Northern Territory Low Emission Carbon Capture Storage and Utilisation Hub

Suggested business model and execution plans

As part of the Northern Territory Carbon Capture, Utilisation and Storage (CCUS) Hub business case project, CSIRO has published a final report summarising project outcomes to date – including technical, economic and policy studies – and presenting a business case and execution plans.

This fact sheet summarises CSIRO's Northern Territory CCUS Hub business case project final report which reviews work completed across all previous project tasks:

- Macro-economic drivers, Northern Territory and regional emissions, low emission product markets, and identification of key learnings from other low emissions hubs being developed globally (Tasks 0–4).
- CCUS hub technical definition and technical risk reduction studies, including detailed studies on the infrastructure requirements for a CCUS hub, renewable power requirements, cross-sector coupling opportunities and road-mapping for CO_2 utilisation for existing and potential future industries (Tasks 5–9).
- Policy and legislative settings; economic modelling and value proposition; and contractual and financial models to develop an appreciation of the scale of investment required to develop a low emissions CCUS Hub and the subsequent economic returns (Tasks 10–13) – detailed reports for these tasks are available here.

Drawing on this substantial body of research, much of it developed collaboratively with industry and government stakeholders, CSIRO has evaluated the financial and commercial viability of the CCUS hub, and has outlined potential business models and execution pathways that could be used for its development.

Taken as a whole, the project outputs provide an important evidence base to support informed decision making should the CCUS Hub moves toward the next stage of development.

The Northern Territory CCUS Hub business case project

- CSIRO is working to identify decarbonisation and transition pathways for existing and potential future industries that may be established in a 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.
- The project is also investigating other decarbonisation opportunities as well as CCUS. These include sector coupling and renewable electrification.
- Task 14 of this project summarises the research from tasks 0–13 and presents potential business models and execution plans for the CCUS Hub.
- Overall, the business case concludes that the Northern Territory has the geological resources, industrial foundations and strategic location to support the phased development of a CCUS Hub.

The low-emission opportunity in the Northern Territory

Global modelling by organisations including the Intergovernmental Panel on Climate Change (IPCC), the International Energy Agency (IEA) and Net Zero Australia indicates that achieving net-zero emissions by 2050 will require a broad range of emissions-reduction technologies.

Alongside renewable electricity generation, electrification, and low-emission fuel switching, carbon capture and storage (CCS) is identified as one of the approaches that may help reduce emissions from hard-to-abate sectors and existing industrial processes.

Many countries are exploring the development of industrial hubs and clusters where shared infrastructure can support decarbonisation of existing industries while enabling the development of new low-emission industries. These hubs aim to bring together energy, industrial production and carbon management systems in a single location. By sharing infrastructure, participating industries may reduce the cost and complexity associated with emissions reduction.

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.

The Northern Territory offers several characteristics that may support this type of development. Existing LNG operations already capture carbon dioxide, providing potential foundation customers for a future CCS hub, and nearby geological basins have significant geological CO_2 storage potential. High solar irradiance and potential wind resources also create opportunities for renewable electricity generation that could support future low-emission industries.

More broadly, the Northern Territory's economy is closely linked to energy exports and resource development, with LNG accounting for a large share of exports to regional trading partners. As these economies pursue their own energy transitions, demand for low-emission fuels, products and carbon management services may create new opportunities for the Territory to diversify its industrial base and support long-term economic growth.

The capital city Darwin, is a gateway to South-East Asia and the location of a globally significant liquid natural gas (LNG) export and industrial activity, and is the proposed site for a large-scale Low-Emission Carbon Capture Utilisation and Storage (CCUS) Hub. This CSIRO-led collaborative project focused on assessing the business case for the CCUS hub based on the Middle Arm Peninsula of Darwin Harbour (Figure 1).

If realised, the NT CCUS Hub could be one of the world's largest multi-user, multi-access hubs. The business case project identifies transition pathways for industry in the region by sharing knowledge and experience that will help improve the likelihood of success. Building on collaborative and regional perspectives, the business case explores an accelerated and sustainable industry transition.

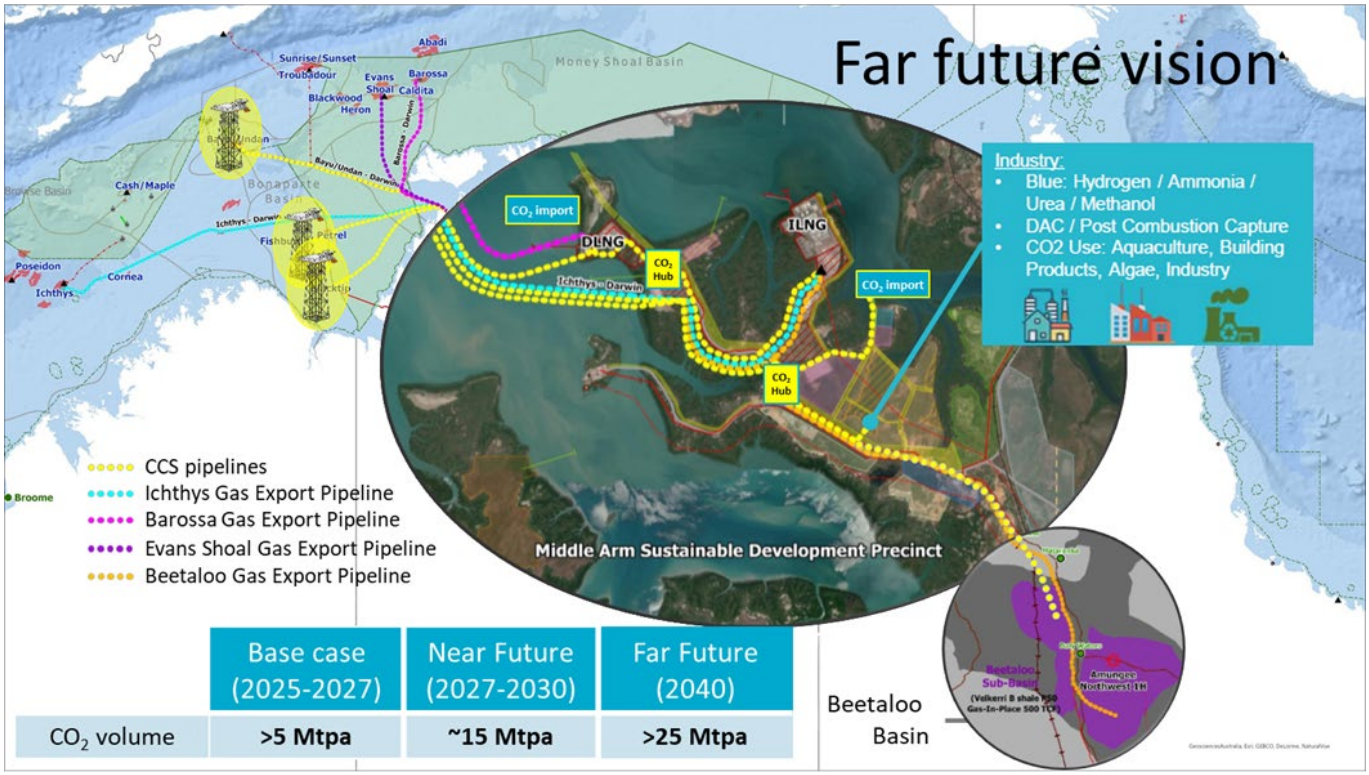

Figure 1: Collaborative Hub Future Phase (2040)

The importance of a business case

Transitioning the global energy system to achieve net zero emissions by 2050 is a complex challenge. Around the world, governments and industry are developing low-emissions industrial hubs that use shared infrastructure to accelerate decarbonisation of existing industries and support new low-emissions development.

CCUS is often a key part of these strategies, but investment decisions depend on clearly defined and well-supported business cases.

Developing large-scale low-emissions industrial infrastructure involves significant technical, financial and coordination challenges. CCUS hubs require multiple participants across capture, transport, storage and industrial sectors, as well as substantial upfront capital investment.

Business cases, underpinned by detailed technical and economic analysis, can help guide development pathways and provide the confidence needed for major investment decisions. International approaches suggest that evidence-based planning can support progression of large-scale CCUS projects elsewhere, providing comparative insights for Australia.

Business case analysis explores potential market demand and future development pathways. In the case of the Northern Territory, emissions modelling suggests that demand for CCUS services from industries located at the Middle Arm Sustainable Development Precinct could vary significantly depending on future industrial development.

Exploring different demand scenarios can help stakeholders understand how infrastructure capacity may evolve over time and how development might respond to changes in industrial activity and energy markets (Figure 2).

Furthermore, business case analysis can examine the broader policy and market settings that may influence project development.

This includes considering how existing regulatory frameworks, carbon pricing mechanisms and investment models interact with emerging low-emissions industries.

Examining international approaches and potential financing structures can provide insights into how risks may be shared and how investment confidence might be strengthened in future project phases.

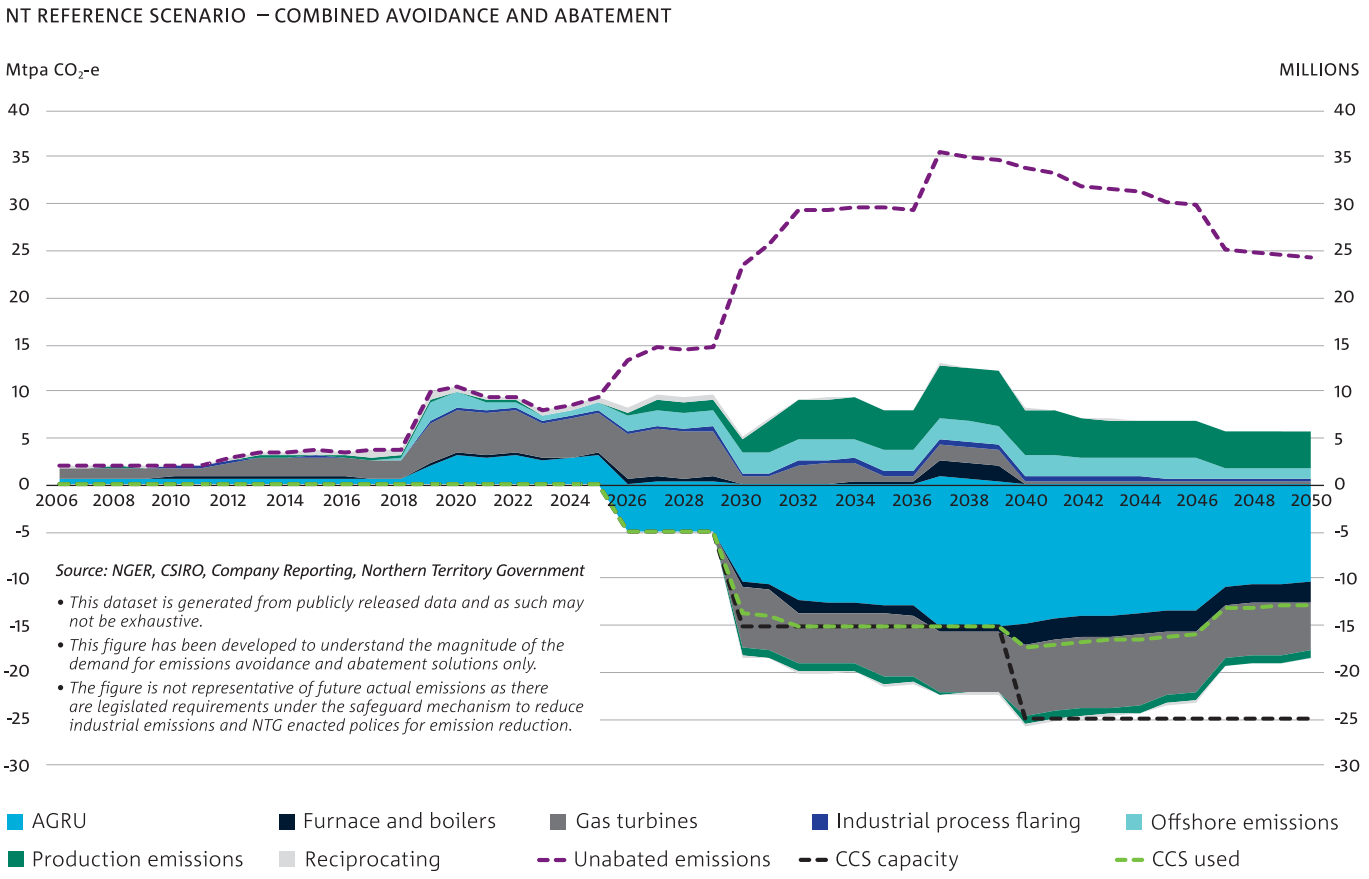

Figure 2: Emissions outlook with all abatement options

Key findings: opportunities in the NT

Overall, the business case finds that the Northern Territory has the geological resources, industrial foundations and strategic location to support phased development of a major CCUS hub.

Existing assets provide a strong starting point

CO_2 is already captured from the Darwin LNG and Ichthys LNG facilities and significant geological storage potential exists in the offshore Bonaparte Basin. Exceptional solar resources and access to natural gas feedstocks provide a foundation for future low-emission industries. The largely greenfield Middle Arm Sustainable Development Precinct (MASDP) could enable shared infrastructure and circular economy principles to be embedded from the outset.

A staged pathway enables growth over time

At the start of the project three development phases were considered. In the Base Case (2025–2027), captured CO_2 from the two LNG plants could be transported for storage in the depleted Bayu Undan field or the Petrel Sub-Basin, enabling around 5 million tonnes per annum (Mtpa) of storage. The Near Future vision adds CO_2 import terminals, a gathering network and additional pipelines to lift capacity to around 15 Mtpa. By 2040 within the Middle Arm, a fully integrated CCUS hub with expanded imports and additional capture could enable storage of more than 25 Mtpa.

Regional markets create new opportunities

Proximity to major Asian economies positions the NT as both a low-emission product supplier and a regional CO_2 storage provider, with forecasts indicating substantial growth in demand for CO_2 shipping and storage services.

New industries could diversify the economy

Low-emission products such as hydrogen, ammonia, methanol and synthetic fuels present opportunities for industrial diversification and growth. Sector coupling within the MASDP could allow industries to share heat, energy and feedstocks, while shared CCUS and hydrogen infrastructure could support cost reductions over time.

Concept designs show a hub capable of handling CO_2 from MASDP industries and imports, with infrastructure that can be developed in phases. Geological storage is not considered a major risk, supporting confidence in long-term capacity.

Key findings: challenges for the NT

Realising this opportunity will require addressing a number of economic, market and policy challenges.

Investment and market risks

The Northern Territory economy is heavily reliant on resource extraction and exposed to global commodity cycles. Achieving growth ambitions will depend on attracting significant private investment during a period of heightened global uncertainty.

Progress will rely on effectively reducing risks to enable investment decisions.

Sustaining long term demand

While emissions modelling indicates strong potential demand for CCUS from MASDP industries, demand could decline after 2043 without new industrial development, as natural gas production falls. Sustained utilisation of large-scale infrastructure therefore depends on attracting additional industries and new sources of CO_2.

Cost competitiveness

Low-emission products currently face cost barriers compared with conventional alternatives that benefit from established supply chains and low-cost inputs. Closing this gap will require shared infrastructure, innovation, scale and targeted policy support.
Renewable electricity costs vary widely depending on load profiles and generation mix, and hydrogen production costs are sensitive to electrolyser efficiency and resource quality. Further work is needed to better understand wind resources and identify low-cost energy storage options.

Although international demand for CO_2 shipping could be substantial, transport costs remain significant, with shipping and import terminal infrastructure contributing materially to overall costs and as such value chain efficiencies will need to be realised.

Policy and regulatory settings

Policy analysis identified gaps in Australia's CCUS and hydrogen frameworks. Existing carbon pricing mechanisms are not sufficient to incentivise large-scale CCUS investment. A clearer national strategy, along with mechanisms that reduce price uncertainty and share risk, will be needed to provide investment certainty.

Coordinated low-emissions industrial development, strong policy support and timely action will therefore be critical if the decision is made to progress the hub to the next stage.

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. Although 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 reports

Learn more about the NT Low Emission Hub research

For further information

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