ATSE

Deep reductions in emissions using CCS

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For as long as fossil fuels are used for energy and industrial processes, carbon capture and storage is an essential technology to limit emissions and keep the global rise in temperature to well below 2°C.

This Action Statement supports the ATSE Energy Position Statement which sets out the challenges and priority focus areas, and a way forward, for the low emission energy systems required to sustain Australia's economic development and future prosperity.

The emissions reduction challenge

In 2015, the Paris Climate Conference (COP21) reached a landmark agreement to hold the increase in the global average temperature to well below 2°C. These targets require an immediate reduction of greenhouse-gas emissions and, later this century, zero or negative emissions.

Australia is a signatory to the Paris Agreement and has its own specific target to reduce emissions to 26-28 per cent below 2005 levels by 2030. Meeting this target will require a range of mitigation actions, including greater energy efficiency and productivity, a switch to low-emissions fuels, renewable energy, energy storage, and perhaps nuclear energy. However, large-scale fossil fuel use will continue for some time to come, and carbon capture and storage (CCS) will be an essential technology for making deep cuts in the associated emissions.

CCS is an increasingly important low-emission technology

CCS encompasses a range of technologies used for capturing and safely storing CO_2 to reduce large-scale emissions to the atmosphere from a variety of combustion and chemical processes. CCS technologies include a number of processes, some recently developed and others that have been used successfully for decades. CCS is a proven, safe, and effective option for reducing CO_2 emissions.

CCS is currently the only technology capable of making deep reductions in emissions from fossil fuel use for power generation and industrial processes. As one of the world's largest fossil fuel exporters, Australia should have a significant interest in the use of carbon reduction technologies for ongoing fossil fuel use, and could contribute its technical and industrial expertise to accelerate the application of CCS by major energy-importing countries such as China.

Energy generation from wind and solar will be increasingly important for reducing emissions, but these are variable sources of electricity. Alongside grid-scale energy storage, the use of coal, gas, or biomass for electricity production, and abatement of the associated emissions using CCS, is a technically viable option for secure and low-emissions back-up for renewable energy generation.

Retrofitting of CCS to existing power stations has been successfully carried out in Canada (Boundary Dam) and the United States (Petra Nova). The application of retrofit CCS is site specific and dependent on factors such as the age of the power station, proximity to potential storage sites, and economics, but is a potential option for some of Australia's existing power stations. Coal and gas still account for over 80 per cent of Australia's total electricity generation, and electricity generation is the largest contributor to greenhouse-gas emissions in Australia.

Carbon capture and storage technologies

CCS technologies effective in capturing and sequestering CO_2 have been used in gas processing for many years. CO_2 is separated from other emitted gases and captured using a range of technologies, most commonly solvents or membranes. The captured CO_2 is then transported by pipeline to a site for secure long-term geological storage. Sites suitable for CO_2 storage usually consist of sedimentary rocks that are porous, permeable, structurally simple, capped by an impermeable rock formation, and occur at a depth of at least 800m in a sedimentary basin. Australia has a number of sedimentary basins that are geologically favourable for CO_2 storage, including the Gippsland Basin in Victoria, which has been identified by the Carbon Storage Taskforce as particularly well suited to large-scale storage, the Surat Basin in Queensland, and the Perth Basin in Western Australia.

Geological storage has been safely underway at the CO2CRC Otway site in western Victoria for more than 10 years. Some depleted oil and gas fields have the potential to store CO_2, with the advantage of existing infrastructure and well-understood geology. Selling CO_2 for US$20-40 per tonne for enhanced oil recovery (EOR) has been useful in offsetting the cost of CCS in the US and Canada. Australia's opportunities for EOR appear to be limited, but should nonetheless continue to be assessed. Australia's LNG production and related CO_2 emissions are increasing and in many cases, the raw natural gas is also rich in carbon dioxide, which must be separated prior to use. The associated CO_2 emissions can be mitigated through CCS, as will be done at the Gorgon LNG project in Western Australia. There, 3-4 million tonnes of reservoir CO_2 will be captured and geologically stored annually, making it the world's largest CCS project.

Biomass sequesters atmospheric CO_2 during its lifetime, but CO_2 is then released when the biomass is used for energy production. This produces a 'carbon neutral' outcome. If bioenergy is combined with CCS (BECCS) and the emitted CO_2 captured, net 'negative emissions' are delivered. Several international bodies have suggested that BECCS may be a component in future global mitigation strategies, but further research is required to determine the mitigation contribution it could make, and its interaction with other uses of biomass. Direct capture of CO_2 from air with CCS has also been proposed as an option for decreasing atmospheric CO_2.

The 2016 Australian Power Generation Technology Report indicates that the levelised cost of electricity from new-build CCS plus coal or gas is greater than that of wind power, but in the same cost range as solar, with CCS having the added benefit of providing 24/7 power. If the cost of energy storage is included for renewable energy generation, then coal- or gas-based energy production with CCS is currently cheaper than wind and solar, although costs for all of these technologies are likely to decrease in the coming years. Retrofitting of CCS to existing coal plants would reduce capital costs further. However, the cost of any CCS project is site- and project-specific. It is possible to utilise captured CO_2 to offset some of the costs of CCS deployment, but this will only account for less than 1 per cent of total anthropogenic emissions.

Excluding CCS from the future energy mix may increase the overall cost of global mitigation. The UK Parliamentary Advisory Group on CCS predicts 'the additional costs of inaction on CCS for UK consumers to be £1-2 billion per year in the 2020s, rising to £4-5 billion per year in the 2040s'. IPCC's 5th Assessment Report also suggests the costs of keeping warming to below 2°C will be 138 per cent higher without CCS.

Despite the carbon reduction benefits of CCS, its introduction in Australia and worldwide has been slow due to a lack of supportive policy initiatives. To encourage the required large investments from industry in commercial-scale demonstration and first-of-a-kind commercial plants, CCS requires bipartisan Government support, including stable and lasting policies for all emissions reduction technologies. With such support, CCS costs will continue to reduce through learning curve experience.

The way forward

ATSE makes the following key recommendations for government, industry, and other stakeholders to reduce carbon emissions through uptake of CCS technology:

1. The Australian Government should consider legislation to limit emissions from existing and new power stations and lead the effort to build and deploy a commercial-scale CCS demonstration plant within the next five years. This is essential to determine the true cost and value of CCS in lowering emissions and increasing energy security in Australia.

> Overseas experience and available data for Australia suggests that retrofit CCS is likely to be cheaper and faster to implement than new-build. Hence, as a first step, there should be a focus on retrofitting CCS technology at some of Australia's existing coal and gas-fired power plants.

> Australia should seek to learn from successful CCS projects by strengthening international cooperation and collaboration in CCS research and development.

> The cost of CCS in Australia both now and in the decades ahead needs to be determined relative to the cost of renewable energy plus appropriate grid-scale storage. Comparison of CCS and renewables costs without consideration of energy storage is inappropriate.

2. Given the importance of iron ore, metallurgical coal, and LNG exports to the Australian economy, Australia should work with major importing countries to accelerate the application of CCS to industrial processes globally.

> CCS is proven to be effective in reducing emissions from large-scale industrial processes, and should therefore be implemented in this sector where possible. As one of the world's major exporters of metallurgical coal and iron ore, Australia has a vested interest in greatly accelerating development and demonstration of industrial CCS to determine the cost in a range of settings.

3. Australian governments should encourage emissions reductions from all energy generation technologies through bipartisan, stable and long-lasting measures, with options to support a technology-neutral approach to emissions reduction such as:

> Regulation of CO_2 emissions from all electricity generation technologies, with a requirement that all generators comply with specified levels; or

> A national price on carbon, which will encourage investment in low-carbon technologies, including CCS, and diminish unabated high-carbon operations.