essential step is to translate this foundation into a formal plan with defined targets and timelines to support the scale-up of CCUS.

Western Australia is home to the operational Gorgon CCS project. This facility was mandated by state government through the Barrow Island Act 2003 and the Gorgon State Agreement as a condition of development of the Gorgon Liquified Natural Gas (LNG) project. However this project is one of a kind under this legislation and similar conditional developments have not been articulated to date by the Western Australia government.

South Australia

South Australia has been supportive of onshore CCS through early legislation and regulation of CO_2 storage which has underpinned the operational Moomba CCS Project. In lieu of a dedicated CCUS strategy Infrastructure South Australia has included CCUS as part of its 20-Year State Infrastructure Strategy 2025 Report [6] where it recommends two actions:

1. Identify key carbon capture and storage infrastructure opportunities and sequencing to aggregate demand and support net zero and commercial opportunities at scale. *Timeframe 5-10 years*
2. Identify the key opportunities for value-add use of carbon dioxide and enabling infrastructure. *Timeframe 0-5 years*

[3] https://www.dcceew.gov.au/energy/renewable
[4] https://www.dcceew.gov.au/energy/renewable/priority-list
[5] https://www.dcceew.gov.au/energy/publications/australias-national-hydrogen-strategy
[6] https://www.infrastructure.sa.gov.au/__data/assets/pdf_file/0009/1139679/ISA-20-Year-State-Infrastructure-Strategy-2025-A4-Print.pdf

Northern Territory

Rather than an overarching CCUS strategy the Northern Territory government has collaborated on the extensive studies by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the creation of the Northern Territory Low Emission Hub (NTLEH) at Middle Arm in Darwin to take advantage of local offshore CO_2 storage opportunities at Bayu Undan and in the Petrel Sub Basin. The work has been shared publicly through twelve Task reports (the reports for tasks 10,11 and 14 are valuable resources for policy recommendations in Australia). [7]

The Northern Territory does not have legislation for storage of CO_2 within state jurisdiction but has passed the Pipelines and Petroleum Legislation Amendment Bill 2026 to allow for transmission of CO_2 through pipelines. This will allow CO_2 captured at Middle Arm to be transported to the offshore Commonwealth jurisdiction for storage.

Victoria

Victoria does not currently have a standalone, dedicated CCUS Strategy but was one of the earliest Australian jurisdictions to establish clear legal pathways for carbon sequestration (Greenhouse Gas Geological Sequestration Act 2008). The state run CarbonNet project is the Victorian Government's primary vehicle for CCUS and is primarily focussed on offshore storage in the Gippsland Basin of brown coal based emissions from the Latrobe Valley via a 100km pipeline. The project was an early mover in Australia, first funded under the Rudd Government CCS Flagships Fund and has been the first project to work through the complexity of joint State and Commonwealth approval processes. However, the project has not yet progressed to Final Investment Decision (FID); the ultimate source of CO_2 is yet to be confirmed.

Victoria hosts the CO2CRC Otway International Test Centre, a long-running research and demonstration facility that has safely injected and monitored CO_2 underground for over a decade to de-risk global containment technologies.

Queensland

The Queensland Resources Industry Development Plan [8] has an ongoing action to "Investigate carbon capture, use and storage (CCUS)". This report dating from 2022 has since been archived, and the current legislative ban on CO_2 storage within the extent of the Great Artesian Basin and the withdrawal of long awarded GHG storage titles has effectively halted CCS for the foreseeable future and posed sovereign risk concerns for any CCS project in Queensland.

New South Wales

While New South Wales has previously considered CCUS, their latest Net Zero Plan [9] focuses on technologies such as fugitive methane reduction, green hydrogen and electrification and does not include any plans for CCS activity (although CCU may be supported). While there is no enabling legislation for CO_2 storage in this state, the New South Wales Government has previously co-funded with industry, through Low Emission Technology Australia (LETA), the New South Wales CO_2 Storage Assessment Program. [10]

Workshop Delegate Insights - National CCUS Strategy

Lack of clear signalling and policy support from the Australian federal ministers and the federal government for CCS.

There are gaps in Federal strategies - no current CCS strategy as there was for hydrogen and renewables.

[7] Northern Territory Low Emission Hub (NT LEH) Carbon Capture Storage and Utilisation (CCUS) business case project - CSIRO
[8] https://nla.gov.au/nla.obj-3084012824/view
[9] https://www.soe.epa.nsw.gov.au/all-themes/climate/net-zero-plan-stage-1-2024
[10] https://www.resources.nsw.gov.au/invest-nsw/coal-innovation-nsw/carbon-capture-and-storage

Why do we need a National Strategy?

- Australia needs leadership, other governments in APAC countries have strategies and are driving CCS. This does not exist in Australia and leaving us behind.
- A strong strategy with timeline and actions will give customers confidence to support and invest in CCS projects.
- APAC countries like Malaysia and Indonesia are ahead of Australia in CCS investment in projects, research & development and technology innovation.
- We do not want Australia to be left behind, what will happen to industries when we cannot compete, especially when other countries decarbonise faster than Australia.
- Australian industries and projects are underpinned by international trading partners, they need to be considered as part of Australian CCS.
- CCS Hubs allow advancement of Technology Readiness Level (TRL) initiatives to generate new innovations and industry.
- CCS is needed to decarbonise Australia and industries, especially in the near term. We need action to help our environment.

Discussion points regarding a National Strategy for CCUS Hubs

- Interfaces with governments need to be clear and efficient, including between State and Federal governments.
- Need more focused government structure, for more efficient engagement with industry, regulations and policy advocacy, currently too many ministers having involvement in CCS and so difficult to get traction/progress.
- WA CCS Action Plan was well received by APAC region customers and industry, a National Strategy will be similarly well received by regional customers.
- Need to include Utilisation in CCUS strategy, not just 'waste' disposal but also capture benefits for potential new industries.
- CCS projects take many years to develop; the strategy needs to guide long term investments and give confidence to investors.
- Innovation and technology support should be part of strategy, to lead more efficient technology to reduce cost of CCS and carbon management technology, grow new industries and skills.
- Aus Trade can be part of CCS strategy.
- DAC is currently not recognised with in regulations for carbon credits and prohibits investment, this does not align with international regulation and industries, legislation needs to change for this.
- CCS needs financial support because CCS is significant cost and cannot be passed onto some customers, especially those industries with low margins (e.g. manufacturing, agriculture etc.).
- Need a strategy with timeline, lighthouse projects (short term) -> scale up (mid term) -> build industries (long term).
- A quick early new/pilot project is better than waiting for a perfect project that takes too long.
- Advocacy: need to engage ENGO, NGO, WWF, Unions who are influence to make change or a difference with government and general public.
- Advocacy: market the benefits of CCUS, Green Hydrogen received more funding than CCS yet CCS will reduce more carbon emissions.
- Advocacy: CCS protects and promotes jobs and secondary industries and jobs, better for the economy.
- Narrative: which is a better narrative for government, 'force' industry to decarbonise, or industry will 'voluntarily' decarbonise themselves to keep fossil fuels going.
- Narrative: use consistent language, terminology, images to educate CCUS to the general public.
- Narrative: branding is important in trying to educate and gain acceptance from general public.

- Narrative: change language to be more meaningful to general public, instead of Carbon Tax, use Carbon Royalty.
- Narrative: get a focus group to get aligned language that resonates with and promotes CCUS to the general public.
- Narrative: move CCS away from the Oil & Gas industry.
- Trust: without trust, facts do not matter!
- Trust: need to build public trust, research and messaging cannot come from or be funded by industry as the general public do not trust industry. Research, messaging and reporting needs to be funded or come from government, CSIRO, Universities etc. that the public trusts.

VRE has policy targets and mandates, CCS needs these.

How do we get to a National CCS Strategy?
- Need Cth Govt to get on board - advocacy to Cth Govt
- State Govt can advocate to Cth Govt on that issue
- Celebrate operational wins and define future opportunities
- Use State influence at the Federal level would be very powerful in the CCS space

All CCS projects under 1 Minister?

Cth National CCS Action Plan/Strategic Delivery plan - set targets, set policies that enable us to reach targets, this then dictates what regulation and funding is required.

We need Industrial Carbon Management Strategy which defines infrastructure, based on concept studies. This should be federal, pushed by WA. Need an in depth concept study on Kwinana hub to assess benefits in terms of facilitating jobs and industry. This is the key gap. Needs to include uncertainty modelling, not deterministic. Need to look at costs vs benefits.

CDR could be very important so how does WA fit into this? We have the CDR roadmap but no implementation.

4.4 Carbon Pricing and Carbon Markets

As the IEA [1] state "Putting a price on CO_2 can incentivise emitters to invest in technologies to reduce emissions. This can be in the form of a carbon tax or through carbon markets …, where facilities are penalised for emitting CO_2 or other GHGs, encouraging investment in emissions-reduction technologies. "

4.4.1.1 Carbon Tax

Under a carbon tax the government sets the price that an emitter must pay to emit per tCO_2e. While this provides certainty about pricing, governments have less control over actual total emissions since emitters may choose to pay to continue to emit.

4.4.1.2 Carbon Market

Alternatively, a carbon market requires an Emissions Trading Scheme (ETS) typically with an emissions cap and verifiable carbon credits which can be earned and traded at a variable prices depending on supply and demand. While a carbon market can help government to better predict overall emissions (to meet the caps imposed), the carbon market alone will not provide enough certainty over the price of emissions for long term infrastructure projects, especially if targets are not routinely enforced and exemptions are possible but not transparent.

The short lived Australian ETS legislation of the 2010s established the Australia Carbon Credit Unit (ACCU). However, the repeal of the ETS by the incoming Abbott government and the subsequent introduction of the Safeguard Mechanism (SGM) with generous emissions thresholds saw a complete halt to interest in CCUS in Australia for almost ten years.

The revised emissions caps of the 2020s SGM Reforms coupled with a Cost Containment Measure for ACCUs was initially welcomed as an incentive to support investment in CCUS. However, the current design has been too uncertain to support CCUS investment before 2030. The SGM will be reviewed in 2026/27 and while there is potential for the SGM to underpin investment in CCUS post 2030, major changes would be needed to provide the required level of certainty for CCUS alone.

Carbon markets require a steady supply of credits, but the transition from ACCUs to Safeguard Mechanism Credits (SMCs) for some CCUS activities is fraught with challenges. Although the 2021 CCS ACCU eligibility method initially supported projects like Moomba CCS, the 2023 SGM reforms mean that large-scale emitters (>100ktpa) now earn SMCs for their abatement if the net emissions from that facility are below the emissions baseline established through the SGM regime. These credits are confined to a closed trading system among SGM participants and it is unclear at present if there is a mechanism for banking or utilisation past the 2030 deadline, creating long-term uncertainty for developers, as projects will last considerably longer. These uncertainties have contributed to a pause in CCUS project development until a completion of the upcoming SGM Review.

One way to increase carbon dioxide removal is through novel Carbon Dioxide Removal (CDR) e.g. the draw down of atmospheric CO_2 through reactions with suitable rocks to store CO_2 in sold form as a carbonate (known as mineral carbonation). Other forms of CDR include Direct Air Capture (DAC) and Bioenergy with CCS (BECCS). However, there are no Clean Energy Regulator (CER) approved methods for ACCUs though novel CDR thus stifling innovation in this field of study. The Minerals Research Institute of Western Australia (MRIWA) published their Roadmap to Decarbonise Western Australia Through Integrated Mineral Carbonation [11] while the State and Commonwealth government has funded CSIRO's Australian Carbon Dioxide Removal Roadmap Study [12] both of which cover the need for formal carbon credit recognition.

Based on the most recent data from the World Bank [13] as of early 2026 58 countries have implemented or scheduled a national carbon tax or an ETS.

Workshop Delegate Insights – Carbon Pricing and Markets (General)

Carbon tax?

Should we talk in terms of ACCU or similar given current government view on general carbon price?

A target future price would help everyone understand what projects are good value.

Need to retain ACCUs to keep heavy industry in Australia or similar mechanism.

Cth approach needs rising carbon price to work otherwise it is a forever subsidy.

Strong view that ETS (EU) is better than our system.

Singapore has a CO_2 rising with time - seen as a good model.

Need to change our system therefore highlight failures of our system (no CCS projects) leading to changes to structure to improve investment.

~ Eight years' timeline from CCS idea to start up requires stability over election cycles.

Moomba CCS has long-term certainty of getting ACCUs, was important to decision to sanction.

The level of government that controls the price levers needs to be the one holding the risk - likely Federal.

Levelising carbon price across countries will be important to industry competitiveness. CBAM may help this.

Risk in linking global carbon credits, Australian credits could be brought up by wealthy foreign companies leading our industry forced to expensively decarbonise.

Carbon price would attract investment to lowest cost decarbonisation option.

[11] https://www.mriwa.wa.gov.au/wp-content/uploads/2024/11/Roadmap-to-Decarbonise-Western-Australia-Through-Integrated-Mineral-Carbonation.pdf
[12] https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/CSIRO-futures/Energy/CDR-Roadmap
[13] https://carbonpricingdashboard.worldbank.org/about

Cost for complete CCS project - what should be a reasonable target to aim for? Differs for every industry. LNG - Depends on how much CO_2 you have to remove. Probably between $100-200/tCO_2e$.

Due to low cost in ACCUs/SMCs, likely not to move before 2030. Then competing against international firms no green premium there so need CBAM.

Mature costing required to inform government.

ERF has underwritten previous credit purchases to facilitate investment - the Emissions Reduction Fund (ERF) acted as a "guaranteed buyer" to reduce the financial risk for developers, making it easier for them to secure bank loans and private investment.

4.4.1.3 Safeguard Mechanism and CCUS implications

The current Safeguard Mechanism is too uncertain to support the 10–20 year investment horizon required for CCUS projects. While the SGM initially generated interest in CCS, multiple Trade-Exposed Baseline Adjustment (TEBA) exemptions and the ambiguity around use of SMCs generated by early adopters after 2030 have created a disincentive to proceed with CCUS at this time. Long-term uncertainty around SMC pricing—particularly the absence of a credible floor price—further undermines investment confidence.

It is also unclear how many facilities will receive relief, making qualification difficult under current settings. With the upcoming review, industry expects further changes and is waiting to understand how significant these will be and what they will mean for the 2030s. Across all likely reform scenarios, a contracts-for-difference approach will be required as a bridge to support project sanction.

The current SMC price remains too low and sits outside the cost window for pre-2030 early adoption, meaning Australia has now lost the opportunity for early CCUS deployment to support SGM baseline reductions. The Cost Containment Measure (fixed price) is insufficient for CCUS economics, and the non-compliance penalty of $330 per tonne is closer to the real cost (which varies greatly depending on source of CO_2, transport and storage options).

Requiring companies to justify using more than 30% offsets is likely to be an onerous administrative process and remains untested. As a result, the SGM effectively forces a binary choice for facilities unable to meet baseline reductions: either shut down or rely on government support through baseline waivers or offset rule adjustments.

There is also the unresolved question of ACCU supply, with methodology bottlenecks creating further constraints. SGM and CBAM reform must occur together, noting that CBAM will not apply to export-exposed facilities unless a regional CBAM emerges (e.g., Japan, Korea, Singapore).

Workshop Delegate Insights – Safeguard Mechanism

Certainty required for $500M investment.

Need to change our system therefore highlight failures of our system (no CCS projects) leading to changes to structure to improve investment.

Current framework is holding back investment.

Generate revenue and tax by catering to CO_2 suppliers of Australia's trading partners.

How to align the final investment decision of multiple projects section.

Gov case compelling to them if guaranteed high price of carbon (e.g. policy).

Safeguard mechanism is a key driver. But investors are asking decarbonisation questions as well.

Should we talk in terms of ACCU or similar given current government view on general carbon price?

Discussed current cost of penalties for being above safeguard mechanism.

Safeguard credits expire in 2030 which means there is no reward for massively decarbonising now.

Longer term safeguard credits beyond 2030 would help.

Invest now with uncertainty seems to be exposing your business if the safeguard changes - leads to inertia.

Need to change our system therefore highlight failures of our system (no CCS projects) leading to changes to structure to improve investment.

Whether your facility can get trade exposed (or similar) relief from penalties is not clear.

Current framework is holding back investment.

The level of government that controls the price levers needs to be the one holding the risk - likely Federal.

Risk in linking global carbon credits, Australian credits could be brought up by wealthy foreign companies leading our industry forced to expensively decarbonise.

Carbon price would attract investment to lowest cost decarbonisation option.

What action do we hope to see in 2027 from the Safeguard Mechanism Review

Is Safeguard Mechanism doing its job/driving emissions reduction in the covered facilities?

Preliminary data indicate 2.5% reduction not 4.9%, common to early stage scheme deployment across the globe but also TEBA influential in major safeguard facilities receiving relief from emissions reduction.

There is uncertainty over limit on SMCs for sale post 2030, this is removing proponent confidence for FID.

2035 NDC declared has 62-70% which may result in a baseline reduction of 4.8-6.2% p.a.

Current 100,000 t/pa threshold across 215 facilities.

Productivity commission has recommended 75,000, 50,000, 25,000 which will increase liquidity but may result in inability of small scale emitters to report and comply.

Worst outcome could be a near term secondary review in 2031 aligning with requirement to declare 2040 NDC.

Currently 2035 NDC target not set in legislation and therefore detrimental to certainty of investment.

Review due by July 2027, release may be influenced by a possible election in as early as August 2027, terms of reference should be established to define timing and publication so as proponents can align their investment timing.

In a world with no ESG premium or carbon price then the impact of safeguard may lead to offshoring of hard-to-abate industries as credit impost never meets cost of abatement.

TEBA appears to have been adopted by many but is removing sanctity and liquidity of credits. Any TEBA exemption is detrimental to achieving NDC and therefore whilst under review its usage should be addressed. Less TEBA may support SMC pricing and encourage more abatement projects to be deployed.

A CBAM cannot do anything for export focussed industries and the majority of covered facilities are export focussed.

Cross party investment across safeguard facilities to generate credits at a targeted safeguard facility with low cost of abatement on a all facilities MAC curve. i.e. large multinational with low concentration CO_2 emissions invests in abatement at a small facility that could not self-fund the abatement like NOX reduction in a small processing facility. $/t cost of abatement works for the multinational when compared to resolving its own emissions.

Could safeguard work with a Safeguard Facility CIS. Particularly in regards to supporting a hubs model in its first deployment. Federal CIS in power market is funded by general revenue (Check). As a federal priority maybe a CIS is required to start the initial phase one of projects.

CIS is Capacity Investment Scheme - designed to encourage investment in **renewable energy generation** and **storage** (like big batteries or pumped hydro). Its main goal is to ensure the electricity grid remains reliable as older coal-fired power stations retire.

Can 15 year Teesside government contract model be adopted to aid investment confidence.

State may be able to deploy a CTH stacked on an SMC to support project FID within WA.

Acceptance that Safeguard requires a stack of additional fiscal support for project deployment (grant CAPEX, OPEX support, credit generation, demand side pull).

Coinvest/Shared facilities for small emitters may be a requirement if economies of scale exist.

Longevity of SMC and sanctity of pricing a major concern.

Can demand side premium market evolution be encouraged ie green/blue products that industrial/ construction/ domestic creating pull/ demand for product?

One major issue is the uncertainty of the upcoming review.

The current SGM is too uncertain to support investment requirements on a 10 to 20 year basis which would be needed for a CCUS project investment.

While initially the SGM did spike interest in CCS we can see that there have been a number of TEBA exemptions and earlier adopters could not use SMC's generated between 2025 and 2030 going forward after 2030 – a disincentive to generate SMCs.

Also too much uncertainty in the long-term SMC is to justify without a good floor price.

It is unknown how many companies will be given relief and therefore qualification can't be done on current uncertainty. Following the review it is likely the SGM will be changed and industry is waiting to see how aggressive that will be and what the impact will be in the 2030s.

It is likely that in all scenarios for SGM reform the contracts for different (CFD) approach will be needed as a bridge to support project sanction.

Current SMC price is being kept too low and is outside the cost window of pre-2030 early adoption. So we have now forgone the advantage for earlier adopters for CCUS to meet SGM baseline reduction.

The emitter community needs to speak out.

The **Cost Containment Measure (Fixed Price)** is not enough in the current market for CCUS projects.

To be allowed to use more than 30% of offsets companies have to provide justification to the CCA - is likely to be an arduous admin process and is not yet tested?

Therefore, the SGM really leads to a binary decision if cannot meet baseline reduction

- shut down the facility
- Government supports the facility by waving emissions baselines and offset rules

And where are all the ACCUs coming from? The ACCU bottleneck for methodologies is also issue.

CBAM and SGM reform must come at the same time. And CBAM is not applicable if it is an export exposed facility unless there is a regional CBAM (e.g. J,K,S).

Safeguard mechanism impact will ramp up over coming decade.

Early abatement affords an opportunity in credit generation but perhaps underwriting of purchasing of those generated credits at a price is required. Increases bankability of project.

State could be underwriter/purchaser of long term SMC.

History of safeguard has been on and off and on leading to uncertainty in investment by corporations.

Safeguard mechanism review - big opportunity to convey that the targets are at risk if we don't push CCS forward. Tangible model needed. All options must be on table.

ETS system that works - $45/tonne is too low

a. Without a clear escalating price of carbon, no incentive to move
b. Resp of Fed Govt to implement this mechanism
c. Safeguard mechanism - can be used to establish the carbon price, but need to get rid of ACCUS.
d. We have a mechanism that can be 'shaped' to work.
    i. Safeguard, no access to ACCUs
    ii. CFDs

Keep safeguard mechanism, ramp it up, targeted support, mandate for geological storage to scale up - gives investors confidence, industry move together. [Similar to RET scheme].

Better way to incentivise investment in CCS:

- Keep safeguard mechanism for continuity but find some way to manipulate the $/tonne upwards, we don't want a persistent low price.
- Remove ACCUS

4.4.2 Pore Space Access

Under current policy settings in Australia, primarily the Safeguard Mechanism (SGM), the emitter of the CO_2 is the responsible party. For example, methane (CH_4) is sold as feedstock for production of ammonia (NH_3). Hydrogen is separated from the carbon leaving considerable CO_2 emissions. To avoid these emissions the ammonia producer currently has four options:

- Use a carbon free source of hydrogen (e.g. green hydrogen- currently small scale and very expensive)
- Use the CO_2 in a utilisation process - currently not supported by the Cleaner Energy Regulator (CER) as an accepted ACCU/SMC method
- Cease operations (or relocate to another jurisdiction)
- Continue operations and meet compliance obligations by purchasing ACCUs and SMCs as offsets, while potentially seeking a variation to exceed current offset caps
- Find a CO_2 Transport and Storage (T&S) operator (could be the original methane supplier) to take the CO_2 at cost that will create a revenue source for the T&S operator.

The last option currently represents the pathway for decarbonising supply chains at the point of emission while achieving the lowest levelised cost of CO_2 at scale. However, this structure places the CO_2 storage provider in a potential monopoly position, granting them the power to dictate both pricing and access.

Since the requirements to meet emissions caps are imposed at a governmental level, global jurisdictions have taken a variety of approaches to ensure pore space access for facilities that must use CCS to fully decarbonise. Australia can consider how to ensure pore space access in our national and state context, and each option will require government involvement.

State Owned Entity (SOE) / Carbon Contract For Difference (CCfD)

Where a state owned entity (typically a NOC) is involved in the development and operation of a CCUS project / hub, pore space access for hard-to-abate industries can be a foundational requirement led by government. In other countries (e.g. UK where there is no NOC) fiscal support mechanisms such as the Carbon Contract for Difference (CCfD) model allows government to prioritise and coordinate access for at-risk industrial emitters. Both these options ensure pricing transparency as well as a coordinated CO_2 supply.

Pore Space Mandate

Another approach is through a pore space mandate for emitters requiring CCS. Criteria for emissions that might qualify could include:

- Critical supply chain emissions e.g. cement, ammonia.
- Hard-to-abate industries only
- Domestic emissions of any type.
- Emissions from carbon negative activities (draw down of CO_2 from the atmosphere) such as BECCS and DAC.

In the recent paper Escape from the Valley of Death: The Case for a Geological Storage Mandate in Australia by Evatt et al, 2025 [14] the authors conclude that "A mandate requiring fossil-origin CO_2

[14] **Escape from the Valley of Death: The Case for a Geological Storage Mandate in Australia, *Alice Evatt(a)*,Peta Ashworth(b), Stuart Jenkins(a), Henry Adams(c), Alana Hollestelle(c), Stefan Trück(d), Tom Kettlety(e), Liam Wagner(b), Mirte Boot(f), Ingrid Sundvor(f), Myles Allen(a) OGEL 2025**

producers to, for example, progressively store an increasing fraction of their emissions would provide industry with a predictable net zero compliance pathway and help de-risk investment". CO_2 emissions are viewed in the same way as rehabilitation or decommissioning obligations in resource development: the emissions generated by an activity (e.g., oil and gas provision) must ultimately be returned to a pre-emissions state.

Given the complexities of applying pore space stipulations or mandates to existing operations, the gradual pace of CCUS project deployment creates a timely opening for policy direction. Proponents can incorporate these requirements into their original financial models, avoiding the disruption that typically follows retrospective regulatory changes.

Two existing Australian examples are useful in the discussion around a pore space mandate. Both were established at the start of their respective industries and not retroactively applied.

The Western Australia Domestic Gas Policy requires LNG exporters to make domestic gas available by reserving gas equivalent to 15% of LNG production for the Western Australia market. [15] The mandate has provided the state with a secure, long-term supply of energy effectively insulating Western Australia from the extreme price volatility and supply shortages often seen in the eastern Australian energy market.

The Mandatory Renewable Energy Target (MRET) was introduced by the Howard Government in 2001 to increase the contribution of renewable energy in Australia's electricity mix by an additional 2% by the year 2010 by mandating that electricity retailers source this 2% "extra" from new wind or solar projects. [16] The MRET has been successful in kickstarting the rollout of renewable energy in Australia though it should be noted that additional costs are borne directly by the consumer. Retailers are incentivised to implement mature, commercially viable technologies (initially onshore wind, hydro, and later basic rooftop solar). Investment in emerging technologies like grid-scale solar, geothermal, wave energy, or large-scale storage have required access to government finance options through the Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA).

4.4.2.1 Global Pore Space Access Examples

Some jurisdictions view pore space as a national resource and require that it be developed efficiently and in the national interest.

Canada

Canada treats pore space as a public asset, which allows the government to reserve and allocate it strategically. This is a pragmatic approach rather than a strict pore space mandate which allows the government to influence pore space allocation. For example, the government of Alberta has moved towards a permitting system based on hubs which require open access to the hub at fair service rates.

Another advantage of the Canadian hub model is "minimizing the risk of pore space sterilisation by limiting perforations and development in storage zones" .[17]

Indonesia

The Presidential Regulation No. 14 of 2024 ("PR 14/2024") establishes the framework for the implementation of CCS operations within the country.

Permit holders who implement CCS activities are required to reserve 70% of their CO_2 storage capacity for CO_2 from domestic sources.

[15] https://www.wa.gov.au/government/wa-domestic-gas-policy
[16] https://cer.gov.au/schemes/renewable-energy-target
[17] https://www.bla.com/en/insights/2021/06/alberta-moves-to-introduce-carbon-capture-and-storage-hubs

Permit holders can allocate 30% of their CO_2 storage capacity for the storage of CO_2 originating from outside Indonesia and can only be carried out by CO_2 producers who invest and/or are affiliated with investments in Indonesia. [18]

It is not yet clear how international and domestic storage will align in CCUS projects in terms of cost allocation.

Europe

The Net-Zero Industry Act (NZIA) 2024 reflects the need to secure European industrial sovereignty and prevent a mass exodus of green manufacturing industries. A very specific driver was the realisation that "Hard-to-Abate" industries (cement, steel, chemicals, waste-to-energy) cannot reach Net Zero without CCS.

- The Injection Target: The Act sets a landmark target of 50 Mtpa CO_2 injection capacity by 2030 under the Carbon Take Back Obligation (CTBO) or Producer Responsibility model.
- It mandates that EU oil and gas producers contribute to this capacity based on their share of historical production - moving the burden of storage development onto those with the technical expertise and capital. This storage obligation currently falls on 44 oil and gas producers across 11 EU member states (based on 2020-2023 oil-equivalent production).

Entities can choose one of the following options to meet obligations:
- Invest in, or develop, CO_2 storage projects – alone or in cooperation
- Enter into agreements with other obligated entities
- Enter into agreements with third-party storage project developers [19]

The retroactive and indiscriminate application of the NZIA has quickly illuminated some unforeseen consequences for this style of CTBO mandate.

- Access Disconnect. Several obligated producers have historical production footprints in locations lacking either established regulatory frameworks for CO_2 storage permitting, or geologically suitable sites.[20]
- Border Bottleneck. The target is strictly an EU geographic mandate; therefore capacity developed in premier offshore storage hubs outside the EU cannot count toward a company's compliance quota without specific, complex international bilateral agreements. This has restricted compliance options to a potentially narrower set of geological basins which may be less suitable and/or poorly understood.[21]
- Value Chain Decoupling. The mandate only regulates the storage component of the value chain, leaving capture and transport to disparate market forces.[22]
- Compressed Maturation and Permitting Timelines. The NZIA effectively compressed the required multi-stage engineering and regulatory pipeline (typically ~10 years) into an unrealistic 5-year window, increasing the risk of bureaucratic bottlenecks, the exact opposite of the NZIA's streamlining objective.[23]

This has led to perverse market distortions and value inflation.

- Acreage Hoarding. Obligated entities are incentivised to acquire and hold any available prospective storage licenses to secure their quota, regardless of whether those sites represent the most cost-effective or geologically optimal solutions for European industry as a whole. [20]

[18] https://www.arma-law.com/news-event/newsflash/indonesias-carbon-capture-storage-regulatory-overview-presidential-regulation-no-14-of-2024
[19] https://www.woodmac.com/news/opinion/ready-steady-store-delivering-on-the-eus-co-storage-obligation/
[20] https://iogpeurope.org/resource/iogp-europe-recommendations-to-address-the-implementation-challenges-of-the-net-zero-industry-acts-nzia-2030-co2-injection-capacity-objective/
[21] https://www.catf.us/2024/08/carbon-dioxide-without-borders-connecting-uk-eu-create-more-resilient-lower-cost-co2-storage-network/
[22] https://carbonmanagementeurope.org/nzia-injection-capacity-obligation/
[23] https://www.woodmac.com/press-releases/wood-mackenzie-analysis-reveals-the-european-unions-eu-carbon-storage-injection-capacity-targets-face-a-significant-shortfall-given-challenges-to-project-delivery/

- By concentrating timely accessible storage in only a few CCS mature jurisdictions, smaller producers without access to pore space may be beholden to a small subset of CCS ready operators who are typically large oil and gas companies.

Legal uncertainty remains a barrier for the roll out the NZIA. The current lack of clarity surrounding late-stage entity exemptions and third-party agreements creates uncertainty regarding how individual compliance quotas will be redistributed. The regulatory ambiguity and compressed timelines of the Net-Zero Industry Act (NZIA) have triggered a wave of major legal challenges. [22]

Workshop Delegate Insights – Pore Space Mandate

Previous emissions externalities have been prohibited and cost born by emitter to the betterment of global society(example given of pollution of lakes and rivers subsequent prohibition).

Introduce a domestic storage capacity reservation policy for earning social acceptance to enable transboundary CCS while preserving capacity for domestic decarbonisation.

Across all CCUS (or only some projects)? A certain % of pore space is allocated for certain sources of CO_2.

Need to set criteria for which projects and which CO_2 but likely will be to assist access to pore space for hard-to-abate (h2a) industries that are domestic emitters (assumption is that gas processing emissions are not deemed h2a).

Would this apply just to hubs with government involvement?

Would there be set pricing? How is costs of storage determined? What %?

What are the ways that the WA Dom Gas policy is applied and how can we think about this in a CCUS setting?

European Example – Net Zero Industry Act (NZIA)

- based on oil and gas production between 2 dates (2020 to 2023?)
- If an oil and gas company produced, say 10% of all hydrocarbons in that time they are obligated to "take back" the same % of CO_2 by a certain date (2030).
- Applies to all producers regardless of their plans or ability to run a CCS project – complexity but sets the expectation that the ultimate source of CO_2 will be part of the solution for the ultimate solution to the CO_2, not the customer or emitter.
- Issues for WA – would this be seen as Sovereign Risk (retrospectively applied)

A possible way to implement in WA. If overall pore space for a project is 200Mt, then

- 30% could be allocated to storage operators own emissions (assumes this is an oil and gas producer / processor with their own emissions under the Safeguard Mechanism)
- 50% could be allocated on a commercial basis (e.g. for international CO_2 imports)
- 20% remaining has to be allocated to a domestic h2a emitter (as defined under the criteria)

Needs to be based on rate of injection rather than overall storage capacity?

Would this be a national pore space mandate or just apply to WA?

What are the unforeseen risks of state/state/Commonwealth interactions around a mandate?

Could the mandate be transferable e.g. if more domestic h2a emissions are likely to go to Mid West from Kwinana what is the impact for the Pilbara with limited emitters.

Whichever you look at it a pore space mandate is a policy and a thumb on the scale to promote CCS.

What is the impact on CCS as a service companies?

Would this need to be driven by the emitter? How to fill spare capacity. What if not enough demand?

How to balance cost of storage vs price charged – domestic vs international.

Would this stifle innovation?

What if transport and storage (T&S) company who is also an emitter is ready but DomCCS is not.

Phasing and timing are crucial.

Need to bring along CCS ready and CCS unready emitters.

A transport and storage (T&S) operator could be charging different $/t for themselves, international and domestic mandated customers – transparency needed? Discounted price but still profitable for domestic emitter (like DOM Gas customers).

Different price for anchor customers vs additional customers?

How do we know the size of the project so that the % is applied correctly.

(Side issue – which Atlas is in any way useful for these conversations as a starting point).

Has the project gone through SRMS? Who is going to provide the numbers to government and check the numbers for government. At screening stage. Before models? After models?

Declaration of Storage has to state and model based on "fundamental suitability determinants".

One of which might be the source of the CO_2. When is the mandate imposed – before or after the DoS.

Would we suggest a tiered system and timeline for different emissions

- High concentration CO_2 streams are relatively few and low handing fruit (ammonia) – these could be prioritised
- Then low CO_2 concentration where technology is ready but cost is higher – second tier.
- Finally CO_2 that is waiting for a technology breakthrough to unlock carbon Capture – third tier.

Advantages for government

- Does not require $$
- Preserves local industry esp. h2a
- Preserves local resource (e.g. pore space)
- Gets past the CCS only for fossil fuels sentiment
- South Australia charges a pore space royalty – combine this with a pore space mandate

Consider the EU geological storage mandate or target, need to understand how it works. Might not be appropriate for WA.

Assume scaling up, know what you are working towards - a target to start with and then go to a pore space mandate. This would be a Federal Gov Requirement.

Mandate to store can assist with the issue of offsets

- If offsets exist and are cheaper, then the CCS industry will not take off
- Removals compliance scheme

Consider implications of domestic geological storage mandate - understand how the EU reservation policy is meant to work.

Treat CO_2 the same as other decom obligations – leave it as you find it, rehabilitation. I.e. take back the CO2 and store geologically.

Supplier may need to bear impact of emissions.

4.4.3 Injection Targets

While Australia's Net Zero Plan sets targets for renewable energy and green hydrogen generation, no milestones have been set for geological carbon storage. This is in contrast to 2030 targets in other jurisdictions such as the EU (50 Mtpa), the UK (20-30 Mtpa), and Japan (13 Mtpa).

Europe

The Net-Zero Industry Act (NZIA) 2024 sets a landmark injection target of 50 Mtpa CO_2 injection capacity by 2030 under the CTBO or Producer Responsibility model which will rise to 350 Mtpa by 2050. [24]

UK

The UK is committed to CCUS to meet net zero targets and has previously set injection targets supported mainly through a hybrid Carbon Contracts for Difference (CCfD) model. The Injection target will rise to 50 Mtpa by 2035. These targets are not legislated but aspirational.

"The Department for Energy Security and Net Zero (the Department) considers carbon capture, usage and storage (CCUS) as essential for the UK to meet its net zero targets. "The government set a target of capturing and storing 20–30 million tonnes of carbon per year by 2030. In December 2024, it concluded that this target was not achievable. It has not yet set revised goals." [25]

Japan

Japan aims to secure CO_2 storage an annual CO_2 storage volume of 6 to 12 Mtpa by 2030, via nine "Advanced CCS Projects" which were selected by the Japan Organisation for Metals and Energy Security (JOGMEC). [26] Five of the selected projects plan to store CO_2 in Japan and the remaining four plan to do so in the Asia-Pacific region. While Japan is focused on domestic storage first, it will be reliant on large scale international storage of CO_2 since it lacks adequate pore space for supporting its target to achieve carbon neutrality by 2050.

Denmark

In the 2023 "Agreement on Strengthened Framework Conditions for CCS in Denmark" they state "3.2 million tons of CO_2 a year will be stored from 2029" [27]

Workshop Delegate Insights – Injection Targets

Injection Target Signalling from Cth Govt - set an aim for targeted CO_2 injections.

4.4.4 Pore Space Royalty

As we move towards a "CCS as a service" model we could regard pore space as a national resource (akin to oil, gas, minerals) and consider a "resource rent" - a payment to the government (the owner of the resource) for the right to sell a non-renewable asset. It should be stressed that the storage of CO_2 for full industrial decarbonisation is more likely to require financial assistance from government rather than generate revenue. State and Commonwealth Governments could impose a resource rent but reduce the % payable (even to 0%) to encourage sequestration.

South Australia has included a storage rental mechanism which operates at $0.25 per cubic metre and is payable by the licensee who utilises the reservoir for storage. [28]. However there are exemptions for CO_2 "Where carbon dioxide is produced or sourced within Australia and is not imported".

Other jurisdictions have already aligned CO_2 storage with oil, gas and mineral resources and apply fees, royalties or rents. In Germany, under recent 2026 Carbon Dioxide Storage and Transport Act,

[24] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:4781345
[25] https://publications.parliament.uk/pa/cm5901/cmselect/cmpubacc/351/report.html
[26] https://www.meti.go.jp/english/press/2024/0628_005.html
[27] Agreement on Strengthened Framework Conditions for CCS in Denmark Climate Action - The Path to Full Carbon Capture and Storage in 2030 20 September 2023
[28] https://www.energymining.sa.gov.au/__data/assets/pdf_file/0009/986436/Consultation_Guideline__Rental_-_PGE_Amendment_Regulations__Feb_2024.pdf

CO_2 has been included under the Federal Mining Act (and subject to fees based on areal extent of the operation) and additionally volume based storage levies may be applied.[29]

Jurisdictions that are operated in part or whole by a State Owned Entity (SOE) rely less on pore space mandates and royalties, as the SOE is an equity owner able to influence development and access provisions. If Australia relies on fully private T&S providers rather than a SOE, pore space access and a royalty structure could become more relevant to ensure the government can capitalise on CO_2 storage opportunities and align CO_2 storage with broader decarbonisation goals. However the royalty will potentially increase the cost of CO_2 storage borne by emitters.

4.4.5 Carbon Border Adjustment Mechanism (CBAM)

As noted in the section on a pore space mandate, a Safeguard Mechanism emission cap could prompt companies to cease Australian operations and move abroad. While the global CO_2 emissions remain the same overall, the Australian economy would suffer through the loss of critical supply chains and jobs. This is a process known as "carbon leakage".

Alternatively, a decarbonised domestic industry will face competition from imported high carbon intensity products that are able to undercut a more expensive decarbonised domestic alternative.

A Carbon Border Adjustment Mechanism (CBAM), is a trade policy that applies a carbon price to imported goods to ensure they face the same emissions costs as domestically produced items, preventing carbon leakage to countries with less stringent climate regulations.

Any industry that wishes to export from Australia to a CBAM protected jurisdiction will have to comply with the carbon intensity requirements or face a tariff / border adjustment.

Several counties now have a CBAM either in operation or in advanced stages.

Europe

- The EU operates the world's first and most comprehensive CBAM. After a two-year transitional reporting phase, it entered full financial enforcement on 1 January 2026.
- Current Status: Importers must now account for embedded emissions and will begin purchasing "CBAM certificates" in February 2027 to cover 2026 imports.
- Price: For Q1 2026, the price was set at €75.36 (~$123) per tonne of CO_2 equivalent.
- Sectors: Iron and steel, aluminium, cement, fertilisers, electricity, and hydrogen. [30]

United Kingdom

The UK has formalised its own version of a CBAM targeted for implementation from 1 January 2027.

The CBAM design is similar to the EU model and will place a carbon price on specified goods imported to the UK from sectors that are at risk of carbon leakage. [31]

Australia

The Commonwealth Government published the final report of the Carbon Leakage Review on 13 February 2026 and recommends that Australia should introduce a Border Carbon Adjustment (BCA) starting with a narrow scope to test the mechanism. There is currently no fixed start date for a BCA and recommendations are being considered as part of the 2026–27 Safeguard Mechanism Review. Some key Australian industries relevant to a BCA would be lime and cement production, ammonia and fertilisers, and alumina/aluminium. These are globally traded commodities which Australia produces.

[29] https://www.gesetze-im-internet.de/kspg/__42.html
[30] https://taxation-customs.ec.europa.eu/news/cbam-successfully-entered-force-1-january-2026-2026-01-14_en
[31] https://www.gov.uk/government/consultations/draft-regulations-carbon-border-adjustment-mechanism-cbam-emissions-and-verification

Workshop Delegate Insights - CBAM

We need a CBAM to protect importing industries and funding support for industries that face CBAM elsewhere (if any).

Another essential part of policy is ensuring that industry doesn't shut down or locate offshore. Need funding to compensate for CBAM with counties to which we export. Derisk via capital investment in infrastructure in government. CFDs with a reasonable return (early subsidy to defray cost) while regional carbon prices increase, gives a buffer. With CFDs, set strike price according to difficulty in decarbonising.

Earmarking some industries for remaining on-shore - subsidise these first/to a greater degree for CCUS and CBAM.

CBAM legislation covering high-carbon imports competing with native low-carbon products (lime, cement/clinker, fertiliser, ammonia) - mirroring other countries.

Tax impact in Europe has depressed industrial investment and production over the last 30 years.

Additional impost and protectionism of CBAM is required to protect remaining industries from leaving Europe.

4.4.6 Approvals - Resourcing and Streamlining

While CCUS projects must comply with all legislation and remain well-regulated to bolster investor and community confidence, unnecessary duplication and delay frequently arise - particularly where State and Commonwealth governments maintain overlapping yet differing requirements for permits and licences.

A CCUS project operating across onshore and offshore environments (e.g., onshore aggregation for offshore storage) necessitates a minimum of three separate environmental approvals: one from the state, one from the Commonwealth, and a specific Sea Dumping Permit. For the latter, responsibility will be transferred to the new (yet to be established) National Environment Protection Australia (EPA) from 1 July 2026 with potential transitional delays.

Because different agencies review these permits in isolation, each must recruit specialised staff to manage carbon storage requirements. In such an emerging sector, bureaucratic bottlenecks are inevitable without a formal agreement to streamline processes and reduce the protracted timelines faced by CCUS projects (likely between 5 and 10 years currently).

Despite the substantial similarities between CCUS and the oil and gas sector, critical distinctions remain; approaching CCUS with an incorrect perspective will only exacerbate project delays. This applies across multiple government agencies, including (but not limited to) Geoscience Australia, National Offshore Petroleum Titles Administrator (NOPTA), National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), the EPA, and their state equivalents.

Europe has addressed this issue through the establishment of Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI) which can receive streamlined permitting and access to EU funding, under the Trans-European Networks for Energy known as the TEN-E Regulation. [32]

Workshop Delegate Insights –Streaming and Approvals

Extensive and prolongated regulatory approval processes to sanction major capital projects.

4.4.7 Data Sharing and Transparency

While Australia maintains a strong framework for geological data transparency, many government-funded projects and studies remain confidential. This is often a result of restrictive industry agreements or poor institutional record-keeping.

We can show the impact of this through three examples.

[32] https://energy.ec.europa.eu/news/235-key-cross-border-energy-projects-boost-europes-interconnectivity-2026-04-09_en

ANLEC R&D (Australian National Low Emissions Coal Research and Development) received over $100 million in State and Commonwealth funding before being wound up in 2025. Its work spanned CO_2 capture, transport and storage and includes some of Australia's most foundational research in these areas. The ANLEC website[33] remains online via Low Emission Technology Australia (LETA) and hosts the final reports and project details for all funded activities. While LETA continues to support access to these resources, they are not easily accessible via government channels. Geoscience Australia was advised of the ANLEC closure but has not, as far as we are aware, obtained a copy of the CO_2 storage reports or made them available. Interim reports and underlying datasets are currently stored across a mix of physical archives and electronic systems, and LETA is exploring options to publish them in an accessible online format.

Shell Australia was awarded funds in 2016 through the Carbon Capture and Storage Research & Demonstration Fund (CCS 49350) to conduct CO_2 injection modelling studies in the Petrel Sub Basin, offshore Darwin. CSIRO were contracted through this funding as technical consultants. While the interim and final data/ reports were submitted to Commonwealth Department of Industry, Innovation and Science they are now lost by both this department and Shell Australia. This work has since been repeated by INPEX upon award of the area that now comprises the Bonaparte CCS Project, given Major Project Status in 2025.

The Western Australia Department of Jobs, Tourism, Science and Innovation (JTSI) jointly funded the Western Australia CCUS Hubs Study with the LNG Jobs Taskforce. This report is, to date, the largest study into CCUS in WA and was conducted by CSIRO and Global CCS Institute (GCCSI). However, the report has never been published – only a 16-slide summary of the findings.

To maximise the value of taxpayer investment, government funding should be contingent upon the full public disclosure and permanent retention of retrievable data, allowing the entire industry to leverage the resulting research and insights. Compare this to the gold standard for CCUS as modelled by Norway's Clean Improvement of Mitigation Technologies (CLIMIT) Program [34] which laid the technological foundation for the Longship / Northern Lights CCUS Hub. A core condition of CLIMIT funding is that results should be shared rather than kept proprietary, and with a mandate to transparently share knowledge and experience on CO_2 management. [35]

Long-term, research is the prerequisite for multi-billion dollar investment decisions and must be fully accessible if publicly-funded.

4.4.8 Platforms for International Cooperation

Cross border cooperation can take place through membership of intergovernmental and knowledge sharing platforms. Table 3 shows Australia's involvement (often as a founding member) in leading international platforms. In addition, Australia has international climate and clean energy partnerships with Canada, China, Germany, India, Indonesia, Japan, The Netherlands, Pacific Island countries, The Republic of Korea, Singapore, The United Kingdom, and The United States [36].

International CCUS cooperation can be further ratified through treaties such as the London Protocol and through a bi-lateral Memorandum of Understanding (MOU) for transboundary movement of CO_2, and for EU countries the CCUS industry has been underpinned by the NZIA, EU CCS Directive, Trans-European Networks for Energy, and EU ETS.

While international co-operation is an important foundation for CCUS in Australia, without other policy support it cannot incentivise CCUS roll out at scale especially for industrial emissions.

[33] anlecrd.au
[34] https://www.regjeringen.no/en/topics/energy/energy-and-petroleum-research/climit-forskning-utvikling-og-demonstrasjon-av-co2-handteringsteknologi/id439219/
[35] https://norlights.com/about-the-longship-project
[36] https://www.dcceew.gov.au/climate-change/international-climate-action/international-partnerships

Organisation	
IEA	International Energy Agency; coordinates energy policy and security.
GCCSI	Global CCS Institute; international think tank to accelerate CCS.
CSLF	Carbon Sequestration Leadership Forum; ministerial-level CCUS initiative.
IEAGHG	IEA Greenhouse Gas R&D Programme; technical collaborative research.
GHGT	Greenhouse Gas Control Technologies; the premier global CCUS conference.
CEM	Clean Energy Ministerial; high-level global forum for clean energy policy.
MI	Mission Innovation; global initiative to accelerate clean energy R&D.
UNFCCC	UN Framework Convention on Climate Change.
Paris Agreement	Legal treaty on climate change (includes Article 6).
IPCC	Intergovernmental Panel on Climate Change (scientific body).
ETWG	Energy Transitions Working Group (G20 mechanism).
ERIA	Economic Research Institute for ASEAN and East Asia.
ACN	Asia CCUS Network; facilitating CCUS in the Asia-Pacific.

Table 3: Australian membership of key international platforms for CCUS cooperation

4.5 Fiscal Support Policy Options to support CCUS projects

In this section we will cover policy options that will require governments to contribute fiscally to a CCUS project, either directly through grants and subsidies, through government backed debt and financing schemes or tax credits.

4.5.1 Grants

4.5.1.1 Advantages of Direct Grants

This has historically been the overwhelming focus of policy support for past Australian Government programs.

Such funding has been crucial to identify potential opportunities such as pre-competitive geological assessment, novel capture technology, CO_2 injection and monitoring research, pilot projects and so on.

While the roll out of CCUS is much slower than hoped, these funding programs have largely prepared Australia to now move quickly under the right conditions. It is also notable that although much funding was announced, in reality many of the policies were rolled back and money reallocated e.g. of the Rudd Government CCS Flagships Fund (~1B) only 217M was ultimately spent over ten years before the fund was closed under the Turnbull Government. [37]

This type of funding is also vital for early-stage initiatives and studies to test feasibility, drive technology innovation and scale up to pilot programs. It helps projects and providers to cross the "valley of death," which is the critical gap between initial discovery and successful commercialisation.

Example

Consecutive grants over many funding cycles have underwritten geological studies of the Bonaparte Basin (offshore Darwin). Each study since 1999 has acquired additional fundamental data which has seen the Petrel Sub-Basin's classification evolve from a potential area of interest to the location of the gigatonne potential INPEX Bonaparte CCS Project (awarded Major Project Status in 2025. This project will partially decarbonise LNG operations and could also store CO_2 from Australia's major trading partners in Japan and Korea. It is of note that INPEX is a partial NOC of

[37] https://www.anao.gov.au/work/performance-audit/low-emissions-technologies-fossil-fuels

Japan and INPEX's involvement aligns with that country's plan for storage of Japanese CO_2 within Asia-Pac.

Rigorous geological assessment is fundamental to ensuring that a CO_2 storage site is both viable and appropriately scaled. Unlike oil and gas exploration, which may only require a simple discovery well, fully de-risking a storage complex demands significantly more upfront data, including sophisticated seismic programs and dedicated appraisal wells. Government grant support to facilitate the acquisition and analysis of these comprehensive datasets is a strategic use of public resources. This investment builds the necessary confidence for industry to commit capital, particularly for large-scale hubs.

There is a perception in government that the State and Commonwealth geological surveys (Geological Survey of WA, Geoscience Australia) have already mapped the subsurface storage locations in their compilation of CO_2 Storage Atlases. However, these documents are a preliminary indication of potential that require extensive extra work. Mapping of CO_2 storage potential is a specialised field, and there is industry concern that the staff in the relevant geological surveys lack this particular knowledge. A storage atlas will be used only as a starting point and either augmented or repeated to provide the required level of investor and regulator certainty. This work will take several years.

4.5.1.2 Drawbacks of Direct Grants

Countries with a high degree of interventionist policy support for CCUS typically rely on direct subsidy to support large scale projects. China has often provided 100% of total installed cost through capital allocation via a state owned enterprise (for example the Sinopec Qilu-Shengli CCUS Project [38] while Norway's Longships program has underpinned Phase 1 with 80% of the total cost through direct subsidy via state owned entity Gassnova [39]. In this way for hard-to-abate facilities, where there is no existing green premium, governments have chosen to protect a decarbonised industry through high levels of targeted support.

The EU Innovation Fund [40] is financed through revenues from the EU Emissions Trading System (EU ETS). Together with the Connecting Europe Facility (CEF)[41] these are major sources of funding, and complemented by national funding programs. Even these funds are not sufficient for projects to take FID, requiring other financial support such as Carbon Contracts for Difference which we will cover in a later section.

As an example of the levels of investment required for CCUS projects, the INPEX Bonaparte CCS Project is estimated at $1.2 billion [42]. As of March 2026 the Commonwealth government "remains committed to its $1.5 billion planned equity investment to support the development of common user infrastructure at the Middle Arm Sustainable Development Precinct (Middle Arm) in the NT". [43]

As Australian CCS projects mature, direct government grants become less impactful unless they cover the bulk of the capital required to reach a Final Investment Decision (FID).

However grants are typically less than 50% of total project value requiring participants to find both cash and in-kind contributions and are capped at levels well below the likely more than a billion dollar total cost of a full CCUS hub.

To defray these financial risks, multiple project participants require access to grant funding, however the time frames between opening and closing grant rounds are insufficient to be able to develop consortia and obtain approvals. This can lead to 'established' projects receiving multiple

[38] http://www.sinopecgroup.com/group/en/000/000/062/62512.shtml
[39] https://ccsnorway.com/northern-lights-the-first-part-of-longship-is-launched/
[40] https://cinea.ec.europa.eu/news-events/news/commission-unlocks-eu27-billion-54-clean-industry-projects-under-inJVation-fund-2026-03-24_en
[41] https://energy.ec.europa.eu/news/235-key-cross-border-energy-projects-boost-europes-interconnectivity-2026-04-09_en
[42] https://territorygas.nt.gov.au/carbon-capture-and-storage
[43] https://www.infrastructure.gov.au/sites/default/files/documents/government-response-middle-arm-industrial-precinct-march-2026.pdf

rounds of funding. Grant stacking in some schemes is possible and not in others which creates distortions in the types of projects offered for grant funding.

Recent funding frameworks have shifted away from supporting FEED and concept studies. Publishing the outcomes of these early-stage assessments, even for projects that ultimately stall, provides the broader industry with critical data and In other jurisdictions, publicising these foundational studies has been a proven mechanism for de-risking and advancing sectors over time.

Workshop Delegate Insights – Direct Grants

What frameworks can we borrow internationally to ensure that research money flows back towards local researchers? Norway / UK have exemplar programs, various consortia etc.

Grant support has been for further along the value chain/down the timeline. Would be good to have grant support for/government undertake feasibility study stage - e.g. Middle Arm NT.

Clear that CCS is required, but Govt policy doesn't reflect this in the current grant system. We want low emissions, then tailor the award to the effective and demonstrable lowering of emissions. The more emissions reductions, the more incentives (goes to HPTI - tax incentive) - this is a win win.

First step: a gov led study to masterplan a hub. Can coordinate as honest broker in the middle to understand proponent needs.

On government financing, they tend to use the same kind of financing for projects - grant-based. Grants are not scalable for ongoing CCS project operation.

$616m for PRF for safeguard transformation for trade effected facilities – direct grant.

- No New/Expanded Fossil Fuel Production: You cannot use this funding for CCS if it is attached to a new or expanded coal or gas production facility that commenced or expanded after June 30, 2023.
- Scope 1 Focus Only: The CCS project must directly reduce the facility's Scope 1 emissions. If the CCS is used to create "blue hydrogen" that is then sold elsewhere, the eligibility becomes more complex and must be framed as "Common User Infrastructure."

4.5.2 Financing

Government could support CCUS through access to debt capital (i.e. a direct loan) with preferential rates or via loan guarantees. The Commonwealth Government uses Specialist Investment Vehicles (SIV) for large scale nation building financing. This type of fiscal support would be very suitable for CCUS projects however some SIVs (CEFC and ARENA) are legislatively prohibited from CCUS investment and others have restrictions for activities that support new or expanded fossil fuel production projects.

Summary of SIVS in Australia

- Government-owned entities
- Designed to invest public funds into specific sectors of the economy to achieve both policy outcomes and commercial returns.
- SIVs act as a bridge between the government and the private sector.
- SIVs provide finance - often in the form of loans, equity, or guarantees - to projects that might be too risky or long-term for traditional commercial banks to fund alone.

SIV Name	Focus Area
Clean Energy Finance Corporation (CEFC)	Renewable energy, energy efficiency, and low-emissions tech.
National Reconstruction Fund (NRF) including the Net Zero Fund	Value-adding in manufacturing, renewables, and medical science.
Northern Australia Infrastructure Facility (NAIF)	Infrastructure projects in WA, NT, and QLD (e.g., ports, mines, energy).

SIV Name	Focus Area
Export Finance Australia (EFA)	Supporting Australian exporters and regional infrastructure.
Australian Renewable Energy Agency (ARENA)	Early-stage R&D and demonstration for new energy tech.
Housing Australia	Social and affordable housing and home ownership.
Regional Investment Corporation (RIC)	Supporting farm businesses and regional resilience.
AIFFP	Infrastructure financing for the Pacific and Timor-Leste.

Table 4 : SIVs in Australia

The final design of the Net Zero Fund (NZF) (part of the NRF) was released in 2026 with $5B in finance available.[44] The NRF itself is strictly prohibited from making investments that finance the extraction of fossil fuels. However It may be possible to use NZF for the application of CCUS technology for industrial decarbonisation (e.g., in hard-to-abate sectors like cement or steel manufacturing). However, a shared CCUS hub is likely to take CO_2 from a variety of sources including gas processing so the support for CCUS via the NZF remains undefined. Project proponents will need to discuss the project elements directly with the Net Zero Fund.

Workshop Delegate Insights - Financing

Express exclusion by federal agencies is prohibitive to progress.

- Clarity needed for industry to make informed investment decision
- Need policy to give best chance of achieving success, regulations to support together with justification for the policy.
- Clear that CCS is required, but Govt policy doesn't reflect this in the current grant system. We want low emissions, then tailor the award to the effective and demonstrable lowering of emissions. The more emissions reductions, the more incentives (goes to HPTI - tax incentive) - this is a win win.
- Govt $ to help energy transition is best spent on multiuser infrastructure. Currently $ being spent on disparate single proponent low impact projects (pilots). This is not as effective - less bang for buck.

4.5.3 Project Equity / State Owned Enterprise (SOE)

Many countries direct equity ownership of CCS projects either partially or wholly via their National Oil Companies (NOC) or other state-owned entities (SOE). This ensures that project risk is carried equally by the government rather than solely dependent on private joint ventures.

While we do not have an NOC in Australia, we do have other examples of SOEs.

In Western Australia, a GTE (Government Trading Entity) is a state-owned organisation that operates in a commercial business environment. Their purpose is to provide public benefit through financial returns (dividends to the State) and non-financial returns (essential infrastructure and services). The setting up of a GTE for CCUS is feasible.

There are 12 Primary GTEs :

Energy

- Synergy (Electricity Generation and Retail Corporation), Western Power (Electricity Networks Corporation), Horizon Power (Regional Power Corporation)

Water

- Water Corporation, Aqwest (Bunbury Water Corporation), Busselton Water (Busselton Water Corporation)

[44] https://www.industry.gov.au/news/net-zero-fund-finalises-design

Ports

- Fremantle Port Authority, Kimberley Ports Authority, Mid West Ports Authority, Pilbara Ports Authority, Southern Ports Authority

Land

- DevelopmentWA (Western Australian Land Authority)

The CarbonNet project in Victoria is a SOE and commenced in 2009. It is pre-FID and will falter without an aligned source of CO_2 as part of the overall project.

Without a clear path or intention to run CCUS though a SOE, Australian policy will need to provide support / mandates to private operators.

Workshop Delegate Insights – Project equity / SOE

How to align the final investment decision of multiple projects.

Need more appetite for private public partnerships?

Dampier Bunbury Gas Pipeline is key example of Gov support for infrastructure working

Ports experience

- GTEs must operate commercially. From the port's experience, a "Build it and they will come" approach doesn't work for any ports' infrastructure.
- Pilbara Ports is a Government Trading Entity (GTE), which means it has to operate commercially and deliver on required investment hurdles.
- Pilbara Ports does not fund its own capital budget, which is state-controlled. Therefore every infrastructure build project has to be supported by a business case that demonstrates the required return is achievable within a reasonable timeframe.
- Where there is flex for government is in how long it takes to deliver ROI.

GTEs can be activated to achieve state priorities.

4.5.4 Tax Credits

According to the IEA [1] tax credits "are a common policy mechanism to promote specific behaviours or encourage the adoption of certain practices, technologies or equipment. A tax credit allows an individual or company to subtract an amount of money directly from the taxes that they owe (i.e. their tax liability). For example, an investment tax credit allows the company to subtract a certain percentage of its investment costs in a project from its tax liability … refundable investment tax credits for CCUS projects can be paid to the taxpayer as a refund in situations where the credit exceeds the taxpayer's liability or in the absence of any tax liability. This is expected to benefit earlier stage companies that do not yet have the taxable income to benefit from a non-refundable investment tax credit."

The USA 45Q tax credit provides projects with a credit of up to USD 85/t CO_2 either permanently stored or used in Enhanced Oil Recovery (EOR). "The credit amount significantly increases for DAC projects to USD 180/t CO_2 permanently stored and USD 130/t CO_2 for CO_2 use. There is a direct pay and transferability option for developers who receive the credit, meaning that the developer can monetise the credit or transfer it to project partners or investors with a large enough tax liability."

Under the Inflation Reduction Act (IRA), certain entities can access payment instead of tax relief through a 5 year Direct Pay option for CCUS projects, which functions more like a direct grant and which incentivises the start-up phase of a project. This type of refundable tax offset is being offered from 2027 for green hydrogen in Australia under "The Hydrogen Production Tax Incentive" (HPTI), as part of the Future Made in Australia (FMA) plan provides tax incentives at $2 per kilogram of renewable hydrogen that is produced.

Tax credits for CCUS are rare outside of North America although Canada introduced the CCUS Investment Tax Credit (ITC) in 2024. [45]

Workshop Delegate Insights – Tax Credit

Merits of a tax credit vs capital grants and what would be best adopted for an Australian hub.

4.5.5 Subsidies and Carbon Contract for Difference

By far the most important policy that can be used to support a large scale multi-user CCUS project is through a Carbon Contract for Difference (CCfD). This bridges the gap between a Base Price (which represents total cost of the project plus a small profit, e.g. $200 per tonne CO_2e) vs a Reference Price. e.g. $150 per tonne CO_2e (which could be based on the ETS pricing scheme within the jurisdiction e.g. the EU ETS).

The "difference" is therefore effectively a subsidy where the government pays the gap. In this example a subsidy of $50 per tonne CO_2e.

There are various models for a CCfD.

4.5.5.1 One-Way CCfD

If the Reference Price (i.e., carbon price) rises above the Base Price a company is not typically required to pay back the surplus to government. For example, if the Reference Price rises above the Base Price, say to $210 per tonne CO_2e in our example, the company is now providing abatement at a cost lower than the reference carbon price. Government no longer subsidises the project while these conditions remain.

4.5.5.2 Two-Way CCfD

In this scenario the company would have to pay back the "windfall" profit of $10 per tonne CO_2e and the project becomes a net gain in terms of government revenue. The SDE++ (Stimulering Duurzame Energieproductie en Klimaattransitie) in the Netherlands will transition to this two-way model in 2027.

There are other design elements that can be part of a CCfD scheme.

4.5.5.3 Budget Caps

Some CCfD or tax credit schemes are unlimited (USA 45Q) while others have a budget cap (e.g., SDE++ €8 billion in 2025) and projects must compete in a "bidding" process to see who can reduce carbon at the lowest cost per tonne.

4.5.5.4 Contract Duration

Typically 15 years (could be 10 years with possible annual extensions up to 15 years); long enough to support revenue certainty to cover the start up phase, which is typically multi-year for a large infrastructure project like a CCUS Hub. This in turn will underpin investment from the private sector by giving the project certainty over a fixed time period.

4.5.5.5 Hybrid CCfD

As reported by the UK government's National Audit Office 2025 " The government has attempted to launch CCUS programmes in the UK twice before without success …in 2012 and 2017" "The

[45] https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/corporations/business-tax-credits/clean-economy-itc.html

cancellation of these competitions dented industry confidence in the government's commitment to CCUS."[46]

After these two failed attempts the Department for Energy Security and Net Zero (DESNZ) developed the Industrial Carbon Capture (ICC) Payment Mechanism Business Model which is a hybrid CCfD scheme and which includes

- A Capture Payment (The CCfD element).
- Capital Expenditure (CAPEX) Recovery (a dedicated payment for the initial construction costs for capture to be paid back over time)
- A T&S Charge with provision for Connection Delay Compensation to emitters. T&S is managed by a private company under a Regulated Asset Base (RAB) – similar to regulated provision of water, gas and electricity.
- Availability Protections – the project can commence and receive payment without waiting for 100% operations to be achieved.

DESNZ determined that a pure CCfD was "not enough" to get the first wave of projects off the ground. While a pure CCfD can assume a mature, liquid carbon market and a low-risk environment, these are not in place yet for vital early clusters which are first of a kind:

- Bankability: Lenders were hesitant to fund projects where the only revenue was a variable carbon-indexed payment. The dedicated CAPEX payment makes the project much more "bankable."
- Carbon Market Immaturity: Because the UK ETS is relatively new and can be volatile, a pure CCfD would have required a very high strike price to cover the risk.
- Infrastructure Coordination: Since projects in clusters like HyNet or the East Coast Cluster depend on shared pipelines, the UK model includes specific clauses to protect the capture plant if the pipeline fails or is delayed - something a "pure" contract wouldn't usually cover – i.e. T&S Counterparty Risk.

4.5.5.6 Comparison to Hydrogen Headstart

In addition to the HPTI, Hydrogen Headstart's Production Credit [47] is a 10-year Contract for Difference program and serves as a bridge to commerciality for an otherwise uninvestable sector. This policy logic applies equally to multi-user CCUS projects. By adopting a comparable CfD model for carbon storage, the government could unlock immediate, large-scale abatement in heavy industry - likely achieving decarbonisation milestones faster than the current trajectory for renewable hydrogen.

Workshop Delegate Insights on CCfD

Do we think that industry alone can get CCS up and running without government fiscal support? No

Emitter requires CAPEX and OPEX subsidisation.

Derisk via capital investment in infrastructure in government. CFDs with a reasonable return (early subsidy to defray cost) while regional carbon prices increase, gives a buffer. With CFDs, set strike price according to difficulty in decarbonising.

An emitter can't get 70% of HPTI credit for CCS adoption because of technology prohibition for blue hydrogen rather than on merits of carbon abatement.

Discussed CfDs - price certainty. in order to work, requires an escalating carbon price. Otherwise just a straight subsidy and might as well just give $ to industry.

In the UK, can control carbon price and CfDs. So it can determine what the return will be under the CfD mechanism. If EU escalates carbon price, UK can respond and increase accordingly which will brings investment forward.

[46] https://www.nao.org.uk/wp-content/uploads/2024/07/carbon-capture-usage-and-storage-programme-summary.pdf
[47] https://arena.gov.au/funding/hydrogen-headstart/

Bring emissions reduction tech in earlier. Due to 8-10 year time frame to develop bring investment forward.

Need to keep the number of business models to a limited number to keep it simple.

CfDs result in a possibility of a return to the taxpayer for their investment.

We have a mechanism that can be 'shaped' to work.

- Safeguard, no access to ACCUs
- CCfDs

To fund, either public or private $:

- Subsidies - unpalatable as taxpayers paying for CCS
- Private - depends on pricing. CCS, expensive, low returns, slow to take off.

Assume scaling up, know what you are working towards - a target to start with and then go to a pore space mandate. This would be a Federal Gov Requirement.

Government must spend more- Industry aligned on a want (not quantum) to state and federal government i.e. type of support without fixing an amount.

4.5.6 Government Purchasing Power

The government can stimulate the growth of low-carbon industries by acting as a lead customer until green product markets are fully established at scale.

4.5.6.1 Government as Customer

The Commonwealth Environmentally Sustainable Procurement (ESP) Policy [48] echoes similar policies from other jurisdictions. It is mandatory for construction projects over $7.5 million IT, textiles, and furniture tenders over $1 million. Bidders must prove use of recycled content and low-carbon materials.

4.5.6.2 Clean Commodities Trading Initiative (CCTI)

One step further is the concept of the Clean Commodities Trading Initiative (CCTI) [49]

- Government entities enter into offtake contracts to support the early-stage production of new clean commodities
- The government would enter into highly tailored offtake contracts with early clean commodity project proponents, committing to purchase a certain volume of their clean commodity over a certain time frame at a guaranteed price. Upon delivery, the CCTI would de-couple the physical commodity from its Environmental Attributes (EAs) e.g. ACCUs

The CCTI could then:

- Sell (or instruct the proponent, as its agent, to sell) the physical commodity with the ACCUs attached to buyers wishing to purchase the product together with the EAs, perhaps to meet their voluntary or mandatory carbon reduction commitments; OR
- Sell (or instruct the project proponent, as its agent, to sell) the physical commodity in conventional commodity markets at conventional commodity prices, without the green premium. It would then retain the ACCUs or trade them elsewhere to address growing demand for emissions reductions in both regulatory and voluntary frameworks being developed.
- Provide the appropriate level of support for targeted early mover projects so construction and production can start as soon as possible

[48] https://www.dcceew.gov.au/environment/protection/waste/sustainable-procurement
[49] https://www.greenenergystatecraft.org/ccti-clean-commodities-trading-initiative

- Accelerate the innovation and learning associated with these major projects which will reduce future costs and help kickstart more new projects
- Ensure that taxpayer dollars are not going just one way; the CCTI is about sharing the financial upsides of these early clean commodity projects wherever possible, to benefit all Australians.

Workshop Delegate Insights - National CCUS Strategy

Would help if where possible Government set minimum standards e.g. in infrastructure projects, that could push a green premiums forward. For example, setting minimum standards for SCM or carbon footprint of concrete. Or government can support pricing gap.

However, this doesn't address our export market as domestically focused, like titanium oxide.

4.6 Policy Combinations

During the webinar series held in the lead up to the workshop, CCUSNA has asked those involved in large multi-user CCUS hubs, either in operation or development, which were the key factors that unlocked FID. The three main policy levers cited were

- an ETS
- a CBAM, and
- a CCUS supportive business model

Australia lacks all three of these elements and it is clear that without serious policy evolution CCUS in Australia will remain a niche decarbonisation option.

By effectively leveraging existing foundations - established emissions reduction targets, significant geological storage capacity, a resource literate state government, new policy combinations will unlock the investment necessary for large–scale CCUS deployment in WA.

Opening existing financing mechanisms, such as Specialist Investment Vehicles (SIVs) to CCUS, through government–coordinated Carbon Contracts for Difference (CCfD) schemes would provide the long–term revenue certainty needed to underpin multi–user hubs.

Domestically, the government could consider the implementation of a pragmatic pore space allocation for hard-to-abate industries through a state owned entity as operator, as a condition of a CCfD or though a pore space mandate. Formal bilateral agreements with regional trading partners could secure international demand and to underpin an expanded CCUS industry in Western Australia.

This integrated approach ensures that Western Australia not only meets its climate obligations but also capitalises on its competitive advantage to become a global leader in secure, large–scale carbon management.

Workshop Delegate Insights

In EU - Looking back at how they got to the investment that they are now.

- Established credits scheme
- EU Directive - permitting and liability mechanism for CCS
- Regulations - guidelines on net zero energy infrastructure to look like and
- Looked at a clear vision - if going to fund something, what would that be
- Establish CO_2 market and infrastructure development - able to trade ETS credits.
- Net Zero industry then set out - had a clear vision/aim. 30Mt by 2030.

- Obliged gas producers to provide CO2 storage space pro rata to the amount of gas they were producing. (based on historical data 2020-2022). Net Zero Industry Act. Provide capacity pro rata to production - no specification for where the CO2 to come from. Only in EU. Excluded Northern Lights area.
- CDR and BECCS. Will also need DAC. Prioritising BECCS - but potential is not great, so complicated.
- Broken CCS value chain. NZA tackles storage (from oil and gas) and transport. Different funding mechanism for BECCS and DACS.
- All councils need to be net zero - focus on Energy to Waste and CCS from that.
- Many projects listed are post-FID

In Australia - lacking

- Identification of desirable projects
- Funding
- Targets
- CBAM

Need to plan 20 years ahead - inaction due to uncertainty . Set target for stored gas by a set date. Good messaging to show govt alignment.

4.7 Business Models

As the IEA states [1] "With new business models come new project complexities. These include greater need for co-ordination across the value chain, mitigation of counter-party risks, allocation of long-term liability, and management of shared, cross-border CO_2 transport and storage infrastructure. Governments can support the deployment of these new models and step in where challenges remain and the private sector struggles to progress. "

4.7.1 Private

Most global CCUS projects are currently operated by private companies – however they have all considerable received support from government through policies outlined in the previous section (e.g. direct grants, CCfD, tax credits, operations within an ETS and CBAM jurisdiction). Without this policy support they would not have proceeded to operational status.

A pure free market model is effectively in place currently in Australia and it is notable that the only projects operating at "commercial" scale are single source, single sink projects where the emitter and T&S entity are under the same ownership i.e. Moomba CCS (both gas production and CCS operated by Santos with Beach as partner) and Gorgon (both LNG and CCS operated by Chevron with Shell and Exxon as partners). Both are only in operation due unique policy intervention - either mandated CCS (Gorgon CCS) or CCS enabled through ACCU award (Moomba CCS).

Under current policy settings a multi-user hub would be a free market model and would require the following

- All parties would need to agree individual contracts for CO_2 supply, T&S etc
- The cost of capture would be borne by the emitter
- The storage operator would decide who will access the facility under a separate negotiated contract with each emitter under a take-or-pay style contract (possibly divorced from the market carbon price). Price charged per tonne CO_2 would be confidential in confidence.
- Transport could be provided by a dedicated operator (e.g. an existing pipeline operator) through a tolling mechanism or the storage operator could cover all operations from the emitter collection point (full T&S).

There are no global operational muti-user hubs that operate in a pure free market form – all require a combination of policy support. See Table 1 and Table 2 for a summary of the policies needed.

Workshop Delegate Insights

Are there private capital sustainability funds that could facilitate private funding models for FID. Yes for DAC to CCS.

4.7.2 Public

The most common form of public operation of CCUS is via a National Oil Company (NOC)such as Norway(Equinor), Malaysia (Petronas), Indonesia (Pertamina) and China (Sinopec, CNPC, CNOOC).

In some jurisdictions award of a CCUS permit requires the state NOC to assume a fixed percentage of the project. In Denmark the Danish NOC Nordsøfonden is legislated to take a 20% participation in all storage licenses. [27] In the Netherlands Energie Beheer Nederland (EBN) acts as the state partner, typically holding 40% equity in all oil and gas extraction, geothermal and CO_2 storage projects.[50]

4.7.3 Joint Public Private Partnerships

Since Australia does not have an NOC, large scale CCS projects will need to comprise a mixture of companies along the value chain from emitter to storage operator. There is scope for a public private partnership based on the following models.

4.7.3.1 Public Private Partnership (PPP)

A PPP is a long-term contract between a government agency (public sector) and a private company or consortium (private sector) to deliver public infrastructure or services. The private sector typically takes on a significant portion of the financial, technical, and operational risk, while the government provides oversight and makes payments based on performance.

Most modern PPPs follow the DBFO model, where the private partner is responsible for

- Design: Creating the engineering and architectural plans.
- Build: Constructing the asset (e.g., a hospital or toll road).
- Finance: Raising the initial capital to pay for construction.
- Operate: Managing and maintaining the asset for a set period (usually 20–30 years)

The government pays the company a regular fee (like "rent") as long as the asset is available and meets quality standards and additionally the private company can collect fees directly from the people using the service (e.g., tolls on a highway).

4.7.3.2 Government Trading Entity (GTE)

In Western Australia, a GTE is a state-owned organisation that operates in a commercial business environment. See previous section "Project Equity / State Owned Enterprise" for more information on GTEs.

4.7.3.3 Regulated Asset Base (RAB)

A Regulated Asset Base is a privately held entity that is regulated and supported by the government. In the context of CCUS a RAB coupled with a CCfD has been used in the UK.

As the IEA stated [1] "Under the RAB, a company acts as a manager for public infrastructure: it owns, invests in and operates infrastructure assets. In return, the government provides an opportunity for the company to recover its investments by establishing a set rate of return."

[50] https://www.ebn.nl/wp-content/uploads/2026/04/EBN-Annual-Report-2025-final-1-1.pdf

5 The Role of Government

5.1 Commonwealth Government

The current perceived deprioritisation of CCUS at the Commonwealth level represents a critical barrier to progress, primarily driven by an overwhelming focus on electricity grid decarbonisation and green hydrogen. This has resulted in a strategic vacuum where the exclusion of CCUS from State Investment Vehicles (SIVs) and federal agencies, coupled with a lack of bipartisan support, prevents the technology from becoming a cornerstone of Australia's industrial strategy. Unlike Denmark or Germany, where broad political coalitions have formalised CCUS legislation, the Australian Commonwealth avoids overt support due to a perceived history of wasted funding. In reality, much of the previously announced funding was only partially spent, yet it funded the foundational work necessary to launch CCUS at scale.

There is an urgent requirement for a Commonwealth–led National CCUS Strategy and Action Plan. This should include sectoral emissions reduction alignment, the resolution of transboundary shipping and liability agreements, and broadening of decarbonisation goals to include long–term hub development. By celebrating operational wins and clarifying the role of CCUS in the national decarbonisation pathway, the Federal Government can lead and foster the necessary collaboration with State Governments and regional partners.

Workshop Delegate Insights

Express exclusion of CCUS for SIVs / federal agencies is prohibitive to progress.

Targeting a $/t rationalisation of Federal money will not achieve a long term hub.

Australia has massive potential but requires regulatory and policy support at Federal level.

There must be Sectorial emissions reduction strategies alignment.

Cth not focused on CCS

Cth Distracted by focus on decarbonisation of the electricity grid.

Fragmentation of focus - e.g. renewables experience, lack of coordination between different State departments and also between State and Cth

Role for Cth govt: - currently a gap at the Federal level in demonstrated interest in and commitment to CCS.

- transboundary agreements
- National Action Plan for CCS
- better collaboration between State and Cth

How do we get to a National CCS Strategy?

- Need Cth Govt to get on board - advocacy to Cth Govt
- State Govt can advocate to Cth Govt on that issue
- Celebrate operational wins and define future opportunities

Cth National CCS Action Plan/Strategic Delivery plan - set targets, set policies that enable us to reach targets, this then dictates what regulation and funding is required.

Role for Cth govt - bring regional partners on board. Shows serious commitment to pursuing CCS. Eliminate vagueness regarding support.

The vacuum of information around Gorgon has led to an information vacuum which has been filled with misleading information about a tax payer funded failure.

Commonwealth government is under the impression that successive Australian governments have "spent all this money on CCS and have nothing to show for it" – Announced money was usually only one quarter spent and has funded some crucial foundational work which allows Australia to launch into CCUS at scale.

The information vacuum has led this government to avoid being a target. and keeping small target is politically valuable, but it means that CCS can become something they don't want to overtly support.

The lack of bipartisan support around climate change is a central challenge.

Denmark and Germany have moved from anti CCS to proc CCS very quickly – underlying this was a commitment from all sides of politics to decarbonise and the understanding that CCUS needed to play a role in that. Danish CCUS legislation co-signed by a coalition of parties form green left to conservative right.

5.2 West Australian Government

Summary

While the Western Australia CCUS Action Plan provides a framework, it currently lacks enforceable milestones and defined delivery targets. This creates an opportunity for the government to convert its existing aspiration for largescale CCUS into a fully actionable plan with clear targets and a timeline. The government's sponsorship of the WA CCUS Hubs workshop (and this report) reflects an openness to stakeholder feedback to establish the actions required to unlock WA's CCUS potential.

To fully unlock the potential of the Western Australia CCUS Action Plan, the State Government has an opportunity to complement its current "statement of intent" with a more active infrastructure-led approach, treating CCUS networks similarly to essential public assets like roads or ports. While state priorities are appropriately focused on electricity grid decarbonisation and managing post-coal capacity, a significant strategic opening exists to build on WA's history of developing foundational, nation-shaping industries. By actively funding early works studies, establishing common-user infrastructure corridors, and mandating inter-agency collaboration, the State can deliver the robust, formal framework needed to accelerate regional deployment.

The Western Australian Government can exert significant influence by leveraging its status as a global resource powerhouse to champion a National CCUS Strategy, aligning state–led operational successes with advocating for crucial federal policy advancements and transboundary agreements.

Workshop Delegate Insights

CCS should be a government led initiative in line with other public infrastructure works.

Government role to coordinate early works studies. Also further define road map so that industry is working together and gets economies of scale. Can stagger different projects, use the same major market and materials. Replicate what CSIRO has done for Darwin Middle Arm.

Concept study funded by the State Government.

Clear signalling and policy support for CCS. WA CCUS Action Plan serves as a key example of the role that government can play to enable industry activity.

WA Action Plan is a good statement of intent but has not moved CCUS forward and lacks deadlines, targets and teeth.

WA ministers and government to encourage federal ministers and government to support CCS and hub development.

Focus funding on Kwinana hub as that's where people are, visibility, industry support, clean air.

$700m in State SIA fund is challenged by political pressure to not directly subsidise Fossil Fuel Industry.

Has State has identified what must happen at SIAs to activate them and what are the "no regrets" spend.

Proponents should target industry sustainment or Premiers priority area.

WA has two nation shaping industries in Iron ore and LNG that attracted and deployed capital in different ways. State played different parts in the nurturing of these industries and needs to remember how this was facilitated and consider similar steps for CCS.

Gov doesn't have endless resources and risk appetite either.

Dampier Bunbury Gas Pipeline is key example of Gov support for infrastructure working.

Don't think we take this risk in gov anymore.

State priority is decarbonization of electricity (Sufficient energy in mix post coal)

Clarity between state and federal government asks.

Where does state sit as an enabler, aligning with state priorities?

How much for a hub - question from within government.

CCS should be a government-led infrastructure initiative, similar to roads, ports, and energy transmission.

Use State influence at the Federal level would be very powerful in the CCS space – National CCS Strategy.

Role for State government:

- Coordinating and facilitating hubs.
- Funding of study phase.
- Dedicated grant funding for feasibility and business case
- Education role/debunking myths about CCS
- Planning common use infrastructure
- acquisition of land and zoning of land and potential for associated investment attraction incentives.
- licencing, regulation (DMPE), establish a legislative framework. This is in train. Bringing in a workable regulatory system.
- Pilbara energy transition plan, develop common infrastructure (e.g. in Pilbara shared infrastructure corridor?)
- If government believes that CCS is real and necessary, the government needs to lead and push through.
- Mandate at State level for all agencies to work together - need to get different departments working together - can there be more integration and better working together?

DEED things Government can deliver: $, policy, regulation - each have pros and cons. Need to understand from industry what is required.

- Opportunity for WA Gov to lead Fed Govt.

Recommendations:

- all CCS projects under 1 Minister?

How do we get to a National CCS Strategy?

- Need Cth Govt to get on board - advocacy to Cth Govt
- State Govt can advocate to Cth Govt on that issue

5.3 Local Government

See also sections on Kwinana, Mid West and Pilbara in this report.

Workshop Delegate Insights

Local Government - also needs to be included in Government discussions - industry and other elements of government need to keep them in the loop to ensure that they are on the journey and community understanding. Also key to social license.

Regional development commissions receiving an abundance of small grants but a coordinated approach at scale of real impact from development commission grant/investment/prioritisation.

NetZero Teesside has support at council and national level working in lock step – community benefits are key.

5.4 Across All Levels of Government

The path forward for Australian CCUS necessitates a fundamental shift in how the Commonwealth, State and local governments interact with each other and with industry. A recommendation is the establishment of a single, dedicated coordinating agency, modelled after Japan's JOGMEC or WA's CODA. This body could act as an intermediary between various government branches as well as with industry and our regional trading partners.

To secure bipartisan support and navigate political realities, government needs to understand and implement policy support for projects that assist the hard–to–abate sectors like ammonia, lime, and waste–to–energy, which offer superior political optics and high climate impact without being exclusively linked to domestic oil and gas.

Furthermore, to restore investor confidence, the government must move beyond single election cycles (three or four years) and provide long–term fiscal guarantees, similar to the policy mechanisms that enabled the FID of the Moomba project or the successful hubs model in UK, Europe, Middle East and USA.

It is essential that all levels of government, together with industry, proactively lead the public discourse on CCUS, framing it as a critical pillar of Australia's decarbonisation strategy. Clear communication must highlight that reaching national emissions reduction targets is mathematically impossible without this technology unless the alternative is the total offshore relocation of our industrial base.

Workshop Delegate Insights

Govt needs to actively coordinate this process, like a leading role and also needs to set itself up to be able to undertake this role, recognising this may take years and require bilateral support to transcend electoral cycles (4 years).

Need one single organisation to lead the funding (e.g. JOGMEC in Japan) to promote regional Japanese CCS projects. Makes it easier for industry to communicate with government and negotiate funding. In between gov and industry - some organisation could sit to facilitate discussions.

Do we need a CODA equivalent to coordinate CCUS? In the same way that safe and timely decommissioning is in the national interest and requires co-ordination between all levels of government and industry to be successful. A one stop shop for all things CCUS funded by government but independent – able to move **at pace** and advise government.

Assist industry to improve social literacy and acceptance of CCS, especially noting that industry may not be currently perceived as a trusted partner by the Australian public / community.

Policy framework has to identify the best use of government money.

Penalise dirty power and ammonia and lime, and or subsidise the decarbonised power ammonia and lime.

Govt should fund a waste to energy ccs technology research centre.

Northern lights successful example: government support percentage was very high. Guarantees from Gov to minimise downside risk is one option.

Gov case compelling to them if guaranteed high price of carbon (e.g. policy).

Safeguard mechanism is a key driver. But investors are asking decarbonisation questions as well.

CCS has to be not about oil and gas, from a social licence perspective. Has to be about keeping WA industry going. About saving union jobs. Works well for a labour government also. And Roger Cook's constituency is Kwinana

Government prioritisation of technology has been flawed and should not be the approach taken by govt.

Government needs to look at the international examples of where and under what models deployment has occurred.

Proponents need to align with government priorities.

Multiple election cycles across project development, sanction and operation are detrimental to investor confidence and need to be addressed as a major inhibitor. ACCU underwriting of Moomba led to project FID.

Acceptance that government support and removing uncertainty and encouraging private investment in the space.

Do we think that industry alone can get CCS up and running without government fiscal support? No.

Industry main focus is decarb of current assets. Decarb Japan and large emitters in Japan. Have been involved in a lot of studies. Hit a wall when we do studies. Technically - all ok. Walls are economic/commercial and regulatory.

Fragmentation of focus - e.g. renewables experience, lack of coordination between different State departments and also between State and Cth.

How are State and Federal working together?

- State and Federal geoscience bodies are coming together at present - in exploration side

- Use same branding and working on consistent terminology

- consultation between DCCEEW and State governments

- Both State and Commonwealth geological surveys need to consult with industry on CO_2 storage – they do not currently have the right level of expertise for such an important foundational Atlas study and need to bring in industry specialist with CCS experience

WA vs Cth:

- Need it from Cth
- But WA proceed and develop a plan, lead - concurrent

Government does provide some input towards large problems (ex-Teesside); EU funding projects shows examples where granting distributions / process for grants can be complex and needs to be managed when you have multiple nationalities / governments involved.

NetZero Teesside has support at council and national level working in lock step – community benefits are key.

Fund (1) ammonia (2) waste, lime, other hard to abate (3) infrastructure (4) new tech research

The lack of bipartisan support around climate change is a central challenge.

How can CCS help combat climate change / support economy/etc in eyes of all parties?

There is also a threat from the Nationals/ Liberals / One Nation to roll back Net Zero.

Future Made in Australia - nation building big picture and supply chain security? (Highlighted by Russia/Ukraine and the situation now developing in Iran).

So how do we give the Climate Change Minister the support they need to decarbonise using CCS?

Who influences them? Will they engage on this?

- Greenpeace, Beyond Zero emissions (BZE), The Australian Institute – all are ideologically opposed to CCS due to link to fossil fuel emitters
- His staff
- Unions
- Using the Hunter Valley Hydrogen Hub as an example we can see a push for regional jobs in Labor heartlands. This is reflected in the "agreed principles for CMT" which is to support the regions and the hard-to-abate sector through CMT (but not domestic oil and gas)

What is driving the Minister towards a solely renewables/ green hydrogen focus as Minister for Climate Change? Is it the link of CCUS to fossil fuels or some other reason?

Contrast current Ministers to Kevin Rudd, Martin Ferguson, Madeleine King who are all current or former Labor MPs/ ministers / prime minister and Ed Miliband - Minister for Energy Security and Net Zero. All of these politicians are Labor and supportive of CCS – what can we learn from their ability to support CCS?

5.5 Role of Industry

While this was not a dedicated conversation topic at the workshop, we have considered (post workshop) the unique role of industry in a large scale multi-user CCUS hub.

- Clearly communicate with government, industry and research communities on the current challenges and potential enablers for multi-user CCUS hubs; for example through active participation in this and other workshops and ongoing engagement activities.
- Foster collaboration and knowledge sharing across the full CCUS value chain through open and active participation in CCUSNA or similar bodies.
- Participate in low emission hub development studies to provide accurate inputs for emissions profiles, infrastructure requirements and costings from Basis of Design (BoD)concept studies, Front End Engineering Design (pre-FEED and FEED) studies to Final Investment Decision (FID).

- Unless government decides to operate CCUS activity solely through state owned entities the role of industry will be to conduct planning, development and operations from emitters through to utilisation, transport and storage under a suitable business model within stable policy settings - which can only be provided by State and Commonwealth government.

Workshop Delegate Insights

Role for industry:

- Educate government on what has worked in other areas/jurisdictions
- Associations provide an overview of what works/strawman
- Success stories for CCS. Gorgon and Moomba. Moomba storing 1.5Mtpa.
- Overview on Gorgon – need to share factual information about this project, the story to demonstrate the successful aspects and learnings (together with DMP)(Chevron - offered to give presentation to State government at any time)(CO_2 storage part of Gorgon is working extremely well). Narrative should be that we have safely sequestered 11M tonnes of CO_2 as of last year. Change the narrative - not a failure. But be open about the technical challenges associated with site water balance - and how this is overcome.
- Need an industry voice to give government a clear idea of what is needed from State and Commonwealth.

6 Hub Coordination and Collaboration

Developing a functional CCUS hub is fundamentally a coordination and alignment challenge rather than a purely technical one, as it requires the synchronisation of multiple proponents with divergent mandates, investment horizons, and risk profiles. The primary obstacle to Final Investment Decision (FID) is the structural misalignment between emitter resource timelines—often spanning only a decade—and the thirty-year infrastructure lifespan required for common-user transport and storage assets. To overcome this "project-on-project" risk, industry advocates for a government-led central coordinating body to act as an "honest broker." This body would masterplan hubs and clusters, manage collective risks, and replicate successful international models like Norway's Gassnova or the Northern Lights project, where high levels of sovereign support and downside guarantees provided the necessary commercial certainty to mobilise private capital.

In the absence of an independent central coordinating body, the development of CCUS infrastructure risks devolving into a series of opaque, bilateral B2B contracts that exclude government oversight and prevent strategic access management. This "first come, first served" commercial approach lacks the transparency required for regional planning and stands in stark contrast to examples such as the United Kingdom's Cluster Sequencing framework. Under the UK model, the government acts as a deliberate gatekeeper, utilising a competitive, phased selection process to ensure that hub access is prioritised for projects that deliver maximum carbon abatement and optimal value for public investment. Adopting a similar directive role would allow Australian governments to move beyond passive support and actively curate a high–impact industrial ecosystem that aligns with national decarbonisation goals. The state already shapes key utility access through various Government Trading Entities (GTEs) and CCUS could be approached in a similar way.

Emissions reductions are driven by government policy (for example via NDC commitments) and as such there is already considerable market intervention by government. It is reasonable that government also be involved in the delivery and coordination of CCUS options within this market to ensure success in reaching those desired policy outcomes. Otherwise the government is entirely reliant on arms-length policy levers to incentivise industry to reach those goals, some of which may lead to negative outcomes, such as industries just leaving Australia.

Industry must provide a unified voice to articulate a clear "ask" to government and the setting up of a body to engage with government beyond the current LNG Jobs Taskforce is a clear and urgent priority to provide a diversified view beyond oil and gas companies.

Workshop Delegate Insights

6.1 Hubs Coordination

Hubs difficult to set up as a lot of players to meet targets at the same time. Alignment of projects for FID.

Misalignment of emitters resource/reserve statements (~10 years) with the optimal investment horizon of hub infrastructure (20-30 year plus).

DBNGP style government support or NRF HV Transmission funding model may be required to facilitate the hub infrastructure over the long term.

Establish a Central Coordinating Body - Government-led or otherwise, to masterplan CCS hubs, align timelines, and manage collective risks.

Key question: how get everyone together with different mandates? Different drivers, timeframes etc of each player.

Real LNG example: shared infrastructure examples weren't there. Even one project FID is very hard. Multiplies with number of proponents.

How on earth is it happening in Europe? Seems to be happening collaboratively.

Northern lights successful example: government support percentage was very high. Guarantees from Gov to minimise downside risk is one option.

Coordination done well can also avoid issues like overlapping construction timelines driving up costs for everyone

Can we learn from the Pilbara Round table experience? Seems a good related example.

Without a central coordinating body that is independent from project proponents, it will fall to companies to attempt single B2B contracts, with no transparency. Government will not be able to play a role in who is allowed access to a Hub.

UK govt central, directive role in deciding on access to each CCUS hubs through Sequencing. Competitive, phased selection framework managed by the Department for Energy Security and Net Zero (DESNZ).

We have a "first come, first served" commercial model. UK government acts as the gatekeeper to hubs - projects have to offer the best value for money and the highest carbon abatement potential.

Role for State government:

- Coordinating and facilitating hubs.
- Funding of study phase.
- Dedicated grant funding for feasibility and business case
- Education role/debunking myths about CCS
- Planning common use infrastructure
- acquisition of land and zoning of land and potential for associated investment attraction incentives.

Government role to coordinate early works studies. Also further define road map so that industry is working together and gets economies of scale. Can stagger different projects, use the same major market and materials. Replicate what CSIRO has done for Darwin Middle Arm.

Ports experience

- GTEs must operate commercially. From the port's experience, a "Build it and they will come" approach doesn't work for any ports' infrastructure.
- Pilbara Ports is a Government Trading Entity (GTE), which means it has to operate commercially and deliver on required investment hurdles.
- Pilbara Ports does not fund its own capital budget, which is state-controlled. Therefore every infrastructure build project has to be supported by a business case that demonstrates the required return is achievable within a reasonable timeframe.
- Where there is flex for government is in how long it takes to deliver ROI.

If Gov can't provide the full answer what can proponents do to reduce the risk?

Ask where projects are on roadmap to FID, and what is process to getting there? Important to timelines to align

CEO level agreement is one thing, but then need details worked through.

Is the issue cultural vs European examples?

Can proponents ask each other what thy each need for FID and support each other to get there?

Euro culture: sitting on the fence and not moving ahead with decarb is not acceptable. Social and legislative drivers. We're not Europe though. So how can industry step up and gov provide the last piece of the puzzle.

Timing of abatement opportunities can be very different for different emitters.

First step: a gov led study to masterplan a hub. Can coordinate as honest broker in the middle to understand proponent needs.

Need for central organising group - Gov or otherwise

Different locations may have different kinds of CCS gov support to enable multiple FIDs to proceed - different intentions in different locations, different levels of support

Coordination Lowers Costs.

Better alignment avoids issues like overlapping construction schedules that inflate costs across all projects.

Coordination framework and effort for aggregating CO_2 supply and CCS value chain.

Sustain economic activity while assisting transition of WA's existing hard-to-abate industry.

How to allocate renewable power in a common user sense - Emitter (individual power) or integrated? - Common requirements or different (can help smooth the load) - Anchor users - Scale of solar park underpinning big projects to unlock spare electricity - Demand risk.

Project on project risk – government intervention needed for renewables, transport and storage companies.

So if package together renewable energy and CCS mega projects – CCS / renewables / waste circulation / excess heat / DAC

Align infrastructure and low emissions hub where CCS is just a player, greenfield vs brownfield precincts.

Low emissions Hub needs chemicals and renewables, otherwise doesn't work.

Design to be plug and play, keep options open until ready to go, lowest cost of regret, minimum investment now until decision.

Hubs to drive diversification at least cost of decarbonisation - Boom bust vs diversified.

Specifications are key and can't be set for e.g. only ammonia if want to expand to other industries. Have to be set by stakeholders in a room, give and take, winners and losers – so it is important who is in the room.

Role of govt is to co-ordinate the collaboration and initiation.

Gassnova in Norway to balance various operators for benefit of Norway Inc rather than only one or two participants.

Allows transparency and first movers can be recompensed. Already in place for gas pipelines in WA?

A Regulatory Asset Base (RAB) can be used to tariff transport and storage company.

Example of DBNGP which was built and funded by state, then was sold but regulated with access arrangements.

Main challenge for infrastructure is not technology but a co-ordination problem.

Spectrum of hubs options (infrastructure) from gov run ↔ gov pays ↔ **gov coordinates** ↔ pure commercial.

6.2 Cross Industry Collaboration

Altona petrochemical complex - has a working group/forum to discuss issues like safety. Rather than trying to build something from scratch, could leverage off existing groups, e.g. Kwinana Industries Council, or other technical groups to learnings. (Post workshop note. Altona has seen a massive change. The complex has faced a "domino effect" of closures that has effectively ended large-scale petrochemical manufacturing at the site. Before the Qenos collapse, there was significant discussion about turning Altona into a CCUS hub (similar to Net Zero Teesside) by capturing emissions from the remaining manufacturers and piping them to offshore storage in the Gippsland Basin (CarbonNet project).)

Studies could be done for multiple groups at once.

Part of running things efficiently, if someone is going down for maintenance, that has many knock-on effects.

Important for conversations around building the entire value chain, like conversations around cross border CCS.

Cluster vs hub - hub is shared infrastructure, cluster is latching a hub into existing group of CCS projects. Which is better? Depends, because hub in WA is needed to derisk, but cluster spontaneously emerges when conditions are right, which can then be linked by hub infrastructure.

CCS Hubs vs Clusters

- Hub = shared infrastructure; Cluster = multiple CCS projects forming organically around a hub.
- WA likely needs a hub first to de-risk early investment; clusters emerge when conditions mature.
- Hub location decisions must consider regional needs and dynamics.
- A South West WA hub would focus on servicing existing industry, retaining jobs, and potentially shipping CO_2, but is unlikely to attract international CO_2 due to distance.
- Getting the right initial pipe size and matching emitter volumes remains a complexity.

Collaboration is essential for building a full CCS value chain, including cross-border CCS opportunities.

Think about how can State govt formalise engagement across the value chain to think about delivery.

Regional specific energy transition groups. All proponents get together once a quarter - has worked in the energy space - need a government chair. Best to keep it regional as best knowledge as what's required to get the project up and running.

6.3 Industry – Government Collaboration

How do we choose between hub locations here? Different needs and dynamics.

In WA things that we can do as a cohort:

a. Identify future potential volumes for each Hub
b. Look at scale for each hub
c. Differential for projects that will be done anyway and capacity for future potential need
d. Identify cost of differential
e. Then coherent set of discussions about government funding mechanisms
f. Concept study funded by the State Government

Industry advise govt on/acknowledgment of what works and is useful - give feedback.

Private industry needs to help government to create industry, roadmap creation may aid investment stability.

Would be good for State Government to start a working group of actual industry in an ongoing sense to develop a wish list and clear ask to government to help progress CCS on, e.g. technical, regulatory, facilitation.

Stop using the LNG Jobs Taskforce as a proxy for industry consultation – this is only consulting a very small section of industry.

JTSI / DEED must do more than a 2 hour workshop once a year on CCUS. This workshop was a much better use of industry and government's time to clearly articulate the biggest challenges and to pose solutions.

Role for industry:

- Educate government on what has worked in other areas/jurisdictions
- Associations provide an overview of what works/strawman
- Success stories for CCS. Gorgon and Moomba. Moomba storing 1.5Mtpa.
- Overview on Gorgon – need to share factual information about this project, the story to demonstrate the successful aspects and learnings (together with DMP)(Chevron - offered to give presentation to State government at any time)(CO_2 storage part of Gorgon is working extremely well). Narrative should be that we have safely sequestered 11M tonnes of CO_2 as of last year. Change the narrative - not a failure. But be open about the technical challenges associated with site water balance - and how this is overcome.

Need an industry voice to give government a clear idea of what is needed from State and Commonwealth.

Clarity needed for industry to make informed investment decision.

What policy needed to give best chance of achieving success, regulations to support together with justification for the policy – between gov and industry.

7 Community support

Summary

Bipartisan support for both CCUS and Net Zero targets is essential for in Australia to avoid the in/out policy switches of the past 20 years which undermine investor confidence.

Australian communities, especially in WA, are very resource literate; however the delayed start up and underperformance of the Gorgon CCS project (and the resulting information vacuum) have allowed a "CCUS does not work" narrative to firmly take hold, alongside the view that CCUS is only used to perpetuate the oil and gas industry.

Better communication strategies are essential to avoid misunderstanding, support social licence, and showcase the realistic scale and risk profile of CCS projects as well as the real consequences of inaction.

Hubs offer powerful stories about collaboration, innovation, and pragmatic decarbonisation—these should be integrated into teaching, communications, and community engagement.

Government will feel emboldened to support CCUS for decarbonisation if they are confident that the community are in support, and vice versa. CCUS in Australia can allow us to achieve two linked goals. We can meet and exceed our emission reductions targets while preserving local industry, protecting domestic supply chains and safeguarding our economy through a planned energy transition.

Workshop Delegate Insights

"Community support" operates at two levels; local community level and the broader political level.

In order for government to support CCS we need to get the community on side.

CCS is a solution, but the problems it solves need to be clear in the minds of the public.

7.1 Broader Community Support

7.1.1 Safety Concerns

There is a low general community understanding of what CCS is, and that low level of understanding can fuel suspicion. There can be lessons learned from psychology and political science about how to build acceptance of CCS even if there are opposing voices.

Concerns about CCS and earthquakes: can run public education about the degree of seismic activity which is concerning; real value anything > 3.5 means minor structural damage, below that not going to see any effects as a result; different regions have different awareness (e.g. well understood in California; poorly understood in Australia). Post workshop comment – this refers to the Moment Magnitude Scale, sometimes historically called the Richter scale. The sentiment expressed is that seismic activity is measured at all scales through natural and human induced activity but that events below 3.5 on this scale are measurable but have no impact / cause damage.

Need to help explain to both public and industry partners / experts that monitoring systems detecting seismic events not necessarily related to CCS project: monitoring where it had not previously existed will inevitably discover the background noise, important not to mistake this normal background for new activity.

Show perceived vs actual risk (against an already accepted risk).

Examples around CO_2 plumes in the ocean and effect on oysters / sea life; mechanisms uncertain but larger scale study shows that the actual effects are negligible – but story creates an aura of discord or concern to the lay public.

Scientists can often get overly focussed on the technical details of a given debate which can give rise to public perception that disagreement or uncertainties are larger than they actually are.

Which demographics should we be talking to? Should we consider education system as a path for people to learn about CCS.

Social media is an underutilised approach to changing views on CCS.

More highly trusted organisations like CSIRO.

Also useful to show what CCS actually looks like to local public; general image is that of Gorgon etc (large industrial facilities); reality is much smaller footprint (i.e. in-situ lab in WA) is a few wellheads with farming region directly adjacent.

7.1.2 Perpetuating Oil and Gas Impact Concerns

Some division in Australia between developing new green industries and existing oil and gas - can be hard to bridge the gap by reminding people that both sides need to develop.

Hubs can improve the optics of CCS by showing it's not just an oil and gas thing

In Norway, the focus of Northern Lights on the hard to abate sector helped to make the project more palatable politically.

Local community support - can become unpopular due to its association with oil and gas

Societal perception has shifted from viewing CCS as a "boring industrial tool" to viewing it as a "moral hazard."

"Permission to Pollute": Many people now believe that CCS announcements are just "sugar hits" designed to allow fossil fuel companies to continue business-as-usual.

Greenwashing Accusations: Because the "quantum" of actual CO_2 captured in Australia is far lower than what was promised 20 years ago, the technology is often labelled as "greenwashing," even when it is being applied to truly hard-to-abate sectors like cement or alumina.

There is a strong anti-fossil fuel narrative in some parts of the community. Can cause government, especially Labor governments, to engage with the sector including the CCS aspects.

There have been accusations of "greenwashing" for Middle Arm.

7.1.3 Timing of Engagement

Education also a factor at the project / community engagement / social acceptance level; at what point are different stakeholders engaged to ensure that sufficient technical data can be generated where needed to answer questions + ensure that (for example the general public) feel that they are properly consulted; also don't want to go in to public consultation with insufficient information and risk creating opposition via an information vacuum.

7.1.4 Local vs National support for CCUS

In Pilbara, we don't think community opposition will be a big issue. Locals are used to big industry and accepting of industrial development. Low population density and many of local population work in big industry which helps.

Could some community groups be open to CCS? It can be challenging to overcome misinformation from people like IEEFA.

While Utilisation technologies are difficult to scale, they are a way to gain social licence –through the circular economy

NetZero Teesside has support at council and national level working in lock step – community benefits are key.

7.2 Government Support

7.2.1 Role of Government (State and Commonwealth) in Education and Public Understanding

We will need Government to assist with Social Licence/education of public and lead statewide education on CCS. Actively debunk myths and misinformation. Improve awareness of CCS as essential to decarbonisation.

Government (State and Commonwealth) can assist industry to improve social literacy and acceptance of CCS, especially noting that industry may not be currently perceived as a trusted partner by the Australian public / community.

Some division in Australia between developing new green industries and existing oil and gas - can be hard to bridge the gap by reminding people that both sides need to develop

"Sugar hits" across last 20 years have been detrimental to political and societal views of CCS. Over the last 20 years, Australian governments have frequently announced massive funding injections or "clean coal" initiatives to provide a temporary "sugar hit" of political progress and positive headlines. When these projects fail to meet their capture targets or are cancelled after years of subsidies, the public and political "crash" is severe. There is a false belief that "we have spent all this money on CCS and have nothing to show for it". In reality the spent funds are usually less than 25% of the announced funding and has been spent to enable Australia to now capitalise on the early work.

Politicians are now wary of being "seen" supporting CCS. It has become a high-risk political move.

There is a strong anti-fossil fuel narrative in some parts of the community. Can cause government, especially Labor governments, to engage with the sector including the CCS aspects.

Labor Party is very cautious - they don't want to be a target, and keeping small target is politically valuable, but it means that CCS can become something they don't want to overtly support.

7.2.2 Bipartisan Support

The lack of bipartisan support around climate change is a central challenge.

If we can depoliticise CCS, it makes it easier for political parties to support project. It is more possible to get political agreement if there are common benefits - e.g. jobs.

Is there a way to get the message out through the union movement? And the Teal MPs?

In order for government to support CCS we need to get the community on side, which takes time to build the case in the public discourse. CCS is a solution, but the problems it solves need to be clear in the minds of the public.

In Norway, the focus of Northern Lights on the hard-to-abate sector helped to make the project more palatable politically.

Groups like CCUSNA can show government the business case for CCS vs no CCS for Australia to meet our NDCs.

Cultural Differences with Europe

Is the issue cultural vs European examples?

Euro culture: sitting on the fence and not moving ahead with decarb is not acceptable. Social and legislative drivers.

In Denmark there has been a shift from no CCS to very broad bi-partisan support from Greens to Right. How was this achieved? Seen as in the national interest.

We're not Europe though. So how can industry step up and gov provide the last piece of the puzzle?

7.2.3 Across Community and Government

Current situation in Middle East has shown Australia how dependent we are on not only oil and gas but by-products (ammonia, sulphuric acid, polymers, plastics, chemicals, helium) . This helps us to underline the need for a planned Energy Transition and the roll that CCUS plays in this.

Ignorance of where energy supplies come from can feed into a complacency. Complacency can be stopped if there is a shock (e.g. when Russian gas supplies stopped to Europe). Without a shock, it can be hard to get people engaged.

Cost of living - decarbonising our industry and power lets us bring more industry to Australia, boosting our standard of living and our economy.

Cement can be a good sector to open conversations and minds to be more accepting of CCS.

CCS has to be not about oil and gas, from a social licence perspective. Has to be about keeping WA industry going. About saving union jobs.

CCS enables us to keep industry onshore, not lose it to other countries.

Explaining the benefits of CCS to preserve jobs in Australia

Telling people what will happen if CCS can't be used - what the outcome will be on jobs, climate, economy.

Good to talk up the economic and jobs benefits to the whole country, and that CCS supports ongoing operation of these industries.

Explaining the benefits of CCS to preserve jobs in Australia.

One industry we could consider as a more palatable problem that CCS solves is data centres.

Hubs can benefit significant emissions reductions by enabling lots of smaller emitters to decarbonise.

There is division in Australia between developing new green industries and existing oil and gas - can be hard to bridge the gap by reminding people that both sides need to develop.

We should focus on the success stories for CCS. Gorgon and Moomba. We need to share factual information about this project, the story to demonstrate the successful aspects and learnings (together with DMPE. Narrative should be that we have safely sequestered 11M tonnes of CO_2 as of last year. Change the narrative - not a failure. But be open about the technical challenges associated with site water balance - and how this is overcome.

7.3 Support For Hubs

What stories can be told w.r.t. hubs specifically? For example can Kwinana be used as an exemplar discussing how different companies can come together / what government and community engagement can be involved with this?

Hubs can improve the optics of CCS by showing it's not just an oil and gas operation.

We can explain the benefits of hubs to improve access for CCS for small emitters enabling wider decarbonisation.

Kwinana can be used as an exemplar discussing how different companies can come together / what government and community engagement can be involved with this.

7.4 Role of CSIRO

CSIRO is a highly trusted voice on this matter.

CSIRO Current focuses are to :

- provide education and technical support for the Australian government
- run outreach programs, though cannot reach everyone

A good example on how CSIRO can contribute is GISERA (Gas Industry Social and Environmental Research Alliance). This is a national collaboration between CSIRO; commonwealth, state and territory governments; and industry to undertake publicly reported, peer-reviewed research on environmental and socio-economic topics that affect communities living in gas development regions. This model can potentially be rolled out for CCS.

For CSIRO to maintain its trust with the Australian public as an independent, credible science and research organisation, CSIRO cannot be involved in policy advocacy.

7.5 Support for Storage of International CO_2 in Australian Pore Space

To achieve government and public support for transboundary CO_2, we can underline the opportunity for WA and Australia to lead impactful climate change action, in lock step with our region. Without the option for CO_2 import from Japan, Korea and Singapore Australia risks falling behind and losing out.

7.5.1 Economic Benefits

Create jobs to develop and operate hub projects and supporting services, activating a new industry of CCS and "Diversify WA".

Generate revenue and tax by catering to CO_2 suppliers of Australia's trading partners.

Sustain economic activity while assisting transition of WA's existing hard-to-abate industry.

7.5.2 Activate Domestic Decarbonisation

Leverage transboundary CO_2 to improve economy of scale and reduce CCS unit cost for CO_2 suppliers of WA.

Introduce a domestic storage capacity reservation policy for earning social acceptance to enable transboundary CCS while preserving capacity for domestic decarbonisation.

7.5.3 Environment and Social Contribution

Utilise WA's abundant CO_2 storage capacity to address global warming (highlight that we have considerably more storage capacity than emissions in WA / Australia)

Improve air quality and cater to other key needs for communities affected by CCS hub development.

7.5.4 Strengthening Strategic Partnerships with Trading Partners

Strengthen the existing long-term strategic partnership between WA / Australia and its trading partners by

continuing to provide energy and resource security; providing Australian storage for decarbonising the existing energy and resource trade value chains; and pursuing CCUS technology R&D collaboration.

7.5.5 Opportunity

Utilise existing legacy infrastructure.

Sustain economic activity while assisting transition of WA's existing hard-to-abate industry.

CCS is mature technology. According to the London Register of Subsurface CO_2 Storage [51] (publicly accessible scientific record tracking how much CO_2 has been permanently stored underground by projects worldwide, see Figure 2):

- more than 384 million tons of CO_2 have been injected and securely stored since 1996.
- In 2023, over 45 million tons of CO_2 were stored worldwide.
- Current growth rates put global storage on course to surpass 1 gigaton by 2030.

[51] https://imperialcollegelondon.github.io/The-London-Register-of-Subsurface-CO2-Storage/

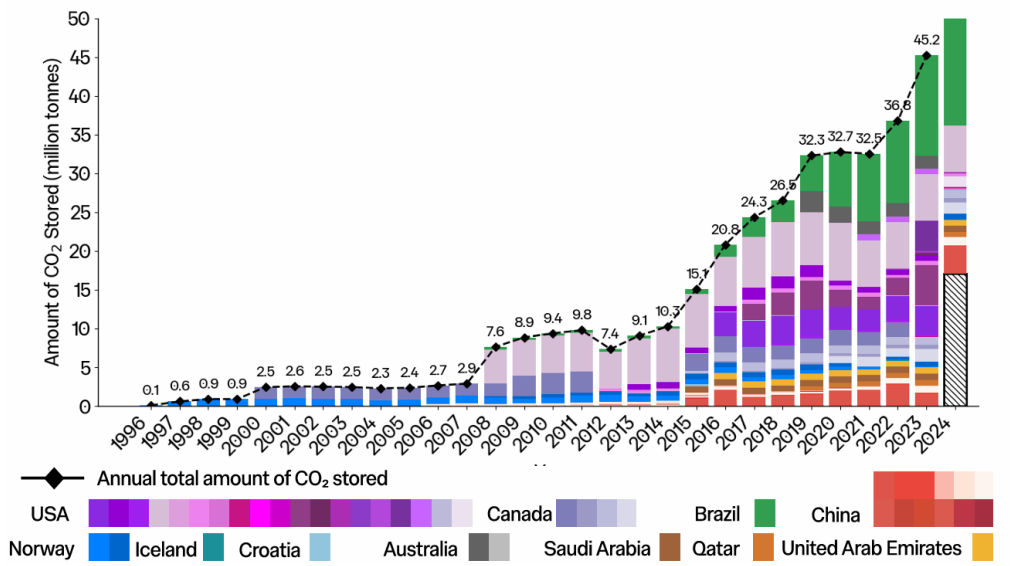

Figure 1. Annual amounts of CO_2 stored with colouring by continent, country, and individual project. See Appendix 1 for the individual project legend. The hashed grey in the bar for 2024 represents the amount of CO_2 stored in 2023 by projects where data has not yet been published

Figure 2: (Source: Gao, X., & Krevor, S. (2025))

8 Prioritising of Projects

What CCUS projects should government support through funding or financing?

Summary

Government faces a dual challenge. The highest purity CO_2 streams in Western Australia currently venting to atmosphere are linked to gas processing and grey ammonia (from gas feedstock). So logically strategic funding should prioritise concentrated and already captured CO_2 to establish the necessary scale for the sector. On the other hand government has committed to assisting the hard-to-abate industries which are considerably less concentrated in both senses - low concentration flue gas, from a range of facilities across a wider area.

Until green hydrogen is widely available at comparable cost, blue ammonia (through use of CCS) is seen as a crucial CCUS priority as it provides high tonnage and concentrated streams. Following ammonia, funds could be directed toward hard–to–abate sectors such as waste, chemicals, lime, mining as well as common–user infrastructure. While small emitters require the most financial assistance, they cannot sustain CCUS independently and must tack onto large emitters and storage providers within collective hub models.

To ensure long–term viability, government funding (currently focussed on pilots and early stage technologies) must support shared infrastructure that rewards effective emissions abatement. Implementing a "Carbon Capture and Value Ladder" for Western Australia could help establish criteria for fundable projects based on public value and the scale of reduction. Additionally removing fossil fuel exclusions for blue hydrogen, ammonia and reducing the grey areas around CCUS financing through government sources will provide the mature, transparent costing required for government decision–making and infrastructure investment.

Workshop Delegate Insights

8.1 Large emitters

Fund concentrated and already captured CO2 first.

Funding to be large enough to get ccs off the ground.

Green H2 is poor way of abating emissions. Ammonia should be supported the most as is concentrated, high tonnage and is not oil and gas (good optics). Also, we don't want decarbonated expensive uncompetitive ammonia.

Can't give money to oil and gas as this won't fly politically. Need to remove the fossil fuel exclusions from financing options tied to CCUS. Blue H2 and ammonia should be included.

Cement, clinker and calcination emissions – can use alternative technology but has not been deployed at scale. CAPEX for electrification is 8 times Post Combustion capture and requires a massive scale of Variable Renewable Energy (Solar and Wind). The Reality (2026): While projects like Leilac-2 (Calix) and the SaltX/Holcim partnership in Sweden are moving toward industrial trials, there is currently no full-scale, 24/7 commercial cement plant running entirely on electrified calcination.

8.2 Hard-To-Abate / Smaller Emitters

Put hubs in places where hard-to-abate is facilitated (waste, lime).

Small emitters need funding the most, but they can only tack onto big emitters who provide the volume and on storage space providers.

Govt should fund a waste to energy ccs technology research centre.

Focus funding on Kwinana hub as that's where people are, visibility, industry support, clean air.

Costs of capture are still the major quantum of CAPEX required and therefore is the major influencing factor for FID.

The further you are away from the consumer, the harder it is to push a green premium. E.g. Aluminium there is a market for green as closer to end user, but Alumina not sure much.

Penalise dirty power and ammonia and lime, and or subsidise the decarbonised power ammonia and lime.

8.3 Infrastructure

Government can provide infrastructure which is not DIRECTLY funding ccs (optics).

Prioritise Multi-User Infrastructure Over Small Pilots.

- Govt $ to help energy transition is best spent on multiuser infrastructure. Currently $ being spent on disparate single proponent low impact projects (pilots). This is not as effective - less bang for buck.

8.4 Relative Ranking

Ways to incentivise outcomes of different technologies in terms of reduction of emissions

Govt $ to help energy transition is best spent on multiuser infrastructure. Currently $ being spent on disparate single proponent low impact projects (pilots). This is not as effective - less bang for buck.

Clear that CCS is required, but Govt policy doesn't reflect this in the current grant system. We want low emissions, then tailor the award to the effective and demonstrable lowering of emissions. The more emissions reductions, the more incentives (goes to HPTI - tax incentive) - this is a win win.

Disconnect between cost of supply and emitter ability to pay

Mature costing required to inform government

Establish projects, what are the criteria for a fundable ccs project, fridge efficiency five star rating (document "Carbon Capture and Value Ladder", by E3G and Bellona).

Have different funding mechanisms. If mandate for producers, this will scale, Oil and Gas pay for it. Pipelines will then come to the party as they know that it will scale.

Establish criteria for fundable CCS projects:

- Identify industries that should be targeted for funding
- Cabon Capture and Storage Ladder (E3G and Bellona)
- Identifies what has public value - governmental subsidies
- Link funding to size of reduction in emissions, to ensure least cost

Fund (1) ammonia (2) waste, lime, other hard-to-abate (3) infrastructure (4) new tech research.

Worldwide examples can be learnt from and are targeting similar hard-to-abate industries with adjacencies to oil and gas production and operations.

Cth National CCS Action Plan/Strategic Delivery plan - set targets, set policies that enable us to reach targets, this then dictates what regulation and funding is required

9 Common Use Infrastructure

Summary

The primary difficulty in delivering common-user CCUS infrastructure is organisational alignment, not technological feasibility, necessitating a strong government role to manage "project on project" risk. Government intervention is essential to facilitate collaboration among stakeholders, allowing them to negotiate specifications and compromises that prevent the inefficient, autarkic duplication seen in the LNG industry. By leading the initiation and investment of shared facilities—similar to the Gassnova model in Norway, the Kalgoorlie pipeline and the construction of the DBNGP—the state can ensure that infrastructure is right–sized for multiple emitters and industries. This centralised coordination also manages the economic mismatch between the long–term investment horizons of hubs and the shorter reserve statements of individual companies, providing the stability needed to underpin the State's industrial transition.

Technical and regulatory assessments must focus on the viability of new infrastructure as well as existing assets, such as the Parmelia pipeline or Mid West rail, while managing decommissioning liabilities. Utilising legacy infrastructure and existing pipeline easements may simplify regulatory approvals and native title consultations, though reopening negotiations remains a hurdle. For new infrastructure financial models like the Regulatory Asset Base (RAB), successfully applied to the Dampier to Bunbury Natural Gas Pipeline (DBNGP), offer a template for state–backed infrastructure that can support open access common user facilities while avoiding the political complexities of direct funding for perceived links to fossil fuels.

Workshop Delegate Insights

9.1 New and Existing infrastructure

We need to assess and make visible what existing infrastructure and depleted geological sites are usable for CCS.

We need to be mindful to not unnecessarily (or be perceived as unnecessarily) deferring decommissioning liability.

Reuse of infrastructure for Kwinana? Eg Parmelia pipeline? Rail to Mid West?

Mid West – single source /sink or hub? Do we need Kwinana and Mid West to support one single hub?

A Regulatory Asset Base (RAB) can be used to tariff transport and storage company.

Example of DBNGP which was built and funded by state, then was sold but regulated with access arrangements.

Discussion on repurchase LNG or ammonia carriers for transport of CO_2

- Repurposing a standard LNG ship for CO_2 is technically very difficult and rarely feasible.
- Physics Mismatch: LNG is carried at -162°C at near-atmospheric pressure. Liquid CO_2, however, must be pressurised (typically 5–20 bar) to stay liquid.
- Different Tank design for different pressure conditions and
- An LNG ship's hull and tank supports are not designed to carry a cargo that is more than twice as heavy (CO_2)
- Ammonia (NH_3) and LPG (Propane/Butane) carriers are the closest technical relatives to CO_2 ships. Cleaning Difficulty: Removing every trace of Ammonia from the "nooks and crannies" of a large cargo tank (behind baffles, in pump sumps) is incredibly difficult. For this reason, the industry generally prefers dedicated vessels or "swing" ships that only move between very similar cargoes (like LPG and Ammonia), rather than mixing CO_2 into the rotation.

CO_2 transport – for shipping within Australia port to port is more expensive than international crew – union impact – this has limited port to port shipping.

To help emitting industries, capture and conditioning likely to sit with emitters but would we consider a centralised hub running dense phase compression (not emitter).

Collectivisation via hubs is the only way to bring the unit costs down.

9.2 Infrastructure Coordination - Role of Government

Role of govt is to co-ordinate the collaboration and initiation

Demand risk. Project on project risk – government intervention needed for renewables, transport and storage companies.

Barriers across the infrastructure chain that require compromise.

Specifications are key and can't be set for e.g. only ammonia if want to expand to other industries. Have to be set by stakeholders in a room, give and take, winners and losers – so it is important who is in the room.

Allows transparency and first movers can be recompensed. Already in place for gas pipelines in WA?

Utilise existing legacy infrastructure but not only infrastructure itself, but access to existing pipeline easements etc that allow for more predictable regulatory approvals and stakeholder consultation processes.

New pipelines – environmental, land use, native title – can be hard to deliver and if we use existing easements – if reused have to reopen negotiation. So this is difficult but not impossible esp. if single project - Do it once and well (by gov) e.g. SIA

Spectrum of hubs options (infrastructure) from gov run ↔ gov pays ↔ gov coordinates ↔ pure commercial. CCUS likely to need at least gov investment and coordination unless we want to replicate the duplication of facilities seen in the LNG industry.

Avoid past experience of multiple autarkic developments side by side when it would be more cost effective and have less impact to create one shared facility.

Gassnova in Norway to balance various operators for benefit of Norway Inc rather than only one or two participants.

Government can provide infrastructure which is not DIRECTLY funding ccs (optics).

Re hubs benefit, explain the benefits of hubs to improve access for CCS for small emitters

But with funding should come "access"(not directing funding to a project that could be perceived as a monopoly or privately operated purely for profit).

Importance of building shared infrastructure across CCS, as WA transitions from reliance on natural gas

Getting right size for first section of pipes and getting emitters in the right scale is a challenge.

$700m in State SIA fund is challenged by political pressure to not directly subsidise Fossil Fuel Industry

9.3 Government Projects with Shared Infrastructure - Lessons Learned

A Regulatory Asset Base (RAB) can be used to tariff transport and storage company.

Example of DBNGP which was built and funded by state, then was sold but regulated with access arrangements. The project was too big for one operator alone to invest in but has underpinned industrial and domestic gas access all along the ~1500 km of pipeline from the State's NW through the Gascoyne, Mid West, Kwinana and to Bunbury.

Goldfields Water Supply Scheme, often called the Golden Pipeline, 1903, longest freshwater pipeline in the world. The pipeline is operated and maintained by the Water Corporation of Western Australia. It has always been considered essential public infrastructure, supplying drinking water to towns across the Wheatbelt and Goldfields.

Cultural barriers to diff parts of the infrastructure chain – compromise needed. Look at Pilbara ports etc as to how to work in this scenario.

9.4 Timeframes and Economics

Every hub will have different economics.

Misalignment of emitters resource/reserve statements (~10 years) with the optimal investment horizon of hub infrastructure (20-30 year plus)

DBNGP style government support or NRF HV Transmission funding model may be required to facilitate the hub infrastructure over the long term.

10 Emissions Aggregation - Clusters

Summary

Centralising the conditioning of flue gases is generally uneconomical due to the high costs of transporting untreated, low–pressure gas, meaning emitters in hubs like Kwinana must manage their own capture and compression. While treating impurities is rigorous, it is necessary to enable the use of multi-user carbon steel pipelines. Very few of the of the current and future emitters based in or near Kwinana produce high purity CO_2. Most are lower concentration industrial and hard-to-abate emitters with process emissions as well as CO_2 from gas turbines To lower costs, the industry is exploring modular, prefabricated designs combined with use of recovery of low–grade waste heat. "Phase 3" (<25,000 CO_2/pa) emitters must rely on CCUS clusters and common user infrastructure to manage the financial burden of participating in carbon storage networks.

Establishing functional low–emissions hubs also requires the integration of high–scale utilities and renewable energy, despite current site constraints in industrial areas, necessitating robust grid connections or massive solar parks that may face land availability issues. The workshop suggests that governments should invest in common infrastructure via Strategic Industrial Areas (SIAs). By aligning renewables, heat recovery, and CCUS into integrated mega projects, the industry can mitigate project–on–project risk and ensure that infrastructure remains "plug and play" for future technology retrofits.

Workshop Delegate Insights

10.1 Capture

The workshop discussed if there was an option to centralise conditioning of flue gases to one central location, vs individual capture and compression into a pipeline designed for a single specification ready for storage. These were the outcome of the discussion.

In Kwinana the hub is only the pipeline - emitters must do their own capture.

Aggregating emissions and co-locating treatment is hard because moving low pressure, untreated gas is very uneconomical.

Typically, gas phase aggregation is only for small distances or where safety is a concern.

Aggregation has to also consider infrastructure for CO2 import.

Specification is constantly evolving and should be revisited continually as new emitters join the hub.

Concern could be changing emitter specifications requiring more treatment.

There are new metering technologies to allow monitoring of impurities, but many components have to be measured by sampling.

Treatment of impurities may seem onerous but it is to enable a carbon steel pipeline which is a major project cost

Western Trade Coast Infrastructure Strategy 2024 - Extensive JTSI review of Kwinana (roads, port, power, water, waste etc) did not include a shared CO_2 pipeline.

A hub is basically a transport network connecting sources and sinks.

Mismatch of development / FID timelines among CO2 emitters, CO2 transporters, CO2 storage owners.

Aggregation of CO_2 to be transported by LCO2 carrier (shipping). For liquefied CO2 impurities might be biggest issues (e.g. dry ice formation). So the Challenges greater in liquefying CO_2 than pipeline transport.

Green vs blue H2 – weigh levels of support vs levels of abatement.

10.2 Low Concentration Emitters

There are a wide range of low concentration emitters in WA that none the less will need access to CCUS to fully decarbonise including gas turbines, lime, pigments, waster to energy, lithium, aluminium.

Very few of the of the current and future emitters based in or near Kwinana are high purity CO_2. Most are lower concentration industrial and hard-to-abate emitters with process emissions as well as CO_2 from gas turbines.

Kwinana is a capture problem not a storage problem. Flue gas capture much more expensive and difficult.

Technological advances: advances in structured packing to improve efficiency of post combustion capture process; Mitsubishi Heavy Industries and others working on this.

What to target to bring cost down: cost of construction high, moving towards prefabricated modular design; energy consumption is key but is more affordable in WA compared to other regions, reduce energy cost by utilising waste heat (increases CAPEX though due to waste recovery).

Low grade waste heat normally vented off, this might be useful for CCUS.

Phase 3 emitters require Common User Infrastructure and will not independently be able to fund CCS. This refers to the anticipated future of SGM where the threshold is lowered (e.g., to 25,000 tonnes) or includes "indirect" emitters in the supply chain.

Low emissions Hub needs chemicals and renewables, otherwise doesn't work.

Design to be plug and play, keep options open until ready to go, lowest cost of regret, minimum investment now until decision. Hubs can drive diversification at least cost of decarbonisation, hedge boom bust cycles vs diversified options

10.3 Utilities and Power (for Capture, Conditioning and Compression)

Ideally renewables but there are constraints to current availability for locations like Kwinana.

How to provide power and heat in a "green" way?

How to provide utilities at scale?

Smaller gas engines at higher efficiency? Adding on as capacity increases.

Is modular, smaller system supplying individual needs a better approach than larger power stations requiring lots of pre-investment.

Could these smaller modular systems be fitted with small, modular carbon capture systems?

Smaller modular systems will take more land which can be a constraint for Kwinana and perhaps Pilbara. For Pilbara can consider location away from the development but then require requirement for substation and transmission lines.

New facilities should be built with the ability to retrofit technology or with options for installing renewables and capture later.

Will the Strategic Investment Area (SIA) actually be able to provide this and how can the CCUS industry influence them to ensure requirements for CCS hubs are included?

Government should be encouraged to invest in common infrastructure via SIAs which supports lots of industries (not just oil and gas).

Lessons from Singapore - utilities on Jurong Island are provided by a government owned utility company to the hub.

10.4 Integration with Renewables

Some issues posed by use of renewables at an SIA.

Ammonia Plant Example

Power needed to power the facility (grey ammonia) and extra needed for CCS components – capture, conditioning and compression. Much higher again for green ammonia. Ideally use renewables throughout – what are the relative requitements?

- Certain minimum CO_2 /tonne specification needs to be met to sell to customer therefore need renewables to at least power the plant
- Around 20MW needed for 1Mt/CO_2 compression
- 120MW needed for green H2
- Running into site constraints – size of solar park needed

- Has to run 24/7, fixed draw (ammonia plant being a 24/7 operation)
- If use renewables then how to operate at night? Use of Battery Energy Storage System (BESS) at this scale not yet demonstrated.
- Requirements are likely to exceed current site can supply so will need grid connection. If the area is World Heritage Listed there will be further constraints.
- Could use blue ammonia to burn for power as peaking / firming though does it make sense to use power to create blue ammonia and then to burn it (can we use the input gas and capture the emissions for example). More studies needed.

How to allocate power in a common user sense at an SIA.

Emitter (individual power) or integrated?

Common requirements or different (can help smooth the load).

Pilbara e.g. Maitland already earmarked and individual projects which means no spare capacity for new projects.

Data centres will form competition for renewables.

Renewables and gas firming - can apply CCS but lower CO_2 captured Vs fully gas with CCS – high CO_2 captured.

Anchor users - Scale of solar park underpinning big projects to unlock spare electricity.

Demand risk.

Project on project risk – government intervention needed for renewables, transport and storage companies.

So plan to package together renewable energy and CCS mega projects – CCS / renewables / waste circulation / excess heat / DAC.

Align infrastructure and low emissions hub where CCS is just a player, greenfield vs brownfield precincts.

11 Utilisation

Summary

Carbon Capture and Utilisation (CCU) is a developing alternative, or complement, to geological storage. CO_2 can be used to create a product with an intrinsic commercial value; however the potential of CO_2 as an industrial input is weighed against significant economic and physical constraints, and general lack of "green premiums" from consumers.

Specific product pathways such as mineralisation into aggregates or use of CO_2 in fertiliser and synthetic fuels are the focus of research and development. However utilisation remains difficult to scale and geological storage offers orders of magnitude more abatement and is expected to remain the primary solution due to the sheer volume of emissions in need of abatement.

Despite these challenges, CCUS hubs provide opportunities for carbon utilisation ecosystems by aggregating high-purity CO_2 supply. Emerging technologies will begin to expand from niche applicants to commercial demand at scale. For utilisation to succeed, robust business models and clear certification frameworks for carbon credits must be established. Ultimately, while high-purity liquid CO_2 and cross-fence collaboration in industrial clusters can stimulate investment, utilisation acts as a supporting feature of a Western Australia CCUS Hub rather than the foundation.

Workshop Delegate Insights

11.1 CCU in Australia

CCU often doesn't solve the carbon problem as e.g. synthetic fuels release carbon back into the universe.

It can be difficult to scale but may be more supported by the community than CCS – social licence.

Examples of operational Australian CCU facilities are Air Liquide, Torrens Island (Adelaide). CO_2 is captured from the AGL Power Station for food grade and industrial use of CO_2. When the power plant closes in 2028 the local CO_2 market will be impacted.

CSBP (WesCEF) in Kwinana produces high purity CO_2 as a by product of hydrogen production from natural gas.

MCI's Myrtle demonstration project at the Orica ammonia facility in NSW, which creates a saleable material from accelerated mineral carbonation from Orica's waste CO_2.

Largest use of CO_2 globally is for enhanced oil recovery (though none in Australia).

Urea production also one of the largest user of industrial CO_2 however the emissions impacts are low as the CO_2 is ultimately released. Local production of urea can replace significant imports to Australia.

Can we use carbon as a valuable input rather than an expensive problem to solve? Big industrial clusters like Kwinana need to get better at "looking over fences". CCU works well in an industrial area (like an SIA). Businesses don't want to just dispose - waste management hierarchy - disposal should be the last thing as long as economically viable.

CCU reactors can run under different conditions to make ammonium nitrate, fertiliser and calcium carbonate. The CCU supply chain and ecosystem are starting to prove up for applications such as aggregates and fertiliser. However customer is not yet willing to pay the green premium in most cases. Much work needs to be done to prove up the technical and business case as CCU cannot rely on carbon credits or a green premium.

Revenue will be generated from people who want CO_2 removed and on products that then sell. Much more work needs to be done on the carbon certification process -voluntary markets, ACCUs, who holds the credits?

We can use mineralised carbon as a substitute for low value construction materials e.g. sand as well as a climate benefit if utilisation is long term and durable.

11.2 CCU in Hubs

There is a cost difference and a volume difference between storage and use - orders of magnitude more for storage – it requires the right business model. In many cases it will still be cheaper and better to store the CO_2 geologically via a Hub.

However CCU makes sense to be co located at a hub. Liquid CO_2 shipped in will be extremely pure so will have value to some potential users.

Existing or developing CCUS Hubs in development have incorporated CCU to take advantage of the available aggregated CO_2.

Examples

The HyNet cluster in the North West of England incorporates CCU

- Blue Hydrogen to Fuel: Low-carbon hydrogen from natural gas at the Stanlow Manufacturing Complex. The CO_2 is captured (CCS), but the resulting hydrogen is used as a "clean fuel" across the region's glass and food manufacturing plants.
- Waste-to-Fuel (CCU): The cluster includes the Protos energy hub, which explores using captured carbon and waste to create sustainable aviation fuels (SAF).

Port of Antwerp-Bruges (Antwerp@C): This hub is one of the most advanced in terms of CCU. Multiple chemical giants (like BASF and Air Liquide) are looking to utilise captured CO_2 as a feedstock for producing polycarbonates and methanol.

11.3 Novel CCU Innovations

There are many CCU innovations under development.

Examples

Masdar (UAE) Hypersaline brine left after desalinisation contains calcium and magnesium ions which can react with a waste stream of CO_2 to form solid carbonates with industrial uses. There are some challenges. The byproduct of this reaction is "new" water which cannot be released back into the ocean. If the energy used to power the CCU process comes from fossil fuels, the CO2 emitted during operations might exceed the CO2 sequestered in the minerals.

Abel Energy's Bell Bay Powerfuels project is pioneering "e-Fuel" facilities designed to meet the surging demand for green methanol in the global shipping industry produced by combining:

- Green Hydrogen: Produced via electrolysis using Tasmania's hydropower and wind resources.
- Biogenic CO2: Captured from forestry residues (wood waste) from Tasmania's sustainable plantations.

Delorean Corporation based in NSW and Victoria employs a waste to energy process centred on biogenic (plant) material to produce biogenic gas with a recent focus on biogenic CO_2 and green fuels.

Calix (an Australian technology company) and its subsidiary **Leilac** (Low Emissions Intensity Lime and Cement) specialise in carbon capture technology specifically for the cement and lime industries. Limestone is heated indirectly which results in a purer stream of CO_2 (above 95%) which eliminates the need for amine capture. Currently scaling up demonstration plants in Belgium, Germany and South Australia.

11.4 DAC vs Hub for CCU

Most CCU projects are linked to existing industrial clusters or facilities and would make sense co-located with a CCS Hub. There are some DAC/CCU projects are in pilot phase .

Examples

Mission Zero DAC - CO_2 mineralisation into building materials and as a feedstock for Sustainable Aviation Fuel (SAF) – they use an electrochemical process that they say is significantly less energy-intensive than traditional thermal DAC.

Carbon Engineering – also have a CCU use case in their Air to Fuels project in the USA.

AirCapture – Early Commercial start up – DAC direct at site for use (e.g. greenhouses, beverages etc). Small scale at present. VC backed.

11.5 CCU - Mineral Carbonation.

Mine tailings could be used to mineralise CO_2. Reactions are extremely slow and CO_2 distribution can be a problem. Hub impact? More likely to take the CO_2 to the tailings than the other way around – so this will depend on CO_2 transport options availability.

Get the settings right for "conventional" CCS and mineral carbonation will follow.

Examples

Bauxite Residue (commonly known as "Red Mud") in the aluminium industry.

Pivotal study *"Bauxite Residue CO_2 Mineral Sequestration Assessment"* (2025) highlights a significant gap between theoretical potential and commercial viability. US$700/t is the "break-even" price for carbon credits required to make bauxite residue mineralisation economically viable. For every tonne of CO_2 you attempt to mineralise, roughly two-thirds of the gas is not successfully mineralised or stays in the liquid phase as carbonates/bicarbonates. The energy required to compress flue gas and pump it through the viscous tailings often generates a significant portion of the emissions you are trying to capture (Scope 2 emissions).

The Mt Keith pilot project has highlighted that mineral carbonation for CDR does not currently qualify for ACCUs. The CER is waiting for the IPCC to issue guidelines.

12 Enabling CCUS Hubs Via Transboundary CO_2.

Synopsis

Establishing a Western Australian CCUS Hub through transboundary CO_2 movement presents a strategic opportunity to leverage the state's abundant geological storage capacity, which far exceeds its domestic emissions. By aggregating local supply with large volumes of CO_2 from trading partners like Japan, Korea and Singapore, Western Australia can achieve the economies of scale necessary to reduce unit costs for local emitters and justify major infrastructure investment.

This approach also strengthens long-term strategic partnerships by providing a decarbonisation pathway for existing energy and resource trade value chains. To gain social acceptance, a domestic storage capacity reservation policy (otherwise known as a pore space mandate) could ensure that international trade does not compromise the state's own decarbonisation needs.

However, the realisation of a Western Australia CCUS Hub faces stiff competition from nations like Malaysia and Indonesia, which are currently outcompeting Australia in securing regional CO_2 supply and infrastructure investment. Significant hurdles remain, including the lack of bilateral agreements for transboundary CO_2 movement.

In comparison to the smaller European short distance CO_2 vessels, long distance large scale CO_2 carriers would be needed for successful and economically feasible shipping of CO_2 from emitter countries (Japan and Korea) to WA. Research in this area is underway via shipping companies and research institutions including Future Energy Exports CRC (FEnEx)[52] While the technology is fundamentally feasible, it remains a first of a kind deployment that requires a demonstration phase to establish operational reliability.

Many industry stakeholders believe that transboundary trade is essential to make a Western Australia CCUS Hub economically feasible. However, it is equally important for Western Australia to develop scenarios that reduce the exposure of domestic CCUS Hubs to the risks of international supply dependence.

Under current policy settings Australia may miss the boat, allowing competing nations with proven CO_2 storage, located in closer proximity to major Asia-Pacific emitters, to secure the available contracts.

Ultimately, the demonstration of a national commitment to CCUS and the adequate support for new Australian sequestration projects will act as a critical de-risking mechanism, helping to secure the international funding and emissions that would help to scale a Western Australia CCUS Hub.

Workshop Delegate Insights

12.1 Why Are We Considering Transboundary CO_2 for a Western Australia CCUS Hub?

"Business Opportunity" - Abundant supply of CO_2 from WA's / Australia's trading partners who do not have suitable geology in proximity and are looking overseas for storage (e.g., Japan, Korea).

"Economic feasibility during weak CO_2 pricing" - With CO_2 pricing still weak in Asia Pacific, catering to CO_2 suppliers that enable access to long-term subsidy schemes such as those made available in Japan and Korea are essential to enable CCS hub infrastructure investment.

"Critical mass CO_2 volumes" - Aggregating domestic CO_2 supply is challenging for underpinning CCS hub infrastructure investment.

"Reduce CCS unit cost for WA" - Enabling CCS hubs via transboundary CO_2 improves economy of scale, reducing CCS unit cost for CO suppliers of WA.

[52] https://www.fenex.org.au/project/low-pressure-low-temperature-liquefied-co2-transportation-technology-for-ccus-demonstrations-phase-1-23-rp1-0177/

"Strengthen the strategic partnership" - Strengthen the existing long-term strategic partnership between WA / Australia and its trading partners by

- continuing to provide energy and resource security;
- providing Australian storage for decarbonising the existing energy and resource trade value chains; and
- pursuing CCUS technology R&D collaboration.

"Utilise WA's abundant CO2 storage capacity" to address climate change. We have considerably more storage capacity than emissions in WA / Australia).

12.2 Why Now?

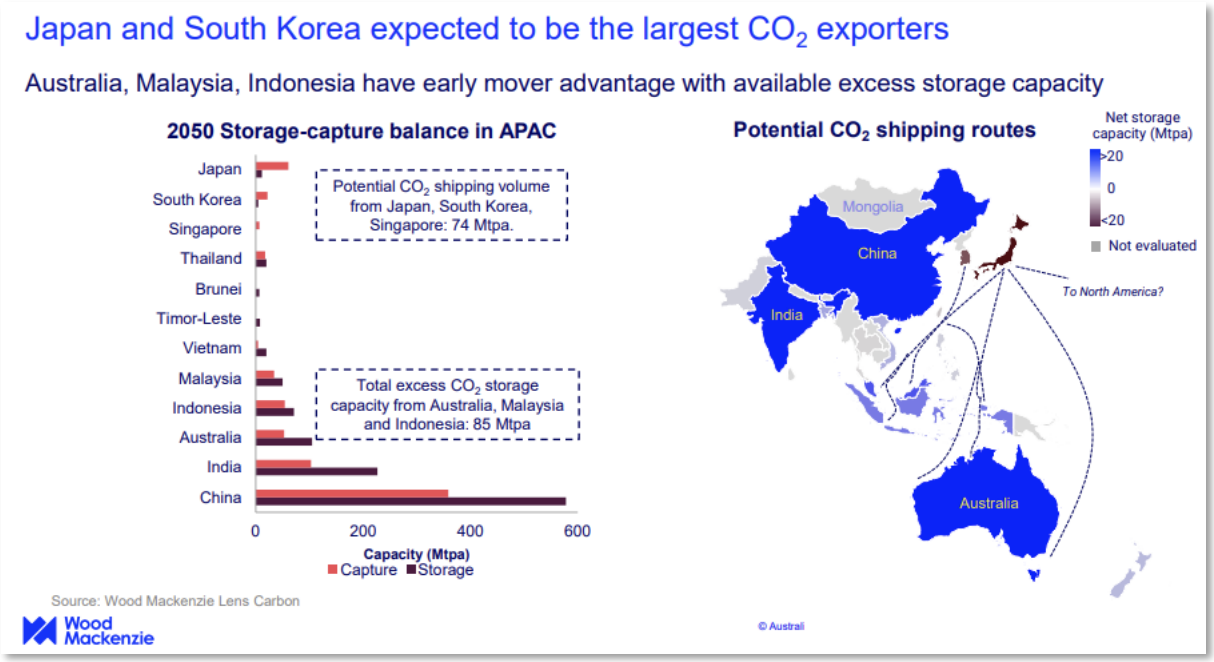

Figure 3: August 2025 Wood Mac CCUS Strategic Planning Outlook 2025-2050

"Timescales"- CCS value chains and hubs, together with the appropriate set of robust policies and regulations take considerable amount of time to develop and implement.

"Competition"- Storage hosting nations are competing for APAC CO_2 supply

- Malaysia and Indonesia are outcompeting WA / Australia for securing CO_2 supply and hub infrastructure investment. While some emphasise the advantage of Australia, Japan and Korea being London Protocol contracting parties for advancing bilateral agreement or arrangement discussions, Malaysia and Indonesia can enable policy and regulation development quickly
- Wood Mac forecasts that by 2050 [53]
- total potential CO_2 shipping volumes from Japan, South Korea and Singapore will be 74 MTPA; and
- total excess CO_2 storage capacity from Australia, Malaysia and Indonesia will be 85 MPTA

The forecast highlights the need for realisation that WA and Australia need to compete for APAC CO_2 supply among other jurisdictions with suitable geologies (Figure 3: August 2025 Wood Mac CCUS Strategic Planning Outlook 2025-2050).

[53] https://go.woodmac.com/l/131501/2025-08-18/34pb9v/131501/1755536947wKBHJAiz/CCUS_SPO_2025_APAC_extract_for_marketing.pdf

12.3 How Do We Establish a Social License for the Import Of CO_2 into WA?

Economic benefits.

Generate revenue and tax by catering to CO_2 suppliers of Australia's trading partners.

Activate domestic decarbonisation.

Leverage transboundary CO_2 to improve economy of scale and reduce CCS unit cost for CO suppliers of WA.

Introduce a domestic storage capacity reservation policy for earning social acceptance to enable transboundary CCS while preserving capacity for domestic decarbonisation.

Strengthening strategic partnership with trading partners.

Strengthen the existing long-term strategic partnership between WA / Australia and its trading partners by

- continuing to provide energy and resource security;
- providing Australian storage for decarbonising the existing energy and resource trade value chains; and
- pursuing CCUS technology R&D collaboration.

12.4 Research Funding

Australian research is co-funded e.g. Japan Organisation for Metals and Energy Security (JOGMEC) has jointly funded the Joint Feasibility Study for Creation of a Supply Chain of Low Carbon Ammonia in Western Australia, with Mitsui E&P.

12.5 What Are The Key Challenges To Transboundary CO_2 Import To WA?

Lack of bilateral agreements / arrangements between Australia and its trading partners for allowing transboundary movement of CO_2 for storage in Australia. This policy area can only be actioned by the Commonwealth Government.

Some projects have linked their development and business case to imported CO_2 to achieve scale.

Australia currently provides the least amount of dedicated policy support for CCUS when compared to both our international equivalents and our major trading partners. This undermines international investment confidence.

There are several technical challenges, including (but not limited to):

- standardisation of CO_2 specification (and acceptable levels of impurities within the CO_2 stream)
- scaling of ship transportation
- reuse of existing infrastructure and depleted geological sites
- Potential to oversize the initial point to point bilaterial project to facilitate second phase adoption by additional proponent

12.6 How To Mitigate For Potential Slow Progress Of Transboundary CO_2.

Focusing on the domestic potential within Western Australia may provide a more stable and cost-effective foundation for the local CCS industry than waiting for international agreements to materialise.

13 Workforce

Summary

The development of CCUS hubs offers Western Australia an opportunity to activate a new industry and "Diversify WA" by creating roles in capture, transport, utilisation and storage. While the state aims to attract CO_2 imports from nations like Japan and Korea, its competitive advantage—rooted in oil and gas heritage—must be validated through real workforce development rather than assumed. Skills are often highly specialised and Western Australia must also address a systemic shortage of entry level university and TAFE–level skills in all areas, which currently constrains the deployment of energy transition projects.

Operationally, a new CCUS asset requires a range of personnel, from mechanical and process engineers for capture to geologists and reservoir engineers for storage. Although the oil and gas sector possesses much of this expertise, emitting industries may face higher hurdles and a need to contract out these specialised services.

To secure a future pipeline of workers, the industry can consider a branding exercise that aligns these roles with the "Energy Transition" to appeal to young people. Recommendations include establishing a CCUS Jobs Taskforce to facilitate industry–led demand.

Workshop Delegate Insights

13.1 Operational Workforce Roles

1. Capture
   - Mechanical Engineer
   - Process Engineer (including dehydration process)
   - Easy for oil and gas as they have the skills and knowledge.
   - Much harder for the emitter– they would need to contract it out.

2. Transport
   - Metering is the core component
   - Compression
   - Measurement Engineers
   - Mechanical Engineers
   - Mechanical Fitter

3. Storage
   - Geologist
   - Reservoir Engineer

4. Utilisation
   - Chemical Engineer

5. Across All
   - Risk Engineer
   - HSE
   - Preventative and planned maintenance

13.2 Other Considerations

Likely needs to be an existing company to gain efficiencies.

10-20 new people would be required for a new asset.

Construction Phase.

Timing is key because of constrained workforce.

Need a mechanism to collaborate.

No difference to existing pipelines in workforce requirements.

Where?

- Tertiary
- Vocational
- Private Training
- Industry Training
- Will need to be a blend of all and will need to import knowledge from overseas.

Are Department of Training and Workforce Development (DTWD) leading any work for capture, transport, holding of CO_2? FEnEx?

LNG Jobs Taskforce Insights

- Demand needs to come from industry not government
- Gov needs to assist not lead
- Micro credentials on decommissioning - leaders can choose
- UK – can do an MSc on Decommissioning
- Teesside is a great case study – specifically looked at unemployed groups who they can upskill – guaranteed apprenticeships.
- Replicate the LNG Jobs Taskforce for CCS – CCUS Jobs Taskforce

Existing story from UK around O&G retraining to assist the offshore wind industry, but simply classing both as "offshore" is misleading, there are specialised skills that don't transfer as well.

Beyond just undergraduate education / universities; huge skills shortage of TAFE / generalist skills throughout all areas (i.e. hard to get a solar install in regions due to lack of expertise) – needs to be addressed.

Expect import of CO_2 from (for example) Korea, Japan, but why would these not go to Malaysia /Indonesia etc; current story is the skills / work force / previous O&G expertise here, need to make sure that this is actually true.

13.3 Branding

Barrier is limited placements for apprenticeships.

Attractive to young people if there is an element of environmental good.

Panel at EXA will discuss multi-faceted approach.

Need to get people into the overarching disciplines (see notes at start of this section) then micro credentials to become specialised.

A branding exercise needs to happen to make skills aligned with oil and gas acceptable to young people.

Need to brand generic skills to "Energy Transition" – not the old industries.

A very strong narrative for CCUS aimed at young people is needed. But it HAS to position it as part of Energy transition, not a thing in its own right.

CCUSNA can play a role in this.

14 Education and Research

14.1 Education

Summary

Enabling CCUS hubs requires an educational shift that broadens current oil and gas–centric curricula to include industrial decarbonisation, CO_2 shipping, and non–traditional storage settings. While university–level Science, Technology, Engineering, and Mathematics (STEM) degrees are vital, Technical and Further Education (TAFE) and vocational sectors show shortages of entry level core skills for all branches of the energy transition. To build a sustainable workforce, key CCUS insights should be integrated into existing disciplines through micro–credentials rather than entirely new degrees, ensuring graduates possess a flexible skillset tailored to emerging hub models. Furthermore, industry and educators must engage in a "branding exercise" that positions these roles as part of the broader "Energy Transition" to improve appeal among young people and overcome the barrier of limited apprenticeship placements.

Education must also function as a public good by providing unbiased information to build social licence and address community concerns communicated in an easily understandable format showing relative risks and uncertainties. Scientists should be careful not to over–emphasise minor technical disagreements, as this can create an "aura of discord" that fuels public anxiety. By framing CCUS as a multifaceted environmental good and a key component of the state's decarbonisation strategy, stakeholders can better align public perception with industrial reality.

Education for CCUS hubs must be multi-layered: universities, TAFE, industry upskilling, and public communication all play roles.

Workshop Delegate Insights

What is it that we need to teach students to help enable CCUS hubs / what skills can be introduced; not necessarily at the "creation of a new course" level but key insights or useful points that can be included when discussing CCUS.

Understanding is that current teaching of CCUS heavily oil and gas focussed / background for staff, what can we do to branch this out further?

Concern about the number of students / knowledge that are coming through in terms of workforce to support future activities in the state.

Beyond just undergraduate education / universities; huge skills shortage of TAFE / generalist skills throughout all areas (i.e. hard to get a solar install in regions due to lack of expertise) – needs to be addressed.

Education not just from perspective of new graduates but also providing public good education / unbiased information – example in Qld CCS problems with mineral mobilisation (building social license).

Scientists can often get overly focussed on the technical details of a given debate which can give rise to public perception that disagreement or uncertainties are larger than they actually are.

Examples around CO_2 plumes in the ocean and effect on oysters / sea life; mechanisms uncertain but larger scale study shows that the actual effects are negligible – but story creates an aura of discord or concern to the lay public.

Concerns about CCS and earthquakes: can run public education about the degree of seismic activity which is concerning; real value anything > 3.5 means minor structural damage, below that not going to see any effects as a result; different regions have different awareness (e.g. well understood in California; poorly understood in Australia).

Need to help explain to both public and industry partners / experts that monitoring systems detecting seismic events not necessarily related to CCS project: monitoring where it had not previously existed with inevitably discover the background noise, important not to mistake this normal background for new activity.

14.1.1 Branding

A branding exercise needs to happen to make skills aligned with oil and gas acceptable to young people.

Need to brand generic skills to "Energy Transition" – not the old industries.

A very strong narrative for CCUS aimed at young people is needed. But it HAS to position it as part of Energy transition, not a thing in its own right.

14.2 Research

Summary

It is a key recommendation from the workshop, **made by several of the working groups,** that the Western Australia government commission CSIRO (or a similarly qualified and respected entity) to conduct a feasibility concept study for each of the three hubs discussed, as a matter of urgency using the Northern Territory Low Emission Hubs as an exemplar.

An area where government funding via direct grants is most useful is in targeted areas of towards engineering research to address technical barriers such as waste–to–energy capture, phase behaviour of contaminants, and corrosion management. Current solvent regeneration costs are high due to thermodynamic constraints, so research into alternative solvents and the use of waste heat is recommended to achieve more than incremental cost reductions.

Additionally, government funding and coordination of early–works feasibility studies—exemplified by the CSIRO work in the Northern Territory—is essential for defining industrial roadmaps. In Western Australia, such coordination would enable industry and government to achieve economies of scale by coordination of planned projects. The CSIRO Gas Industry Social and Environmental Research Alliance (GISERA) model further serves as a template for independent research to build public trust regarding environmental and socio–economic impacts.

Sustainable research capability in Australia is currently hindered by fragmented funding and short cycles that do not align with workforce demands. To prevent a brain drain of expertise, smoothing mechanisms are needed to support the talent pipeline, particularly for Higher Degree by Research (HDR) students and international recruits. Regional infrastructure investment, like WA's In-Situ laboratories, can anchor this expertise and incentivise further spending. Strengthening strategic partnerships with international bodies—such as the Japanese Ministry of Economy, Trade and Industry (METI) via JOGMEC—and adopting frameworks from the UK or Norway will ensure that research investment remains tied to industry demand.

Workshop Delegate Insights

A key use of government funding to support CCUS is through direct grants for research in the following areas:

14.2.1 Engineering and Technology Research

- phase behaviour due to contaminants, effect / prevalence of corrosion problems / questions / management
- incidentals, may be ppm level contaminants, how well can these be measured, what frequency, are there new technologies that can help to improve this monitoring?
- metering, monitoring CCS, understanding incidental contaminants etc that may come in
- multiple different techniques required for different chemical species, how can industry choose the correct technique for a given mineral. Problem: don't necessarily understand what materials / minerals will precipitate out during CCS as the chemistry / geochemistry are complex also including different ratios of reactants, conditions, flowrates etc
- cost movements are largely incremental due to some technical limitations - big cost is regenerating the solvent, done with temperature (boiling a lot of liquid). Can make some headway through using waste heat or increasing concentrations of CO_2, but some limitations due to thermodynamics. That's why people are looking at different approaches (e.g. other solvents which boil at lower temperatures).

14.2.2 Feasibility Studies, Techno Economic Studies.

- The work of CSIRO on the Northern Territory Low Emission Hubs is an exemplar of the role of government funding for feasibility studies.
- This work provides a solid base for industry and government to get the ball rolling.
- The study can consider real world examples, ways to incentivise outcomes of different technologies in terms of reduction of emissions and feed into policy options for State and Commonwealth.
- It is suitable for government to coordinate such early works studies. For WA this will also further define the CCUS road map in the state so that industry is working together to achieve economies of scale. Can stagger different projects, use the same major market and materials.
- CSIRO holds a level trust with the Australian public as an independent, credible science and research organisation,
- A good example on how CSIRO can contribute is GISERA (Gas Industry Social and Environmental Research Alliance). This is a national collaboration between CSIRO; Commonwealth, State and Territory governments; and industry to undertake publicly reported, peer-reviewed research on environmental and socio-economic topics that affect communities living in gas development regions. This model can potentially be rolled out for CCS.
- In addition CSIRO can provide education and technical support for the Australian government and run outreach programs, though cannot reach everyone

14.2.3 Current State Of Research Funding For CCUS?

Depends on the particular area / organisation being discussed.

How is the current state of research funding for CCS? Depends on the particular area / organisation being discussed. General point: require impact for Australia or the particular funding body; balance of these required to keep organisation viable with continuous funding. Investment in training initiatives etc often out of sync with demand cycles, so require methods to smooth out the revenue stream and ensure sustainable operation

Research driven by researchers: need to ensure that we don't have a brain drain of expertise; requires both local training to continue and bring in people internationally; significant number of international students coming in, particularly for HDR (Higher Degree by Research – MSc and PhD).

If able to combine CCS research work with other semi-independent work e.g. geo-mechanics, building capability, jobs training etc quite useful, when sufficient capital invested in research in a particular region, assists further spending based on advancement of current state of the art (ex in-situ lab in WA).

Does a hub need to have a dedicated research / lab associated with it to answer immediate questions for that particular location or is this best handled by separate / centralised / existing facilities and organisations?

What frameworks can we borrow internationally to ensure that research money flows back towards local researchers? Norway / UK have exemplar programs, various consortia etc.

Government does provide some input towards large problems (ex-Teesside); EU funding projects shows examples where granting distributions / process for grants can be complex and needs to be managed when you have multiple nationalities / governments involved.

Strengthen the existing long-term strategic partnership between WA / Australia and its trading partners by pursuing CCUS technology R&D collaboration. E.g. Ministry of Economy, Trade and Industry of Japan (METI) supports research in Australia via Japan Organisation for Metals and Energy Security (JOGMEC).

15 Kwinana Specific

Summary

The Kwinana hub itself is primarily cluster with a capture and transport challenge rather than a storage one, as flue gas capture remains complex and costly and there is no local storage option. A central narrative for this region should focus on protecting local industry and jobs - essential for retaining existing businesses in Kwinana, Kemerton, and Bunbury that cannot be easily electrified. Kwinana will require government support and coordination and a clear industrial carbon management strategy to define necessary infrastructure. This strategy should explore the reuse of existing assets, such as the Parmelia pipeline or rail to the Mid West, while ensuring that the hub is right–sized for local industrial CO_2 volumes rather than relying on international CO_2 imports.

A significant gap in current planning is the need for an in–depth, state–funded concept study for the South West, similar to the Northern Territory's Middle Arm study. This work must utilise probability and options modelling to account for the long lead times of CCUS projects, ensuring that investment is staged. Because the industrial landscape in Kwinana and the Mid West is a moving target due to project additions and cancellations, a holistic study is a high priority to manage uncertainty. By applying "least cost of regret" analysis and uncertainty modelling, the government can determine the best timeline to bring Kwinana and South West Western Australia emitters into a Kwinana cluster, ultimately securing the long–term viability of Western Australian industry.

Workshop Delegate Insights

Kwinana is a capture problem not a store problem. Flue gas capture much more expensive and difficult.

One approach doesn't fit all locations. In Kwinana can be about protecting industry and gov will support. Pilbara more private sector led - gov regulation and sticks to encourage this.

What stories can be told w.r.t. hubs specifically? For example can Kwinana be used as an exemplar discussing how different companies can come together / what government and community engagement can be involved with this?

Mid West – single source /sink or hub? Do we need Kwinana and Mid West to support one single hub?

Reuse of infrastructure for Kwinana? Eg Parmelia pipeline? Rail to Mid West?

Identifying core needs for the Kwinana hub will be essential. South West WA hub is servicing existing industry, creating new opportunities for industry, could be shipping out CO2. Local hub cannot rely on international CO2 to come this far. International CO2 should go to closest location it can go to. South West hub helps retain industry rather than creating industry.

Getting right size for first section of pipes and getting emitters in the right scale is a challenge.

15.1 Kwinana Concept Study

We need an Industrial Carbon Management Strategy which defines infrastructure, based on concept studies. This should be federal, pushed by WA.

Need an in depth concept study on Kwinana hub to assess benefits in terms of facilitating jobs and industry. This is the key gap. Needs to include uncertainty modelling, not deterministic. Need to look at costs vs benefits.

South West Hub - would rely on WA industrial CO2 only. Hub in South West required to keep these businesses alive in WA. Value of businesses in Kemerton, Kwinana, Bunbury etc. Used to value investment in CCS for this area. Perth basin potential hub. Issue is how you bring the emitters in at the right time. Concept study should look at volumes from emitters (now and future) and a timeline. Only works if carbon price increases over time. Need concept study in the first place to look at the way to get there. Political support in Kwinana.

In terms of gov support models, not 'one model fits all' - differences between Kwinana and Pilbara.

Need a South West Hubs study to be done such as NT study

- Holistic study
- Look at funding requirements

- Focus on industries that can't be electrified

Look at option probability modelling. Look at different scenarios and model the outcomes. Then can stage investment. Deals with the issue of uncertainty.

- Options valuation model for Kwinana
- Expected value/NPV of today based on different scenario
- Reality is carbon price will increase, takes 8 years to develop a CCS project, too late to start once the price is higher in 8 years time.
- **Least cost of regret**

Needs a State government funded Hub Study in South West (similar to NT Middle Arm), Mid West and Pilbara. Pilbara was done 2 years ago and not changed much but Kwinana/MW was only done as supply to Pilbara and not to Dongara. Plus MW/Kwinana is moving target in terms of industries due to additions and cancellations and strategic rethinking, so should be higher priority than redoing Pilbara.

Probability/Option economics analysis for South West Hub.

Conduct an in-depth concept study for the Kwinana hub, including uncertainty modelling and cost–benefit analysis.

16 Mid West Specific

Summary

The Mid West is primarily viewed as a storage play that could potentially import CO_2 from other regions, due to its abundant storage potential although it currently lacks sufficient local industrial volume. Significant barriers to development include the high cost of transport and aggregation, and also high capture costs associated with lower purity streams from Kwinana. Technical and legal complexities surround the repurposing of existing infrastructure; for instance, transferring hydrocarbon pipelines or wells to CO_2 services involves difficult liability shifts between joint venture partners and the renegotiation of lease agreements. Furthermore, the geologically faulted nature of the Perth Basin presents flow assurance and pressure management challenges, especially when injecting gas into highly depleted reservoirs or scaling up to include saline aquifers. Social factors also include consultation fatigue among local communities due to the high density of resource and renewable projects in the North Perth Basin.

Potential solutions to these constraints include attracting new industries, such as ammonia plants, to co-locate near the hub to mitigate transport costs. Strategic infrastructure options involve repurposing the Parmelia gas pipeline or utilising the DBNGP easement for a new pipeline, while initial small–scale movements could be facilitated by trucking. Information sharing from analogues like the Moomba project in South Australia—which benefits from a regulatory framework that allows CO_2 storage permits to overlap production permits—could provide a pathway for more efficient well and acreage utilisation. A state–funded holistic concept study for the Mid West and Kwinana is a high priority to address these financial and technical gaps, as the region remains a moving target for industrial planning and strategic rethinking.

Workshop Delegate Insights

Mid West likely more a storage play (perhaps also importing CO2). Not necessarily enough industry locally. Complication for Mid West is cost of transport. However, can attract future industries to be near CO2 hub. Eg new ammonia plant.

The area has some key strengths

- Some storage sites are well understood and there is a mix of depleted field and saline aquifer storage options
- Social licence pretty positive
- Mid West has onshore storage (cost advantages; relatively proximal to Perth - but still some distance)

16.1 Barriers

Volume of CO_2.

Concentrations (low hanging-fruit from things like Waitsia and Beharra Springs - potentially Belisama; less low-hanging from other sources like Mungarra, Strike).

Aggregation, even from Kwinana, is not necessarily straightforward - requires getting some lower purity streams.

Lack of regulations (but those are coming).

Ability to repurpose/re-utilise infrastructure (e.g. wells from hydrocarbon to monitoring, pipelines - legal issues around liabilities moving from hydrocarbons to CO2 [different JV partners, difficult transferring licences etc.] which potentially creates the need for drill new wells, impacts project economics and possibly reservoir integrity). Also difficult to transfer a hydrocarbon pipeline to a CO2 pipeline; requires renegotiating lease agreements - potentially requires building a new pipeline instead, which impacts economics and requires more CO2 to make the project viable.

Understanding of storage potential (in some parts).

Lots of pore space; not all covered by 3D seismic.

While there is quite good 3D seismic coverage, it's not all over acreage that will be suitable/targeted for CCS. Most of the 3D is over existing production licences.

Ability for GHG exploration permits to cut across production permits.

Cost of aggregating/transporting CO_2 to the Mid West (pipeline requires large volume and is expensive).

Flow assurance issues putting gas into highly depleted reservoir; phase change issues.

If you were developing a hub (scaling up) you would be potentially faced with both depleted reservoirs and saline aquifers, which creates challenges around pressures.

Perth Basin is geologically faulted so pressure management and consideration of water management.

A degree of consultation fatigue, as a result of a range of gas, renewable, mining and other projects across a relatively small geographic area in the North Perth Basin.

Getting to scale; getting the confidence associated with that (could theoretically do something smaller scale in the Mid West, but the economics don't work).

Transboundary seems like a big ask (would the CO_2 get past Malaysia, Indonesia, Darwin, Burrup before coming to the Mid West?).

Not necessarily enough industry locally. Complication for Mid West is cost of transport.

Potential solutions

Repurpose Parmelia gas pipeline (somehow address the issue around leases) and phase consideration dense vs gas phase.

South Australia have a different regulatory framework which has made it easier to repurpose wells (exact details unknown; worth investigation).

SA legislation also allows for GHGEPs over production permits.

Aggregate CO_2 from Kwinana and get it to the Mid West (Kwinana as CO_2 aggregation hub; Mid West as storage hub.

Truck CO_2 as a means to get things started (impractical at large scale; but gets things moving).

Shipping (cost prohibitive).

Rail (has been looked at but cost prohibitive).

New pipeline (could use DBNGP easement - but note that the DBNGP doesn't necessarily sit in the middle of the easement, which may create complexity around coexistence within the easement).

Information sharing from Santos; Moomba also a depleted reservoir - decent analogue for Mid West.

16.2 Mid West Concept Study

Combine with Kwinana Study.

State government funded Hub Study in South West (similar to NT Middle Arm), Mid West and Pilbara. Pilbara was done 2 years ago and not changed much but Kwinana/MW was only done as supply to Pilbara and not to Dongara. Plus MW/Kwinana is moving target in terms of industries due to additions and cancellations and strategic rethinking, so should be higher priority than redoing Pilbara.

A study to understand what the financial gaps are for various volumes/transportation types.

17 Pilbara Specific

Summary

The Pilbara represents a premier opportunity for CCUS due to its high concentration of large–scale emitters and existing sequesterers, yet current proponents are not yet capturing CO_2. Developing a multi–user, common–user infrastructure could lower the barrier to entry for the next wave of decarbonisation, particularly if government policy justifies initial overcapacity to allow for future expansion. While the region could potentially be private sector–led, success requires a co–funded model, policy direction, and a risk–sharing commitment to provide commercial certainty. Integrating CCUS with other energy industries, such as renewables and decommissioning, while utilising infrastructure corridors like the Dampier to Bunbury Natural Gas Pipeline (DBNGP) for new CO_2 pipelines, could further optimise land use in industrial zones like Maitland. For new infrastructure financial models like the Regulatory Asset Base (RAB), successfully applied to the DBNGP, offer a template for state–backed infrastructure that can support open access common user facilities while avoiding the political complexities of direct funding for perceived links to fossil fuels.

An updated Pilbara Concept Study could need to address the complexities of land access, lay down areas, native title, and the high cost of a skilled workforce in a low–unemployment environment. It should investigate the infrastructure required balancing locally captured versus transboundary CO_2 imports, noting that liquid CO_2 arriving at –45°C must be stored in close proximity to jetties (some delegates say within a 5–7 km radius, others even less) - due to heavy insulation requirements. The study should also examine local aggregation models, such as the Pilbara Clean Fuels Bunkering Hub, to balance commercial sensitivities, e.g. technical need to connect domestic dense–phase compression with imported liquid streams. Given that Kwinana and the Mid West may now form a combined hub rather than transporting CO_2 north, the updated study should re–evaluate the Pilbara's role as a standalone interconnected network.

Workshop Delegate Insights

17.1 Opportunity

Large scale existing emitters - Woodside, Chevron, Yara and future opportunities including NH_3 and Perdaman but even the current emitters are not capturing CO_2.

For new industry and trade plus new uses in manufacturing.

Sequesterers are already existing.

CO_2 pipeline new asset that grows over time as more emitters want to sequester and more sequesters develop pores.

Can hub be developed as a multi product multi-user common user infrastructure?

Build some room for expansion in there - discussion with government to justify initial overcapacity beyond first proponents and lowers barrier to entry for next wave of decarbonisation.

If assets are regulated, seen as best outcome, if building excess capacity. Helps give certainty about what getting into.

Pilbara might be more private sector led – with gov regulation and sticks to encourage this.

Need policy direction and a cofunded model plus firmed up commitment to use and risk sharing.

Can industrial zone be developed that deals with heritage and industrial users can come in and use the existing infrastructure.

Have infrastructure corridors like DBNGP that might be able to use to build a CO_2 pipeline.

This is an opportunity in the industrial areas.

Don't look at CCUS in isolation, what other new energy industries can be added - decommissioning, renewables - need large laydown areas at port. Teesside example.

Challenges include space in laydown areas and aggregating demand unless there is a government priority.

Can we learn from the Pilbara Round table experience? Seems a good related example.

17.2 Infrastructure

Clear case that Pilbara is a first choice, high concentration of volumes but challenges with land access, native title, small population, cost of building and complexity.

Don't think will be community pushback in Pilbara but the broader WA voting community.

Have the ability to facilitate trade - is a common trade route - what additional infrastructure needed? Prefer common user so can become a true hub - need to do more work around what infrastructure.

Does transboundary CO_2 dock offshore or need to come into port - potentially for regulation - but are you making it harder or more costly to decarbonise.

Thinks there is a need for imports to supplement as emissions from large domestic users are hard to abate.

Cost of skilled workforce - quite a large issue to be grappled with particularly when projects are cost sensitive and WA unemployment rate is low. Potential opportunity to reskill oil and gas workforce as decommissioning comes.

Pilbara and Kwinana have scale to help the business case.

How well are we connecting up funders and users.

So many component parts - for too long have looked at one solution now requires some level of aggregation, cofunding and government policy.

Pilbara Clean Fuels Bunkering Hub a model of how to balance aggregation and commercial sensitivities of individual users.

There are different ideas of what a hub would be - maybe interconnected network.

Local emitters compress CO_2 to dense phase but imports cold -45 liquid.

Opportunity for new common user CO_2 pipeline from industrial users to storage.

An import terminal and storage could be compact although common user land in proximity to the jetty is the issue.

Longest terminal to storage pipeline for imported CO_2 is about 7km in a colder place.

Pilbara e.g. Maitland already earmarked and individual projects which means no spare capacity for new projects.

Advances in structured packing

- Pilbara energy transition plan, develop common infrastructure (e.g. in Pilbara shared infrastructure corridor?).

Import trade - can't have too distant from jetty as very cold and needs to be heavily insulated. 5-7 km radius ideally co-located with jetty.

17.3 Pilbara Concept Study

State government funded Hub Study in South West was done 2 years ago and needs to be updated – possible that Kwinana and Mid West will form a combined Hub and not transport CO_2 to Pilbara as conceived in the previous study.

What would an updated Pilbara Concept Study now include?

18 Who also needs to be part of the conversation

Workshop Delegate Insights

18.1 Politicians and Government

MPs, Senators and staff (State and Commonwealth) .

Environmental Specialist from regulator groups. E.g. NOPSEMA, DISR (NOPTA).

Productivity Commission.

Co-ordinator General role (QLD / WA has just established this).

CODA and NOPSEMA - Decommissioning – does a Declaration of Storage allow decom timeframe to be deferred? Certain timeframes for decom clash with CCUS repurposing – State vs Commonwealth assets.

18.2 Investors, Credit Agencies And Verification Groups

Capital investment.

Big green private investment funds.

Insurance Groups.

DNV / RISC – insurers and investors will look to them for verification.

Carbon Credit generation bodies (NBS) in the voluntary market.

Puro Earth, Verra – credit agencies .

Carbon Accounting Professions – ACCU / SMC.

18.3 Emitters

Power generators.

Miners and processors – ID key industries / mineral and their customer e.g., lithium, critical minerals, esp. Alumina - South 32 .

Steel / Iron? – Bluescope Hi Smelt, POSCO / Green Iron / Blue Iron.

Japan, Korea and Singapore – emitters and aggregators. AKBC / AJBCC / AustCham Singapore.

18.4 Customers

Ultimate low carbon product group - i.e., customers of a low carbon product e.g., miners, farmers.

Cement customers – e.g., gov uses building products from decarb products?

Data Centres – Microsoft, Google – DAC credits too?

18.5 Transport and Terminals

DBNGP pipeline – Easement encroached, new corridor needed to link to leave Perth.

Rail – use existing industry studies on bullets via rail car.

Leading Japanese and Korean EPC firms.

Shipping – terminals (e.g. VOPAK).

Department of Transport covers Maritime matters – invite them for CO_2 shipping forums.

18.6 Capture

Capture specialists, process engineers, low conc CO_2 specialists.

Calix.

18.7 Jobs and Training

Unions, training and job force, TAFE.

School of Chemical Engineering, Curtin – graduate ready program for CCUS competing, Job ready Industry – green and decarb tech.

18.8 Advisors / Think Tanks / Misc

Big 4 – Deloitte, EY etc.

Grattan Institute.

Power generators esp. Gas with carbon capture and storage (CCS) to firm renewables.

AEP, slb, Kent, Baker Hughes, Kellogs.

South Australia / Carbon Net.

DAC.

Well Engineers.

Supply chain operators.

LCLF/SAF - Impact on hub if there is a redirection of CO_2 from storage to usage – hub can be flexible in this respect? Helps government to take the macro view.

Should we have invited the detractors or run a separate workshop with them?

19 Summary and Next Steps

CCUSNA greatly appreciates the high level of engagement demonstrated by the delegates. We are equally encouraged by the strong attendance at the pre-workshop webinars and are pleased to present the key outcomes of the workshop within this report.

Before focusing on the next steps, we would like to highlight the significant opportunities offered by a multi-user CCUS hub in Western Australia.

The Australian community has elected State and Commonwealth governments that have promised real action to mitigate the worst impacts of climate change. For industries where alternative options—such as electrification and efficiency measures—have been exhausted, CCUS offers a definitive pathway toward full decarbonisation.

Western Australia is home to industrial clusters with emissions profiles that are projected to grow as Australia seeks to onshore critical elements of the fundamental supply chain. Without a common-user CCUS hub, many emitters will be forced to either seek offsets through nature-based solutions—while continuing to release CO_2 into the atmosphere—or enter into market-based commercial arrangements with a limited selection of transport and storage operators.

In contrast, a hub provides both small and large emitters with cost transparency, economies of scale, and a shared approach to managing long-term financial risks. Furthermore, Western Australia possesses the potential to assist our key international trading partners in their efforts to decarbonise.

Western Australia possesses numerous geological storage sites and has the capacity to store gigatonnes of CO_2 safely and permanently on and offshore.

Existing pipelines can be assessed for repurposing, while existing easements may be utilised for the development of new, dedicated CO_2 networks. Additionally, road, rail, and shipping all represent potential transport options—either in isolation or in combination—that can be developed to connect CO_2 sources with optimal storage locations.

Western Australia possesses a highly skilled workforce capable of developing large-scale CCUS projects, alongside world-class research facilities that can be tasked with optimising the required technologies.

We are not starting from scratch; CCS is a tried and tested suite of technologies operating successfully globally and in Australia already. Foundational studies funded by government and industry over the last 25 years have built a strong foundation and de-risked many elements needed for the local capture, transport, and storage of CO_2.

The workshop has highlighted the next steps required in WA to achieve FID for one or more multi-user CCUS hubs. These steps do not need to be sequential but should be progressed concurrently. Our first priority is to commence the journey and complete the initial steps, which in themselves are low-cost but high-impact, allowing government and industry to assess progress, adapt strategies, or pivot delivery mechanisms to achieve full decarbonisation at a large scale.

The workshop has highlighted these least cost of regret next steps (see Figure 4).

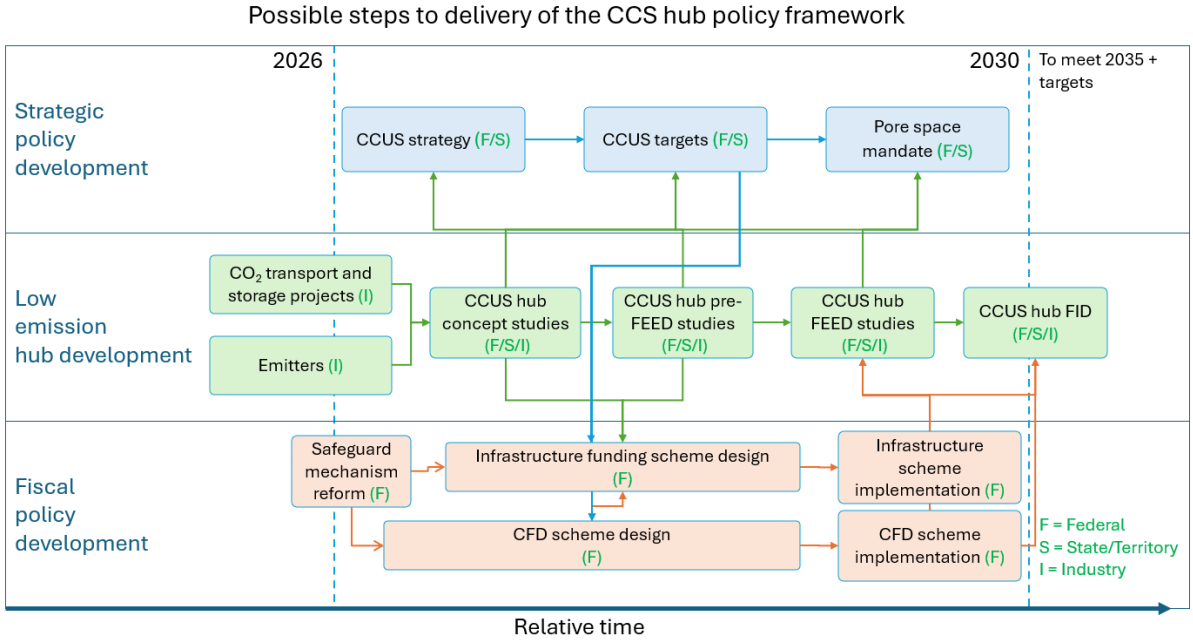

Figure 4: Concurrent activities suggested by workshop delegates to achieve a multi-user CCUS in Western Australia. (Summary figure courtesy of Dr Andrew Ross, CSIRO)

Develop an aligned National and Western Australia CCUS Strategy

- Establish clear deployment targets and timelines: Define binding national targets for CO_2 capture and storage capacity to signal long-term policy direction.
- Resolve pore space access in advance to avoid difficulties of a later retroactive approach.
- Revise the Safeguard Mechanism: Align the framework with a predictable carbon pricing mechanism to provide industries with long-term investment certainty.
- Enable Transboundary Storage: Finalise bilateral agreements to facilitate the cross-border transport and permanent storage of CO_2.
- Implement robust funding mechanisms: Introduce Carbon Contracts for Difference (CCfD) structures and/or tailored financial incentives to underpin private investment.
- Establish a dedicated coordination body: Create an overarching entity using Gassnova and CODA as possible models, to streamline regulatory approvals and infrastructure alignment.
- Designate Track 1 Hubs: Select and prioritises fast-track hub projects to catalyse immediate deployment and achieve early operational milestones.
- Develop materials to assist with public perception and explain the role of CCUS in full decarbonisation (funded by government and industry)

CCUS concept studies for each Western Australian hub location to provide a technical definition basis and a reference case that includes near and far future cases. These studies will identify project timelines, potential participants and inform suitable government led business models (e.g. Carbon Contracts for Difference (CCfD).

Update the assessment of potential storage locations to improve current government Atlas publications and methodologies. It is essential to incorporate lessons learned from the experience of projects such as Gorgon and ZeroGen to geologically de-risk the entire storage system prior to FID.

Develop materials to assist public understanding of CCUS and explain its role in full decarbonisation, through a collaboration of government and industry.

Utilise real options frameworks to identify the financial impacts of acting at different timeframes

- Quantify inaction (articulate the cost of doing nothing)
- Conduct environmental and economic modelling. Assess the compounding costs and regulatory liabilities of delayed implementation at different stages.
- Incorporate compression premiums. Account for the incremental escalation in capital and operational costs that occurs when project delivery must be accelerated under constrained timeframes.

If commenced in 2026, these parallel initiatives will facilitate critical pre-FEED and FEED activity. Through the active collaboration of industry, research institutions, and local, State, and Commonwealth governments, fundamental milestones can be achieved concurrently.

- **Government-backed business models.** Establishing commercial viability, likely a Carbon Contract for Difference (CCfD) structure.
- **Predictable carbon pricing**. Driving investment via an escalating CO_2 price structure implemented through the Safeguard Mechanism's next iteration.
- **Infrastructure equity investment**. Securing direct capital allocation for shared transport and storage networks.
- Implementing a **Carbon Border Adjustment Mechanism (CBAM)** to protect industrial competitiveness.

This coordinated foundation will underpin positive Final Investment Decisions (FID) by the early 2030s, positioning Australia to meet its legislated 2035 emissions reduction targets with Western Australia serving as a cornerstone contributor.

20 Glossary, Abbreviations and Acronyms

ACCU	Australian Carbon Credit Unit
ANLEC R&D	Australian National Low Emissions Coal Research and Development
ARENA	Australian Renewable Energy Agency
BCA	Border Carbon Adjustment
BECCS	Bioenergy with Carbon Capture and Storage
BoD	Basis of Design
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism
CCfD	Carbon Contracts for Difference
CCS	Carbon Capture and Storage
CCTI	Clean Commodities Trading Initiative
CCU	Carbon Capture and Utilisation
CCUS	Carbon Capture Utilisation and Storage
CCUSNA	Carbon Capture Utilisation and Storage Network Australia
CDR	Carbon Dioxide Removal
CEF	Connecting Europe Facility
CEFC	Clean Energy Finance Corporation
CER	Clean Energy Regulator
CH_4	Methane
CLIMIT	Clean Improvement of Mitigation Technologies
CMT	Carbon Management Technologies
CO_2	Carbon Dioxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTBO	Carbon Takeback Obligation
DAC	Direct Air Capture
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DCCEEW	Department of Climate Change, Energy, the Environment and Water, Australia
DESNZ	Department for Energy Security and Net Zero, UK
DISR	Department of Industry, Science and Resources, Australia
EA	Environmental Attribute
EOR	Enhanced Oil Recovery

EPA	Environment Protection Authority, State or Commonwealth
ESP	Environmentally Sustainable Procurement
ETS	Emissions Trading Scheme
FEED	Front End Engineering Design
FEnEx	Future Energy Exports CRC
FID	Final Investment Decision
FMA	Future Made in Australia Innovation Fund
GA	Geoscience Australia
GCCSI	Global CCS Institute
GCS	Geological Carbon Storage
GHG	Greenhouse Gas
GISERA	Gas Industry Social and Environmental Research Alliance
GSWA	Geological Survey of WA
GTE	Government Trading Entity
HDR	Higher Degree by Research
HPTI	Hydrogen Production Tax Incentive
IEA	International Energy Agency
IRA	Inflation Reduction Act (USA)
JOGMEC	Japan Organization for Metals and Energy Security
JV	Joint Venture
LETA	Low Emission Technology Australia
LNG	Liquified Natural Gas
METI	Ministry of Economy, Trade and Industry, Japan
MOU	Memorandum of Understanding
MRET	Mandatory Renewable Energy Target
MRIWA	Minerals Research Institute of Western Australia
NAIF	Northern Australia Infrastructure Facility
NBS	Nature Based Solutions
NH_3	Ammonia
NOC	National Oil Company
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NRF	National Reconstruction Fund

NTLEH	Northern Territory Low Emissions Hub
NZF	Net Zero Fund
NZIA	Net Zero Industry Act (EU)
OECD	Organisation for Economic Co-operation and Development
OPEX	Operating Expenditure
OPGGSA	Offshore Petroleum and Greenhouse Gas Storage Act 2006
PCI	Projects of Common Interest
PMI	Projects of Mutual Interest
PPP	Public Private Partnership
RAB	Regulated Asset Base
SDE++	Stimulering Duurzame Energieproductie en Klimaattransitie
SGM	Safeguard Mechanism
SIV	Specialist Investment Vehicle
SMC	Safeguard Mechanism Credit
SOE	State Owned Entity
STEM	Science, Technology, Engineering, and Mathematics
TAFE	Technical and Further Education
TEBA	Trade-Exposed Baseline Adjustments
T&S	Transport and Storage
TRL	Technology Readiness Level
WA	Western Australia

21 Workshop Sessions

Delegates were free to convene a session on any topic as long as it contributed to the convening theme "**What are the opportunities and challenges in developing a multi-user CCUS hub in Western Australia (for Kwinana, Mid West and/or the Pilbara regions)".**

Where delegates proposed similar themes, it was agreed to combine the themes into one conversation. The notes taken during these conversations form the bulk of this report, along with additional research-based information on CCUS policy options in Australia.

The following is a list of all the conversations that took place during the two day workshop.

- Enabling and Incentivising Transboundary CCS. Enabling Commercial Competition for Trans-Boundary CCS. How to enable a Western Australia hub via transboundary CO_2? How to achieve scale and push down $/t CO_2 and incentivise cross-border CO_2?
- How do we create good community support for hubs?
- Prioritising Emitters (who gets $)?
- Minister Bowen's role in support for CCUS for action on Climate Change.
- How to align the final investment decision of multiple projects?
- Where is the Money? Who Pays for this? How to bridge the gap of cost of CCUS and ability to pay?
- Infrastructure and Renewables. Developing hub transport infrastructure (and funding commercial models. What is the role and importance of a consistent supply of renewable electricity to a Western Australia CCUS Hub?
- Aggregation hubs - Provision of shared infrastructure.
- How can the government help? What is the government's role? I'm from government, how can I help? How do we get State and Commonwealth government departments to work together/ break down silos to better facilitate development approvals and funding? How can the State Government Help? Is CCUS or CCUS Hubs viable or feasible without government fiscal support? How can government partner with industry to support investment? What is the role of both government and industry in working collaboratively to kick start the CCUS Industry? Role of Industry particularly LNG companies in hub planning and development.
- Utilisation in CCUS Hubs. What are the opportunities for the U-utilisation in CCUS? What are the U opportunities for a CCUS Hub?
- Pilbara CCUS Hub (Opportunities, Investment, Infrastructure)
- Post-combustion and low concentrations CO_2 Capture. How can lower concentration emitters collaborate to support CCUS advancement in WA? What can we do technically to help make capture for hard to abate industries more attractive? Are there novel technologies for example? How can we realise low concentrate CO_2 capture? What is necessary to create value chain? What cost level $/ton CO_2 would we need to achieve to accelerate Formation of CCUS Hubs?
- Pore Space Mandate
- What are the key barriers to a Mid West hub and how do we overcome them?
- Long-term CO_2 Price Predictability to Facilitating Investment in Decarbonisation
- The importance of a national CCUS Strategy to support Hubs
- What are the next steps? (Sequence)
- Operational Workforce of a CCUS project.

- Who is not here that should be here?
- Role of Education / Research.
- What action do we hope to see in 2027 from the Safeguard Mechanism Review?

22 Action Plans

A feature of the Open Space Technology model of workshop facilitation is an invitation for delegates to convene further conversations . Delegates propose an Action Plan which can follow on from the workshop around a specific conversation topic.

CCUSNA is not the facilitator of the Action Plans but will stay across developments arising.

22.1 Action Areas

Social Acceptance
- Create a draft Carbon Management National Strategy and complete input and alignment process

Transboundary CCS
- Assess benefit of transboundary CCS for Australia and develop policy recommendations

Government Advocacy
- Form Advocacy Group to help achieve bipartisan support for CCUS
- Influence required leg/reg changes

Geological Storage Mandate – Australia Wide and/or Statewide
- Think through design considerations

Kwinana Hubs Development
- Identify what position is on next steps
- Consult with Kwinana Industries Council about advocacy position and target activities

Design the Pilbara CCUS Hub
- Engage for alignment

Social and Political Acceptance
Convene a group to draft a snapshot / fact based short paper / comms tool about
- What is CCUS
- Why we need it
- Debunk Myths
- Communicate to public and parliaments

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