Northern Territory Low Emission Carbon Capture Storage and Utilisation Hub

Opportunities for CO_2 utilisation within a Northern Territory CCUS Hub

CSIRO has been working with stakeholders to explore how CO_2 utilisation can support the Northern Territory's decarbonisation and economic growth objectives.

This report comprises the first report of the Northern Territory Low Emission Carbon Capture Storage and Utilisation (CCUS) Hub Business Case project.

The report builds on previous CSIRO research to further explore opportunities for CO_2 utilisation in the Northern Territory. Researchers have used techno-economic modelling to calculate the levelised cost of production for five CO_2 utilisation products and identify a possible roadmap to their generation.

The low-emission opportunity in the Northern Territory

The Northern Territory's abundant natural gas, solar resources, and CO_2 storage potential, along with its proximity to international markets, make it a key player in energy exports and decarbonisation in Australia and the region.

The NT Government has adopted a 2050 net-zero emissions target and is seeking ways to rapidly decarbonise existing energy supplies and attract future zero-emission industries.

Capital city Darwin, a gateway to South-East Asia and the location of globally significant liquid natural gas (LNG) export and industrial activity, is the proposed site for a large-scale Low Emission CCUS Hub. Led by CSIRO, a collaboration is underway on a business case project assessing the Hub's viability on the Middle Arm Peninsula.

If realised, the NT CCUS Hub could be one of the world's largest multi-user, multi-access hubs. One of the aims of the business case project is to identify transition pathways for industry in the region by sharing knowledge and experience that will help improve the likelihood of success. By taking a collaborative and regional view, an accelerated and sustainable industry transition can be explored.

The Northern Territory CCUS business case project

- CSIRO is working to identify decarbonisation and transition pathways for existing and potential future industries that may be established in Low Emissions Hub in the Darwin region of the NT.
- We are working collaboratively with the NT Government and industry on the business case project to assess the viability of a large-scale low-emission CCUS Hub on the Middle Arm of Darwin Harbour.
- This project is also investigating other decarbonisation opportunities as well as CCUS including sector coupling and renewable electrification.
- Task 9 of this project explores opportunities to deploy CO_2 utilisation in the NT, with a focus on the Middle Arm Sustainable Development Precinct. It builds on the CSIRO CO_2 Utilisation Roadmap published in 2021.
- Five CO_2 utilisation opportunities with potential for deployment in the Northern Territory have been identified and a possible development roadmap has been identified.

What is CO_2 utilisation?

CO_2 utilisation is the process of using CO_2 captured from industrial emissions or directly from the atmosphere to create valuable products. Examples of these products include chemicals and fuels, materials for the building sector, food products and plastics.

CO_2 utilisation can provide an abatement opportunity by reducing emissions compared to conventional production and, in some cases, even creating net zero or negative emission products.

While most CO_2 utilisation applications are not yet commercially mature or cost-competitive with conventional products, producers may be able to charge a premium for CO_2-derived products if they support customers' emissions abatement objectives.

For this report, CSIRO identified five CO_2 utilisation opportunities with potential for future deployment in the Northern Territory:

- CO_2 derived methanol – used in the production of plastics and textiles
- jet fuel
- urea – a nitrogen derived fertiiser
- CO_2 derived methane – a potential alternative to natural gas
- mineral carbonates – such as mineral aggregates for building materials.

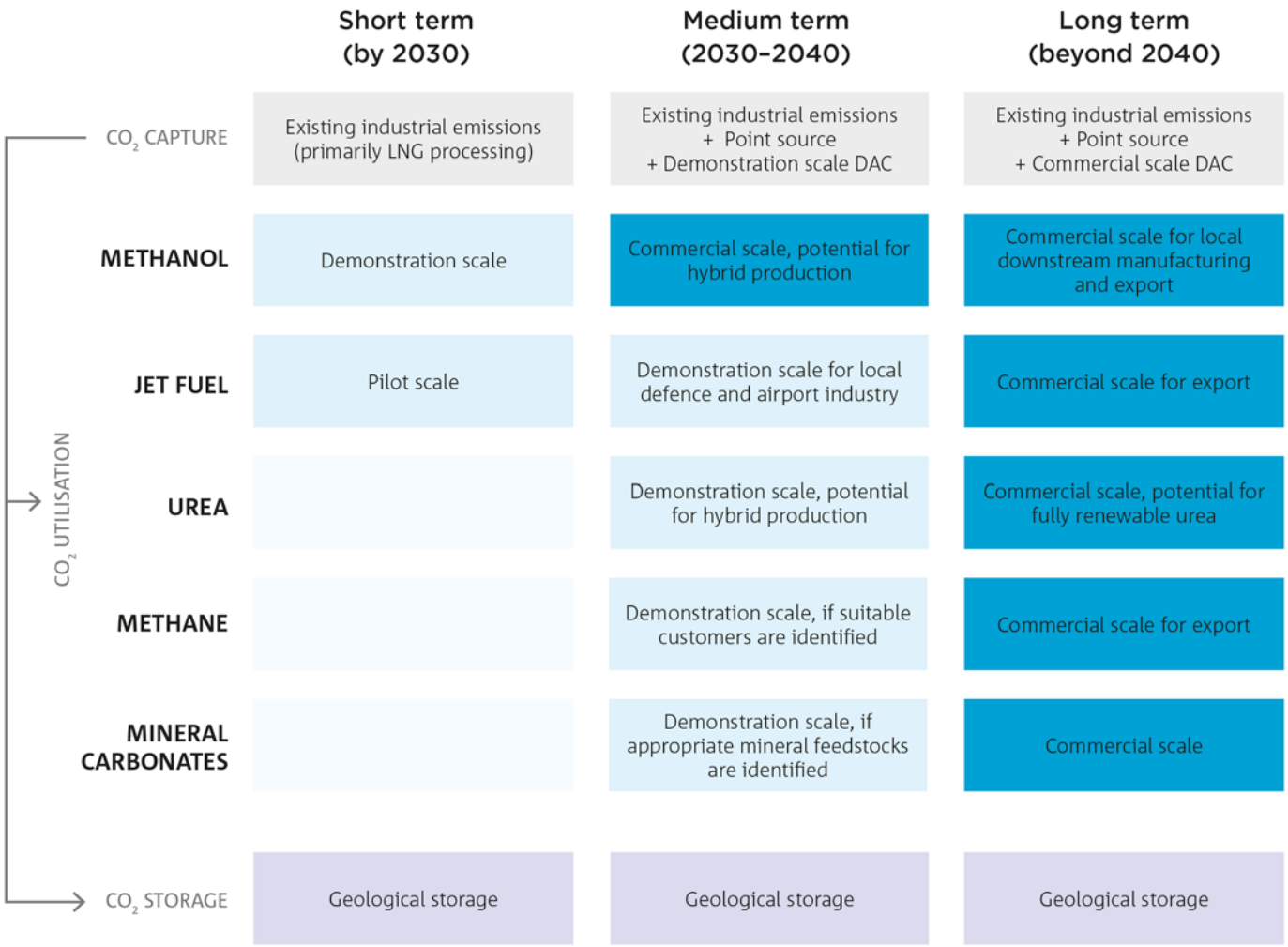


Figure 1: Integrated plan for deployment and scale-up of CCU in the NT

Approach and key findings

Using techno-economic modelling, CSIRO researchers calculated a levelised cost of production for each of the five technologies under base and best-case scenarios.

The levelised cost of production calculates the lifetime costs of production per tonne of product.

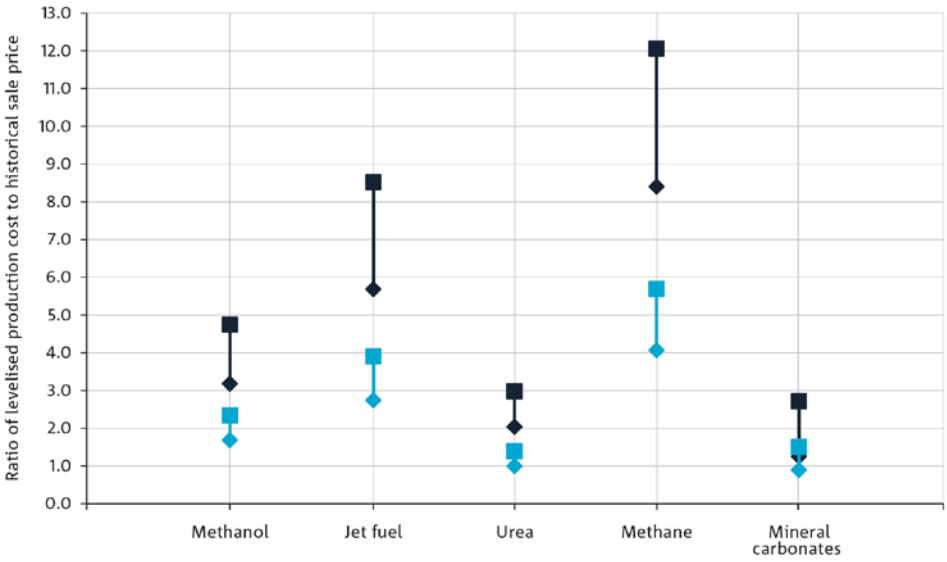
Under the base-case scenario, all CO_2-derived products would need to be sold at a significant premium to break even on production costs. Balancing the sustainability and affordability of CO_2 and other input requirements will be critical to attracting customers for CO_2-derived products.

Under the best-case scenario, all modelled products have significant cost-reduction potential due to technological improvements, feedstock affordability, and economies of scale. With a low-cost CO_2 source (i.e. where CO_2 was provided as part of a hub), mineral carbonates and urea may achieve a break-even price without charging a premium.

The deployment plan for the NT describes an indicative scale-up pathway for the five products in the report. Methanol has the greatest scale-up potential in the short term, with other opportunities including jet fuel and urea production reaching demonstration scale in the medium term.

The economic feasibility of all CO_2-derived products will depend on a variety of other factors including the ability to charge a premium for CO_2 abatement, the cost of competing low-emissions products, and cost increases for fossil-fuel-derived products. Analysis of these factors falls outside the scope of this report.

A hub model – such as that proposed in the NT – can support the deployment and scale-up of CO_2 utilisation activities through increased efficiencies, and the enablement of research, development and demonstration of CO_2 utilisation and related technologies.



This figure shows the best and base case levelised costs of production for CO_2-derived products expressed as a ratio to historical sale prices for their conventionally produced equivalents. Two different CO_2 feedstocks are shown, acid gas removal unit (AGRU) and direct air capture (DAC), which show the impact of varying CO_2 costs on the levelised cost of production. AGRUs are used for liquefied natural gas (LNG) processes and are a source of near zero-cost CO_2 that is commercially mature. DAC technologies are emerging and have yet to reach commercial scale globally, producing CO_2 at a higher cost.

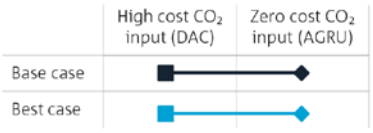


Figure 2: Best and base case levelised cost of production for five prioritised CCU opportunities as a ratio of conventional sale price

The CCUS business case project includes inputs from the wider Northern Territory Low Emissions Hub (NT LEH) collaboration group, whose current members include the Northern Territory Government, Xodus, INPEX, Santos, Woodside Energy, Eni, Total Energies, SK E&S and Tamboran Resources. CSIRO has sought feedback from government and industry on the technical content of the report, CSIRO has sole discretion on including such feedback.

More information

Read the report

Learn more about the NT Low Emission Hub Research

For further information

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B&M | 20-00423