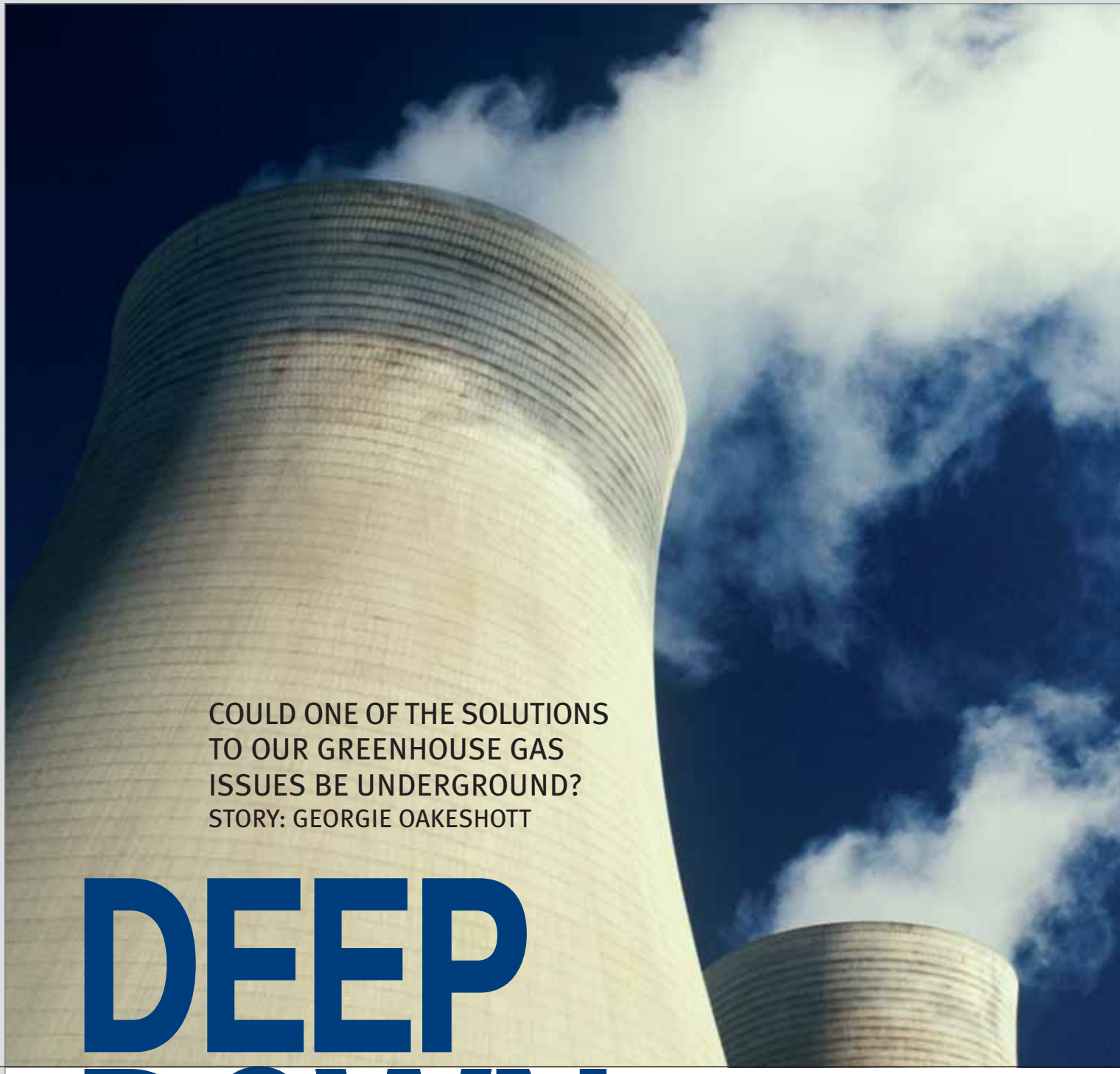

COULD ONE OF THE SOLUTIONS TO OUR GREENHOUSE GAS ISSUES BE UNDERGROUND?

STORY: GEORGIE OAKESHOTT

DEEP DOWN

Carbon dioxide: two simple words that have the whole world talking—or arguing to be more accurate. As the debate on greenhouse gas emissions hots up, along with the planet, the search is on for new ways to quench our thirst for energy without putting the world out to dry.

The International Energy Agency forecasts a 60 per cent increase in global energy demand by 2030, with fossil fuels expected to meet more than 80 per cent of this demand.

Accompanying these predictions are warnings about a global increase in temperatures of around 2 per cent, with heatwaves, droughts, more intense storms and rising sea levels to go with it.

"Geosequestration is not something for the distant future, it is happening now in various parts of the world."

Photo: AAP

That's why scientists, politicians, environmentalists and mining companies are closely examining options for dealing with our emissions, including the option of burying them deep underground, using a process known as geosequestration.

That process involves capturing carbon dioxide (CO_2) from major stationary sources (such as power stations), transporting the CO_2 (usually by a pipeline) and then injecting it into suitable geological formations.

Geosequestration has captured the interest of the House of Representatives Science and Innovation Committee, which is currently looking into the science underpinning the technology; the potential environmental and economic benefits and risks; the skill base in Australia to advance it; regulatory and approval issues; and how to best position Australian industry to capture possible market applications.

"The inquiry is assessing the potential application of geosequestration technologies to Australia, and how Australian scientists and industry might benefit from national and international developments," said Committee Chair, Petro Georgiou (Member for Kooyong, Vic).

Considering geosequestration is only just beginning to gain public recognition here and overseas, it's surprising to discover how far the technology has advanced.

The global flagship for sequestration is in the North Sea, about 250 kilometres off the coast of Norway, where more than a million tonnes of carbon dioxide have been injected 1,000 metres beneath the seabed every year since 1996.

In Australia several commercial projects have been announced in Western Australia, Queensland and Victoria. A major demonstration project is also underway in the Otway Basin in western Victoria, with plans to commence injecting carbon dioxide underground next year.

"Geosequestration is not something for the distant future, it is happening now in various parts of the world," says Dr Peter Cook, chief executive of the Cooperative Research Centre for Greenhouse Gas Technologies (otherwise known as the CO2CRC), which is responsible for the Otway Basin project.

"Australia is in the fortunate position of having outstanding researchers and technologists, an extensive knowledge base and in many parts of the country the right geology. It is likely to gain greater benefit from the application of geosequestration than almost any country," he says.

The right geology for securing carbon dioxide deep underground is a porous and permeable rock, such as sandstone, where the grains are smaller than a millimetre.

"Geosequestration looks at storing the carbon dioxide between those grains," explains CSIRO expert Dr Lincoln Paterson. "It is a space normally occupied by water, so as you put the CO_2 in, it pushes the water out."

Sedimentary basins and depleted oil and gas fields are prime sites for geosequestration. According to Dr Cook, Australia has enormous capacity—enough storage space for hundreds of years of carbon dioxide emissions. But is it safe?

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"Use or modification of any natural system carries a risk, and there can never be 100% certainty," admits Dr Cook. Nevertheless he believes the chances of carbon dioxide leaking from a well-characterised site are "very low".

There has been at least one major natural escape where carbon dioxide was released from an African volcanic lake (Lake Nyos), asphyxiating thousands of people and domestic animals.

But Dr Cook doesn't believe this occurrence is any way analogous to geosequestration sites being researched world-wide.

"CO2CRC modelling indicates that it is extremely unlikely that a catastrophic leak could ever occur in any areas being considered for geosequestration, because of the nature of the geology in which the CO_2 would be stored," Dr Cook says. "The main lessons from the Lake Nyos event is that CO_2 should not be stored in unstable volcanic environments (particularly volcanic lakes); there is no prospect of CO_2 being stored in such a geological location in Australia."

To put this all in perspective, says Dr Cook, there are over 1,000 places around the world where explosive natural gas is stored underground, some under major cities and often at depths far shallower than the depths at which CO_2 will be stored. "People accept that in Australia, and around the world without difficulty," he says.

But not every submission to the inquiry is so supportive. The Climate Action Network of Australia, an alliance of organisations including the Australian Conservation Foundation, Greenpeace and the World Wildlife Fund Australia, says proponents of geosequestration must guarantee no significant impact on subterranean biodiversity and water supplies and that this must be confirmed through independent and publicly available scientific review and monitoring.

CANA believes no geosequestration projects should be approved and no research and development projects should go ahead until stringent and unambiguous regulatory principles are in place, which have involved full public consultation.

"Governments must establish a stringent legal framework for regulating geosequestration facilities that ensures the proponents of geosequestration assume complete legal liability for the full economic, environmental and social costs of leakage over the lifetime of the storage," says CANA.

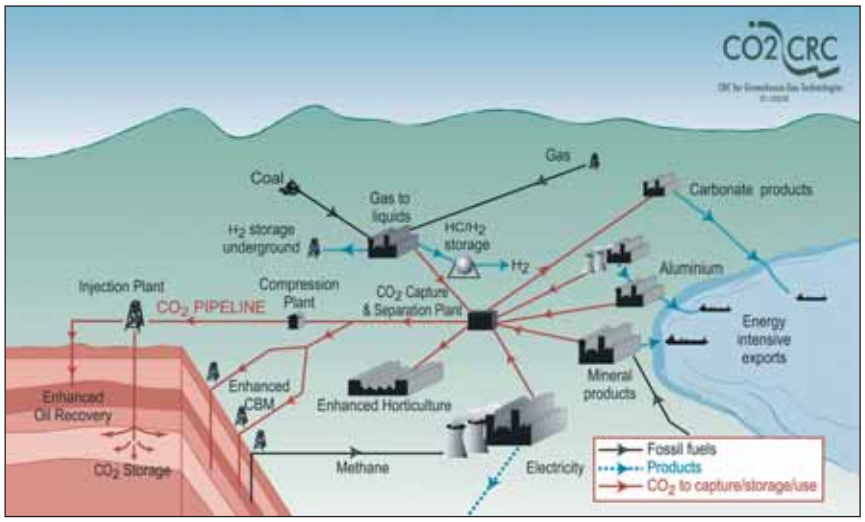
It also raises concerns about the economic costs. "Geosequestration takes investment away from renewable energy, energy efficiency and demand management, which are sustainable, create more jobs than fossil fuels, are lower risk alternatives, more proven and mature technology, less costly and deliver equal or better greenhouse emission reductions at source. Geosequestration will instead mean investment in new fossil fuel infrastructure," CANA says.

Similar concerns are expressed by the Western Australian Environment Department. "Research and operational expenditure on geosequestration is likely to compete for funds with other low or zero emission technologies that have potential environmental benefits," the department says. "While a healthy balance of funding for a range of solutions is likely to be beneficial, it may be unwise to view geosequestration as a magic bullet which then risks diverting effort from reducing power demand and hence emissions, or developing other generation technologies."

CANA also points to research showing it is "clearly possible" that electricity generated from coal with geosequestration may be more expensive than other less polluting sources, such as gas and wind power.

Figures quoted in the submission from the CO2CRC indicate that retail electricity prices could increase by about 15 to 20 per cent.

The future siting of power stations would also become an issue. "At the present time, siting of a power station depends on factors such as the market for the electricity, the source of the fossil fuel (usually coal), the location of cooling water and the planning regime," says Dr Peter Cook. "In the future, consideration will also have to be given to the location of a potential geosequestration site. Indeed it would be prudent for all future power stations in Australia to be sited with full consideration being given to future geosequestration options."



An emission free vision for the future. Diagram: CO2CRC

As for overall benefit, Dr Cook estimates that use of geosequestration could eventually save the Australian economy some $2 billion per annum.

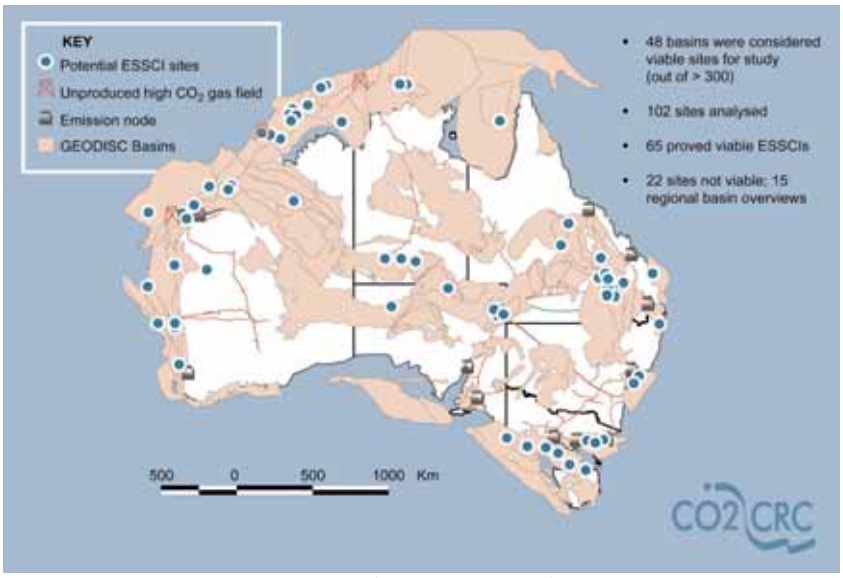
"Geosequestration has the potential to be one of the most important technologies available to us for decreasing CO_2 emissions to the atmosphere whilst continuing to access the benefits of fossil-fuel based energy systems," Dr Cook says.

"We're not saying it's a silver bullet. We're saying it will be part of the mix of measures that will be

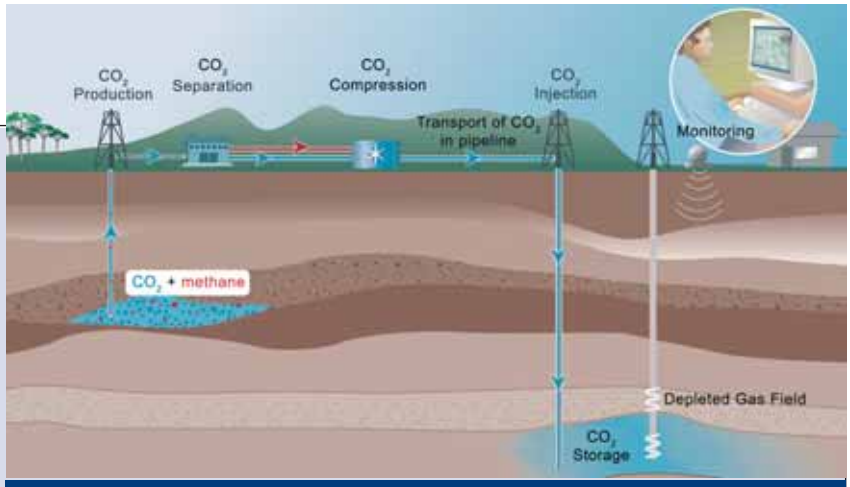
"Governments must establish a stringent legal framework for regulating geosequestration facilities."

needed to address climate change and carbon dioxide concentrations. Where it fits in the mix is still to be determined in terms of whether it will be 10 per cent of the solution or 50 per cent of the solution. It won't be the total solution, but it will be an important part of the solution." ■

For more information on the geosequestration inquiry by the House of Representatives Science and Innovation Committee, visit www.aph.gov.au/house/committee/scin or email scin.reps@aph.gov.au or phone (02) 6277 4150.



Location of Australian sites assessed for CO_2 storage potential. Map: CO2CRC



CO2CRC pilot project concept. Diagram: CO2CRC

LEADING THE WAY

GEOSEQUESTRATION projects being undertaken in Australia are some of the most advanced in the world, according to the project developers.

In the Otway Basin of western Victoria the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) is undertaking a large scale demonstration of geological storage of carbon dioxide.

The project involves carbon dioxide production from a natural gas well; transport by pipeline; injection into a deep porous/permeable geological formation overlain by an impermeable seal; and the monitoring and verification of the behaviour of the stored CO_2-rich gas.

"Up to 100,000 tonnes of CO_2 will be injected until 2009 and monitoring will continue until mid 2010," notes the CO2CRC in its submission to the House of Representatives inquiry into geosequestration.

"Injection, logging, monitoring and modelling technologies will be evaluated for their cost effectiveness and accuracy and industry (including small and medium enterprises) will have the opportunity to learn from the project and develop commercial opportunities from the findings."

In Queensland, the ZeroGen project claims to be a world first, commercial scale demonstration project that will integrate coal gasification technology with carbon capture and storage for baseload electricity production.

While still in its development stage and subject to funding and approvals, ZeroGen's developers, the Stanwell Corporation, estimate that it will result in a net saving of up to 420,000 tonnes of CO_2 per year when the plant is operating at its expected maximum capacity and availability.

At its Denison Trough site, near Emerald in central Queensland, two wells have been completed: one, the natural gas production well, is 1,500 metres deep and the other, the CO_2 injection well, is 2,000 metres deep.

"The project has undergone extensive value engineering studies and peer reviews and has been endorsed by the world's largest electricity research organisation—that is, the Electric Power Research Institute, or EPRI—based in the United States", Stanwell Corporation's acting chief executive officer, Gary Humphrys, told the House of Representatives Science and Innovation Committee. "EPRI has advised that the ZeroGen project represents a major step towards the ultimate commercial deployment of advanced coal-powered systems with CO_2 capture and storage."