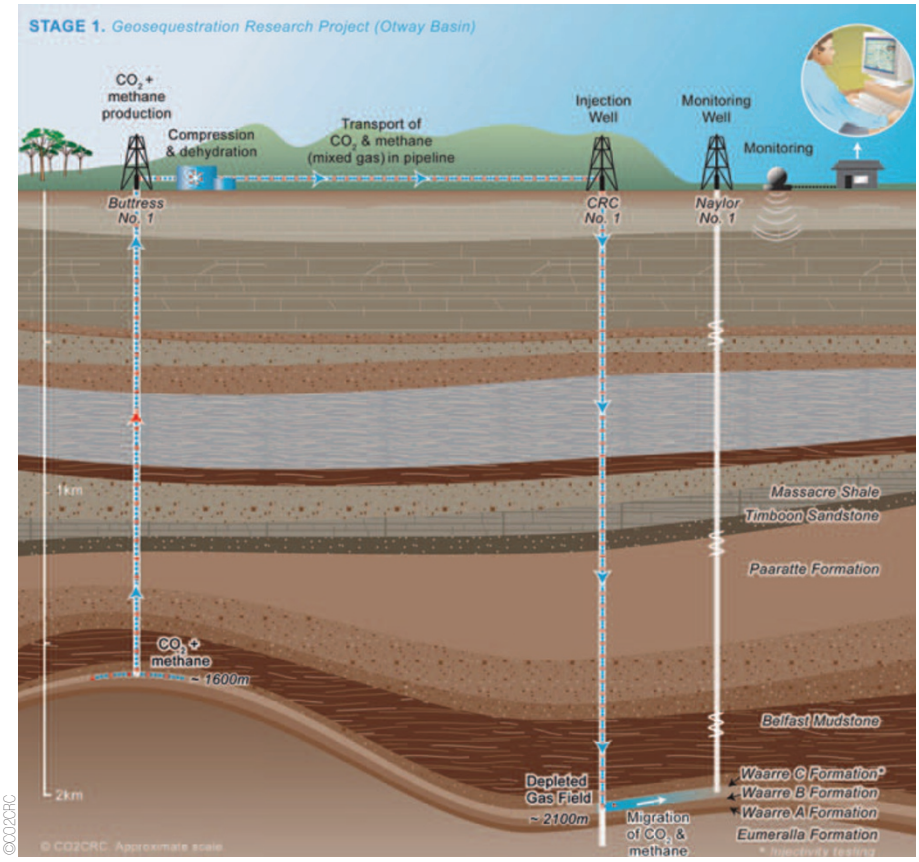
Carbon storage deep down under

As the world's largest trial carbon storage project gets underway, some are questioning its necessity. Hannah Hoag reports from Australia

Perched on the southern edge of Australia, the Otway Basin spreads offshore from Cape Jaffa in South Australia, through Victoria, to the northwest coast of Tasmania. For nearly 100 years, gas wells have been drilled into the onshore portion of the basin that was formed when Antarctica broke free of Australia. Now researchers are probing the basin for its capacity to store carbon dioxide generated from Australia's coal-burning power plants. But some are asking if the world needs another demonstration project.

The Otway Basin Pilot Project, Australia's first carbon sequestration demonstration project — and perhaps the most intensely monitored — kicked off in February when the drilling of a 2,100-metre well began near the small town of Warrnambool, about 250 kilometres from Melbourne. Peter Cook, head of the Canberra-based Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) that runs the project, says they plan to begin injecting gas into the new well in July. By the end of the year, up to 100,000 tonnes of supercritical carbon dioxide will have been injected into the natural reservoir.



Concept for the Otway Basin pilot project

PROMISING PROSPECTS

Consisting of porous sandstone overlain with an impermeable mudstone, the Otway Basin has been identified as Victoria's most suitable onshore carbon storage site. After the carbon dioxide is injected, researchers expect it to disperse through the porous rock, but remain locked below the mudstone seal. Geologists say rock samples from the site show that both the sandstone layer and the cap-rock above it have the correct features to safely inject and store the carbon dioxide.

If the gas does leak, it will be detected by an extensive monitoring system sniffing the surrounding soil, water and air. Tracers will distinguish the injected carbon dioxide from that produced by vegetation or other natural sources. "Because of the risk assessment and all our geological knowledge of the site, we don't expect any carbon dioxide to leak, but there could be some force that we cannot see," says Kevin Dobbs, at CSIRO Petroleum in Perth and CO2CRC.

> "These are important experiments in terms of bringing down the costs of carbon sequestration"
> Peter Cook

WORLD FIRSTS

The reservoir holds promise for the state's future efforts to curb its greenhouse gas emissions. According to a study by the Australian Petroleum Cooperative Research Centre, Australia could currently store 25–30% of its carbon dioxide emissions using such sites. And Cook says that as more suitable sites are found and as power plants are built closer to storage facilities, the capacity to capture carbon dioxide will grow. Well-chosen and maintained sites should be able to retain 99% of buried carbon for over 1,000 years.

Although it is the world's largest carbon burial demonstration site, Otway Basin is smaller than the world's biggest commercial carbon burial project at Sleipner in the North Sea. There, the injected carbon dioxide enhances oil recovery, enabling Statoil to recover some of the costs of carbon storage

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Black and brown coal produces 85% of Australia's electric power generation

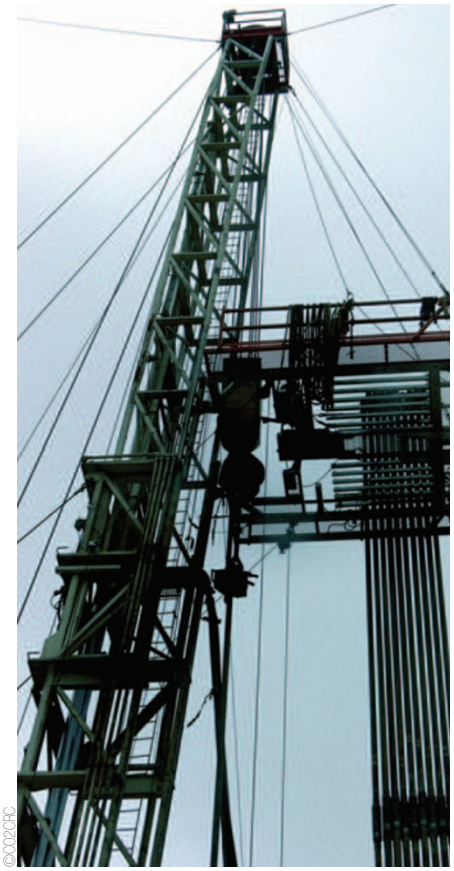
and save carbon taxes. The Otway project will help determine which injection and monitoring methods are most cost-effective for underground burial. "These are important experiments in terms of bringing down the costs of carbon sequestration," says Cook.

CHALLENGING CONSENSUS

Many environmental groups are not enthusiastic about burying carbon, saying that scientific efforts and financial investments should focus on cutting emissions rather than the subterranean storage of greenhouse gases. "The current commitment of public funds by the Australian, Queensland and Victorian governments toward R&D of coal capture and storage [is] about A$800 million," says Ian Lowe, president of the Australian Conservation Foundation, and emeritus professor at Griffith University. "By comparison, we have spent less than A$100 million on all forms of renewable energy supply and about A$10 million on efficiency improvements."

But it is unlikely that coal is on its way out in Australia. Black coal and the dirtier brown coal are abundant and account for producing 85% of the country's electric power generation. In 2003, Australia was the world's leading coal exporter, supplying 238 million tonnes of coal to the international market. Globally, 25% percent of the world's energy demand is met by coal, and the International Energy Agency only expects coal use to rise – nearly 1,400 gigawatts of new coal-fired power generation capacity may be built globally between now and 2030, compared with the current global capacity of 1,100 gigawatts.

Others are asking whether we are wasting time we don't have by building small-scale carbon capture and storage facilities. "Every step we delay, more power will come on the grid without this technology and it will become more and more entrenched," says Dobbs. How much more additional research is needed before we start to deploy carbon capture and storage technology? David Hawkins, the director of the climate change centre at the Natural Resources Defense Council, a US non-profit, recommends the carbon dioxide emissions from all new plants be captured and stored. "We know enough about the geologic storage mechanisms to do this safely and effectively," he says.



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Drilling at the Otway Basin test site

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RISK ASSESSMENT

Hawkins and Stefan Bachu, a senior geosciences advisor at the Alberta Energy and Utilities Board, Canada, presented a paper at the 8th International Conference on Greenhouse Gases in Norway last year evaluating the risks posed by proceeding with large-scale carbon capture and storage compared with delaying implementation. The pair found that if the technology was up and running by 2012 — even with "unrealistically high assumed leakage from the sites" — net carbon dioxide emissions to the atmosphere from these plants would be far less than if their construction were delayed for the data analysis from additional demonstration projects. "We aren't arguing that we go out and drill a hole anywhere and start pumping carbon dioxide into it — there need to be site surveys," he says. "But rather than a ten year research program, if there is a coal-powered plant being built it should have its carbon dioxide captured."

Either the cost of carbon capture and storage will have to drop or the cost of carbon emissions will have to rise before these plants are built. In their recent report, *The Future of Coal*, researchers at the Massachusetts Institute of Technology found that the technology would not be adopted until carbon emissions cost $30 per tonne. Until then, it will always be cheaper to float the carbon dioxide into the air than to bury it into the ground. □

Hannah Hoag is a freelance science writer.