

# Gas processing and conversion

CSIRO scientists are developing efficient and low-cost processes to value add to Australia's large natural gas reserves.

Australia has a rich endowment of natural gas, much of which is located offshore, as shale gas or as coal seam gas. These gas resources have the potential to provide cleaner sources of transport fuels, chemicals and energy. To best use these resources, CSIRO is looking at a variety of ways to liquefy or transform natural gas so it is easier to use and transport. Natural gas can be cooled to form Liquefied Natural Gas (LNG) or chemically converted to liquid transport fuels such as gasoline and diesel, and other chemicals. Processes that convert natural gas to liquid fuels are known as Gas-to-Liquid or GTL processes.

Working with the nation's biggest gas producers, CSIRO applies its expertise in the areas of chemical and process engineering and industrial chemistry to address the challenges of natural gas processing and conversion.



CSIRO's unique facilities enable investigation of a wide range of operating conditions and long-term testing of processes.

## Research projects

CSIRO is working on a number of research projects that involve:

- ♦ developing, testing and demonstrating new catalysts to improve the efficiency of natural gas processing
- ♦ making the conversion of natural gas to synthetic fuels and chemicals more economically feasible by developing processes that reduce plant size and cost
- ♦ improving gas separation technologies for oxygen, hydrocarbons and carbon dioxide (CO<sub>2</sub>) for process efficiency improvements and greenhouse gas mitigation
- ♦ developing a concentrated hydrogen supply from GTL processes for fuel cell and hydrogen economy applications
- ♦ researching plastics production from biologically-derived materials such as eucalyptus oil
- ♦ developing purification steps to produce cleaner LNG, resulting in lower processing costs.

CSIRO research is increasing Australia's fuel security and independence by developing more economic methods to purify gas reserves and developing technologies to generate cleaner transport fuels and chemicals.

## Expertise

The gas processing and conversion team uses a multifaceted approach to create more efficient and novel ways to purify and convert natural gas into synthetic liquid fuels and chemicals.



CSIRO is investigating catalyst design to make gas conversion processes more efficient.

We have expertise in:

- ♦ novel GTL processes to produce alternative liquid fuels and chemical products
- ♦ GTL equipment and syngas (a mixture of hydrogen and carbon monoxide and an intermediate in the production of fuels and chemicals from natural gas) microgenerator design
- ♦ catalyst testing and analysis for gas processing
- ♦ GTL equipment design
- ♦ chemical analysis and characterisation of synthetic fuel products
- ♦ low emission routes to hydrogen and synthetic liquid fuels, involving chemical looping
- ♦ high temperature processing of non-oil or non-conventional feedstocks
- ♦ natural gas purification
- ♦ scale up of Fischer-Tropsch processing methods.



*CSIRO has a long-term partnership with Chevron to develop gas conversion technologies for industry application in Australia.*

## Facilities

Our gas processing and conversion research facilities and laboratories are unique in the South-East Asian region. We have developed a range of novel gas processing rigs for chemical processing and analysis of natural gas.

CSIRO has also built Australia's first synthetic fuels research facility. Able to run continuously and unmanned, this unique facility, known as SynCat, is improving GTL processes through focused research programmes. The facility also provides a training ground for Australia's gas processing industry.

## Our partners

CSIRO's gas processing and conversion research draws on a range of capabilities from various CSIRO business units.

We have strong networks with research organisations in Australia and around the world, and work closely with industry, government and university partners including Chevron, Defence Science and Technology Organisation (DSTO), Curtin University, Qenos, Southern

Oil Refineries, The University of New South Wales, Monash University, Ceramtec (USA), the Western Australian Energy Research Alliance (WA:ERA), the Western Australian Government, The University of Western Australia, University of Sydney, University of Tasmania and Swinburne University.

## Getting involved

For further information on how the gas processing and conversion team can work with your organisation and collaborate on research efforts, please contact Dr Seng Lim.

## Key contacts

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## Case study

CSIRO has successfully used heterogeneous catalysis in a process called catalytic partial oxidation (CPO), to achieve high natural gas conversions and high syngas (an intermediate in the GTL process) yields at elevated pressures. The syngas is well suited for further processing via Fischer-Tropsch synthesis to produce synthetic diesel.

We have also developed a process that produces syngas and electricity using CPO. CPO has the advantage over other methods of syngas production of being exothermic (giving off rather than requiring heat/energy for the reaction to proceed). The heat of the reaction can be used to turn a turbine to generate electricity at the same time as producing syngas. The use of CPO for syngas production could also lead to smaller processing facilities compared to those for reforming, allowing the development of gas fields previously considered uneconomic or non-commercial.

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