



Northern Territory Low Emission Carbon Capture Storage and Utilisation Hub

Building the understanding of sector coupling opportunities

CSIRO has been working to build an understanding of sector coupling options that could increase efficiency and reduce waste in industries that could be developed as part of a Low Emissions Hub in the Northern Territory.

This report has been delivered as part of the Northern Territory Low Emission Carbon Capture Storage and Utilisation (CCUS) Hub Business Case project. The report builds understanding of how sector coupling could be considered to realise efficiencies and reduce waste across existing and future industries located on the Middle Arm of Darwin Harbour.

The low-emission opportunity in the Northern Territory

The Northern Territory's abundant natural gas, solar resources, and CO₂ 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 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.
- This project is also investigating other decarbonisation opportunities as well as CCUS. These include including sector coupling and renewable electrification.
- Task 5 of this project was an initial assessment of options for sector coupling as part of the Middle Arm Sustainable Development Precinct development.
- Sector coupling could increase process efficiencies and provide future options for industrial transition as new low-emission technologies become commercially available at scale.

What is sector coupling?

While there is no universally agreed-upon definition for sector coupling, it is generally understood to mean creating connections between the energy sector and other sectors such as industry and transport so they can work together more efficiently and sustainably. The need to increase efficiency is a critical requirement of global emissions reduction goals.

For this report, sector coupling includes electrification, beneficial use of process heat, repurposing of existing facilities, and the creation of new products from waste streams.

The research is focused on the sector coupling opportunities of existing and future potential industries that could be located within the Middle Arm Sustainable Development Precinct (MASDP).

The report summarises some of the benefits of sector coupling, such as reduced environmental impacts and potential reduced costs from sharing infrastructure; as well as some of the barriers, such as project complexity and technical risks.

Six technologies were considered in detail. These were selected for how they could be implemented into industrial chemical synthesis routes and included the production of ammonia, urea, methanol and derivatives. These were:

- hydrogen
- cryogenic air separation including liquid air energy storage
- ammonia and urea synthesis
- methanol synthesis
- direct air carbon capture
- mineral processing of critical energy metals.

It should be noted that the technologies were reviewed at a high level and further research will be required to gain a detailed understanding of their ultimate viability in the MASDP.

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.

Key findings

The review identified several sector coupling opportunities across hydrogen generation technologies, including using 'waste' oxygen from electrolysis as an input feedstock for auto thermal reforming of methane, and using waste heat to drive endothermic reactions or the regeneration of carbon capture materials, including in direct air capture.

Cryogenic air separation: a mature technology that uses refrigeration and compression to liquify and separate oxygen, nitrogen and noble gases, also offers sector coupling potential. The compression trains and chiller systems used for air separation could support other processes – for example, when liquifying hydrogen for storage or transportation. Additionally, when considering the integration of variable renewable energy into industrial processes in the precinct, liquid air energy storage can be used for long duration electrical energy storage.

The report concludes that technology can be used to create a low emissions production hub for the synthesis of ammonia, urea, methanol and derivatives.

Two possible integrated processes are presented: one representing near-term development, the other representing the transition and integration of new technologies into this development in the medium-to-long term. Success will depend on sharing technological and financial risks; potential regulatory frameworks; and the establishment of a central co-ordinating body to manage stakeholder needs.

More information

[Read the report](#)

Learn more about the [NT Low Emission Hub Research](#)

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