Carbon Capture and Storage Law for New Zealand: A Comparative Study

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Carbon capture and storage, or geosequestration, is an emerging technique to address climate change by reducing emissions of carbon dioxide. New Zealand law does not presently provide for carbon capture and storage. The Crown Minerals Act 1991 and the Resource Management Act 1991 do not make it possible. Canada and Australia offer useful comparisons, as, to a lesser extent, do the European Union and the United States. The comparisons assist in an analysis of the main issues involved in creating a legal regime for New Zealand: rights to real property, title or permits, relationship with oil and gas operations, regulation, liability, and relationships with other legislation.

1. INTRODUCTION

Carbon capture and storage, or "CCS", is a technology for reducing the emission of carbon dioxide, the main greenhouse gas ("GHG") responsible for anthropogenic climate change. CCS, also known as geosequestration, is therefore a means of slowing the rate of global warming.[1] It is an emerging

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1 A useful overview of CCS is provided by Simon Shackley and Clair Gough (eds), *Climate Change and its Storage: An Integrated Assessment* (Aldershot: Ashgate, 2006). It examines the general context of climate change, geology, engineering, public perception, two case studies and a comparison with nuclear power. A legal chapter examines international, European and United Kingdom laws, particularly those concerning marine and environmental matters. Two other valuable introductions are International Energy

technology; projects on a commercial scale are only just appearing. There are four stages to CCS: capture, transport, injection, and storage or disposal. In capture, carbon dioxide (CO_2) is caught or separated at the source of its production. The most likely sources are large-scale combustion, especially in a coal-fired power station. The capture or separation is a matter of chemical engineering, and a number of different processes are under investigation to separate CO_2 from other gases like ordinary air. Other CO_2 production sources that may be suitable are natural gas treatment plants (natural gas from the Kapuni field in Taranaki is 40 per cent CO_2 before treatment) or industrial plants like cement and steel works. The transport of CO_2 will most likely entail dedicated pipelines. Storage, or geosequestration, requires a geological formation into which it is possible to inject quantities of CO_2, and which will prevent the gas from finding its way back to the surface. It therefore requires a reservoir element and a seal. Depleted gas reservoirs have such characteristics, and may be suitable CCS sites, but deep saline aquifers may play a greater role.

It is the capture and separation stage that presents the greatest technological and economic challenges to the implementation of CCS on a large scale. In contrast, pipelines and wells, whether used for exploration, extraction, or injection, are long-established technologies, proven in extensive use in the petroleum industry. (The injection of gases into geological formations is already common in many countries for natural gas storage, for enhanced oil recovery, and for the disposal of dangerous material such as "sour gas" containing hydrogen sulphide.) Similarly, it is geologically possible for natural formations to hold large quantities of gases under high pressure without escape to the atmosphere. There are numerous examples where formations have retained their integrity for millions of years. Further, the risk of leakage declines over time; injected CO_2 tends rapidly to become more stable, merging with subsurface fluids and materials. It is estimated that the fraction of CO_2 retained in well-chosen and well-managed CCS geological storage sites is very likely to exceed 99 per cent over 100 years and is likely to exceed 99 per cent over 1,000 years.[2] However, it is plainly essential to select suitable storage formations, to investigate old wells into the formation to prevent leakage, to manage injection

Agency ("IEA"), *CO_2 Capture and Storage: A Key Carbon Abatement Option* (Paris: OECD/IEA, 2008) and the report of the Australian House of Representatives Standing Committee on Science and Innovation, *Between a Rock and a Hard Place: The Science of Geosequestration* (Canberra: Parliament of the Commonwealth of Australia, 2007), chapter 7 of which analyses the legal issues.

2 B Metz et al (eds), Intergovernmental Panel on Climate Change Special Report, *Carbon Dioxide Capture and Storage* (Cambridge: Cambridge University Press, 2005); also at <www.ipcc.ch> 14. "Very likely" is a probability between 90 and 99%; "likely" is one between 66 and 99%.

carefully, and to carry out extensive monitoring and verification for a long period.

CCS will come at a price. The International Energy Agency estimates that capture and storage from coal-fired power plants will typically cost USD 50 per tonne of CO_2 mitigated, once the technology has matured. Today's costs are about twice as much. The costs at gas-fired power plants will be somewhat higher. Total electricity generation costs including CCS are about 75 to 100 per cent higher than for conventional steam cycles without CCS, but may reduce in the longer term. The calculation of such costs is complicated by the large increase in construction costs between 2000 and 2008.[3] The emergence of CCS on a large scale will plainly depend upon how these costs compare to the emergent price put on carbon dioxide emissions by climate change policy measures. Price pressure of some kind is a *sine qua non* for CCS to have any kind of economic viability.

One must take care not to overstate the role that CCS may play in the fight to reduce anthropogenic climate change. On the international level, the International Energy Agency ("IEA") in its examination of the effect of different policy scenarios globally thinks that CCS will play a role, but by no means a dominant one. It evaluates the differences between the Reference Scenario, which is the continuation of existing policies, and the 450 Scenario, which sees the introduction of policies likely to stabilise CO_2 concentrations at 450 ppm in the atmosphere. The 450 Scenario would see a total of $600 billion injected into CCS projects from 2010 to 2030.[4] CCS plants would be deployed mainly after 2020, and by 2030 would satisfy 5.4 per cent of global demand for electric power. CCS would play a substantial role in the United States, but a smaller one in other parts of the world. A carbon price is necessary to make CCS power plants competitive with conventional plants. CCS will become commercial with a carbon price and cap-and-trade in the OECD and other major economies from 2021 on, but investment in CCS will require the support of governments to mitigate risks. CCS will make a significant contribution to the decarbonisation of electric power production globally by 2030 under the 450 Scenario: 1.1 Gt of CO_2 reduction, out of 9.3 Gt, i.e. 11.8 per cent. But one must be realistic; that contribution comes well after the contributions of demand reduction (mostly in response to energy efficiency measures), renewables and nuclear. CCS is only one part of the overall picture.

This need for care not to overstate the role of CCS is all the greater in New Zealand. Among developed countries, it has a unique emissions profile, in that agricultural emissions contribute 48.2 per cent of total emissions (in

3 IEA (2008), supra note 1, at 45, 60–66.

4 International Energy Agency, *World Energy Outlook 2009* (Paris: OECD/IEA, 2009) 223–235, 271–273 for the facts and figures in this paragraph.

2007), mainly in the form of methane, compared to a more typical 11 per cent.[5] In addition, gas and coal produce only about 34 per cent of the country's electricity; most is generated from hydro and geothermal energy, although the proportion varies according to rainfall.[6] There is only one large coal-fired power station, at Huntly, and it is aging and less efficient in its use of energy than a modern plant would be. There are few other point sources of CO_2 large enough for commercial-scale CCS. CCS is therefore less of a solution for New Zealand than it is for many other countries. CCS will at most be one of a number of methods put in place to reduce the nation's CO_2 emissions and comply with its obligations under the United Nations Framework Convention on Climate Change. On the other hand, CO_2 emissions and the use of fossil fuel in electricity generation have grown rapidly since 1990, and technological options can change quickly. New sources of natural gas, or new uses for the large lignite deposits of Southland, could open up new scenarios where CCS is relevant.[7]

The New Zealand government is co-ordinating research on CCS, primarily on the availability of suitable sink formations.[8] Possible CCS disposal regions include Taranaki, Waikato, Otago and Southland. Taranaki is attractive on account of the collocation of sources of CO_2, likely sink formations, and a higher degree of geological knowledge. The Waikato has deep coal and saline aquifer potential. It is not known whether the most promising sites will be found onshore or offshore. However, New Zealand is tectonically active, and faulting limits the size and stability of potential sink formations, so there is a premium on risk assessment techniques.[9] The Ministry of Economic Development is undertaking a programme of work on the regulatory and legal issues.[10] The New Zealand government is taking part in international research collaboration, in particular the Australia-based Cooperative Research Centre for Greenhouse Gas Technologies ("CO2CRC") and the Global Carbon Capture and Storage Institute.

Whatever views one holds on the future role of CCS in New Zealand, there

5 *New Zealand's Greenhouse Gas Inventory 1990–2007* (Wellington: Ministry for the Environment, ME 928, 2009) 19.

6 Ministry of Economic Development, *Energy Data File 2009*, 102.

7 "Get real on clean technologies, Minister tells coal industry", *New Zealand Herald*, 28 February 2008, details an exchange between the Minister of Energy and coal company Solid Energy on the extent to which CCS should be a priority.

8 R Funnell, "Overview of New Zealand's CO_2 Storage Options", in *Carbon Capture and Storage: Where are We Now? Proceedings of the International Carbon Capture and Storage Seminar*, Wellington, 27 April 2009, at <www.crl.co.nz>.

9 D Darby, R Funnell and K Higgs, "Geosequestration: its Role in a Sustainable Future for New Zealand Gas Resources", 2006 Petroleum Conference Proceedings, at <www.crownminerals.govt.nz>.

10 K Riddell, "Strategy and Regulations for CCS in New Zealand", in *Carbon Capture and Storage: Where are We Now?*, supra note 8.

is sure to be agreement that the legal framework should not be an obstacle to it. At present it is. The purpose of this article, therefore, is to inquire into the requirements for a suitable legal framework for CCS. It does so by a comparative analysis that features Canada and Australia, and touches on the United States and the European Union. The article examines rights to real property, the system of titles or permits for CCS, regulation, the relationship of CCS with oil and gas operations, relationships with other legislation, and liability. The article does not trace each issue into a fully shaped solution for New Zealand law; sometimes the solution is reasonably obvious, but at others it needs a good deal more consideration. The focus of the article is on the storage or disposal part of the CCS sequence; the earlier stages raise few legal issues any different from those concerning any large construction project.

2. THE PRESENT LAW

2.1 New Zealand

New Zealand law does not provide for carbon capture and storage. The Crown Minerals Act 1991 ("CMA") may be the first thing that comes to mind as doing so, but in fact it cannot be read to include CCS among the activities that it authorises. In order to ascertain the import of the CMA, one works back from the offence provision, s 100: every person commits an offence against the Act who contravenes s 8. Section 8 says that no person may prospect or explore for, or mine, Crown-owned minerals in land unless he or she holds one or another kind of permit granted under the Act or is otherwise exempt. One must therefore analyse three elements: (i) prospect, explore for, or mine; (ii) Crown-owned; and (iii) mineral. For the moment we will focus on the first element.

"Prospecting" is defined in s 2 of the CMA:

> **Prospecting** means any activity undertaken for the purpose of identifying land likely to contain exploitable mineral deposits or occurrences; and includes—
> (a) Geological, geochemical and geophysical surveys; and
> (b) The taking of samples by hand or hand held methods; and
> (c) Aerial surveys,—
> and **to prospect** has a corresponding meaning

The core of the definition appears to be "exploitable mineral deposits or occurrences". It is arguable that this could extend to mineral structures in the subsoil, which could be exploited by CCS operations. However, one must be careful with the use one makes of more open language in a definition like this; one must read the statute as a whole.

"Exploration" means:

> … any activity undertaken for the purpose of identifying mineral deposits or occurrences and evaluating the feasibility of mining particular deposits or occurrences of one or more minerals; and includes any drilling, dredging, or excavations (whether surface or sub-surface) that are reasonably necessary to determine the nature and size of a mineral deposit or occurrence …

Whether this allows activities directed at establishing the existence of a formation capable of storing CO_2 is by no means clear. Are such formations mineral deposits or occurrences? That strains the language somewhat. The evaluation of the feasibility of mining may be a limiting condition within the definition; if so, there is no room for CCS operations at all.

"Mining" and "to mine" are defined to mean:

> … to take, win, or extract, by whatever means, a mineral existing in its natural state in land, or a chemical substance from that mineral, for the purpose of obtaining the mineral or chemical substance …

The verbs are take, win, extract, and obtain. There is nothing said about depositing, injecting, storing, disposing, or sequestering. It seems clear that CCS operations cannot be included within this definition. It is likely that this clear definition of "mining" and "to mine" must colour the interpretation of "explore" and "prospect". The statute must be read as a whole, and in particular, one would expect a set of carefully crafted definitions in the one section to be mutually reinforcing. This would prevent the more elastic readings of general words in the definitions of "explore" and "prospect", and clarify that the Act as a whole only authorises mineral activity in the conventional sense. This reading back, to construe "explore" and "prospect" in the light of "mining" and "mine", is especially valid when s 32, in protecting the right of a permit holder to subsequent permits, shows that the Act is engaged in the management of rights at different stages in the one sequence of mineral activity.

The prohibition in s 8 is against prospecting, exploration for, or mining Crown-owned minerals without a permit granted under the Act. The permits granted under the Act are stated in s 30. The holder of a prospecting permit has the right to "prospect", the holder of an exploration permit has the right to "explore", and the holder of a mining permit the right to "mine". So the rights that can be conferred on permit holders are confined by the definition of the three verbs.[11] These are the only rights that the Minister can grant; he or she

11 *Greymouth Petroleum Holdings Ltd v Todd Taranaki Ltd*, unreported, High Court, Wellington, CIV-2004-485-1651, Wild J, 25 July 2006 observed at para 55 that the Act

is bound by the legislation. It is unlikely that the Minister can exceed these statutory definitions by including more generous rights as permit conditions.[12]

Section 2 also defines "mining operations" as operations in connection with mining, exploring, or prospecting for any Crown-owned mineral, including a variety of connected activities. One of those (paragraph (d)) is "[t]he deposit or discharge of any mineral, material, debris, tailings, refuse, or wastewater produced from or consequent on, any such operations". The last words of this definition rule out the inclusion of CO_2 from a combustion source not associated with mineral activity. It should also be noted that this definition does not take the central place in the permitting regime; the permits are granted for prospecting, exploring, and mining as defined.

The necessary conclusion is that permits for CCS operations cannot be issued under the CMA. If the definitions of "prospect", "explore" and "mine" do not include CCS operations, then those operations are not prohibited by s 8 of the CMA, and are not an offence under s 100. This is an interesting and perhaps unexpected consequence, but it does not alter the fact that the CMA permitting regime does not include CCS operations.

At this point one can turn to the definition of "petroleum" in the CMA, in respect of elements (ii) and (iii) identified above, because petroleum is the mineral most likely to be associated with arguments about CCS, and because it is declared by s 10 to be Crown-owned notwithstanding any Crown grant, certificate of title or other instrument of title. Section 2 says:

> **Petroleum** means—
> (a) Any naturally occurring hydrocarbon (other than coal) whether in a gaseous, liquid, or solid state; or
> (b) Any naturally occurring mixture of hydrocarbons (other than coal) whether in a gaseous, liquid, or solid state; or
> (c) Any naturally occurring mixture of one or more hydrocarbons (other than coal) whether in a gaseous, liquid, or solid state, and one or more of the following, namely hydrogen sulphide, nitrogen, helium, or carbon dioxide—
> and, except in sections 10 and 11, includes any petroleum as so defined which has been mined or otherwise recovered from its natural condition, or which has

manages petroleum exploration and mining by prohibiting those activities except pursuant to a permit for a defined area of land. The regulation is primarily of activities, except by permit. At para 77 it notes that "mining operations" are defined in an inclusory way, but the point is not developed.

12 *Cudgen Rutile (No 2) Ltd v Chalk* [1975] AC 520 (PC) is the case in point. Section 105(1)(m) authorises the making of regulations prescribing the duties of permit holders and the activities to be carried out under permit, but it cannot authorise regulations that in effect amend the definitions that Parliament has chosen to give in s 2.

> been so mined or otherwise recovered but which has been returned to a natural reservoir for storage purposes in the same or an adjacent area

Although a court is likely to draw on expert evidence if this comes into dispute, there seems to be no room at all for anyone to argue that carbon dioxide is one of the hydrocarbons. Nor does there seem to be any room to argue that a substance is naturally occurring if it is a product of combustion or the product of natural gas treatment and injected in a CCS operation. There is no authorising of CCS operations. The reference to storage at the end of the definition is tightly confined: what is returned to a reservoir must be petroleum; it must be a naturally occurring mixture; it must have been mined or otherwise recovered in its natural condition; it must be returned to a reservoir in the same or an adjacent area; and, because of the exception of ss 10 and 11, it is still not vested in the Crown. Finally, storage is the action of keeping or accumulating a thing for future use.[13] The purpose of CCS operations is the permanent sequestration or disposal of GHGs. The possibility that the sequestration may not be perfect over geological time frames does not detract from that. Readiness for retrieval is the last thing that is intended. Carbon capture and "storage" is therefore something of a misnomer. Overall, these constraints mean that the references to storage in the definition of "petroleum" in the Crown Minerals Act do not authorise CCS operations.

Let us turn to the Resource Management Act 1991 ("RMA"). Under the RMA, no person may discharge any contaminant from any industrial or trade premises onto or into land, or into water, unless the discharge is expressly allowed by a rule in a regional plan, by a resource consent, or by regulations.[14] Thus under present law CCS injection would require a resource consent from the regional council, unless it is named as a permitted activity in the regional plan (which is unlikely), or unless it takes place beyond the 12-mile limit, where the RMA does not apply. One can imagine an argument that the RMA can facilitate CCS operations, relying, in respect of saline aquifers, on its continuation of the vesting in the Crown of all waters and rights to waters in their natural state,[15] and relying on the designation procedure to allow a network operator to deal with property-based objections. However, the Act would quickly show that

13 *Concise Oxford Dictionary* (10th ed, rev 2002), *New Shorter Oxford English Dictionary* (1993). N Bankes, J Poschwatta and E M Shier, "The Legal Framework for Carbon Capture and Storage in Alberta" (2008) 45 Alberta Law Review 585, note that the terms "disposal" and "sequestration" are more suitable. However, it is impractical to abandon the general usage of the term "carbon capture and storage".

14 Section 15. The term contaminant includes greenhouse gases: *Genesis Power Ltd v Greenpeace NZ Inc* [2008] NZRMA 125 (CA) para 15. Section 104E is relevant to the discharge of greenhouse gases to air only.

15 RMA s 354, which brings forward the declaration of water rights made in the Water and Soil Conservation Act 1967.

it was never intended for anything like CCS operations. It provides no rights suitable for the exploration and assessment of subsurface structures that may take years, nor for storage, disposal, and long-term monitoring after injection. Its administration is in the hands of regional councils who have no expertise in deep subsurface geology. Again, one finds that CCS sequestration activities would have only the most modest authorisation under the present New Zealand legislation.

2.2 Canada

Having determined the insufficiency of present New Zealand law for carbon capture and storage purposes, we can usefully consider relevant comparisons. That offered by Canada is useful because of a comparable legal regime and a physical setting, the Western Canadian Sedimentary Basin of the prairie provinces and British Columbia, which offers particularly good CCS potential, especially in deep saline aquifers. These aquifers can easily accommodate many decades and even centuries of storage.[16] They underlie large sources of CO_2 such as multiple coal-fired power stations and oil refineries in the Edmonton region. The enormous oil sands developments in the Fort McMurray region of Alberta are not too distant. The oil sands resources are very large, but the extraction and upgrading of oil from them requires a substantial energy input, which results in major CO_2 emissions.

In Western Canada, CO_2 has been successfully sequestered for the purpose of enhanced oil recovery ("EOR") since the 1970s. CO_2 is injected into an oil field in order to reduce the viscosity of the oil and to increase the amount that can be recovered. One such project is at Weyburn, Saskatchewan. The Weyburn-Midale CO_2 Monitoring and Storage Project, launched in 2000, now combines EOR with CCS research.

Climate change policymaking in Canada is complicated by the constitutional division of powers between the federal and provincial governments. The governments of resource-rich provinces are hostile to any federal action on climate change that may intrude on their jurisdiction over natural resources industries, but the federal government is responsible for international climate change negotiations and the consequent responsibilities.[17]

In 2007 the Canadian federal government issued a policy statement *Regulatory Framework for Air Emissions*.[18] Building on previous policy

16 Ecoenergy Carbon Capture and Storage Task Force, *Canada's Fossil Energy Future: The Way Forward on Carbon Capture and Storage* (Report to Minister of Energy, Alberta, and the Minister of Natural Resources, Canada, 2008) 12.

17 See N Bankes and A R Lucas, "Kyoto, Constitutional Law and Alberta's Proposals" (2004) 42 Alta L Rev 355.

18 Minister of Environment, at <www.ec.gc.ca>.

announcements, it stated a national objective of reducing emissions by 20 per cent from 2006 levels by 2020, and 60 to 70 per cent by 2050. Emissions intensity obligations will be one of the main policies to reach those objectives. They will be imposed in key industrial sectors: electricity generation produced by combustion; oil and gas (including oil sands, upstream oil and gas, natural gas pipelines, and petroleum refining); pulp and paper; iron and steel; iron ore pelletising; smelting and refining; cement; lime; potash; and chemicals and fertiliser.[19] Within those regulated sectors, existing facilities will be required to reduce emissions by 18 per cent by 2010 (6 per cent per annum from 2006 base level) for each unit of production, and thereafter at a continuing rate of 2 per cent per annum. New facilities (2004 or later) will have a three-year grace period before the 2 per cent per annum obligation begins. Regulated emitters will be able to comply with these requirements by choosing among three different options. Firstly, they can make actual reductions in emissions, including by means of CCS. Secondly, they can make contributions to a "climate technology fund" that is to be established, at a rate of $15 per tonne from 2010–2012, $20 from 2013, and inflation-adjusted thereafter. The extent to which a firm can discharge its obligations by fund payments will be capped at 70 per cent, falling to zero in 2018. Thirdly, they can comply through emissions trading. (Offsets were expected to provide tradable credits only for reductions from activities outside the industrial air emissions regulations.)[20] For emitters who took early action to reduce GHG emissions between 1992 and 2006, a one-time credit for early action will be a fourth option. Equivalency agreements will allow the federal scheme to be suspended in favour of a provincial scheme that is at least as stringent.[21]

In March 2008 the federal government produced a set of five additional documents elaborating and expanding these proposals for GHG and air pollution regulation.[22] They contained new detail about cleaner fuel standards, co-generation, the programme for credit for early action, and the programme for the offset system and other emissions trading. However, what was most striking was that CCS was proposed as the benchmark for emissions from new electricity generation and new oil sands projects:[23]

19 This list of sectors is as refined by Minister of Environment, *Regulatory Framework for Industrial Greenhouse Gas Emissions*, March 2008, 2.

20 Minister of Environment, Canada, *Regulatory Framework for Air Emissions*, 2007, 14.

21 Equivalency agreements are made under s 10 of the Canadian Environmental Protection Act, 1999 ("CEPA"), SC 1999, c 33. Where the federal minister and a provincial government have an agreement in force, then the specified CEPA regulations are suspended within the signing province.

22 Environment Canada News Release, "Government Details of Greenhouse Gas Regulatory Framework", 10 March 2008, at <www.ec.gc.ca> with the proposal documents.

23 Minister of Environment (2008), supra note 19, at 11.

> The government therefore intends to develop targets based on carbon capture and storage for upgrader and in-situ facilities in the oil sands sector, and for new coal-fired electricity-generating facilities, that begin operation in 2012 or later. The targets will apply in 2018. The exact specification of these targets will be determined during the development of the proposed regulations. Emissions of a regulated facility that are captured and stored will be considered as emission reductions. Application of these targets is expected to generate an additional 30 Mt in reductions in 2020 beyond those expected from the basic regulatory framework.

This put very strong pressure on the proponents of new oil sands projects or coal-fired power stations to find a way to bring CCS into operation on a commercial scale. In relation to coal, the government stated its intention that the regulations "will effectively end the construction of dirty coal-fired plants"[24] and require the coal plants of the future to use clean technologies such as CCS. Further emphasis was given to CCS by an option for companies to receive credit for pre-certified investments in their own CCS projects, as if they had paid the money into the federally administered technology fund.[25] These proposals were criticised for reliance on emissions intensity rather than absolute reductions and an unduly low price on carbon.[26] But the offset system is a key part of Canadian domestic action on climate change, and is being developed with a view to setting up a carbon market in connection with the United States.[27]

As some Australian and American states have done, some Canadian provinces have taken significant climate change measures even though the federal government has not. British Columbia has introduced legislation for a cap-and-trade system, and has already implemented a carbon tax. Ontario is developing a cap-and-trade system. British Columbia, Manitoba, Ontario and Quebec are all partners in the Western Climate Initiative along with seven American states, and Saskatchewan and Nova Scotia are observers.

As for CCS as a particular response to climate change and the need to reduce GHG emissions, an advisory task force in 2008 recommended a target for Canada for 2015 of bringing three to five CCS projects into operation, to sequester 5M tonnes of GHGs per annum. It identified as its second priority

24 Minister of Environment, *Taking Action to Fight Climate Change*, March 2008, 3.

25 Minister of Environment (2008), supra note 19, at 16. CCS was the main focus of the pre-certified investment option.

26 M Bramley, Pembina Institute, "Analysis of the Government of Canada's April 2007 Greenhouse Gas Policy Announcement", 28 May 2007, at <www.pembina.org>; N Bankes, "The Federal Government's Climate Change Policy and the Role of Carbon Capture and Storage", 2008, at <www.ablawg.ca>.

27 Environment Canada, *Canada's Offset System for Greenhouse Gases: Program Rules and Guidance for Project Proponents (draft)*, June 2009.

(after funding) the need to move quickly to confirm legislation and regulation relating to pore space and disposition rights, liability, and increasing the transparency of regulatory processes.[28] The federal government has allocated $650 million for large-scale CCS projects.

Alberta is Canada's leading province for oil and gas operations. In January 2008 it announced a new Climate Change Strategy,[29] setting an objective of reducing emissions of CO_2 by 200 megatonnes by 2050, which is one half of business-as-usual projections and 14 per cent below 2005 levels, while maintaining economic growth. The three main elements are CCS, energy conservation and efficiency, and greening energy production. The Specified Gas Emitters Regulation[30] requires Alberta facilities that emit more than 100,000 tonnes of GHGs per annum to reduce emissions intensity by 12 per cent. A company can comply by reducing its emissions, by purchasing Alberta-based credits, or by contributing to the province's Climate Change and Emissions Management Fund. According to the Alberta Strategy, 70 per cent of the emissions reduction is to be achieved through CCS. In July 2008 the province announced that it would contribute $2 billion to CCS projects, and in February 2009 introduced legislation for that purpose.[31] The Act, five sections long, addresses only this aspect of CCS. The province has established the Alberta Carbon Capture and Storage Development Council, which produced an interim report in October 2008.[32] The report indicates an awareness of the legal issues, but does little to say how they should be resolved.[33]

Substantial geological and technical investigations are already under way by different groups in Canada. One of the largest is the Wabamun Area CO_2 Sequestration Project at the University of Calgary. That project estimates the cost of capture currently ranging between $40 and $120 a tonne, and that of sequestration between $3 and $12 a tonne.[34] Another is the Alberta Saline Aquifer Project, a consortium of oil and pipeline companies. A different group is investigating the pipeline to meet the needs of CCS to move CO_2 from the

28 Ecoenergy Carbon Capture and Storage Task Force (2008), supra note 16, at 23.

29 Alberta Environment, *Alberta's 2008 Climate Change Strategy: Responsibility / Leadership / Action*, 2008.

30 Alta Reg 139/2007, made under the Climate Change and Emissions Management Act, SA 2003, c 16.7. Also made under that Act is the Specified Gas Reporting Regulation, Alta Reg 251/2004.

31 Carbon Capture and Storage Funding Act, SA 2009, c C-2.5.

32 Alberta Carbon Capture and Storage Development Council, *Accelerating Carbon Capture and Storage in Alberta*, October 2008, at <www.energy.gov.ab.ca>.

33 For a critique, see N Bankes and J Poschwatta, "Comments on the Interim Report of the Alberta Carbon Capture and Storage Development Council, *Accelerating Carbon Capture and Storage in Alberta*", 2008, at <www.ablawg.ca>.

34 "Cutting Emissions Could Sidetrack Carbon Storage", *Financial Post*, 17 January 2009.

point of capture to storage. There is also interest, as in other countries, in biological carbon sinks, land use, land use change, and forestry.[35]

The leading analysis of the legal issues for CCS in Canada is "The Legal Framework for Carbon Capture and Storage in Alberta" by Nigel Bankes, Jenette Poschwatta and E Mitchell Shier.[36] They point out that in the design of law for CCS much can be learned from the law developed for analogous operations, including natural gas storage, enhanced oil recovery, and acid gas disposal.

2.3 Australia

Just as in Canada, climate change policy in Australia has developed at different rates between state governments and the Commonwealth (federal) government. A change of Commonwealth government in late 2007 led swiftly to ratification of the Kyoto Protocol and a new emphasis on policy development. A national emissions trading scheme ("ETS") is under development as the cornerstone of the country's response.[37] Although the enactment of an emissions trading scheme has been highly controversial, there has been a much higher degree of consensus on the role of carbon capture and storage. It is thought that CCS must play a significant part in reductions in emissions of GHGs, especially because of the major place that coal occupies in its supply of energy. A White Paper issued in December 2008 makes the central role of CCS clear.[38]

Work on carbon capture and storage has been under way for some years. At the national level, the Ministerial Council on Mineral and Petroleum Resources established a working group on CCS in 2003. The Council endorsed a set of Guiding Principles in November 2005[39] which have been much discussed internationally.[40] Internationally, the Australian government took the lead in amending the Protocol to the London Dumping Convention in order to authorise

35 S A Kennett, "Carbon Sinks and the Kyoto Protocol: Legal and Policy Mechanisms for Domestic Implementation" (2003) 21 JERL 252.

36 N Bankes, J Poschwatta and E M Shier, "The Legal Framework for Carbon Capture and Storage in Alberta", supra note 13.

37 Generally, see T Bonyhady and P Christoff (eds), *Climate Law in Australia* (Annandale: Federation Press, 2007).

38 Commonwealth of Australia, *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future*, December 2008, at <www.climatechange.gov.au>. A good general review is J Fahey and R Lyster, "Geosequestration in Australia: Existing and Proposed Regulatory Mechanisms" (2007) 4 JEEPL 378, at <http://ssrn.com/abstract=1120688?>.

39 Ministerial Council on Mineral and Petroleum Resources, *Carbon Dioxide Capture and Geological Storage: Australian Regulatory Guiding Principles*, 2005, at <www.ret.gov.au>.

40 N Bankes and J Poschwatta, "Australian Legislation on Carbon Capture and Storage: A Canadian Perspective" (Calgary: University of Calgary ISEEE Research Paper, June 2008) 20–21.

CCS operations in marine areas.[41] With the states it launched the Cooperative Research Centre for Greenhouse Gas Technologies. In 2008 it launched the Global Carbon Capture and Storage Institute to co-ordinate projects around the world, with a proposed budget of $100 million (Australian) per annum. The federal and state governments are supporting pilot plants in the Otway Basin in Victoria and the Gorgon project in Western Australia.

Within the Commonwealth government, work began in 2006 to produce legislation for CCS. In August 2007 a Parliamentary Standing Committee report, *Between a Rock and a Hard Place*, was tabled, making a thorough analysis of the issues (including the economics and public perception), and generally supporting the departmental work that was under way.[42] An "exposure draft" of the legislation was released in May 2008. Departmental suggestions that it would be skeletal in form were not fulfilled; it came in at a portly 450 pages.[43]

The legislation was introduced in May 2008 as the Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008. It was an amendment of the Offshore Petroleum Act 2006, which was itself wending its way through the legislative process.[44] In Parliament, there was bipartisan support for the Bill, but there were two controversial aspects. The first was long-term liability; the Opposition argued that a CCS industry would only be viable if the government assumed long-term liability for failures of sequestration. The second was the argument that the Bill gave undue primacy to the holders of petroleum tenements (licences) in a way that could allow the petroleum industry to inhibit the growth of a CCS industry.[45] A number of changes were made in

41 *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter, 1972*, at <www.imo.org>. On the Australian-sponsored amendment that was adopted on 2 November 2006 and came into force on 11 February 2007, see Fahey and Lyster (2008), supra note 38, at 7. On the Protocol generally and the need to clarify the place of CCS, see R Purdy, "Geological Carbon Dioxide Storage and the Law", in S Shackley and C Gough (eds), *Carbon Capture and its Storage* (Aldershot: Ashgate, 2006) 87, at 102; International Energy Agency, *Legal Aspects of Storing CO_2* (OECD/IEA, 2005); and International Energy Agency, *Legal Aspects of Storing CO_2: Update and Recommendations* (OECD/IEA, 2007).

42 House of Representatives Standing Committee on Science and Innovation, *Between a Rock and a Hard Place: The Science of Geosequestration* (Canberra: Parliament of the Commonwealth of Australia, 2007). Chapter 7 analysed the legal issues.

43 Allens Arthur Robinson Newsletter, *Focus: Climate Change*, November 2007, 2.

44 Its progress was slow because it was legislation that represented the Offshore Constitutional Settlement, between the Commonwealth, states and Northern Territory, and required state legislation to mirror it. In general terms it was a rewrite and update of the Petroleum (Submerged Lands) Act 1967 (Cth), the main statute for oil and gas operations offshore.

45 S Barrymore and A Mathison, "Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008 (Cth)" (2008) 27 ARELJ 348; J Fahey and L McMurtrie, "Carbon Capture and Storage Bill before Senate", Mallesons Stephen Jaques Newsletter, October 2008.

response to these concerns and other parliamentary scrutiny.[46] Provisions that might have prevented EOR operations were removed. On long-term liability, the government moved its position, and in the Senate agreed to amendments that would result in the Commonwealth assuming liability for CCS failures after site closure and a closure assurance period, and for failures where the operator company has ceased to exist. As for the petroleum industry, it did well in protecting its interests, as we shall see below. It did not obtain an absolute veto of GHG activities, nor did it get a one-off general option to incorporate GHG rights into petroleum titles, although companies can get non-competitive access to GHG rights in some circumstances. It did not get the ministerial power it sought to require GHG operators to negotiate in good faith with petroleum companies in certain circumstances. Nor was a power to make regulations for third-party access removed.

After these amendments in course of the parliamentary process, the legislation was enacted as the Offshore Petroleum Amendment (Greenhouse Gas Storage) Act 2008 (Cth) ("GHG Storage Act"), amending the Offshore Petroleum Act 2006 and renaming it the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) ("OPGGSA"). The GHG Storage Act received royal assent on 21 November 2008, and the majority of its provisions came into force on 22 November 2008.[47]

Carbon capture and storage legislation is under development in some states as well as at the Commonwealth level. The current situation is as follows:

(i) In Victoria, the Greenhouse Gas Geological Sequestration Act 2008 has been enacted commencing 1 January 2010. It is stand-alone legislation, but its model is similar to the OPGGSA, the main point of difference being that the state government accepted no transfer of long-term liability.
(ii) In South Australia, a CCS regime is provided by amendments in 2009 to the Petroleum and Geothermal Energy Act 2000. The petroleum industry expresses itself pleased with the recognition it gives to the rights of pre-existing licences.
(iii) The Queensland legislature has enacted the Greenhouse Gas Storage Bill 2009. It is different from the Commonwealth Act in that petroleum (or mineral) operators cannot secure GHG rights over the area of their title on a non-competitive basis; and GHG operators will be able to get rights over pre-existing petroleum rights under a very complex regime.

46 S Barrymore and A Mathison, "Update: Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008 (Cth)" (2008) 27 ARELJ 469.

47 M Gibbs, "Greenhouse Gas Storage in Offshore Waters: Balancing Competing Interests" (2009) 28 ARELJ 52.

(iv) There are no announced plans for onshore legislation in Western Australia, Tasmania, New South Wales, or the Northern Territory.

Meredith Gibbs and Phillipa McCormack perceive three patterns in this legislation: to amend the petroleum law (Commonwealth and South Australia); stand-alone legislation (Victoria and Queensland); and project-specific state agreements (Western Australia).[48] In Western Australia, the Barrow Island Act 2003 (WA) specifically authorises CCS for the Gorgon project, where significant amounts of CO_2 will be stripped from produced natural gas and will be disposed of by geosequestration.

The Australian OPGGSA and state Acts are a major achievement, and will undoubtedly influence legislatures addressing CCS beyond the shores of Australia. The legislation is the result of a sustained process of policy development and law reform. Nonetheless, even the most blasé reader of statutes must be impressed — appalled — by the sheer size and detail of the OPGGSA. It has 791 sections, and covers 1103 pages. About one third of the sections are about CCS, and many more affect CCS and petroleum equally. There are particular reasons for this size, in the special legislative history of Australian offshore legislation as the result of negotiation between the state and Commonwealth governments. To cut down the scope for states to go their own way, the titles provisions had to be extremely detailed, even at the price of flexibility; and they had to be cast in terms of administrative authorisations instead of contractual or proprietary grants of rights.[49]

2.4 The United States

Although this article focuses on Canada and Australia in its comparisons, we can note in passing that some states in the United States have enacted legislation to facilitate carbon capture and storage. The Interstate Oil and Gas Compact Commission has issued a model statute for CCS, based upon existing state laws for natural gas storage — the logical extension, as Fish and Wood put it, of a known regulatory programme.[50] Wyoming, for example, has declared that

48 M Gibbs and P McCormack, "No Consistent Approach to CCS Legislation", Blake Dawson, Greenhouse Update, October 2008. For a detailed tabulation, see R Harvey, "Carbon Capture and Storage Legislation" [2008] AMPLA Yearbook 168; and, at a slightly earlier stage, Fahey and Lyster (2008), supra note 38.

49 T Daintith, *Discretion in the Administration of Offshore Oil and Gas* (Melbourne: AMPLA, 2005) 13 & 175.

50 J R Fish and T R Wood, "Geologic Carbon Sequestration: Property Rights and Regulation" (2008) 54 Rocky Mountain Mineral Law Institute 3-1; Interstate Oil and Gas Compact Commission, *Storage of Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces* (2007).

the ownership of pore space below the surface is vested in the surface owner, although giving protection to existing mineral owners at the same time. There are few judicial decisions on matters relating to CCS and the ownership of pore space, and most of them will take the issue as a matter of first impression.

2.5 The European Union

The European Union is committed to the deployment of CCS as part of an aggressive strategy of reducing GHG emissions. The European Commission will require near-zero emissions from coal after 2020.[51] In 2009 the EU adopted a Directive on the Geological Storage of Carbon Dioxide.[52] The Directive removes barriers to CCS in existing EU law; it requires new combustion plants to be capable of retrofitting with carbon capture technology, although it does not require such retrofitting. It controls the selection of CCS storage sites through site characterisation, and then provides for storage permits. After closure of an injection site, liability under the Emissions Trading Scheme and the Environmental Liability Directive can be transferred to the competent public authority. However, the legislation of member states will also play a significant role.

3. RIGHTS TO REAL PROPERTY

Against that background of the state of CCS legislation in different countries, we can turn to consider specific legal issues in turn. The first is property law and the ownership of land. The possibility that the owner of an estate in land must give consent to carbon capture and storage operations under his or her land is a real one, but raises complex legal issues. (One can take it as given that operations or installations on the surface of privately owned land will require either the consent of the landowner or statutory authority.) The starting point in the law of most countries, certainly including New Zealand, Australia and Canada, is that rights deriving from the ownership or possession of an estate in land are presumed to be capable of exercise on all parts of the land, including

51 Generally, see N Bankes and M Roggenkamp, "Legal Aspects of Carbon Capture and Storage", in D Zillman et al (eds), *Beyond the Carbon Economy* (Oxford: Oxford University Press, 2008) 339.

52 Directive 2009/31/EC, adopted by the European Council on 6 April 2009.

upwards and downwards, indefinitely: *cuius est solum eius est usque ad coelum et ad inferos*.[53] Windeyer J refers to:[54]

> the elementary principle of the common law that a freeholder … is entitled to take from his land anything that is his. Except for those minerals which belong to the Crown, the soil and everything naturally contained therein is his.

As with all such generalisations, the real issues lie in the multiple exceptions, but this is the general rule from which an exception is to be established.

What rights are held by a mineral owner (the Crown or some private person), in relation to the surface owner, will depend upon the interpretation of the original grant or instrument of severance, reading words as they were meant in the vernacular of the mining world, the commercial world, and landowners, at the time of the grant.[55] Whether a grant of mineral rights includes a right to the spaces left after the minerals have been extracted was a live issue in the nineteenth-century courts of England and Scotland. Sometimes it would depend on language that indicated the grant of a corporeal interest, such as mines, seams, or veins.[56] A conveyance of "minerals", or of land subject to a right to work named minerals, will generally give no right to control the space occupied or formerly occupied by mineral substances, even though a conveyance of "mines" may do so.[57]

Where mineral rights are owned separately, they do not necessarily entail rights to everything in the subsurface. The surface owner is not confined to the mere plane surface;[58] rather, he or she is presumed to be entitled to possession of the land in all its respects below the soil, apart from whatever

53 G W Hinde, N R Campbell & P Twist, *Principles of Real Property Law* (Wellington: LexisNexis, 2007) 6.002; B J Barton, *Canadian Law of Mining* (Calgary: Canadian Institute of Resources Law, 1993) 31.

54 *Wade v NSW Rutile Mining Co* (1969) 121 CLR 177, 185. There is a contrary view expressed by A J Bradbrook, "Ownership of Geothermal Resources" [1987] AMPLA Yearbook 353; A J Bradbrook, "The Relevance of the Cujus Est Solum Doctrine to the Surface Landowner's Claim to Natural Resources Located Above and Beneath the Land" (1988) 11 Adel L R 462; and, following him, K Gray and S F Gray, *Elements of Land Law*, 3rd ed (London: Butterworths, 2001) 21. However, his view that *cuius est solum* may not apply below 200 metres is not supported by authority.

55 *North British Railway Co v Budhill Coal and Sandstone Co* [1910] AC 116 (HL Scot).

56 See B J Barton, *Canadian Law of Mining*, supra note 53, at 34. A Canadian case that is often cited in this respect is *Little v Western Transfer and Storage Co* [1922] 3 WWR 356 (Alta SC TD). See Bankes, Poschwatta & Shier, supra note 36, at 604, referring to the "English" rule and the "American" rule. *Little*, in their view, is understood to require the consent of the mineral owner to use pore space.

57 *Mitchell v Mosley* [1914] 1 Ch 438 (CA) at 450; *Halsbury's Laws of England*, 4th ed, vol 31, para 12.

58 *Pountney v Clayton* (1883) 11 QBD 820, at 833, 839.

mineral rights are vested in another. The default position is that the subsurface is in the same ownership as the surface, subject only to particular grants of mines and minerals. An interference with the landowner's right to possession underground is therefore trespass, just as on the surface. In *Austin v Rescon Construction (1984) Ltd*[59] a construction company inserted anchor rods under the neighbouring property for temporary support; exemplary damages were awarded against it to deprive it of the profits of its trespass. It was no defence that permission to enter was unreasonably withheld. *Waugh v Attorney General*[60] dealt with a tunnel that the Navy had used for many years, connecting two of its yards under some private properties. For the time that there was no authorisation in place, the tunnel was a trespass. Damages were measured by the Navy's profit using the tunnel rather than a longer route through the streets. Damages did not need to be measured by the landowners' loss.

In Western Canada, the private ownership of oil and gas rights is common, although by no means prevalent, so these matters of ownership are significant, most plainly in the case of a CCS operation that proposes to use a depleted oil and gas reservoir. Bankes, Poschwatta and Shier distinguish between cases where there is split title, that is, a division between owners of different mineral rights (different persons holding the rights to oil, gas, and coal for example), and cases where there is no such split.[61] New Zealand has seen less petroleum activity than Alberta, and it has had a vesting of all rights to oil and gas in the Crown since 1937; so while the Albertan issues could arise in some circumstances in New Zealand, the manner in which they would is rather different. For example, questions of interpretation of freehold oil and gas leases do not arise. More comparable is their analysis of the disposal of CO_2 into saline aquifers, because in Alberta, the Water Act declares the Crown to be the owner of all water including underground water. Finally, one notes that an Alberta statute declares that a sink right is a property right, in terms that include geological and biological sinks.[62] It appears to be an assertion of provincial jurisdiction against the federal government.

In Australia, questions of ownership of storage capacity have not arisen in the debate about the new Commonwealth legislation, for the simple reason that it is for offshore areas, where there are no private property rights except possibly aboriginal title. The offshore situation in New Zealand is controlled by the Foreshore and Seabed Act 2004 which declares that the full legal and beneficial ownership of the public foreshore and seabed is vested in the Crown as its absolute property.[63]

59 (1989) 57 DLR (4th) 591 (BC CA).

60 [2006] 2 NZLR 812.

61 Bankes, Poschwatta & Shier, supra note 36, at 606.

62 Climate Change and Emissions Management Act, SA 2003 c C-16.7, s 9.

63 Section 13. The Act goes on to establish procedures for the vindication of territorial

Onshore in Australia, ownership raises more complexity. Some substantial analysis of the issues has been carried out.[64] A direct way of dealing with them was employed in Victoria, where the Greenhouse Gas Geological Sequestration Act 2008[65] declares:

> (1) The Crown owns all underground geological storage formations below the surface of any land in Victoria.
> (2) Subsection (1) does not apply in relation to any land (other than Crown land) to the extent that the underground geological storage formation is within 15.24 metres of the surface of the land.
> (3) Subsection (1) applies despite any prior alienation of Crown land.
> (4) The Crown is not liable to pay any compensation in respect of a loss caused by the operation of this section.

That assertion of Crown ownership is backed up by a prohibition of exploration or development of such formations without an authorisation under the Act. The Queensland Act is similar.[66]

It is clear that CCS legislation for New Zealand needs to address ownership if CCS onshore is to be possible. Whether it needs to make a claim of ownership in the style of Victoria or Queensland is less clear. Such declarations may leave more unanswered questions than their sweeping tone might suggest. What CCS operations need, in practical terms, is firstly authorisation, so that they are legal; and secondly, protection, so that no one else can interfere with the operations in the exercise of proprietary rights. If legislation can provide these two things, then much of the debate about property rights can be circumvented. Legislation in any form is likely to be scrutinised for the possibility that it causes a breach of the principles of the Treaty under the Treaty of Waitangi Act 1975, with a consequential claim to the Waitangi Tribunal. In 2003 the Tribunal found that the vesting of all petroleum in the Crown by the Petroleum Act 1937 caused such a breach,[67] but the government did not accept this, maintaining that Maori and non-Maori owners of land had been treated equally.

claims and customary rights orders, but if made they are unlikely to affect rights to CCS formations.

64 Minter Ellison, *Carbon Capture and Storage: Report to the Australian Greenhouse Office on Property Rights and Associated Liability Issues* (Canberra: Australian Greenhouse Office, 2005).

65 No 61 of 2008, s 14. An underground geological storage formation is stated to include any seal or reservoir of an underground geological formation; and any associated geological attributes or features of an underground geological formation.

66 Greenhouse Gas Storage Act 2009 (Qld) s 27: all GHG storage reservoirs in land in the state are and are taken always to have been the property of the state.

67 Waitangi Tribunal, *Petroleum Report* (Wellington: Legislation Direct, 2003).

4. TITLES OR PERMITS FOR CCS

The next issue is the set of titles (or rights, permits, or licences) that may be granted for carbon capture and storage operations. The new Australian Commonwealth legislation implements a carefully devised set of titles. Under Chapter 3 of the Offshore Petroleum and Greenhouse Gas Storage Act 2006, three main titles are available for CCS purposes, modelled on existing petroleum titles:[68]

GHG titles or declaration	*Part and sections*	*Comparable petroleum title or declaration*
GHG assessment permit	Part 3.2 ss 288–311	Petroleum exploration permit
Declaration of identified GHG storage formation	Part 3.2 ss 312–317	Declaration of petroleum location
GHG holding lease	Part 3.3 ss 318–354	Petroleum retention licence
GHG injection licence	Part 3.4 ss 355–373	Petroleum production licence

The first step in obtaining GHG titles is the release of acreage by the Crown for bidding for GHG purposes through a "work bid" or a "cash bid" process. The Minister has a wide discretion in the release of acreage. The matters that the Minister may take into account in evaluating bids are set out in the Act and in criteria to be disclosed by the Minister. Once obtained, the GHG assessment permit allows the holder to explore for storage formations and injection sites. Its term is 6 years, with one renewal for 3 years. The holder of a GHG assessment permit (or the holder of a petroleum retention licence or production licence) may apply for a declaration of an "identified greenhouse gas storage formation". A substantial work programme is likely to be required, including modelling of potential migration paths of stored gases. The declaration lasts for the life of the project: s 312 et seq. The holder of a permit under a declaration can apply for a GHG holding lease, if a GHG source will not be available within 5 years but will be within 15 years, and is entitled to the grant of one if its application is in order: s 325. Its term is 5 years with one right of renewal: ss 322 and 347. Alternatively, if the holder of a permit under a declaration is ready to commence injection operations within 5 years, it can obtain a GHG injection licence, subject to satisfying an elaborate set of criteria and a public interest test: s 361. An injection licence authorises the injection and permanent storage of GHGs in identified storage formations, subject to a number of requirements,

68 This account follows M Gibbs, "Greenhouse Gas Storage in Offshore Waters: Balancing Competing Interests", supra note 47.

including a site plan and a site closing work programme.[69] It remains in force indefinitely until a site closing certificate is issued by the Minister, and in this respect connects with provisions, discussed below, for liability.

Onshore state legislation is similar. Queensland's Greenhouse Gas Storage Act 2009 provides for competitive tendering for a GHG exploration permit, renewals, application for a potential storage area, and a GHG injection and storage lease, either on the basis of a permit or by competitive tender. In Victoria, the Greenhouse Gas Geological Sequestration Act 2008 provides for exploration permits, retention leases, and injection and monitoring licences.

A formal system of allocation of rights to CCS formations is necessary in order to accommodate the different stages of the CCS process, and to balance the competing interests. Bankes and Poschwatta identify the desirable features of a system of allocation of title to CCS formations.[70] There is a strong case for a formal system of allocation that provides security of tenure for CCS operators, that recognises the value of reservoir formations as a public resource, and that makes such formations available on transparent and competitive terms. This implies nomination of lands for CCS purposes after review of public interests such as environmental suitability, offers of land in a bidding system, work requirements, and release of acreage and deep rights that are not being pursued. In addition, there is a clear need for different titles for the different stages of exploration, assessment and exploitation of CCS formations; at an early stage of exploration a company is not able to provide all the details and assurances necessary to permit injection operations to begin. In this, CCS is similar to the sequence of oil and gas or hardrock mineral activities from reconnaissance to production and rehabilitation. All such natural resources require a systematic framework for the allocation of rights.

In contrast to the elaborate Australian frameworks, the closest parallel to CO_2 disposal in Alberta is the "letter of consent" system which has evolved for acid gas disposal operations, under the oversight of the Alberta Energy and Utilities Board, now the Energy Resources Conservation Board ("ERCB").[71] It is informal in ways that stand in contrast not only to the Australian CCS legislation, but also to Alberta's own legislation for the disposition of oil and gas rights. It is deficient in respect of openness, publicity, charges and returns to the public, indemnification for loss to the public, term, and assignment.

69 Gibbs, ibid, at 65.

70 Bankes & Poschwatta, supra note 40, at 64–70.

71 Mines and Minerals Act RSA 2000, c M-17, Energy and Utilities Board, Directive 065: Resources Applications for Conventional Oil and Gas Reservoirs, revised 3 July 2007. See Bankes, Poschwatta & Shier, supra note 36, at 603. The ERCB was reconstituted on 1 January 2008, and replaces the EUB as regulator of oil and gas and other mineral resources activities.

5. RELATIONSHIP WITH OIL AND GAS OPERATIONS

Carbon capture and storage operations may often take place close to oil and gas operations, especially if the target storage formation is a depleted oil or gas reservoir. One main issue is that the CO_2 that is injected in CCS operations can migrate into adjoining formations, so as to damage petroleum resources, making petroleum production more difficult. The other main issue is that CCS storage formations can be compromised by oil and gas wells, both old ones and new. Where the plugging and abandonment of a well has not been adequate, a CO_2 leak is possible. Carbon dioxide is corrosive; with water it forms acid which can attack steel and cement, although the cements being used are more resistant to attack than hitherto. Petroleum companies can worry about new restrictions on their operations, about being shut out of acreage that is set aside for CCS, and about being pressed to make room on offshore installations for CCS operators. Conflicts between resource users are not unprecedented — for example, in respect of surface rights or navigation and fishing; or between coal and coal seam methane.

In Australia, the conflict between petroleum and CCS operations was one of the most controversial issues in the passage of the OPGGSA in 2008. Opponents argued that the Bill gave undue preference to the holders of petroleum tenements (licences) in a way that could allow the petroleum industry to inhibit the growth of a CCS industry. A number of changes were made in response, to give the petroleum industry protection but not a general veto.[72] The result in the Act is a set of very intricate provisions to balance the different interests. Meredith Gibbs has analysed them carefully,[73] and only the main features are noted here. The most basic feature of the OPGGSA's balancing is to draw a distinction between petroleum titles where the title (or its predecessor) was in existence before the new law came into effect on 22 November 2008, and those that arose under the new rules. "Pre-commencement" petroleum titles are protected by a number of restrictions on GHG (greenhouse gas, or CCS) operations. The Minister has a wide discretion to impose conditions on GHG titles. Any "key GHG operation" requires the consent of the Minister, to be exercised taking into account present or future petroleum activities. Where GHG operations pose a "significant risk of a significant adverse impact" (a "SRSAI") on petroleum operations he or she must take into account the existence of any agreement with the petroleum operators. (The meaning of "adverse impact" was tightened up in the legislative process.) In certain circumstances, the petroleum operator has a power of veto where there is a SRSAI. In other cases the Minister must balance the competing

72 Barrymore & Mathison (2008), supra note 45; Fahey & McMurtrie (2008), supra note 45; Barrymore & Mathison (2006), supra note 46.

73 Gibbs, supra note 47.

concerns in a public interest test. The petroleum title holder has preferential rights to GHG titles in certain circumstances. After the issue of a GHG title, the Minister retains a power to make directions to its holder where the GHG activities pose a SRSAI on petroleum operations.

The OPGGSA provides a much more level playing field in respect of "post-commencement" petroleum titles. Where there is overlap, GHG (i.e. CCS) operators will continue to be restricted in a number of ways, but petroleum operators will be subject to similar restrictions in respect of their own activity. There is no automatic priority for either industry. The Minister employs a "public interest" test more often. The Minister can use a policy of spatial separation to keep petroleum and GHG operations out of each other's way, and in making the key decision about opening acreage up for bidding, he or she must now consider GHG issues as well as petroleum.

Broader policy issues can be discerned within these intricate OPGGSA provisions. While the petroleum industry of Australia has reason to feel satisfied with the security of tenure that it obtained for its holdings, it comes at the cost of reduced security of tenure for the new GHG titles, which may make the investment climate for CCS less attractive — an outcome that is at odds with a policy preference of stimulating the development of a CCS storage industry.[74] Less easy to see is whether these provisions will allow CCS to emerge as an independent industry, or to emerge as an offshoot of the petroleum industry. The petroleum industry could be tempted to see itself as the sole proprietor of CCS, holding the expertise and holding much of the relevant acreage, and providing new services to utility companies and coal companies. As a matter of public policy, legislators will need to work carefully to find an industry structure that will not discourage the introduction of CCS.

Scott Singleton and Ryan Gawrych have analysed state legislation on overlapping interests.[75] They describe the Commonwealth model as giving absolute primacy to pre-commencement petroleum titles in the face of a SRSAI, but Queensland as conferring significant discretion on the Minister in determining grants. South Australia has required GHG grant applications to pass a compatibility test, but Victoria has made no provision at all for restrictions on grants in overlap situations. All three states have followed the Commonwealth's example of post-grant powers to restrict activities that may affect other resource entitlements. Victoria relies strongly on this aspect, but South Australia much less. The public interest plays a key role in each jurisdiction, although only Queensland and Victoria have elaborated it. Each jurisdiction also restricts future petroleum operators in respect of what would

74 Gibbs, ibid, at 75.

75 S Singleton and R Gawrych, "Overlapping Land Interest Issues for GHG Grants and Activities", Paper presented at AMPLA National Conference, Sydney, 28–31 October 2009. The paper includes a useful tabular analysis of the OPGGSA and three state Acts.

otherwise be GHG activities, and each allows for the Minister to intervene in the event of one resource user having an impact on another.

6. REGULATION

Regulation can be distinguished from the allocation of titles in that it involves the granting of permission but nothing of a proprietary character. It is more fine-grained, examining particular operational proposals, and checking them for purposes such as safety and the conservation of natural resources. Alberta has an oil and gas regulatory framework that over the years has become very sophisticated, but is unadapted for carbon capture and storage. Australia has a new system specifically for CCS. New Zealand, by comparison, has a long way to go even in relation to conventional petroleum operations.

The regulation of petroleum operations in Alberta is within the jurisdiction of the Energy and Resources Conservation Board, under the Oil and Gas Conservation Act ("OGCA"),[76] the Energy Resources Conservation Act,[77] and a number of other statutes. Generally, regulation by the ERCB is kept quite separate from ownership and the granting of dispositions by the provincial Department of Energy, like petroleum and natural gas licences, so that all oil and gas operations, including those respecting privately owned minerals, are covered. The principal instrument of the ERCB's regulation of the oil and gas industry is the approval process for well licences under the OGCA.[78] A company may not drill a well without a licence under the OGCA, even if it holds a petroleum and natural gas licence. A range of other provisions provide for control over the waste of oil and gas, well spacing, plugging and abandonment ("P&A"), and other aspects of oil and gas operations. These provisions are general enough to include CCS, but poorly adapted. The closest analogies to CCS in the present regulations are the provisions for enhanced oil recovery and acid gas disposal ("AGD").

Under s 39 of the OGCA, no person may commence a scheme for enhanced recovery (enhanced oil recovery or EOR) or for the storage or disposal of any fluid to an underground formation through a well, without the approval of the ERCB. This prohibition is broad enough to include CO_2 injected for CCS purposes.[79] An application is referred to the Minister of the Environment, and any Board approval is subject to the conditions imposed by that Minister unless

76 RSA 2000, c O-6.

77 RSA 2000, c E-10.

78 *Canada Energy Law Service* (Thomson Carswell) § 176.

79 Bankes, Poschwatta & Shier, supra note 36, at 611. The description of the Alberta regulatory regime in the following paragraphs relies upon that article.

Cabinet orders otherwise.[80] The OGCA and its subordinate Regulations and Directives classify wells for the injection of CO_2 or other gases used in EOR or disposal or storage as a Class III well, for increased levels of monitoring, surveillance, and higher standards on completion for cementing and casing, logging to show hydraulic isolation, operating parameters, and other tests. These extra requirements are aimed at the presence of hydrogen sulphide, so they should be adequate for the less toxic CO_2. Applications must be notified to persons with subsurface interests that may be affected. Interestingly, few applications for either EOR projects or AGD projects have triggered a public hearing or produced formal reasons for decision. In one case, Alberta Environment took part in the hearing as a "friend of the Board" in order to explain water resources matters and the question of hydraulic connection. The Board decided that there was no link between withdrawals of water for the EOR scheme and the changes observed by the intervenors.[81]

The abandonment of oil and gas wells, including wells for EOR and AGD operations, is controlled by the ERCB, so as to leave downhole and subsurface structures in a permanently safe and stable condition, and in particular to cover, with cement, all non-saline ground water and to isolate or cover all porous zones.[82] Completion reports and plug logs must be submitted to the ERCB. Much of this regulatory scheme can be applied directly to the abandonment phase of a CCS project, with one exception: it does not provide for ongoing monitoring and verification of the well after abandonment.[83] This monitoring and verification, over a long period, is expected to be an important aspect of CCS projects.

The regulation of EOR projects is aimed at optimisation of hydrocarbon recovery, safety, protection of the environment, and equitable treatment of other well licensees.[84] EOR projects have a similar geographical scale to likely CCS projects, which makes them a useful analogy in terms of regulation, but on the other hand their objectives are very different: the injection of CO_2 is merely a means to the end of increased hydrocarbon recovery. In fact, the Directive covering the conservation of gases produced from an EOR scheme allows inert gases such as nitrogen and carbon dioxide to be vented to the atmosphere.[85] That is not exactly the point of a CCS scheme.

80 OGCA s 39(4).

81 Case Resources Inc Enhanced Oil Recovery Scheme, Oil Well, Effluent Pipeline and Water Pipelines, Carrot Creek Field, EUB Decision 2002-032, 21 March 2002.

82 ERCB/EUB Directive 020: Well Abandonment Guide. Surface land reclamation is dealt with by Alberta Environment.

83 Bankes, Poschwatta & Shier, supra note 36, at 618.

84 ERCB Directive 065, s 2.1.2.

85 ERCB/EUB Directive 060, Upstream Petroleum Industry Flaring, Incinerating, and Venting, s 8.5.

AGD schemes are similar to CCS in that they are concerned with permanent disposal, and are therefore a good analogy, although they are much smaller; CCS schemes will probably be 10 or 100 times the size of current acid gas operations. ERCB scrutiny focuses on several matters for which useful comparisons with the regulation of CCS can be made, including equity in respect of other mineral rights owners, and safety in respect of above-ground releases. (Where public hearings have taken place, the main safety issue to be raised is the potential for flaring, and therefore acid gas emissions, in the event that the injection facility is shut down for any reason.)[86] In respect of containment, reservoir characteristics and hydraulic isolation, the ERCB requires a great deal of information to demonstrate that the injected fluids will be contained "within a defined area and geologic horizon, to ensure that there [will be] no migration to hydrocarbon-bearing zones or groundwaters".[87] However, this emphasis on structural trapping is less suitable for injection into a saline aquifer, and the plume spread and migration characteristic of CCS injection into such formations will need to be addressed more explicitly. Indeed, that last point brings one to the general theme of Bankes, Poschwatta and Shier's analysis of the Alberta regulatory regime. While the injection of CO_2 is controlled by the ERCB at present, the regulation needs considerable amendment in order to deal properly and explicitly with CCS.[88]

In the new Australian OPGGSA there are numerous regulatory controls along with the provisions for allocation of titles that we considered earlier. Geological formations are classified as potential, eligible, or (after a declaration as above) identified.[89] The site plan is an important regulatory instrument for a particular site.[90] "Key greenhouse gas operations" require the approval of the Minister at the stage of the GHG assessment permit or GHG holding lease. The range of operations defined as "key" is very wide. The Minister may take into account general matters in relation to the public interest but also a variety of possible effects on petroleum operations.[91] "Serious situations" authorise the regulator to use emergency powers.[92] The site closing certificate, as described above, is another means of detailed regulatory control.

When one turns to New Zealand, it is striking how little regulation there is of petroleum activities in this sense under the Crown Minerals Act 1991. There is no obligation to submit plans and obtain approval before beginning

86 Bankes, Poschwatta & Shier, supra note 36, at 615.

87 ERCB/EUB Directive 065, s 4.2.2.

88 Bankes, Poschwatta & Shier, supra note 36, at 616, 619. Bankes & Poschwatta, supra note 40, at 71 develop that analysis in a detailed comparison with the Australian OPGGSA.

89 Sections 20, 21 & 312.

90 OPGGSA s 457.

91 OPGGSA ss 7, 27, 292, 321 & 749(2)(b).

92 OPGGSA s 379.

drilling. The closest is that the operator must notify Crown Minerals of its intention to drill a well in its permit area.[93] This contrasts with the obligation in Alberta to obtain a well licence from the ERCB. There is no obligation to plug and abandon a well. (Plugging and abandonment or "P&A" are the operations required to leave a well safe, without any risk of pressure blowouts, or migration of fluids from one stratum to another — for example, from a saline aquifer into a potable water aquifer.) The closest is an obligation to send an abandonment report to Crown Minerals not later than 120 days after the well is abandoned, stating the positions of "any" cement plugs or bridge plugs, along with details of any casing, tubing or downhole equipment recovered, and details of any items left in the well.[94] This is insufficient. One has little confidence in the catch-all requirement that "All well-drilling operations carried out under a permit must be carried out in accordance with recognised good exploration and mining practice".[95] The obligation to plug and abandon should be imposed by statute. Evidence in a case described by David Coull shows that while the obligation is usually imposed as a permit condition in the case of mining permits, it has never been imposed in the case of exploration permits.[96] There are thought to be twenty or thirty "orphan" wells, suspended without plugging and abandonment obligations attached. Who knows how many other wells have been abandoned without compliance with P&A obligations where they were attached.[97] This is unsatisfactory in general terms, and as a matter of protecting the integrity of reservoir formations that may one day be vital for CCS, it seems to be a serious mistake. The obligation to plug and abandon should be accompanied by ancillary duties to satisfy the regulator that the obligation has been performed, to provide further information, and to carry out such further works as the regulator requires.

Some general observations can be made about the comparison of regulatory regimes. First, that of Alberta is much more complex than that of New Zealand. This is not surprising; New Zealand's industry and number of wells is far smaller than Alberta's. More than 350,000 wells have been drilled in Alberta,

93 Crown Minerals (Petroleum) Regulations 2007, SR 2007/138, reg 32.

94 Ibid, reg 47.

95 Ibid, reg 35.

96 D Coull, "Cross-Boundary Mining and Exploration in New Zealand: The Implications of *Greymouth v Todd*" [2006] AMPLA Yearbook 497. See the Minerals Programme for Petroleum 2005, para 5.6.24, which says that mining permits (for petroleum production) will be subject to a condition requiring the proper decommissioning of production facilities and the permanent abandonment of wells.

97 A regional council could have jurisdiction over such matters under the Resource Management Act 1991, but there has been no substantial effort to exercise it. Taranaki Regional Council, in its Regional Plan, makes the drilling of oil and gas wells a permitted activity if they are cased, and comply with one or two other minor stipulations.

and a mere 773 in New Zealand.[98] However, we should not allow the simple fact of the size difference to mask the fact that oil and gas exploration and development are complex, and need detailed regulation. Nor should we let the size difference excuse deficiencies in the New Zealand regulatory regime for oil and gas, even before one gets to CCS projects. Secondly, one notes how completely Alberta law keeps disposition of tenures — ownership — separate from regulation. This happens less in New Zealand. Thirdly, so far the Alberta regulatory regime has not come to grips with CCS at all. In a mature petroleum province with a number of stationary CO_2 sources and a political commitment to push forward with CCS, this is striking.

7. LIABILITY

Liability often looms large in debate about climate capture and storage law reform, but the term is a very general one. There is civil liability, primarily negligence and nuisance in tort law, but also trespass and occupiers' liability;[99] criminal liability for acts or omissions that cause serious harm to others; environmental liability for pollution and failure to comply with the requirements of the regulatory scheme; and liability for GHG emissions beyond what is allowed by the relevant emissions trading scheme or other regulatory system. In any such situation, liability breaks down into general liability — for example, to pay money damages, and remedial liability, in putting the matter right.[100] A further perspective on liability or responsibility is the different stages of the CCS process at which it may arise. Any analysis of civil liability is complicated by the question of limitation periods and in particular whether the period runs from the date of an act causing damage, from the date when the damage is or could reasonably be discovered, or from the date when the actual loss is sustained.[101]

98 D Hawkins and S Bachu, "Deployment of Large-Scale CO_2 Geological Storage: Do We Know Enough to Start Now?", Paper presented to 8th International Conference on Greenhouse Gas Control Technologies, Trondheim, Norway, 2006, at <www.events.adm.ntnu.no>; see Bankes, Poschwatta & Shier, supra note 36, at 597. For New Zealand, to the end of 2007, a total of 773 wells are recorded as having been drilled: McDouall Stuart, "Riches for the Want of $ — Exploration in NZ", 2003 (617 wells to end 2002); and Ministry of Economic Development, *Energy Data File*, June 2008, Table H.1 (156 in years 2003–2007).

99 It may be observed generally that the ownership or possession of land in itself rarely results in liability; some act or defined omission causing harm is generally required.

100 See Bankes, Poschwatta & Shier, supra note 36, at 621 on this aspect.

101 G P Campbell, "Carbon Capture and Storage: Legislative Approaches to Liability — Managing Long Term Obligations and Liabilities", Paper presented at AMPLA National Conference, Sydney, 28–31 October 2009. On the commercially important questions of

The most controversial question in CCS law-making has been whether, after closure of a CCS operation, responsibility should be transferred from the operator to the state. The default position — unless the law is changed somehow — is that there is no such transfer, and the operator remains liable for negligence and otherwise. The EU Directive of 2009, building on some years of policy work, provides for a transfer of responsibility to the competent authority for monitoring, corrective measures, and ETS liability, but only (i) after the elapse of a minimum of twenty years from closure; (ii) if all available evidence indicates that the stored CO_2 will be completely and permanently contained; and (iii) on the making of a financial contribution for thirty years' monitoring.[102] But the transfer is heavily qualified — for example, as to negligence.

In Australia, the initial policy position was that liability should be based on the existing rules of regulation and common law, but that the practical consequence of closure was that the government may assume responsibility in a manner that would minimise exposure to health, environmental, and financial risks for project operators, governments, and future generations.[103] However, when the Bill was introduced in the Commonwealth Parliament in 2008 it said nothing about government liability. In the House of Representatives the relevant Committee recommended that there should be a transfer of long-term liability on strict conditions; but in the Senate the equivalent Committee recommended against a transfer; liability should stay with the company responsible. However, the Senate chose to follow the House of Representatives' Committee recommendations. The government accepted this change in position, and the Bill was enacted with provisions for government liability.

On one side of this interesting debate are arguments against government liability. Industry regulation does not generally extend to excluding liability for negligence and other wrongs, and the legal framework for CCS should be no different from that applying to any other industry. We should not burden the taxpayer. We should not hand out special favours. "Polluter pays" is the relevant principle; the true costs of CCS should be internalised. We should not create a disincentive for the adequate management of stored GHGs. A claim by companies to be relieved of liability is inconsistent with their claim that the

how risk of liability may be allocated between a sequestration company and CO_2 suppliers, see Campbell ibid, and S Golding, "Some Considerations in Drafting Carbon Capture and Storage Contracts" (2009) 28 ARELJ 418.

102 Directive 2009/31/EC on the Geological Storage of Carbon Dioxide, 23 April 2009, Arts 18–20.

103 Ministerial Council on Mineral and Petroleum Resources, *Carbon Dioxide Capture and Geological Storage: Australian Regulatory Guiding Principles* (2005) 46. I draw with thanks on an unpublished paper, C Kubs, "The Future of Long Term Liability for Carbon Capture and Storage in New Zealand: Stick to the Status Quo or Follow in Australia's Footsteps?", University of Waikato, 2009.

risks to the community are small. Companies would only be liable if they fail to meet a duty of care.

On the other side of the debate, the main argument is that it is important, even urgent, for governments to foster this new industry. Foreseeability is not easy to establish while it is new. The existence of uncertain liability creates a poor investment climate and impedes commercial development. The lack of any track record makes it difficult to obtain insurance. Any problem with CCS injection is going to appear relatively soon, and the risk decreases quickly after the end of injection operations, so that a few years post-closure the residual risk to the government is very small. Practically speaking, we must accept that companies simply do not last forever, and there would be de facto inheritance of risk over time. Without a government assumption of liability, an injured party may be left without any existing party to sue.

It is an interesting question of legal policy. Can companies be induced to manage risk better by the threat of indistinct future liability, or by a set of specific near-term obligations as to closure? Useful comparisons could be made with similar questions in relation to minesite reclamation, nuclear industry insurance, and bank deposit guarantees.[104]

Under the OPGGSA as enacted, an application for a site closing certificate must include modelling and assessment of the behaviour of the injected GHGs.[105] The applicant must carry out a decommissioning programme including plugging and abandonment of wells to prevent the escape of GHGs. The Minister may issue a pre-certificate notice which sets out the monitoring, measurement and verification requirements and the financial security that the applicant must post. The Minister may withhold a pre-certificate notice if injected GHGs are not behaving as predicted, of if there is a SRSAI on natural resources, the environment, or human health and safety. After a pre-certificate notice is issued and complied with, a site closing certificate is then issued. It remains in force indefinitely. Fifteen years or more after injection operations end, if injected GHGs are behaving as predicted, if the storage formation is stable, if there is no SRSAI, and if there has been no further injection of GHGs, then the Minister may declare the end of a closure assurance period. The effect is that from that point on, where the operator incurs any liability out of its operations, the Commonwealth will indemnify the operator, and the Commonwealth assumes liability where the operator has ceased to exist.[106]

The onshore Australian legislation may be noted briefly. In Queensland, injected GHGs become the property of the state after decommissioning, but

104 On minesites and oil spills, see Bankes, Poschwatta & Shier, supra note 36, at 625.

105 Part 3.4, Div 7, ss 386–398.

106 Sections 400–401. For a good general appraisal of the issues, see Minter Ellison, *Carbon Capture and Storage*, supra note 64; and R Campbell, "Long-Term Liability for Offshore Geosequestration" [2006] AMPLA Yearbook 515.

the extent that liability is thereby transferred is unclear.[107] In Victoria, risk must be evaluated before an authority is cancelled, and long-term monitoring and verification must be paid for, but there is no provision for liability or its transfer.[108] In South Australia, common law liability is unaltered.[109] There is no equivalent in these Acts of the OPGGSA indemnity.

In Canada, Bankes, Poschwatta and Shier consider that it is likely that losses suffered because of CCS projects in Alberta will be subject to the general law of torts in common law, as are losses at present from oil and gas operations.[110] There is no special scheme of liability for blowouts or other release events in Alberta, although there is one under the federal legislation governing the offshore and the north.[111] However, the OGCA regime in Alberta does cover liability for the costs of remediation for proper abandonment, and for failure to comply with ERCB orders as to spills, blowouts, or similar incidents. An Orphan Fund is an important component of the regime. The Fund is financed by an industry levy, in order to meet the costs in cases of default in paying for the works to deal with such spills, blowouts, and the like. However, the Fund only covers the costs of control and remediation of a release, and does not cover liability for other harms it may cause. It is very arguable that the example of the present regime for oil and gas demonstrates that it is entirely possible to require the CCS industry itself to provide the additional security necessary to ensure that resources will be available to take remedial action in the event of a leak or release.[112] One matter, however, that does require change is that a CCS operator be required to take an assignment of all licences for abandoned wells within its approval area, so that the CCS operator (and not the operator of the abandoned well) be liable for repressurisation of the formation.

8. RELATIONSHIP WITH OTHER LEGISLATION

The last set of issues is a general one: the way that carbon capture and storage legislation would connect with other aspects of the legal system — other statutes in particular. Of those, the first is the climate change legislation. In the international sphere there has been a long debate, still unresolved, whether to

107 Greenhouse Gas Storage Act 2009 (Qld) s 181. The section is entitled "Responsibility for injected GHG streams after decommissioning" but ownership does not generally impose liability.

108 Greenhouse Gas Geological Sequestration Act 2008 (Vic) ss 112, 174 et seq. Section 187 deals with the occupiers' liability of the holder of an authority.

109 Petroleum Act 2000; and Campbell, supra note 106.

110 Bankes, Poschwatta & Shier, supra note 36, at 620. They provide a useful appraisal of the ways that CCS operations could attract liability.

111 Canada Oil and Gas Operations Act, RSC 1985, c O-7, s 26.

112 Bankes, Poschwatta & Shier, supra note 36, at 624.

accept CCS projects for credits under the Clean Development Mechanism.[113] Under national or sub-national legislation establishing emissions trading schemes, it needs to be decided whether CCS is a simple abatement, a reduction in emissions, or whether it is an offset, which would entitle the owner of the facility to offset credits. In the ETS of the European Union, it is an abatement. The advantage of it being an offset is that the ownership of storage can be treated differently from that of the sources. The generator of the source would not be liable, for example, in the event of any failure of permanence of the storage, unless contractually bound. Offsets also make it easier to deal with multiple generators feeding into the one storage.[114]

The new Australian Act, the OPGGSA, does not address the treatment of CCS in emissions trading. Australian law-making on emissions trading is under way. At the same time, one notes that New Zealand's Climate Change Response Act 2002, with the major 2008 amendments establishing the emissions trading scheme, and with the alterations of 2009, makes little reference at all to CCS: s 168(1) authorises the making of regulations to prescribe the criteria for the type of carbon dioxide capture and storage for which a person may register under the Act as a participant. More will probably need to be done to produce a satisfactory interface.

The second set of relationships is with environmental regulation, chiefly in New Zealand the Resource Management Act 1991. As noted earlier, without law reform CCS operations require discharge permits under the RMA, and no doubt a number of other consents. A CCS regime of a kind could in theory be made the subject of a code nested within the RMA, under a national policy statement and national environmental standards, but it is unlikely to be satisfactory in practice. More likely to be an acceptable solution is CCS legislation outside the RMA, but with an interface that ensures that the RMA continues to control matters that properly belong under it. It may be possible for the CCS legislation to control subsurface operations that involve formations with no known hydraulic connection with surface features or with freshwater aquifers reasonably capable of surface use, in lieu of the RMA.

It is a serious concern that neither the RMA nor any equivalent extends beyond the twelve-mile limit, so as to be effective in New Zealand's Exclusive

113 At its October 2009 meeting the CDM Executive Board, having had the matter under consideration since 2005, could only agree on presenting a summary of possible consequences: "Carbon dioxide capture and storage in geological formations as CDM project activities", at <www.cdm.unfccc.int>. Also see P Martins Barata, "Carbon Capture and Storage in the Clean Development Mechanism: Overcoming the Stalemate" (2008), Think Piece, Centre for Law & the Environment Carbon Capture Legal Programme, at <www.ucl.ac.uk>.

114 See an excellent explanation by L Chiam, "Abatements and Offsets: Legal Issues in Reducing Emissions and Developing Offset Projects" (2008) 27 ARELJ 105.

Economic Zone ("EEZ"). It has been recognised for some time as a gap in the country's environmental management system, but policy initiatives in the field have not been productive. The matter needs to be dealt with whether or not CCS projects in the EEZ are foreseeable.

A third set is in relation to surface rights — that is, the right to enter and use privately owned land. In Alberta, the Surface Rights Act,[115] which has equivalents in the other prairie provinces of Canada, eliminates all rights of entry that a mineral owner holds as a matter of implication in a grant or as a matter of common law, and provides the means for a mineral operator to obtain either a surface rights agreement or a right of entry order from the Surface Rights Board. New Zealand's equivalent, in the Crown Minerals Act 1991, is not so extensive, and is subject to the constraints, described above, on the operations that can be carried out under permits issued under it unless it is amended to facilitate CCS.

Finally, safety and third-party access to CCS facilities may need consideration. The uptake of CCS will be constrained if the owner of a facility such as a pipeline or an offshore platform can shut others out from using it. In New Zealand, there has only been light regulation of such situations.[116] The Gas Act's definition of "gas" begins with fuel, but it provides that it includes any gaseous substance that the Governor-General in Council declares by Order in Council to be a gas for the purposes of the Act. It is a nice question of interpretation whether CO_2 could be the subject of such an order. If such an order can be made, and is, then the "co-regulation" of the Minister and the Gas Industry Company would apply. The safety regulation of the Gas Act would also apply. CO_2 presents hazards if compressed, as does any gas under pressure, and if concentrated it can asphyxiate by excluding oxygen; but it is not inflammable like natural gas, and it is not poisonous like carbon monoxide or the hydrogen sulphide in sour gas. However, express legislation is more likely to be suitable to deal with both safety and third-party access.

9. CHARACTER OF THE LAW REQUIRED FOR CARBON CAPTURE AND STORAGE

Some of the characteristics of the law reform necessary for New Zealand become clear in the process of making these comparisons. Property rights issues can get complicated, but straightforward and equitable solutions should

115 RSA 2000, c S-24. Bankes, Poschwatta & Shier, supra note 36, at 610 conclude that it is wide enough to authorise the injection of CO_2 for CCS purposes.

116 B J Barton, "Self-Regulation, State Regulation, and Co-regulation in Energy in New Zealand", in B Barton, L Barrera-Hernández, A Lucas and A Rønne (eds), *Regulating Energy and Natural Resources* (Oxford: Oxford University Press, 2006) 137.

be within reach. Long-term liability is a matter that involves policy choices that will probably be contested, but careful legislative design offers a range of solutions. A system of titles or permits akin to that under minerals or petroleum legislation is probably necessary. A regulatory framework will have to be designed to accompany it. Deficiencies in existing regulation for the exclusive economic zone, and for plugging and abandonment of wells, need not wait for CCS legislation for the remedy that they so clearly need.

One key question is whether the CCS legislation should be part of the petroleum legislation, under the Crown Minerals Act 1991, as it is in the federal Australian and South Australian legislation. There is certainly a case for building on existing legislation wherever possible.[117] The institutional and technical capacity required for CCS is similar in most respects to what is required for petroleum, so the CMA, administered by Crown Minerals on behalf of the Minister of Energy, is suitable. The need to establish a proper balance between CCS and petroleum operations means that there would need to be a high degree of connection with the CMA if a stand-alone statute was chosen. Public policy in New Zealand is likely to reflect a need to accommodate the desire of the petroleum industry to protect its interests, without giving it a veto or monopoly on the emergent CCS industry.

The final question to ask about new CCS legislation is, big or small? The Australian federal legislation is at an extreme few would recommend, and has its own special reasons for being so elaborate. One is tempted by the thought that at an early stage of a new technology all that is needed is a one-section power in the Crown Minerals Act to authorise the Governor-General to approve a CCS scheme and all that it requires, notwithstanding any rule of law to the contrary. However, the analysis of the Alberta letter of consent procedure for injection exposes the risks of going to such an extreme — and that is in the context of an otherwise elaborate regulatory regime. Laws that are somewhat longer than the bare minimum are part of the price we pay for formality, clarity, and openness. Sweeping unconstrained discretionary powers do not promote the rule of law. One can see the reason in the recommendation of Bankes and Poschwatta to steer a middle course, for amendments to statutes for disposition of titles, with regulations to carry more detail.[118] At the same time they make a credible case for legislation that gives flexibility, as do aspects of the Australian regime, to amend licences and consents in the light of new knowledge, and to accommodate adaptive management and "learning by doing". CCS has barely begun to evolve.

The International Energy Agency takes a similar view. Its key message for

117 Bankes & Poschwatta, supra note 40, at 65, 77. The same choice, they note, has been made in the European Union.

118 Ibid, at 71.

the development of legal regimes for carbon capture and storage is that: "A number of national legal and regulatory issues merit attention; however, the near-term priority should be spurring additional demonstration projects."[119] Delays in law-making should not impede demonstration projects, and we should not delay in providing basic legal frameworks for them, accepting that experience will cause them to be modified in due course. The need to get CCS under way is pressing, particularly in light of the number of coal-fired power stations being constructed internationally. Even if CCS is only to be a small part of the action we must take to stabilise the global climate, we must move to enact adequate legislation for it.

119 International Energy Agency, *Legal Aspects of Storing CO_2*, supra note 41, at 9.