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The Treatment of Carbon Capture and Storage Projects Within Emissions Trading Systems

by

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Abstract

Following the entry into force of the Kyoto Protocol, a new global market for trading allowances to emit greenhouse gases, known as the carbon market, has emerged. As an alternative to a command and control penalty regime or carbon taxes, regulation of emissions is increasingly taking the form of emissions trading through cap and trade schemes. Many jurisdictions including the European Union, Alberta and New South Wales are adopting cap and trade systems as their preferred method of achieving reductions. Given this development, it is important to determine how carbon capture and storage, a popular mitigation technology, is accounted for within these systems. This is the subject matter of this thesis.

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Epigraph

"[T]he Earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use and the effects of rapid population growth in many regions. These changes represent a major threat to international security and are already having harmful consequences over many parts of the globe...It is imperative to act now."

Conference Summary Statement from the World Conference on "The Changing Atmosphere: Implications for Global Security" held in Toronto, Canada, June 1988, reprinted in (1990) 5 Am UJ Int'l L & Pol'y 515.

Chapter One: Introduction

1.1 Background

Greenhouse gases ("GHGs") are essential gases, "both natural and anthropogenic that absorb and re-emit infrared radiation."[1] The thickening of the layer of GHGs has an effect on the earth's climate exhibited through a warming of the earth's atmosphere, ultimately creating what has been coined the "greenhouse effect".[2] Carbon dioxide ("CO_2") is responsible for over 60% of the greenhouse effect.[3] By the year 2030, the demand for energy is estimated to increase by 60%,[4] and the majority of that energy demand will be satisfied by using fossil fuels which are significant contributors to the increase of CO_2 emissions.

The United Nations recognized the need to take a proactive role in the development of mechanisms to encourage a reduction of GHG emissions. In 1988, the World Meteorological Organization ("WMO") and the United Nations Environment Programme ("UNEP") established the Intergovernmental Panel on Climate Change ("IPCC"), a global scientific body with a mandate to assist policy makers by providing information on climate change. The first IPCC Assessment Report, issued in 1990, reflecting the views of approximately 400 scientists, played a significant role in the development of the United Nations Framework Convention on Climate Change ("UNFCCC"),[5] which came into force on March 21, 1994. The UNFCCC has been ratified by 192 countries to date, including Australia, Canada and the countries of the European Union. The objective of the UNFCCC is to establish a framework for governments to implement programs, policies and regulations to address GHG emissions and "to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations

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[1] *United Nations Framework Convention on Climate Change*, 9 May 1992, 1771 UNTS 107, 31 ILM 849 (entered into force 21 March 1994) [*UNFCCC*].
[2] John Goetz, et al, "Development of Carbon Emissions Trading in Canada" (2008-2009) 46 Alta L Rev 377 at 379.
[3] *Ibid.* at 380.
[4] National Academies, "Joint Science Academies' Statement: Global Response to Climate Change" (7 June 2005), online: National Academies <http:www.nationalacademies.org/onpi/06072005.pdf>.
[5] *UNFCCC, supra* note 1.

in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[6] The primary commitment of the developed country Parties and other Parties in Annex I to the UNFCCC is adopting national policies and taking corresponding measures to limit GHG emissions.[7] To facilitate this, the Parties also committed to reporting on their progress, with the aim of returning to 1990 levels of GHG emissions.[8]

The Kyoto Protocol[9] came into force on February 16, 2005 and was established as a framework for achieving the objectives of the UNFCCC. The Protocol introduces quantifiable GHG emission limitation and reduction commitments for those developed countries and countries undergoing transition to a market economy listed in Annex I of the UNFCCC.[10] The Kyoto Protocol aims to stabilize GHG emissions at a level that will prevent damage to the climate by reducing human-induced GHG emissions on a global scale to 5% below 1990 levels in the first commitment period from 2008 to 2012.[11] Each Annex I Party that has ratified the Protocol has accepted binding emission reduction targets.[12] Each Annex I Party has an assigned amount ranging from 8% reductions, to 10% increases compared to 1990 levels.[13] The Protocol has three flexibility mechanisms available to assist the Parties in meeting their commitments: international emissions

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[6] *UNFCCC*, *supra* note 1, art 2.
[7] *Ibid,* art 4.2(a).
[8] *Ibid,* art 4.2(b).
[9] *Kyoto Protocol to the United Nations Framework Convention on Climate Change,* 11 December 1997, 2303 UNTS 148, 37 IL.M 22 (entered into force 16 February 2005) [*Kyoto Protocol*].
[10] Annex I parties are the industrialized countries and economies in transition listed in Annex I of the *UNFCCC.* Their responsibilities under the Convention are various, and include a commitment to reducing their GHG emissions to 1990 levels by the year 2000. Annex B countries are the emissions-capped industrialized countries and economies in transition listed in Annex B of the *Kyoto Protocol* that have binding emission reduction obligations. In practice, Annex I of the Convention and Annex B of the Protocol are used almost interchangeably.
[11] *Kyoto Protocol*, *supra* note 9, art 3(1).
[12] *United Nations Framework Convention on Climate Change, Kyoto Protocol Reference Manual on Accounting of Emissions and Assigned Amounts* (Germany: United Nations Framework Convention on Climate Change, 2008), online: UNFCCC <http://unfcc.int/resource/docs/publications/08_unfcc_kp_ref_manual.pdf> at 13.
[13] Jacob Werkman, "Compliance and the Kyoto Protocol: Building a Backbone into a "Flexible Regime" (1999) 9 Y B Int'l Env L 48 at 49.

trading,[14] the Clean Development Mechanism ("CDM")[15] and Joint Implementation ("JI").[16] Through these mechanisms, parties can generate, cancel, acquire, and transfer emission allowances (also known as carbon credits). Carbon credits earned through these compliance mechanisms may be traded to other Kyoto Protocol participants or banked for future use in meeting emission reduction requirements. Parties can implement domestic or regional emissions trading systems to facilitate meeting their commitments.

In order for Parties to meet their reduction targets, mitigation technologies are being increasingly employed. Mitigation options include carbon capture and storage ("CCS"), "energy efficiency improvements, the switch to less carbon-intensive fuels, nuclear power, renewable energy sources, enhancement of biological sinks, and reduction of non-CO_2 greenhouse gas emissions".[17] CCS has become a popular mitigation option because it has the potential to reduce overall mitigation costs while providing increased flexibility within emissions trading schemes in achieving GHG emission reductions.

CCS is the process of capturing and storing CO_2 that would otherwise accumulate in the atmosphere.[18] Geological carbon storage involves the separation and capture of CO_2 at the point of emissions, the transportation of CO_2 and the storage of CO_2 in deep,

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[14] *Kyoto Protocol*, *supra* note 9, art 17. Emissions trading allows countries that have unused assigned amounts to sell this excess capacity to countries that are over their targets.

[15] *Ibid*, art 12. The Clean Development Mechanism allows a country with an emission-reduction or emission-limitation commitment under the *Kyoto Protocol* to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction credits, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets.

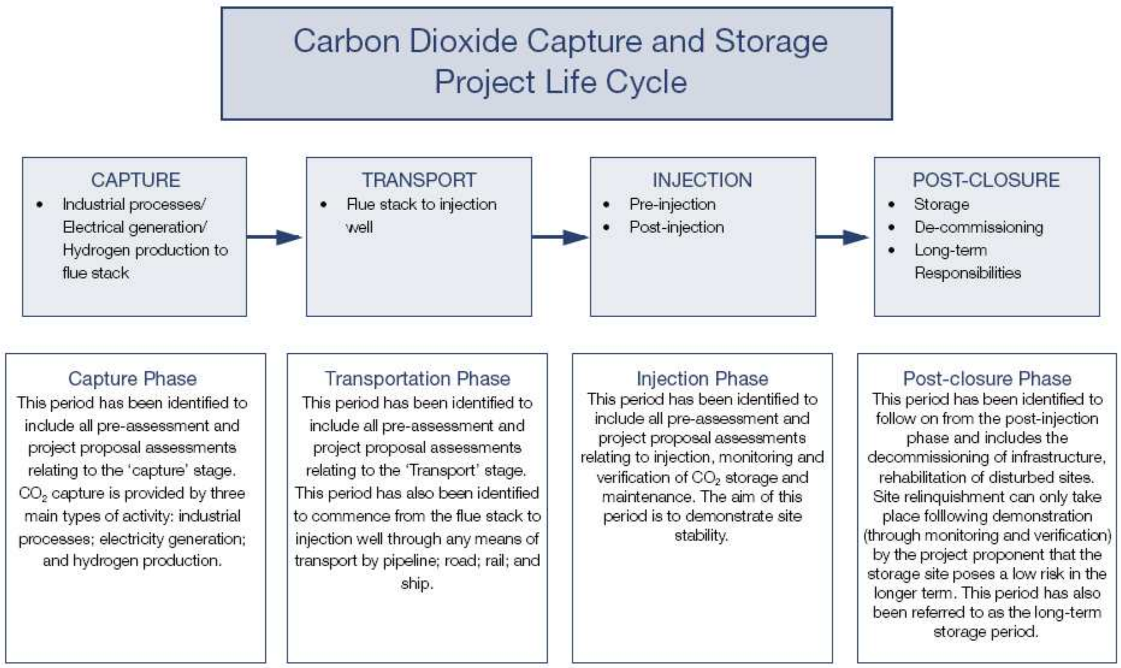
[16] *Ibid*, art 6. Joint Implementation allows a country with an emission-reduction or limitation commitment under the *Kyoto Protocol* to earn emission reduction units from an emission-reduction or emission removal project.

[17] Intergovernmental Panel on Climate Change, *IPCC Special Report on Carbon Dioxide Capture and Storage*, Metz, B, et al, eds (Cambridge, U.K.: Cambridge University Press, 2005) at 3 [IPCC Special Report].

[18] There are two types of carbon storage: geologic carbon storage and terrestrial carbon storage. This thesis will focus on geologic carbon storage. Terrestrial carbon storage involves the net removal of CO_2 from the atmosphere by plants during photosynthesis and its fixation in vegetative biomass and soils. National Energy Technology Laboratory, "Carbon Sequestration Atlas of the United States and Canada" 3rd ed (Report prepared for the United States Department of Energy, December 1, 2010), online: National Energy Technology Laboratory < http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasIII/index.html> at 6 [CCS Atlas].

underground geologic formations.[19] The following table describes each step of the CCS chain:

Table 1



Source: Ministerial Council on Mineral and Petroleum Resources, *Carbon Dioxide Capture and Geological Storage: Australian Regulatory Guiding Principles* (Australian Government, Department of Resources, Energy and Tourism, 2005), online: <http://www.industry.gov.au/assets/documents/itrinternet/Regulatory_Guiding_Principles_for_CCS20051124145652.pdf>.

The purpose of CO_2 capture is to produce a concentrated stream that can be readily transported to a CO_2 storage site.[20] CO_2 capture is usually from large, centralized sources

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[19] IPCC Special Report, *supra* note 17 at 199. Storage of CO_2 can take place in natural underground reservoirs such as oil and gas fields, coal seams and saline water-bearing formations utilizing natural geological barriers to isolate the CO_2 from the atmosphere. CO_2 storage may take place either at sites where the sole purpose is CO_2 storage, or in tandem with enhanced oil recovery, enhanced gas recovery or enhanced coalbed methane recovery.

like fossil fuel power plants, fuel processing plants and other industrial plants.[21] CO_2 is then transported from the source to the storage site via pipelines.[22] Finally, CO_2 is injected and permanently stored in an underground geological reservoir.[23] Geological storage of CO_2 relies on injection at depths of more than 1 km - CO_2 may be placed into oil and gas reservoirs,[24] saline formations,[25] unmineable coal seams,[26] organic-rich shales[27] and basalt formations.[28]

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[20] *Ibid* at 107. There are three main methods for capturing CO_2: Post-combustion systems separate CO_2 from the flue gases produced by combustion of a primary fuel (coal, natural gas, oil or biomass) in air. Oxy-fuel combustion uses oxygen instead of air for combustion, producing a flue gas that is mainly H_2O and CO_2 and which is readily captured. Pre-combustion systems process the primary fuel in a reactor to produce separate streams of CO_2 for storage and H_2 which is used as a fuel. Other industrial processes, including processes for the production of low-carbon or carbon-free fuels employ one or more of these same basic capture methods. The monitoring, risk and legal aspects associated with CO_2 capture systems appear to present no new challenges, as they are all elements of long-standing health, safety and environmental control practice in industry.

[21] *Ibid* at 108. Capturing CO_2 directly from small and mobile sources in the transportation and residential and commercial building sectors is expected to be more difficult and expensive than from large point sources.

[22] *Ibid* at 181. “A transportation infrastructure that carries carbon dioxide in large enough quantities to make a significant contribution to climate change mitigation will require a large network of pipelines”.

[23] Jon Gibbons & Hannah Chalmers, “Carbon Capture and Storage” (2008) 36 Energy Policy 4317 at 4319; IPCC Special Report, *supra* note 17 at 197:

> Depleted oil and gas reservoirs, possibly coal formations and particularly saline formations (deep underground porous reservoir rocks saturated with brackish water or brine), can be used for storage of CO_2. At depths below about 800–1000 m, supercritical CO_2 has a liquid-like density that provides the potential for efficient utilization of underground storage space in the pores of sedimentary rocks. Carbon dioxide can remain trapped underground by virtue of a number of mechanisms, such as: trapping below an impermeable, confining layer (caprock); retention as an immobile phase trapped in the pore spaces of the storage formation; dissolution in the *in situ* formation fluids; and/or adsorption onto organic matter in coal and shale. Additionally, it may be trapped by reacting with the minerals in the storage formation and caprock to produce carbonate minerals.

[24] CCS Atlas, *supra* note 18 at 28. The characteristics that have held oil and gas in the reservoirs for millions of years make them excellent target locations for geologic storage of CO_2. An added benefit of oil and gas reservoirs is that they have been extensively explored, which results in a wealth of data available to plan and manage proposed CCS. As a value-added benefit, CO_2 injected into an oil reservoir can enable incremental oil to be recovered. A small amount of CO_2 will dissolve in the oil, increasing the bulk volume and decreasing the viscosity, facilitating the flow to the wellbore. In the United States and Canada, it is estimated that 143 billion metric tonnes of CO_2 storage is available. At current CO_2 emission rates, this indicates 40 years of storage potential in oil and gas reservoirs.

[25] *Ibid* at 15, 27. Saline formations are layers of porous rock that are saturated with brine. They are more extensive than coal areas or oil and gas bearing rock and represent an enormous potential for CO_2 storage. In the United States alone, it is estimated that there is a CO_2 storage potential ranging from 1,653 billion

In general terms, if the formation is chosen properly, there is no reason to doubt the ability of underground formations to retain CO_2 for very long periods. Natural CO_2 fields indicate that under favourable conditions CO_2 can be retained in the subsurface for millions of years.[29] Each type of geologic formation has different trapping mechanisms, hydrodynamic conditions and depositional environment.[30] In fact, "the depositional environment, or the area where the sediment was deposited over many years, influences how formation fluids are held in place, how they move, and how they interact with other formation fluids and solids".[31] Thus, certain geologic properties may be more favourable to long-term containment required for CCS storage.

Several large scale CCS projects around the world are already being implemented. Currently, there are several million tonnes of anthropogenic CO_2 injected each year into commercial and demonstration CCS projects. In Europe, Norway hosts the most significant CCS commercial project in Sleipner which injects 1 MMt CO_2/year into a marine sandstone reservoir.[32] In Canada, the Weyburn-Midale CCS project in Saskatchewan is a commercial enhanced oil recovery project using an oil field reservoir and injecting 1.8 MMt CO_2/year.[33] In Victoria, Australia, the Otway Basin CCS

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metric tonnes to more than 20,213 billion metric tonnes of CO_2. At current CO_2 emission rates, calculations indicate more than 40 years of storage potential in saline formations.

[26] *Ibid* at 29. In the United States and Canada, it is estimated that there is CO_2 storage potential ranging from 60 billion metric tonnes to 111 billion metric tonnes in unmineable coal seams. At current CO_2 emission rates, calculations indicate more than 15 years of storage potential in assessed coal areas.

[27] *Ibid* at 31. Shales are most often used in a geologic storage system as a confining seal or caprock. If the horizontal permeability in shales is increased through engineering, CO_2 storage becomes feasible. With horizontal drilling, operations are basically engineering the porosity and permeability into shales to create flow pathways.

[28] *Ibid* at 30. Basalt formations are geologic formations of solidified lava. These formations have a unique chemical makeup that could potentially convert all the injected CO_2 to a solid mineral form, thus isolating it from the atmosphere permanently. Some key factors affected the capacity and injectivity of CO_2 into basalt formations are effective porosity of flow top layers and interconnectivity.

[29] Sam Holloway et al, "Natural Emissions of CO_2 from the Geosphere and their Bearing on the Geological Storage of Carbon Dioxide" (2007) 32 Energy 1194 at 1199.

[30] CCS Atlas, *supra* note 18 at 15.

[31] *Ibid.*

[32] *Ibid* at 12.

[33] *Ibid.* "MMt" is short form for million metric tonne. "Mt" is short form for megatonne.

demonstration project has injected 100,000 Mt CO_2 into a gas field sandstone reservoir.[34] Given the large scale deployment of CCS projects, it is important to determine how CCS will be accommodated within emissions trading systems.

1.2 Thesis Objective

The principal objective of my thesis is to evaluate the alternative ways in which CCS may be accommodated within emissions trading schemes. Emissions trading regimes recognize GHG abatement through either: (1) reducing emissions from the source; or (2) removing emissions from the atmosphere by placing them into sinks. Credits arising from CCS projects can be dealt with in one of two ways: (1) as an avoided emission created by a regulated party;[35] or (2) as an offset credit created by an unregulated, third party.[36]

After determining how an emissions trading scheme credits CCS, I will evaluate how successful it is in accommodating the development of CCS. Success will be determined by how clearly CCS is treated within a regime's legislation, along with how effective and efficient the emissions trading scheme is overall. Effectiveness will be determined by certainty, environmental accountability, investment predictability and ability to link with other trading systems. Efficiency will be determined by administrative simplicity, costs and flexibility. These criteria will be discussed in detail in chapter four of this thesis.

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[34] *Ibid.*

[35] With respect to the issue of avoided emissions, it will be necessary to determine when and where the captured CO_2 is treated as an avoided emission.

[36] Offset credits result from projects that reduce or sequester GHG emissions that would not have occurred in a business-as-usual situation. In order to be deemed an offset for compliance purposes, a CCS project would need to meet certain eligibility criteria, such as additionality, leakage, permanence and verification. Offsets will be discussed at length in chapter four of this thesis.

1.3 Methodology

To achieve my objective of evaluating alternative ways in which CCS may be accommodated, I use a comparative method to study regimes which have employed mandatory emissions trading schemes. I examine the way in which CCS is treated within the regimes of: (1) the European Union ("EU Emissions Trading Scheme – EU ETS"); (2) Alberta, Canada ("Specified Gas Emitters Regulation - SGER"); and (3) New South Wales, Australia ("Greenhouse Gas Reduction Scheme - GGAS"). Specifically, I used legal databases, including AGIS Plus Text, HeinOnline and LegalTrac, to undertake a literature review of secondary sources on the design of cap and trade emissions schemes. I focused on the literature surrounding the design criteria of cap-setting and offsetting because the design of an emissions cap and offset system has a direct impact on the efficiency and effectiveness of an emissions trading regime. In order to determine whether a regime is successful at accommodating CCS, I will apply the criteria of efficiency and effectiveness to each of my comparative regimes.

I apply legal analytical reasoning to the primary sources[37] and secondary sources from my comparative regimes in light of the legal theories discussed in the literature review. Within each comparative regime, I searched legal databases, including AGIS Plus Text, HeinOnline, International Legal Materials and LegalTrac, for terms including as "carbon capture and storage", "carbon sequestration", "geological sequestration", "emissions trading", "cap and trade", "carbon credits", "carbon accounting", "carbon offset", "emissions" and "avoided emissions". The key primary sources include legislation, regulations, and guidelines from the European Union, Alberta and New South Wales, and international protocols and conventions to which these jurisdictions are a party. The key secondary sources are: (1) legal academic commentaries written on the emissions regulatory frameworks in the European Union, Alberta and New South Wales; and (2) reports and commentaries from national and international resource organizations, such as

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[37] There is no relevant case law.

the Pembina Institute,[38] the Canadian Institute of Resources Law,[39] Environment Canada,[40] the International Energy Agency[41] and the Intergovernmental Panel on Climate Change.[42]

1.4 Framework

This thesis is divided into eight chapters. Following this introductory chapter, I discuss the distinction between avoided emissions and sequestration. I will then discuss the role of the IPCC and its development of internationally agreed upon CCS accounting methodologies.

In chapter three, I discuss the role that international flexibility mechanisms may play with respect to the crediting of CCS projects. This chapter focuses on the opportunities of the CDM and JI. Specifically, will CCS be eligible for crediting in the CDM and JI? I conclude that while CCS is not currently eligible in the CDM or JI, it will be eligible soon.

Chapter four is a literature review on the general design features of cap and trade schemes. I focus on the design features of cap-setting and offsetting because understanding those design features is essential to determining how successfully CCS is accommodated within a cap and trade scheme. The evaluation criteria of efficiency and effectiveness will be fleshed out in this chapter.

Chapters five, six and seven analyze the GHG emissions frameworks in the European Union, Alberta and New South Wales, respectively. Within each chapter, I will ask the same questions: (1) what is the general description of each trading regime? (2) what are

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[38] Online: Pembina Institute <http://pembina.org>.
[39] Online: Canadian Institute of Resources Law < http://cirl.ca/>.
[40] Online: Environment Canada <http://www.ec.gc.ca>.
[41] Online: International Energy Agency <http://www.iea.org>.
[42] Online: Intergovernmental Panel on Climate Change <http://www.ipcc.ch/index.htm>.

the methods of achieving compliance within the regime? (3) how does the regime accommodate CCS? (4) applying the criteria of effectiveness and efficiency, how successful is the regime at accommodating CCS? The same questions are posed for each regime; however, the format in which they are answered will be different given the vast differences in each regime's emissions framework.

Chapter eight is a summary of my conclusions.

1.5 Conclusion

After reviewing the treatment of CCS within the GHG emissions frameworks in the EU, Alberta and New South Wales, I conclude that the EU ETS, due to its efficiency and effectiveness as an emissions trading regime and due to its clear treatment of CCS within its emissions trading legislation, is the most successful regime at accommodating CCS. I also conclude that treating injected CO_2 as an avoided emission is a superior method of accounting for CCS projects. This approach clearly accounts for emissions from the capture, transport and storage elements of the CCS chain, as long as each entity downstream of the capture facility is a covered entity. However, having a robust offset regime in place also accommodates the development of CCS. Treating CCS as an offset allows entities that are traditionally left out of the market to have an incentive to engage in CCS. Regardless of whether a regime chooses to treat injected CO_2 as an avoided emission or as an offset credit, the key is that the CO_2 must be properly accounted for throughout the CCS chain.

Chapter Two: Avoided Emissions and Sequestration

2.1 Introduction

This chapter provides the contextual background for my thesis. First, I discuss the distinction between avoided emissions and sequestration under the Kyoto Protocol.[43] The reason why this discussion is necessary at the outset is because credits arising from CCS projects are dealt with in one of two ways: (1) as an avoided emission, i.e. the emission is treated as never being "emitted"; or (2) as an emission that is placed into a sink or sequestered, thereby creating a carbon credit. Second, I discuss the role of the IPCC and its development of internationally agreed upon CCS accounting methodologies.

2.2 Avoided Emissions and Sequestration

First, it is necessary to determine whether geological sequestration is recognized as a legitimate activity by the Kyoto Protocol. The international regime contemplates the use of sequestration through Article 2(1)(a)(iv) of the Protocol which states that each Annex I Party shall, in achieving its quantified emission reduction commitments elaborate policies and measures such as "[r]esearch on, and promotion, development and increased use of…carbon dioxide sequestration technologies…". The Kyoto Protocol does not elaborate on the meaning of CO_2 sequestration technologies. Thus, the Kyoto Protocol does not specify whether "sequestration" refers to biological sequestration, geological sequestration, or both. Article 3 of the Protocol does state that a sink must be a Land Use, Land-Use Change, and Forestry ("LULUCF") activity, which refers to the capture and storage of CO_2 by vegetation and soils. Geological sequestration is not mentioned; however, as will be discussed at length in chapter three of this thesis, the Conference of the Parties to the Kyoto Protocol has made a commitment to explore CCS as an offsetting activity under the CDM of the Kyoto Protocol.

Even though the Kyoto Protocol is not clear in its treatment of geological sequestration, this does not limit an Annex I Party from implementing its own geological sequestration policies in order to meet its emission commitments.

As discussed in chapter one, each Annex I Party has accepted binding emission reduction targets under the Kyoto Protocol. Annex I Parties to the UNFCCC and Annex B Parties to the Kyoto Protocol are obliged to meet their GHG emission reduction commitments under the Kyoto Protocol as follows:

> The net changes in greenhouse gas *emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation* since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I. *The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner* and reviewed in accordance with Articles 7 and 8.[44]

Thus, reduction commitments can result from either: (1) reducing emissions from the source; or (2) removing emissions from the atmosphere by placing them into sinks. Therefore, the question arises as to whether GHG reductions arising from geological sequestration projects, such as CCS, are the result of projects aimed at reducing emissions by sources or enhancing removals by sinks.

Reducing emissions from the source or treating CO_2 as an "avoided emission" means that captured CO_2 is treated as though it were never emitted. Enhancing removals by sinks or "carbon sequestration" refers to the capture and long term storage of CO_2 in forests, soils, oceans and in underground reservoirs. The IPCC seeks to clarify CCS accounting so that Annex I Parties can meet their commitments using this mitigation technology.

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[43] *Kyoto Protocol*, *supra* note 9.

2.3 CCS Accounting Methodologies

Accounting is necessary to demonstrate the effectiveness of CCS as an emissions mitigation tool and to protect the integrity of a GHG emissions trading scheme.[45] Accounting across the entire chain – capture, transport and storage - is necessary to ensure that CO_2 is ultimately stored.

Parties to the UNFCCC and Kyoto Protocol are obliged to use common reporting standards for their annual inventory reporting of anthropogenic emissions by sources and removals by sinks.[46] According to Article 5(2) of the Kyoto Protocol:

> *Methodologies for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol shall be those accepted by the Intergovernmental Panel on Climate Change* and agreed upon by the Conference of the Parties at its third session. Where such methodologies are not used, appropriate adjustments shall be applied according to methodologies agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise such methodologies and adjustments, taking fully into account any relevant decisions by the Conference of the Parties.[47]

The IPCC is the leading body for the assessment of climate change. Established by UNEP and the WMO to provide the world with a clear scientific view on the current state

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[44] *Ibid*, art 3(3) [emphasis added].
[45] Accounting refers to the process of making quantitative estimates of the amount of CO_2 handled in various stages of the CCS chain through monitoring. Monitoring refers to technologies and processes used to learn about specific aspects of CO_2 behaviour in the subsurface and near surface at CCS sites, including those employed to measure CO_2 stocks and flows.
[46] *Kyoto Protocol*, *supra* note 9, art 7.
[47] *Ibid*, art 5(2) [emphasis added].

of climate change and its potential environmental and socio-economic consequences,[48] the IPCC is open to all member countries of the UN and WMO. The IPCC is a “scientific body that reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters”.[49] By endorsing the IPCC, “governments acknowledge the authority of their scientific content”.[50]

Given its mandate to provide internationally agreed upon methodologies for accounting and reporting, the IPCC offers guidance in its 2006 Guidelines for National Greenhouse Gas Inventories (“IPCC 2006 Guidelines”).[51] The IPCC Guidelines were requested at the seventeenth session of the Subsidiary Body for Scientific and Technological Advice (“SBSTA”) of the UNFCCC, held in New Delhi in 2002, to update the Revised 1996 Guidelines.[52] The IPCC 2006 Guidelines cover new sources and gases as well as updates to previously published methods where technical and scientific knowledge have improved:

> This guidance assists countries in compiling complete, national inventories of greenhouse gases. The guidance has been structured so that

[48] Online: Intergovernmental Panel on Climate Change <http://www.ipcc.ch/organization/organization.htm>.
[49] *Ibid.*
[50] *Ibid*. Note that amid an increasingly intense public debate about the science of climate change and costs of curbing it, the IPCC has come under closer scrutiny, and controversies have erupted over its perceived impartiality toward climate policy and the accuracy of its reports. The InterAcademy Council (“IAC”) has called for a new leadership structure with shorter terms, tighter review procedures, and better lines of communication. Founded in 2000, the IAC was created to mobilize top scientists and engineers around the world to provide evidence-based advice to international bodies such as the United Nations and World Bank - including preparing expert, peer-reviewed studies upon request. Online: <http://reviewipcc.interacademycouncil.net/ReportNewsRelease.html>.
[51] Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (Prepared by the National Greenhouse Gas Inventories Programme), Eggleston, S, et al, eds (Japan: Institute for Global Environmental Strategies, 2006), online: Intergovernmental Panel on Climate Change <http://www.ipcc.nggip.iges.or.jp/public/2006gl/index.html> [IPCC 2006 Guidelines].
[52] Intergovernmental Panel on Climate Change, *Revised 1996 IPCC Guidelines for National Greenhouse Inventories* (Prepared by the National Greenhouse Gas Inventories Programme), Houghton, J, et al, eds (Paris, France: Institute for Global Environmental Strategies,1996), online: Intergovernmental Panel on Climate Change <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html>.

> any country, regardless of experience or resources, should be able to produce reliable estimates of their emissions and removals of these gases. In particular, default values of the various parameters and emission factors required are supplied for all sectors, so that, at its simplest, a country needs only supply national activity data. The approach also allows countries with more information and resources to use more detailed country-specific methodologies while retaining compatibility, comparability and consistency between countries. The guidance also integrates and improves earlier guidance on good practice in inventory compilation so that the final estimates are neither over- nor under-estimates as far as can be judged and uncertainties are reduced as far as possible.[53]

The IPCC 2006 Guidelines provide the following default rule for CCS activities:

> Where CO_2 emissions are captured from industrial processes or large combustion sources, emissions should be allocated to the sector generating the CO_2 *unless* it can be shown that the CO_2 is stored in properly monitored geological storage sites as set out in Chapter 5 of Volume 2.[54]

This suggests that in order to treat injected CO_2 as an avoided emission, governments must be able to demonstrate the fate of the CO_2 from the point of capture to the point of storage.[55]

The IPCC 2006 Guidelines have developed the monitoring and reporting requirements for all elements of the CCS chain, including transportation, injection and storage elements. In particular, the IPCC 2006 Guidelines contemplate the estimating, verifying and reporting of emissions from storage sites. The following table illustrates the reporting chain.

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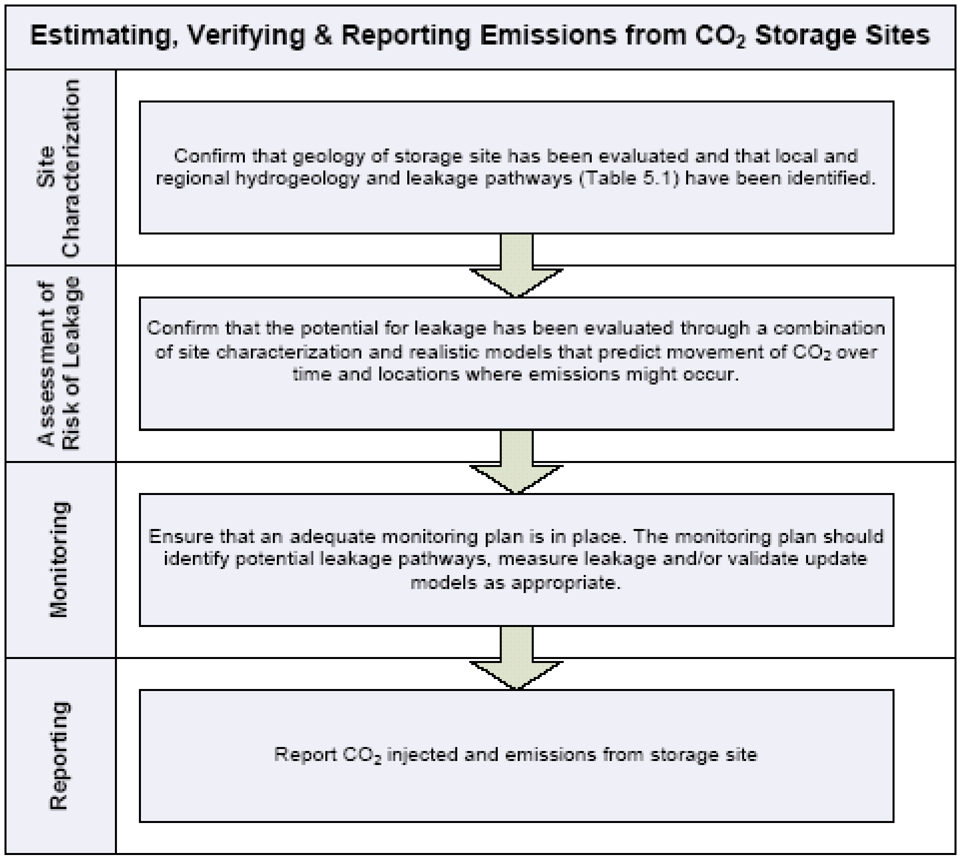
[53] IPCC 2006 Guidelines, *supra* note 51 at vi.
[54] *Ibid*, vol 1, s 8.2.1 [emphasis added].
[55] See Paul Zakkour, "CO_2 Capture and Storage in the EU Emission Trading Scheme, Monitoring and Reporting Guidelines for Inclusion via Article 24 of the EU ETS Directive" (Report prepared for the UK

Table 2



Source: Monitoring Procedure: IPCC 2006 Guidelines, *supra* note 51 at 5.13.

According to Zakkour, this monitoring procedure:

> [i]nvolves the development of an assurance-based scheme to demonstrate good storage site selection, evaluation of risks of containment loss, demonstration of a bespoke (or "adequate") monitoring plan, adaptive learning principles, and monitoring and reporting. As such, it creates a *de facto* approvals process for appropriate CO_2 storage site selection, risk assessment, and monitoring design, and thus the basis for claiming non-emissions as described above.[56]

Department of Business Enterprise and Regulatory Reform, November 2007), online: <http://www.co2captureandstorage.info/Best%20Practice%20Docs/2007BERR.pdf>.

The IPCC 2006 Guidelines provide guidance on how to account for and monitor emissions of CCS projects implemented in Annex I countries. Annex I countries must be aware of the IPCC 2006 Guidelines when drafting legislation applicable to the CCS chain because it ensures environmental accountability for each part of the chain.

2.4 Conclusion

CO_2 injected into CCS projects can be classified as either a sequestration activity or as avoided emissions. In either case, all CO_2 must be accounted for within the CCS chain. The international regime allows individual States to account for CCS in whichever way they choose as long as a methodology is chosen to appropriately account for GHG emissions.

There are two main ways in which a State can implement crediting of CCS projects: through domestic measures or through international mechanisms. The next chapter will focus on the opportunities available through the international mechanisms of the CDM and JI to implement CCS.

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[56] *Ibid* at 5.

Chapter Three: Treatment of CCS under the Kyoto Protocol

3.1 Introduction

There are two main ways in which a state can implement crediting for CCS projects: through domestic measures or through international flexible mechanisms, such as the CDM and JI of the Kyoto Protocol. Chapter three will focus on the international opportunities of the CDM and JI to implement CCS. In this chapter, I will first provide an overview of the CDM and JI mechanisms. Second, I discuss the primary barriers facing CCS as an offset under the CDM and JI, namely permanence issues relating to seepage and leakage. Third, I offer some conclusions on overcoming these barriers.

As discussed in chapter two, the international regime contemplates the use of biological sequestration through Article 2(1)(a)(iv) of the Kyoto Protocol which states that each Annex I Party shall, in achieving its quantified emission reduction commitments elaborate policies and measures such as "[r]esearch on, and promotion, development and increased use of (…) carbon dioxide sequestration technologies(…)". However, neither the Kyoto Protocol nor the Marrakesh Accords[57] provide explicit guidance on whether the deployment of geological sequestration could be encouraged through the CDM or JI. Recently, in Cancun in December 2010, a decision in principle was made to make CCS eligible within the CDM, but much work on the details remains. This chapter discusses the opportunities offered by the CDM and JI mechanisms of the Kyoto Protocol to implement CCS. Specifically, will CCS be eligible for crediting in the CDM and JI?

3.2 Overview of the Clean Development Mechanism and Joint Implementation

[57] Conference of the Parties, *Report of the Conference of the Parties on its Seventh Session, held at Marrakesh from 29 October to10 November 2001*, UNFCCC, 7th Sess, UN Doc FCCC/CP/2001/13/Add.1, Decision 17/CP.7 (2002) [Marrakesh Accords].

The Kyoto Protocol allocates each Annex B country an assigned amount of units ("AAUs") that are equal to the country's allowable GHG units.[58] Each Annex B country can trade or sell AAUs with another Annex B country in order to comply with GHG reduction obligation under the Kyoto Protocol.[59] The Kyoto Protocol permits contracting parties to utilize three types of flexibility mechanisms to meet their GHG reduction targets: international emissions trading, the CDM and JI.

Both CDM and JI are project-based, credit-trading mechanisms that permit any Annex B country, or private entities thereof, to earn emission reduction units by engaging in a project that helps another country decrease its GHG emissions.[60]

3.2.1 The Clean Development Mechanism

The CDM is a baseline and credit mechanism, which allows Annex I countries to earn emission credits by participating in emission reduction projects in 'developing countries', i.e. non-Annex I countries.[61] Such projects are arguably more cost effective than projects implemented in Annex I countries because developing countries have, on average, lower energy efficiencies, lower labour costs, weaker regulatory requirements, and less advanced technologies. The CDM is meant to deliver technology and sustainable development benefits to the host country.[62]

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[58] *Kyoto Protocol*, *supra* note 9, art 3 and Annex B. Annex B of the *Kyoto Protocol* lists parties that assume GHG reduction obligations and establishes the specific reduction target for each of these countries. A country's AAUs are determined in an amount that is equal to its baseline emissions minus the percentage of emissions reductions required under the Protocol. Annex B countries include developed countries and economies in transition.

[59] *Ibid*, art 17.

[60] Inho Choi, "Global Climate Change and the Use of Economic Approaches: The Ideal Design Features of Domestic Greenhouse Gas Emissions Trading with an Analysis of the European Union's CO_2 Emissions Trading Directive and the Climate Stewardship Act" (2005) 45 Nat Resources J 865 at 875.

[61] Non-Annex I countries do not have their own commitments under the *Kyoto Protocol*.

[62] *Kyoto Protocol*, *supra* note 9, art 12(2).

At the start of the relevant CDM project, a baseline is calculated based on the amount of emissions that would occur in the absence of the project. The difference between this baseline and emissions result in the creation of Certified Emission Reductions ("CERs").[63] Baselines are important because they enable the calculation of emissions reductions achieved by the project.[64] The actual GHG emissions of a project are determined by monitoring the project's performance over time. Thus, baseline and monitoring methodologies affect the size of emissions credits generated from a project.[65] Accurate and consistent baselines and monitoring methodologies are therefore important in ensuring that a credit from one project or country is equivalent to a credit from another.[66] Baselines are developed by project participants, audited by DOEs and approved by the CDM Executive Board ("EB"). CDM project activities need to result in emission reductions that are "real, measureable and long-term."[67]

The CDM has an intricate rule system to ensure environmental accountability. The highest authority of the CDM is the Conference of the Parties ("COP") serving as the Meeting of the Parties ("MOP") to the Kyoto Protocol ("COP/MOP"),[68] but the daily

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[63] Sander Simonetti, "Legal Protection and (the Lack of) Private Party Remedies in International Carbon Emission Reduction Projects" (2010) 28 J Energy & Nat Resources Law 171 at 173.
[64] See Marrakesh Accords, *supra* note 57, Annex G.
[65] *Ibid*.
[66] Katia Karousakis, "Joint Implementation: Current Issues and Emerging Challenges" (Paper prepared for the Organisation for Economic Co-operation and Development and the International Energy Agency, October 2006), online: OECD <http://www.oecd.org/dataoecd/45/32/37672335.pdf> at 19.
[67] *Kyoto Protocol*, *supra* note 9, art 12(5)(b).
[68] The COP is the highest decision-making authority of the *UNFCCC*. It is an association of all the countries that are Parties to the *UNFCCC*. The COP is responsible for keeping international efforts to address climate change on track. It reviews the implementation of the Convention and examines the commitments of Parties in light of the Convention's objective, new scientific findings and experience gained in implementing climate change policies. A key task for the COP is to review the national communications and emission inventories submitted by Parties. Based on this information, the COP assesses the effects of the measures taken by Parties and the progress made in achieving the ultimate objective of the Convention. The MOP is the highest decision-making authority of the *Kyoto Protocol*. The *UNFCCC* established two permanent subsidiary bodies: the Subsidiary Body for Scientific and Technical Advice and the Subsidiary Body for implementation. These bodies give advice to the COP and each has a specific mandate. They are both open to participation by any Party and governments often send representatives who are experts in the fields of the respective bodies. Online: UNFCCC <http://unfccc.int/essential_background/convention/convention_bodies/items/2629.php>.

supervision of the mechanism is carried out by the CDM EB. The EB is the gatekeeper of the CDM and has authority to do the following:

(a) Make recommendations to the COP/MOP on further modalities and procedures for the CDM;

(b) Make recommendations to the COP/MOP on any amendments or additions to rules of procedure for the EB;

(c) Report on its activities to each session of the COP/MOP;

(d) Approve new methodologies related to, *inter alia*, baselines, monitoring plans and project boundaries in accordance;

(e) Review provisions with regard to simplified modalities, procedures and the definitions of small scale project activities and make recommendations to the COP/MOP;

(f) Be responsible for the accreditation of operational entities and make recommendations to the COP/MOP for the designation of operational entities;

This responsibility includes:

(i) Decisions on re-accreditation, suspension and withdrawal of accreditation;

(ii) Operationalization of accreditation procedures and standards;

(g) Review the accreditation standards and make recommendations to the COP/MOP for consideration;

(h) Report to the COP/MOP on the regional and subregional distribution of CDM project activities with a view to identifying systematic or systemic barriers to their equitable distribution;

(i) Make publicly available relevant information, submitted to it for this purpose, on proposed CDM project activities in need of funding and on investors seeking opportunities, in order to assist in arranging funding of CDM project activities;

(j) Make any technical reports commissioned available to the public and provide a period of at least eight weeks for public comments on draft methodologies and guidance before documents are finalized and any recommendations are submitted to the COP/MOP for their consideration;

(k) Develop, maintain and make publicly available a repository of approved rules, procedures, methodologies and standards;

(l) Develop and maintain the CDM registry;

(m) Develop and maintain a publicly available database of CDM project activities containing information on registered project design documents, comments received, verification reports, its decisions as well as information on all CERs issued;

(n) Address issues relating to observance of modalities and procedures for the CDM by project participants and/or operational entities, and report on them to the COP/MOP;

(o) Elaborate and recommend to the COP/MOP for adoption at its next session procedures for conducting the reviews referred to in paragraphs 41 and 65 below including, *inter alia*, procedures to facilitate consideration of information from

> Parties, stakeholders and UNFCCC accredited observers. Until their adoption by the COP/MOP, the procedures shall be applied provisionally;
>
> (p) Carry out any other functions ascribed to it in decision 17/CP.7, the present annex and relevant decisions of the COP/MOP.[69]

The approval and registration of CDM projects is subject to a process involving the project participants, host and home country authorities and the CDM EB. First, the project developer has to prepare a project design document ("PDD") describing the proposed project activity, which is validated by a designated operational entity ("DOE").[70] A PDD must include a detailed description of the project, a proposed baseline methodology,[71] estimated lifetime of the project and which crediting period was selected, a description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity, environmental impacts, information on public funding, stakeholder comments, monitoring plan and calculations.[72]

Paulson outlines the next steps of the process as follows:

> To ensure that projects contribute to the sustainable development priorities of the host country, a letter of approval from the Designated National Authority [DNA] of the host country is also required. Projects that involve an Annex 1 country also need a letter of approval from the DNA of this country. If the project gets a positive validation, the DOE sends its validation report, including the PDD and the written approval of the project from the parties involved, to the EB making a request for registration which then has to be approved by the EB. If the project is

[69] Marrakesh Accords, *supra* note 57, Annex C.
[70] Emma Paulson, "A Review of the CDM Literature: From Fine-Tuning to Critical Scrutiny" (2009) 9 Int Environ Agreements 63 at 65. DOEs are independent firms accredited by the EB to perform the tasks of validating, verifying and certifying the CDM project activities throughout the CDM project cycle.
[71] Marrakesh Accords, *supra* note 57, Annex B, s 2(b). With respect to the proposed methodology, a project developer must submit either an approved methodology or a new methodology. To date, there are no approved methodologies for CCS. This issue is addressed further in this chapter.
[72] *Ibid*, Annex B.

> registered, the project owner then monitors the emission reductions made by the project and provides a monitoring report to a second DOE for verification. On the basis of the monitoring report and information collected through on-site inspections, the DOE writes a verification report, and if the monitoring is found to be satisfactory, it certifies to the EB that the claimed emission reductions actually have been made. If the EB has no further objections, it issues an amount of certified emission reductions (CERs) corresponding to the verified emission reductions to the project participants through the CDM registry.[73]

The CERs created through the CDM project cycle will then be credited to the Annex I country's binding emission target or alternatively, can be traded to another Annex I country or private party.

3.2.2 Joint Implementation

JI works similarly to CDM, with the exception that the host country is another Annex I country. The emission rights generated by JI projects are called emission reduction units ("ERUs"):

> 1. For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, provided that:
>
> ...
>
> (b) any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur;[74]

While Article 6 expressly refers to the enhancement of removals by sinks, Article 12 does not contain any such reference.

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[73] Paulson, *supra* note 70 at 65.
[74] *Kyoto Protocol*, *supra* note 9, art 6(1)(b).

Pursuant to the JI Guidelines,[75] there are two 'tracks' for generating ERUs, which differ in their respective procedures for the verification of the GHG emissions reductions. Under track 1, project monitoring and verification takes place under the responsibility of the host country, whereas under track 2, verification is carried out by a professional independent third-party verifier, hired by the project participants and supervised by the Joint Implementation Supervisory Committee ("JISC").[76] The functions of the JISC include: accrediting independent entities and reviewing the standards and procedures for accreditation, periodically reviewing and revising the guidelines and criteria for baseline setting and monitoring, developing the PDD documents for JI projects, carrying out reviews of determination and verification as required, developing any additional rules of procedure that may be required, and reporting to the COP/MOP on its activities.[77]

Track 1 of JI is also known as the 'fast track', "because standards are more flexible, external third-party determination is not required and baseline and monitoring procedures are set by the host country."[78] In order to be eligible for track 1, the host country must meet the requirements set out in the JI Guidelines:[79]

> (a) it is a party to the Kyoto Protocol;
> (b) its assigned amount has been calculated and recorded; [80]
> (c) it has a national system in place for estimating anthropogenic emissions by sources and anthropogenic removals of greenhouse gases by sinks;[81]
> (d) it has a national registry in place;[82]
> (e) it has annually submitted its most recent required inventory;[83] and

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[75] Conference of the Parties Serving as the Meeting of the Parties, *Report of the Conference of the Parties serving as a Meeting of the Parties to the Kyoto Protocol on its First Session, held at Montreal from 28 November to 10 December2005*, UNFCCC, 1st Sess., U.N. Doc. FCCC/KP/CMP/2005/8/Add.2 (2005) at 2 [JI Guidelines].
[76] Simonetti, *supra* note 63 at 177.
[77] JI Guidelines, *supra* note 75, para 3.
[78] Simonetti, *supra* note 63 at 177.
[79] JI Guidelines, *supra* note 75, para 21.
[80] *Kyoto Protocol*, *supra* note 9, arts 3(7), 3(8).
[81] *Ibid*, art 5(1).

(f) it has accurate procedures in place for accounting and submission of information.[84]

In addition to meeting all the eligibility requirements, transitioning to track 1 requires the host country to establish national guidelines, procedures and institutions, including procedures for approving projects, monitoring and verification.[85]

Where a host country does not meet all of the eligibility requirements, track 2 must apply. The UNFCCC maintains an updated, publicly accessible list of parties that meet the eligibility requirements.

In both tracks, a baseline must be established in order for the project to be approved. The JI baseline is "the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of greenhouse gases that would occur in the absence of the proposed project…''.[86] To facilitate the development of baselines and monitoring methodologies under JI, "[m]ethodologies for baselines and monitoring, including methodologies for small-scale project activities, approved by the Executive Board of the clean development mechanisms, may be applied by project participants under joint implementation, as appropriate."[87] This applies to track 2 projects; however, track 1 participants may also adopt this approach. Though the JISC is providing further guidance on the JI Guidelines for baseline setting and monitoring, the approaches to baseline setting and monitoring are likely to vary more under JI than under CDM and be

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[82] *Ibid,* art 7(4).
[83] *Ibid,* arts 5(2), 7(1).
[84] The party should submit supplementary information on its assigned amount in accordance with art 7(1) of the *Kyoto Protocol* and make any additions to, and subtractions from, its assigned amount pursuant to arts 3(7) and (8) of the *Kyoto Protocol*, including for the activities under arts 3(3) and (4) of the *Kyoto Protocol,* in accordance with art 7(4) of the *Kyoto Protocol*.
[85] Karousakis, *supra* note 66 at 15.
[86] JI Guidelines, *supra* note 75, Appendix B, para 1.
[87] Report of the Conference of the Parties serving as a Meeting of the Parties to the Kyoto Protocol on its first session, held at Montreal from 28 November to 10 December 2005, UN Doc FCCC/KP/CMP/2005/8/Add.2, Decision 10/CMP.1 at para 4(a).

more dependent on any national guidelines that host countries develop.[88] Overall, there is likely to be more variability in the baselines and monitoring approaches in JI than there is in the CDM because of this two track approach.

To conclude, if a host country meets all the eligibility requirements and qualifies for track 1, it is allowed to set its own national guidelines and procedures for the approval of JI projects, verification, and transaction of ERUs. Track 1 guidelines are therefore more flexible than track 2 because host countries can decide on the criteria for project development and qualification without the involvement of the JISC.[89] Therefore, CCS could qualify under track 1 if a host country deems CCS as an appropriate project within its national procedures. However, since track 2 projects must follow the international rules for JI project approval and verification of ERUs and be supervised by the JISC, CCS would likely be determined by the same standards set by the CDM EB. Thus, it is likely that if the EB or the COP/MOP decides that CCS is eligible for crediting, then the JISC would also approve it for track 2 crediting.

As compared to CDM, JI is relatively recent.[90] Since JI officially started in 2008, it is not surprising that more carbon credits are produced by CDM projects. Thus, I will discuss CCS issues with respect to the CDM. In particular, permanence has been the primary barrier for CCS as a legitimate international offset under the CDM. I will argue that permanence issues can be satisfactorily addressed and that CCS should therefore be accepted as a valid CDM project. If CCS were to be accepted as a valid CDM and JI project, more CCS projects would be developed worldwide and the carbon credits arising from CCS projects would become internationally fungible.

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[88] Karousakis, *supra* note 66 at 20.
[89] *Ibid* at 7.
[90] CDM had a jump start because CERs obtained from the year 2000 up to the beginning of the first commitment period could be used for compliance: *Kyoto Protocol*, *supra* note 9, art 12(10). ERUs, however, can only be issued for a crediting period starting after the beginning of the year 2008: JI Guidelines, *supra* note 75, para 5.

3.3 Carbon Capture and Storage: Key Issues

Permanence has been the primary barrier for CCS as a legitimate international offset. Permanence has been considered since 2005 by the COP/MOP, the Subsidiary Body for Scientific and Technological Advice ("SBSTA")[91] and the CDM EB.[92] The consideration of the eligibility of CCS projects for the CDM gained particular interest following the submission of three CCS methodologies for approval by the CDM EB in 2006.[93] The CDM EB, which considered and rejected these methodologies, identified a number of issues related to CCS project activities:

A. Policy or legal issues:

Acceptable levels of long-term physical leakage (seepage) risk and uncertainty (e.g. less than X% seepage by year Y with a likelihood of Z%);

Project boundary issues (such as reservoirs in international waters, several projects using one reservoir, etc) and national boundaries (approval procedures for projects that cross national boundaries);

Long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period (i.e. liability);

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[91] The SBSTA was established by art 7(2)(i) of the *UNFCCC*. The SBSTA's task is to provide the COP with advice on scientific, technological and methodological matters. Two key areas of work in this regard are promoting the development and transfer of environmentally-friendly technologies, and conducting technical work to improve the guidelines for preparing national communications and emission inventories. The SBSTA plays an important role as the link between the scientific information provided by expert sources such as the IPCC on the one hand, and the policy-oriented needs of the COP on the other. It works closely with the IPCC, sometimes requesting specific information or reports from it, and also collaborates with other relevant international organizations that share the common objective of sustainable development.

[92] The IPCC Special Report, *supra* note 17, summarizes the status of research, technology development, and deployment of CCS. The IPCC Special Report was presented at a side event at COP/MOP 1 in Montreal in December 2005. At the side event, the SBSTA encouraged Parties to the *UNFCCC* and the private sector to support the acceleration of CCS technologies. COP/MOP1 decided: (1) to organize a workshop on this in May 2006; (2) to solicit submissions by parties on CCS as CDM project activities, taking into account issues related to project boundary, leakage and permanence; (3) to request the CDM EB to consider proposals for new methodologies for CCS project activities, and (4) to consider all this material at its next meeting in view of achieving a decision.

[93] NM0167: "The White Tiger Oil Field Carbon Capture and Storage (CCS) Project in Vietnam"; NM0168: "The capture of the CO_2 from the Liquefied Natural Gas (LNG) complex and its geological storage in the aquifer located in Malaysia"; SSC_038:"Anthropogenic ocean sequestration by changing the alkalinity of ocean surface water (alkalinity shift)".

Accounting options for any long-term seepage from reservoirs (e.g. new modalities and procedures such as those for LULUCF).

B. Issues of a largely technical and methodological nature, which require geological, petroleum engineering, and other specific expertise in order to address. These include:

The development of criteria and a step-wise guidance for the selection of suitable storage sites with respect to the release of greenhouse gases, and how this relates to applicability conditions for methodologies;

Guidance on the development of adequate and appropriate monitoring methodologies for physical leakage (seepage) from the storage site;

Guidance related to the operation of reservoirs (e.g. well sealing and abandonment procedures) and remediation measures and how these may need to be addressed in baseline and monitoring methodologies.[94]

In December 2006, the COP 12/MOP 2 decided that more time was needed to carefully consider these issues and solicited submissions on the following:

(a) Long-term physical leakage (seepage) levels of risks and uncertainty;

(b) Project boundary issues (such as reservoirs in international waters, several projects using one reservoir) and projects involving more than one country (projects that cross national boundaries);

(c) Long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period;

(d) Long-term liability for storage sites;

(e) Accounting options for any long-term seepage from reservoirs;

(f) Criteria and steps for the selection of suitable storage sites with respect to the potential for release of greenhouse gases;

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[94]CDM EB, *Recommendation on CO_2 Capture and Storage as CDM Project Activities based on the Review of Cases NM0167, NM0168 and SSC_038*, CDM EB, 26th Mtg, Annex 13 (2006), online: UNFCCC <http://cdm.unfccc.int/EB/026/eb26_repan13.pdf> at 1.

(g) Potential leakage paths and site characteristics and monitoring methodologies for physical leakage (seepage) from the storage site and related infrastructure for example, transportation;

(h) Operation of reservoirs (for example, well-sealing and abandonment procedures), dynamics of carbon dioxide distribution within the reservoir and remediation issues;

(i) Any other relevant matters, including environmental impacts.[95]

The integration of CCS in the CDM was further considered at COP 13/MOP 3 in Bali, where the Parties agreed to further work on this issue in order to reach an agreement during COP 14/MOP 4 in December 2008 in Poznan.[96] At Bali, the CDM EB was requested to continue to consider proposals for new methodologies and intergovernmental, non-governmental organizations[97] and parties[98] were invited to communicate their views. These submissions were synthesized by the SBSTA[99] and then considered at its twenty-eighth session in Bonn in June 2008.[100] No conclusions were reached for the COP/MOP in Poznan.

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[95] Conference of the Parties Serving as the Meeting of the Parties, *Report of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol on its Second Session, held at Nairobi from 6 to 17 November 2006*, UNFCCC, 2nd Sess, UN Doc FCCC/KP/CMP/2006/10/Add.1 (2007) at para 21.

[96] Online: UNFCCC <http://unfccc.int/meetings/cop_14/items/4481.php>.

[97] Greenpeace International, the International Emissions Trading Association, the International Petroleum Industry Environmental Conservation Association, the International Risk Governance Council, the World Coal Institute, WWF, the International Chamber of Commerce and Sustain US have submitted their views.

[98] Japan, Saudi Arabia, Canada, Norway, Portugal, Korea, Brazil, New Zealand, Slovenia have submitted their views on the topic, online: UNFCCC <http://cdm.unfccc.int/about/ccs/index.html>.

[99] See Subsidiary Body for Scientific and Technological Advice, *Synthesis of Views on Issues Relevant to the Consideration of Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities*, UNFCCC, 28th Sess, UN Doc FCCC/SBSTA/2008/INF.1 (2008); See also Subsidiary Body for Scientific and Technological Advice, *Synthesis of Views on Technological, Methodological, Legal, Policy and Financial Issues Relevant to the Consideration of Carbon Dioxide Capture and Storage in Geological Formations as Project Activities under the Clean Development Mechanism Project Activities,* UNFCCC, 29th Sess, UN Doc FCCC/SBSTA/2008/INF.3 (2008).

[100] See Subsidiary Body for Scientific and Technological Advice, *Report of the Subsidiary Body for Scientific and Technological Advice on its Twenty-Eighth Session, held at Bonn from 4-13 June 2008*, UNFCCC, 28th Sess, UN Doc FCCC/SBSTA/2008/6 (2008), item 125-127.

At its fifth session in Copenhagen in December 2009, the COP 15/MOP 5 further considered the inclusion of CCS in geological formations as a CDM project activity. After considering the Annual Report of the CDM EB in 2009,[101] the COP 15/MOP 5 set out two options with respect to CCS. Under option 1, CCS shall not be eligible under the CDM in the second commitment period owing to unresolved concerns and issues at the international level, including:

(a) *Non-permanence, including long-term permanence;*

(b) Measuring, reporting and verification;

(c) Environmental impacts;

(d) The definition of project activity boundaries;

(e) Issues of international law;

(f) Issues of liability;

(g) The potential for the creation of perverse incentives for increased dependency on fossil fuels;

(h) Safety;

(i) The absence of insurance coverage to provide compensation for damage to the environment and to the atmosphere resulting from storage site leakage.[102]

Under option 2, CCS in geological formations will be CDM eligible in the second and subsequent commitment periods. Under this option, the COP/MOP requests the SBSTA to recommend modalities and procedures for inclusion under the CDM for adoption at its

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[101] Conference of the Parties Serving as the Meeting of the Parties, *Annual Report of the Executive Board of the Clean Development Mechanism to the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol at its Fifth Session, held at Copenhagen from 7 to 19 December 2009,* UNFCCC, 5th Sess, UN Doc FCCC/KP/CMP/2009/16 (2009), Annex II.

[102] Ad Hoc Working Group on Further Commitments for Annex I Parties under the KyotoProtocol, *Report of the Ad Hoc Working Group on Further Commitments for Annex 1 Parties under the Kyoto Protocol to the Conference of the Parties serving as the Meetingof the Parties to the Kyoto Protocol at its Fifth Session*, UNFCCC, 10th Sess, UN Doc FCCC/KP/AWG/L.15 (2009) at 29 [emphasis added].

sixth session in 2010 and its seventh session in 2011 in relation to the list of issues above.[103]

The SBSTA agreed to continue its consideration of CCS in geological formations as a CDM project at its 32nd session in May 2010. The issue of CCS project approval within the JI mechanism was not addressed at the Copenhagen conference.

At its session in Cancun in December 2010, the COP 16/MOP 6 finally made a decision on the inclusion of CCS in the CDM. The Cancun meeting agreed that CCS should be eligible under the CDM but on a conditional basis, i.e. provided that some of the more technical concerns addressed at COP 15/MOP 5 can be "addressed and resolved in a satisfactory manner".[104] The SBSTA shall report on appropriate "modalities and procedures" at the next COP/MOP in South Africa in December 2011, which will result in the adoption of a CCS/CDM eligibility rule book. Thus, there is a decision in principle to make CCS eligible within the CDM, but much work on the details remains.

As set out by the COP/MOP, the inclusion of CCS projects under the CDM raises a number of issues, most importantly, the issue of permanence. This chapter will focus on the issues surrounding permanence, including leakage, seepage of CO_2 from the storage site and how those issues can be addressed through temporary or permanent credits.

3.3.1 Permanence: Leakage Issues

In this section, I discuss the issues relating to leakage. Leakage in this context is not physical leakage or 'seepage' of CO_2 from the storage site. Rather, leakage is defined as "the net change of anthropogenic emissions by sources of greenhouse gases which occur outside the project boundary, and which is measurable and attributable to the CDM

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[103] *Ibid.*
[104] Subsidiary Body for Scientific and Technological Advice, *Draft Decision of 4 December 2010 on Carbon Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities,* UNFCCC, 33rd Sess, UN Doc FCCC/SBSTA/2010/L.24 (2010).

project activity."[105] To account for the problem of leakage, it was decided in the Marrakesh Accords that adjustments should be made for leakage when calculating the amount of CERs to be issued from a CDM project:

> 50. Reductions in anthropogenic emissions by sources shall be adjusted for leakage in accordance with the monitoring and verification provisions in paragraphs 59 and 62 (f) below, respectively.
> …
>
> 59. Subsequent to the monitoring and reporting of reductions in anthropogenic emissions, CERs resulting from a CDM project activity during a specified time period shall be calculated, applying the registered methodology, by subtracting the actual anthropogenic emissions by sources from baseline emissions and adjusting for leakage.
> …
> 62.
> …
> (f) Determine the reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the CDM project activity, based on the data and information derived under paragraph 62 (a) and obtained under paragraph 62 (b) and/or (c), as appropriate, using calculation procedures consistent with those contained in the registered project design document and in the monitoring plan;[106]

With respect to CCS capture technology, the IPCC addresses the following leakage issue:

> The energy required to operate CO_2 capture systems reduces the overall efficiency of power generation or other processes, leading to increased fuel requirements, solid wastes and environmental impacts relative to the same type of base plant without capture. However, as more efficient plants with capture become available and replace many of the older less efficient plants now in service, the net impacts will be compatible with clean air emission goals for fossil fuel use. Minimization of energy requirements for capture, together with improvements in the efficiency of energy conversion processes will continue to be high priorities for future

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[105] Marrakesh Accords, *supra* note 57, Appendix B. A more detailed description of "leakage" is discussed in chapter four of this thesis.
[106] *Ibid*, paras 50, 59.

> technology development in order to minimize overall environmental impacts and cost.[107]

Also, according to Philibert, Ellis and Podkanski, an important aspect of leakage is linked to the energy requirements for capture and storage - for example, upstream emissions from refineries, "due to the additional energy consumption imposed by the energy penalty of capture and storage must be accounted for under the leakage provisions (while the emissions resulting from on-site combustion of the fossil fuels should be accounted for as project emissions)".[108] Minimizing energy requirements and improving efficiency will assist in limiting leakage issues; however, regulations must also extend outside of the "capture" boundary. If the project boundary includes capture but not storage then leaks from the storage site must be accounted for under leakage provisions. If the project boundaries include storage, any leaks must be treated as emissions.

3.3.2 Permanence: Seepage

In this section, I address the issue of physical leakage or 'seepage' of CO_2 from the storage site.[109] According to the Kyoto Protocol, CDM project activities need to result in emission reductions that are "real, measurable and long-term".[110] In the context of potential CCS projects, this is only possible if the CO_2 is not re-emitted. Seepage from storage reservoirs is possible through either a gradual and long term release, or a sudden release of CO_2 caused by disruption of the reservoir.[111]

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[107] IPCC Special Report, *supra* note 17 at 107.
[108] Cedric Philibert, Jane Ellis & Jacek Podkanski, "Carbon Capture and Storage in the CDM" (Paper prepared for the Organisation for Economic Cooperation and Development and the International Energy Agency, November 22, 2007), online: IEA <http://www.iea.org/papers/2007/CCS_in_CDM.pdf> at 23.
[109] Seeepage is also discussed in chapter four of this thesis.
[110] *Kyoto Protocol*, *supra* note 9, art 12(5)(b).
[111] IPCC Special Report, *supra* note 17 at 373.

According to the IETA, "the risks of seepage are considered controllable on an insignificant level provided appropriate site selection and management".[112] Similarly, Philibert, Ellis and Podkanski argue that:

> If the geological formation is properly chosen, underground formations can retain CO_2 for very long periods. The risk of CO_2 leaks is higher during and shortly after the injection phase, when the gas pressure is high. If they occur, leaks are thus more likely to do so during, or shortly after, the crediting period. Any emissions that occur during the crediting period (which includes emissions related to the capture, separation, transport, and storage process – as well as of potential leaks of the stored CO_2) could be accounted as project emissions. Project boundaries should include the entire reservoir and adjacent zones that the CO_2 plume may reach. This would ensure that possible leaks – which should be accounted for as "leakage" if beyond the project boundaries – do not simply go unnoticed. If any observed faults in the integrity of the storage reservoir are properly addressed, the risk of leaks decreases over time as more CO_2 dissolves in water, gets trapped in pores and reacts with rocks, thereby reducing the pressure. There is, however, a need to provide strong incentives for guaranteeing long-term site monitoring and proper storage remediation, in case any leaks occur.[113]

As set out above, the highest risk of CO_2 leaks from the storage site occurs during the injection phase and shortly thereafter. Ongoing monitoring during the injection phase provides information about the fate of a CO_2 plume (i.e. whether it is moving towards a potential source of leaks such as a fault or a well), while post injection monitoring further improves the knowledge of the CO_2 behaviour and allows for model verification.[114]

If seepage of CO_2 occurs during the crediting period, these emissions can be monitored and reported against project baselines, and accounted for by deducting the amount from the project baseline for that year. However, if seepage from the storage reservoir occurs after the crediting period, then liability for the emissions needs to be effectively managed

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[112] Letter from the International Emissions Trading Association to the UNFCCC Secretariat (31 May 2007) in accordance with UN Doc FCCC/KP/CMP/2006/L.8, online: UNFCCC <http://unfccc.int/resource/docs/2007/smsn/ngo/018.pdf> at 7 [IETA, "Submissions to the UNFCCC"].
[113] Philibert, Ellis & Podkanski, *supra* note 108 at 5.

in order to maintain the environmental integrity of the CDM. According to the IETA, seepage of emissions beyond the crediting period could be managed within the CDM by either:

> (a) Creating longer-term liability for project developers/operators to buy GHG compliance units such as CERs in the event of seepage emissions as part of a CCS project approvals process (e.g. a permitting/licensing regime for CO_2 storage operations); or,
>
> (b) Applying a default or discount factor to account for future seepage emissions so that either a portion of CERs are not issued, a portion are set aside in a credit reserve, or a portion of the revenue from CERs sales is set aside in a contingency fund. This could serve to essentially cap liability for all actors in the market at the chosen default or discount rate.
>
> Whichever the approach, the most important consideration is that the structure of liability provisions needs to be practical and predictable for both project developers and the wider GHG market.[115]

The causes of leaks are likely to vary depending on the type of geological storage formation. For example, in the case of a saline formation, seepage may result from insufficient geological data on the cap rock,[116] whereas, "leaks from storage in an oil or gas field could mostly result from a well failure, due to chemical dissolution of the well bore isolation material (cement) or corrosion/failures of completion components".[117] In general terms, if the formation is chosen properly, there is no reason to doubt the ability of underground formations to retain CO_2 for very long periods. Natural CO_2 fields indicate that under favourable conditions CO_2 can be retained in the subsurface for millions of years.[118] The IPCC estimates that, for appropriately selected and managed geological reservoirs, more than 99% of CO_2 injected is "very likely" to remain in place

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[114] *Ibid* at 14.
[115] IETA, "Submissions to the UNFCCC", *supra* note 112 at 11.
[116] *Ibid.*
[117] *Ibid.*
[118] Holloway, *supra* note 29 at 1199.

over the first 100 years of storage, and is “likely” to remain in place over 1000 years.[119] Several large scale CCS projects are already being implemented. Currently, more than three million tonnes of anthropogenic CO_2 are injected each year underground in three major storage projects: Sleipner in Norway, Weyburn in Canada and In Salah in Algeria.[120] No seepage has been detected for any of these projects.[121] With appropriate site selection the local health, safety and environment risks of geological storage would be comparable to the risks of current activities such as natural gas storage, enhanced oil recovery and deep underground disposal of acid gas.

Nevertheless, the variation in potential seepage rates or risks from different storage options may mean that different rules may be needed for different types of CCS projects. Given that some stored CO_2 could escape, it will also be important to determine who is liable for any releases.[122] Liability issues are important both in the short-term (i.e. over the crediting period of a CDM project activity) and in the longer-term (potentially for hundreds or even thousands of years).[123]

The risk of CO_2 leaking from its storage site depends on several factors. These include the distance to the source of CO_2, site storage capacity, depth, porosity, permeability, and existence of fractures and faults in the seal above the reservoir, and well completion components, among other parameters.[124] In the case of CCS in former oil or gas fields, an account of all abandoned wells, including the condition of their sealing, will need to be completed. The retention time of CO_2 is therefore site specific. Strict criteria for site selection could be seen as one means of guaranteeing the environmental integrity of geological storage. Consistent standards are needed to ensure the highest level of prevention of leakage into the ground, water, and air systems over the long term. Any

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[119] IPCC Special Report, *supra* note 17 at 14. “Very likely” corresponds to a probability of between 90-99% and “likely” corresponds to a probability of between 66-90%.
[120] Philibert, Ellis & Podkanski, *supra* note 108 at 14.
[121] *Ibid.* There was no seepage detected as of 2007.
[122] *Ibid.*
[123] Liability issues are a separate and broader topic that will not be discussed in this thesis.
[124] *Ibid* at 15.

regulation of well design should include operational practices, materials used, number and age of wells, potential geophysical changes, pathways in the event of leakage, and duration of storage.[125] Using the experience of the oil and gas industry, CCS projects have adapted technologies for use in current CO_2 storage projects. While current oil and gas well design standards are thoroughly tested, some CCS-specific standards may be appropriate.[126]

The handling of potential impermanence of CCS operations is a critical factor in maintaining the environmental integrity of the CDM and JI, and by extension, international emissions trading. While there is little literature on accounting for the potential impermanence of CCS, there are a significant number of publications on accounting for the impermanence of CO_2 sequestration in the terrestrial biosphere. The literature suggests various accounting strategies to allow sequestration to be treated as the negative equivalent of emissions.[127]

Several options have been suggested to address the potential seepage from CCS projects. The first is to discount any credits generated by CCS projects by a certain amount. This would be appropriate if leaks were almost certain to take place. However, it is unlikely that CDM CCS projects would be approved if it was thought that they were likely to lead to significant levels of re-emissions. Determining an appropriate level of "discount" might also be challenging. How could carbon credits be discounted to accurately reflect the amount of CO_2 that escapes, and how can one predict the amount of leakage over hundreds or thousands of years? Lokey suggests that to resolve this problem, allowances

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[125] Paul Freund, "Legal Aspects of Storing CO_2," (Paper prepared for the International Energy Agency, July 2004), online: International Energy Agency <http://www.iea.org/textbase/work/2004/storing_carbon/Freund.pdf > at 32.

[126] Kate Robertson et al, "International Carbon Capture and Storage Projects Overcoming Legal Barriers" (Report prepared for the National Energy Technology Laboratory, June 23, 2006), online: National Energy Technology Laboratory <http://www.netl.doe.gov/energyanalyses/pubs/ccsregulatorypaperfinalreport.pdf> at 7.

[127] IPCC Special Report, *supra* note 17 at 373.

could be taken out of future allocation pools for tonnes of leakage that occur. [128] However, she notes that "how to allocate discounted credits is unclear since leakage could occur over hundreds or thousands of years."[129] Furthermore, discounting the credits would provide little incentive for remediation of leaks.

The second option is to generate only "temporary" credits. This option has been used to address the permanence problems that exist with other carbon sinks, or LULUCF activities, which refers to the capture and storage of CO_2 by vegetation and soils. As with CCS, carbon sinks achieve emission reductions only as long as the CO_2 remains sequestrated. To address the impermanence of carbon sinks, temporary CERs ("tCERs") and long-term CERs ("lCERs") are used.[130] Every five years, the net CO_2 removals achieved by these projects must be verified and certified by independent review. Both tCERs and lCERs eventually expire, whether the carbon remains stored or not as a consequence of these activities.[131] This expiration takes place at the end of the commitment period following the one for which tCERs were issued, or at the end of the crediting period, i.e. maximum 60 years, for lCERs.

Should such 'temporary' crediting mechanisms be applied to the emission reductions achieved by CCS project activities or should CCS projects benefit from traditional CERs? If traditional CERs are issued for CDM CCS project activities, how then should the issue of permanence be addressed? The idea of using separate credits for CCS called

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[128] Elizabeth Lokey, "Valuation of Carbon Capture and Sequestration under Greenhouse Gas Regulations: CCS as an Offsetting Activity" (2009) 22 Electricity Journal 37 at 42 [Lokey, "CCS as an Offsetting Activity"].
[129] *Ibid*.
[130] Note that before the rules on forestry projects for the CDM were agreed upon, there was a long discussion on how to handle the permanence issue in terms of the issuance of CERs: See Michael Dutschke, "Permanence of CDM Forests or Non-Permanence of Land Use Related Carbon Credits?" (Discussion paper prepared for the Hamburg Institute of International Economics, 2001), online: <http://www.econstor.eu/bitstream/10419/19417/1/134.pdf>; Kevin Marechal & Walter Hecq, "Temporary credits: A solution to the potential non-permanence of carbon sequestration in forests?" (2006) 58 Ecological Economics 699; Gregg Marland, Kristy Fruit & Roger Sedjo, "Accounting for Sequestered Carbon: the Question of Permanence" (2001) 4 Envtl Sci & Pol'y 259.
[131] Philibert, Ellis & Podkanski, *supra* note 108 at 20.

geological sequestration units ("GSUs") has thus been proposed. Lokey states that "[i]t is possible that these GSU offsets would have an implicitly lower value than other, less risky forms of emission offsets or, on the contrary, perhaps these GSUs would have a higher value since the sequestration is more permanent than other types of offsets."[132] Along those same lines, Bode and Jung argue that expiring CERs similar to those issued for CDM forestry projects could be one option for guaranteeing liability for the stored CO_2 in the framework of the international climate regime.[133]

The third option is to issue "permanent" CER credits. This would ensure fungibility of the CERs in the international carbon market, however there is a need to ensure proper accounting of any leaks and to assign liability in a way that favours effective storage site remediation over simple replacement of allowances if leaks occur.[134] If permanent CERs are issued to CCS projects, liability for long-term seepage could be assigned to the buyer of the CERs, to the project participants or to the host country.

Although some restrictions have been placed on the manner in which reduction credits are generated and used by carrying out forestry projects,[135] the Kyoto Protocol does not

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[132] Lokey, "CCS as an Offsetting Activity", *supra* note 128 at 42.
[133] Sven Bode & Martina Jung, "Carbon Dioxide Capture and Storage (CCS) – Liability for Non-Permanence under the UNFCCC" (Discussion paper prepared for the Hamburg Institute of International Economics, 2005) at 10.
[134] *Ibid* at 20.
[135] See Conference of the Parties, *Report of the Conference of the Parties on the Second Part of its Sixth Session, held at Bonn from 16 to 27 July 2001*, UNFCCC, 6th Sess, UN Doc FCCC/CP/2001/5 (2001) [Bonn Agreements] and the Marrakesh Accords, *supra* note 57. The Bonn Agreements and the Marrakesh Accords impose several restrictions on forestry activities. First, the total GHG emission reductions Annex B parties can claim from both human-induced forest management and JI-related forestry activities must be limited to a total of 54 megatons of carbon, a little more than 2% of aggregate emissions from Annex B countries, which were apportioned among Annex B countries according to the formula contained in Appendix Z to the Bonn Agreements. Second, afforestation and reforestation projects should be the only eligible activities under the CDM during the first commitment period: Bonn Agreements at 44. Qualifying afforestation and reforestation CDM project activities account for only a maximum of 1% of base year emissions, multiplies by 5, that a party may use toward its first commitment period goals: Bonn Agreements at 46. Third, the use of early reduction credits shall not be allowed, except in the CDM context: Marrakesh Accords, pt 2, vol II at 23. Fourth, Annex B countries may use banked GHG emission credits in any subsequent commitment period, but removal units earned from eligible human-induced LULUCF activities, including JI projects, carried out in Annex B countries may not be banked. The amount

limit the maximum number of credits that can be generated by other types of land-based sink-creating activity. Nor does it expressly put a quantitative ceiling on the total amount of GHGs to be covered by opting-in to flexibility mechanisms.[136] Thus, even though the credits created through the CDM and JI are meant to be supplemental to domestic actions for the purpose of meeting commitments under the Kyoto Protocol, there is no quantitative limit with respect to CCS, and thus there is great potential for its creation and use.

3.4 Conclusion

In order to resolve the issues of permanence, an approval mechanism for CCS projects must incorporate the necessary assurances with respect to leakage, seepage, monitoring and appropriate crediting. If these issues are properly addressed then CCS could be made available for crediting under the CDM and JI flexibility mechanisms.

Necessary assurances over leakage would need to address the CCS project's boundaries, along with minimizing the energy consumption imposed by the energy penalty of CCS.

Necessary assurances over seepage would need to address storage site integrity which depends on various factors, like the geological characteristics of the reservoir, the history of human usage, and the quality of well and sealing packages.

Necessary assurances over crediting would need to address proper accounting of any leaks and the assignment of liability in a way that favours effective storage site remediation over simple replacement of allowances if leaks occur.

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of bankable credits earned from JI and CDM projects is limited to 2.5% of the nation's AAUs: Marrakesh Accords, pt 2, vol II at 61.

[136] *Kyoto Protocol*, *supra* note 9, arts 6, 17 which use the phrase "shall be supplemental to domestic actions"; however, it does not impose any limit on the percentage of emissions reduction credits that any Annex B country may use toward meeting it emission reduction target.

Finally, central technical and accounting issues relating to CCS are already covered in the IPCC's Guidelines for National Greenhouse Gas Inventories.[137] The process outlined therein sets a blue-print for project approvals. Such a process can be developed within the context of the current framework for JI or CDM project approvals. In conclusion, the COP/MOP, JISC and CDM EB could refer to national guidelines and protocols, regulatory developments in the EU ETS, and the IPCC Guidelines for adopting criteria and procedural requirements for the selection and monitoring of appropriate storage sites, and for the creation of appropriate credits for CCS project activities. Such assessments could be included in the PDDs and their accurate fulfillment would thus have to be validated by the DOEs. Given the high technical complexity of CCS projects and the specific knowledge requirement to assess the adequacy of storage sites and monitoring issues, it would be wise to create groups of international experts to assist these national entities.[138] The CDM EB and JISC could be tasked to confirm the fulfillment of this procedure before proceeding to the registration of the CCS project. Thus, the CDM EB and JISC could follow the IPCC Guidelines for a general framework, and look to more practical guidelines from EU projects[139] and private initiatives[140] for more specific guidance.

Thus, it is possible for CCS to be eligible as an international offset under the CDM and JI mechanism. The next chapter brings the focus back to domestic measures. Chapter four discusses the design requirements of a cap and trade emissions scheme and how certain design requirements may affect the implementation of CCS within domestic schemes.

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[137] IPCC 2006 Guidelines, *supra* note 51, c 5.

[138] Anatole Boute, "Carbon Capture and Storage under the Clean Development Mechanism – An Overview of Regulatory Challenges" (2008) 2 Carbon and Climate Law Review 339 at 351.

[139] EU leaders have committed to the establishment of a network of up to 12 CCS demonstration plants in the EU by 2015. See the CCS Directive, *infra*.

[140] For example, see DNV, "CO_2QUALSTORE: Guideline for Selection and Qualification of Site and Projects for Geological Storage of CO_2" (Report No: 2009-1425, 2009), online: DNV <http://www.dnv.com/binaries/CO_2QUALSTORE_guideline_tcm4-412142.pdf>. DNV is an international company based in Norway. It provides risk management services. DNV has developed a comprehensive guideline for safe and sustainable geological storage of CO_2. DNV offers DOE services under the CDM.

Chapter Four: The Design of Cap and Trade Systems

4.1 Introduction

Following the entry into force of the Kyoto Protocol, a new global market for trading allowances to emit GHGs, known as the carbon market, has emerged. As an alternative to a command and control penalty regime or carbon taxes,[141] regulation of emissions is increasingly taking the form of emissions trading through cap and trade schemes.[142] Many jurisdictions including the European Union, Alberta and New South Wales are adopting cap and trade schemes as their preferred method of achieving reductions.

Given the rising popularity of cap and trade schemes, it is important to determine how CCS projects are treated within these systems. This chapter reviews the literature on the design of cap and trade schemes in order to determine how such systems accommodate CCS.

An extensive body of literature on cap and trade schemes has developed since the inclusion of the emissions trading provision in the Kyoto Protocol.[143] The first part of this literature review discusses the general concepts underlying cap and trade schemes, and provides an overview of the key design criteria: (1) scope, (2) sectors, (3) setting the cap, (4) allowance provisions and (5) offsetting. The second part of this literature review will focus on the literature relating to design principles of setting the cap and offsetting. I focus on the literature surrounding the design criteria of setting the cap and offsetting

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[141] A carbon tax is a fee emitters must pay for every metric tonne of CO_2 emitted above a threshold or per metric ton emitted cumulatively. Elizabeth Lokey, "Valuation of Carbon Sequestration under Greenhouse Gas Regulations" (2009) 22 Electricity Journal 11 at 13 [Lokey, "Valuation of Carbon Sequestration"].

[142] There are now regulated cap and trade schemes operating in the European Union, New South Wales, Alberta, and the North Eastern and Mid-Atlantic United States. Delphi Group, "Cap-and-Trade Systems: The Basics" (Ottawa: Delphi Group, 2009), online: Delphi Group <www.delphi.ca> at 1. The Delphi Group is a Canadian strategic consulting agency specializing in the area of climate change and corporate responsibility.

[143] *Kyoto Protocol*, *supra* note 9, art 17.

because their design has a direct impact on the efficiency and effectiveness of an emissions trading regime. In order to determine whether a regime is successful at accommodating CCS, I will apply the criteria of efficiency and effectiveness to each of my comparative regimes.

The methodology chosen for selecting the literature related to setting the cap was to canvass secondary material that is representative of the two major schools of thought on this issue: absolute vs. intensity-based caps. I chose to review cap-setting because the European Union uses an absolute cap as part of its design criteria, while Alberta and New South Wales both use an intensity-based cap. The type of emissions cap used in an emissions trading system has a significant impact on the efficiency and effectiveness of the scheme. As part of the discussion in chapters five, six and seven, I determine whether either of the caps has proven to be more effective and efficient in relation to CCS accommodation.

The methodology chosen for selecting the literature on offsetting was to review secondary literature on compliance offsets and draw the key criteria from the literature. When designing an emissions trading scheme, a regime must decide whether it will incorporate offsets into its scheme and to what extent offsets may contribute to its reduction obligations. For each comparative regime, I will discuss how well a scheme accommodates CCS by determining whether offsets form a part of a regime and whether CCS qualifies as an offset within that regime.

4.2 Key Design Features of Cap and Trade Schemes

4.2.1 General Overview of Cap and Trade Schemes

Cap and trade schemes involve setting a target cap[144] on the allowable emissions for certain industrial sectors for a given period of time. The caps are usually less stringent for the interim target dates in the short term and more stringent in the long term.[145] Large emitters are usually the first to be regulated, and individual caps for various industrial sectors are set. Emitters that are regulated within each sector either receive (allocation) or purchase (auction) allowances from the overall cap.[146] The aggregate of all the allowances that the regulator allocates is equal to the cap. Regulated emitters can then buy and sell these allowances to meet their targets, make in-house reductions through measures such as installing more efficient equipment, or purchase qualifying offsets to apply to their emissions reduction targets.[147]

Cap and trade schemes provide the opportunity for emissions to be reduced to the level of the cap at the lowest cost:

> If allowances are trading at $30, then emitters will find it cheaper to implement any emission reduction measures that cost less than $30 per metric ton. Thus, given heterogeneity in the cost of emissions reductions across the economy, some firms will find it cheaper to abate emissions, while others will find it cheaper to purchase permits. Trading maximizes economic efficiency through equalizing the marginal cost of emission reductions across the economy.[148]

If emitters exceed their individual caps, they must pay penalties that are designed to be more expensive than simply purchasing allowances or offsets.[149]

4.2.2 General Overview of Key Design Features

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[144] A cap is measured in tonnes of CO_2 or CO_2 equivalent.
[145] Lokey, "Valuation of Carbon Sequestration", *supra* note 141 at 14.
[146] *Ibid.*
[147] *Ibid.*
[148] Adam Millard-Ball, "Cap-and-Trade: Five Implications for Transportation Planners" (Paper prepared for the 2009 Transportation Sector Annual Meeting, Stanford, CA: Stanford University, 2009) at 4.
[149] Lokey, "Valuation of Carbon Sequestration", *supra* note 141 at 14.

Cap and trade schemes have broad acceptance in the literature, yet many details about the design of cap and trade schemes are still hotly debated. According to Bushnell and Chen, "[p]olicy-makers must often balance equity considerations with the desire to achieve cost-effective and meaningful reductions in emissions. The differential impacts of GHG regulation on various industries, regions, and consumers make the design of those regulations very contentious."[150]

The literature does, however, agree that an effective, fair and functional cap and trade scheme relies on the careful consideration of a number of key design factors.[151] These factors are:

(a) Scope

(b) Sectors

(c) Allowance provisions

(d) Setting the Cap

(e) Offsetting

4.2.2.1 Scope

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[150] James Bushnell & Yihsu Chen, "Regulation, Allocation, and Leakage in Cap-and-Trade Markets for CO_2" (Report prepared for the National Bureau of Economic Research, 2009), online: The National Bureau of Economic Research <http://www.nber.org> at 2.

[151] See Richard Baron & Stephen Bygrave, "Towards International Emissions Trading: Design Implications for Linkages" (Report prepared for the International Energy Agency, 2002), online: International Energy Agency <http://www.iea.org/papers/2002/linkages.pdf>; See William Blyth & Martina Bosi, "Linking Non-EU Domestic Emissions Trading Schemes with the EU Emissions Trading Scheme" (Report prepared for the International Energy Agency, 2004), online: International Energy Agency <http://www.org/papers/2004/non_eu.pdf>.

The scope of a cap and trade scheme determines the jurisdiction of the scheme and which gases will be regulated. The geographic boundaries of a cap and trade scheme are typically the jurisdictional boundaries of the regulatory body establishing the scheme. While some cap and trade schemes only cover CO_2,[152] other schemes cover all six GHGs[153] covered by the Kyoto Protocol.[154] According to Sterk, "a domestic emissions trading regime may choose to regulate solely one or several of them."[155]

4.2.2.2 Sectors

Cap and trade schemes typically include emitters based on both the amount of GHGs emitted and by sector. A cap and trade scheme will typically only apply to large final emitters ("LFEs")[156] in sectors that are responsible for emitting the most GHGs within a jurisdiction.[157] LFEs typically include cement facilities, chemical plants, coal mining operations, fertilizer plants, gas plants, heavy oil operations, oil sands plants, petroleum refining operations, pipelines and power plants.[158]

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[152] For example, the EU ETS and the Regional Greenhouse Gas Initiative in the United States only cover CO_2.

[153] These 'Kyoto gases' are carbon dioxide (CO_2); methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). *Kyoto Protocol*, *supra* note 9, Annex A.

[154] For example, the schemes in Alberta and New South Wales cover all six GHGs. See Alberta Environment, *Specified Gas Reporting Standard* (Edmonton: Alberta Environment, 2007), online: Alberta Environment <http://www3.gov.ab.ca/env/air/pubs/ghg_specified_gas_reporting_standard.pdf> [*SGRS*]; See online: New South Wales Greenhouse Gas Abatement Scheme <http://www.greenhousegas.nsw.gov.au/documents/Intro-GGAS.pdf>.

[155] Wolfgang Sterk et al, "Ready to Link Up? Implications of Design Differences for Linking Domestic Emissions Trading Schemes" (Paper prepared for the German Federal Ministry of Education and Research, 2006), online: Wuppertal Institute for Climate, Environment and Energy <http://www.wupperinst.org/uploads/tx_wibeitrag/ready-to-link-up.pdf> at 14.

[156] For example, LFEs in Alberta are those facilities that emit 100,000 tonnes of CO_2e per year and in Canada are those facilities that emit (at the most) 50,000 tonnes of CO_2e per year. Equivalent carbon dioxide ("CO_2e") is the concentration of carbon dioxide that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas. Examples of such greenhouse gases are methane, perfluorocarbons and nitrous oxide. See Environment Canada, *Turning the Corner: Regulatory Framework for Industrial Greenhouse Gas Emissions* (Ottawa: Environment Canada, 2008), online: Environment Canada <http://www.ec.gc.ca/doc/virage-corner/2008-03/pdf/COM-541 _Framework.pdf> [Federal Framework].

[157] Delphi Group, *supra* note 142 at 2.

4.2.2.3 Allowance Provisions

Allowance provisions typically include allocation, banking and/or borrowing.

Regulators generally have three options when allocating emission allowances: allocation, auctioning or a combination of the two. Allocation provides allowances for free and is based on historical emissions, known as ‘grandfathering’. Grandfathering has been criticized as giving rise to windfall profits, being less efficient than auctioning, and providing little incentive for innovative new competition to provide clean, renewable energy.[159] One solution is to divide an emissions trading scheme into phases so that the rights are only valuable for a limited period, or to auction a portion of the allowances.[160]

Auctioning provides that emitters bid on allowances, with supply and demand dictating the price. If auctions are competitive, emitters will “calculate their abatement costs more accurately and will not have the same incentive to manipulate allocations”.[161] However, smaller firms may have difficulty bidding against larger, more established firms, and thus, giving away some allowances may be appropriate.[162]

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[158] See Alberta Environment, “Report on 2007 Greenhouse Gas Emissions” (Edmonton: Alberta Environment, 2007), online: Alberta Environment <http://environmental.alberta.ca/documents/2007_GHG_Report.pdf>.

[159] See Grant Boyle, “A Review of Emerging GHG Emissions Trading in North America: Fragmentation or Progress?” (2008-2009) 46 Alta L Rev 173 at 178; See Jonathan Nash, “Too Much Market? Conflict Between Tradeable Pollution Allowances and the ‘Polluter Pays’ Principle” (2000) 24 Harv Envtl L Rev 465.

[160] Although the first (2005 – 2007) and second (2008 – 2012) phases of the EU ETS saw a vast majority of allowances granted free of charge, the general tendency now – as is the case with the third phase (2013 - 2020) of the EU ETS - is to mandate the increasing use of auctioning. Robin Rix & Leanne Paul, “Broader and Deeper: Proposed Reforms to the Third Phase of the EU ETS” in Kim Carnahan, ed, *Greenhouse Gas Market 2008: Piecing Together a Comprehensive International Agreement for a Truly Carbon Market* (Geneva, Switzerland: International Emissions Trading Association, 2008) 52 at 53.

[161] Boyle, *supra* note 159 at 178.

[162] *Ibid.*

A combination will typically involve allocation for an initial phase and an overlap of auctioning in this initial phase and/or for subsequent phases.[163]

Banking occurs when a regulated entity has surplus allowances for a given compliance period and holds or 'banks' them for use in a future compliance period.[164] Borrowing occurs when a regulated entity lacks sufficient allowances for a given compliance period and borrows allowances from a future compliance period to meet its present needs. However, "[b]orrowing is not common in cap-and-trade schemes as it defers total emissions reductions and thus compromises the primary goal of expedient emissions reductions within the cap".[165]

4.2.3 Setting the Cap: Absolute Cap vs. Intensity-Based Cap

Regulators can choose to implement an absolute cap or an intensity-based cap.

In an absolute cap scheme, the regulator sets an overall limit on the total emissions. This overall limit or cap determines the number of emission permits to be supplied by the regulator. Regulated emitters are required to hold permits or allowances for the amount of emissions they generate in a certain time period. Lokey states that "[t]hese emitters can then buy and sell these allowances to meet their reduction targets, make in-house reductions through measures such as installing more efficient equipment, or purchase qualifying offsets to apply to their CO_2 reduction targets."[166] Lokey further notes that "[i]f emitters exceed their individual caps, they must pay penalties that are designed to be more expensive than simply purchasing allowances or offsets."[167] Kuik and Mulder note that in an absolute cap scheme, the polluter has a choice between holding more permits or generating less pollution:

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[163] See discussion on the EU ETS in chapter five.
[164] Boyle, *supra* note 159 at 178.
[165] *Ibid.*
[166] Lokey, "Valuation of Carbon Sequestration", *supra* note 141 at 14.

> The cost minimizing level of pollution is that at which the costs of abating one more unit of pollution equals the price of the pollution permit. If the permits can be freely traded among polluters, one market price for a pollution permit will emerge and all polluters will be faced with an equal marginal cost of pollution. Hence, polluters with high marginal abatement costs will abate less and polluters with low marginal abatement costs will abate more, thereby minimizing total national abatement costs given the prefixed national emissions cap.[168]

Most absolute cap schemes have phases for which the cap is predetermined and transparent to all: "[o]ver time, the cap is typically reduced or 'ratcheted' down from one phase to the next. This decreases overall GHG emissions and stimulates abatement innovation and investment moving forward".[169]

An alternative approach to absolute caps, and one currently favoured in Alberta[170] and New South Wales[171] is to use an intensity-based cap. In an intensity-based scheme, a regulator establishes a baseline level of emissions for each emitter in a regulated group and emitters that reduce emissions beyond the baseline can earn credits which can be traded at market prices among other emitters.[172] An intensity-based scheme involves trade in credits that are created when an emitter demonstrates performance beyond the designated baseline.[173] An intensity-based cap limits the amount of emissions for every unit of economic output (units of production at the micro level and Gross Domestic Product ("GDP") at the macro level).

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[167] *Ibid.*
[168] Onna Kuik & Machiel Mulder, "Emissions Trading and Competitiveness: Pros and Cons of Relative and Absolute Schemes" (2004) 32 Energy Policy 737 at 739.
[169] Delphi Group, *supra* note 142 at 2.
[170] Canada's proposed climate change program involves intensity targets: Federal Framework, *supra* note 156.
[171] *Electricity Supply Act 1995*, No 94 (NSW) [*Electricity Act*]; See New South Wales Greenhouse Gas Abatement Scheme, online: <http://www.greenhousegas.nsw.gov.au>.
[172] Boyle, *supra* note 159 at 177.
[173] *Ibid.*

Goetz summarizes the basics of an intensity-based scheme:

> Under this model, there is generally no initial allocation of allowances, and the target represents a percentage of the baseline. Credits will only be conferred on a regulated emitter in respect of its performance if it keeps its emissions below its target. Alternatively, there could be an initial allocation of allowances in an intensity-based system by giving each regulated entity allowances equal to its production in past years multiplied by an intensity target. One controversial advantage of using intensity targets is that industry will not be penalized for increasing its production. However, it is the fact that intensity-based targets do not guarantee any absolute reductions in emissions that renders such targets vulnerable to frequent criticism from environmentalists. Another disadvantage is that companies cannot be rewarded for reducing production or moving it out of the jurisdiction, although techniques also exist in a cap-and-trade context to correct this problem.[174]

Proponents of absolute caps argue that intensity-based caps "do have a strong following since they ease the abatement obligations of business in periods of rapid economic growth".[175] In fact, intensity-based caps "may even increase [total emissions] as long as this is justified by an increase of production or GDP – the reason which makes this approach generally more attractive to industry."[176]

Scholars who favour intensity-based caps argue that it may reduce the overall economic costs of an emissions trading regime. Kuik and Mulder list some of the advantages of an intensity-based scheme as follows:

> In the first place, it links up well with existing practices in environmental policy that commonly set individual permits of firms or voluntary agreements with industries in terms of relative standards. Second, in relation to this common practice of permit giving, the tradability of the permits increases flexibility of the scheme and provides a continuous

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[174] Goetz, *supra* note 2 at 382.
[175] Milken Institute, "A Cap-and-Trade Program Design for Greenhouse Gases: Achieving Flexibility and Cost-Effectiveness in Tackling Climate Change" (February 2007), online: Milken Institute <http://www.milkeninstitute.org> at 12. The Milken Institute is a U.S. based, publicly supported, non-partisan, independent think tank. For more than 15 years, the Milken Institute has addressed social and economic challenges, including climate change.
[176] Sterk, *supra* note 155 at 18.

> incentive for firms to increase their (relative) environmental performance. Thirdly, from a political perspective the problem of the initial distribution of pollution permits among firms may be less complicated if there is already agreement between energy-intensive firms and the government on energy-efficiency standards, such as in the Netherlands. Permits are more or less created automatically when a firm produces cleaner than required by the relative standard. Finally, producers often favour [intensity-based] cap-and-trade because they fear that absolute cap-and-trade will effectively prevent them from expanding their production and output, even if they produce in the most environmentally friendly way. This latter argument is especially cogent if the firm or industry operates on an international market where foreign competitors are not subject to the same level of environmental regulation.[177]

Thus, intensity-based caps may foster a vibrant economy by allowing emitters to increase production without being restricted by an absolute cap.

However, scholars who favour the absolute cap argue that an intensity-based cap is not effective. An intensity-based cap will not achieve a particular emissions reduction target with certainty.[178] Emissions may not be reduced if economic growth and industrial output is strong. From an environmental perspective, the most obvious disadvantage to an intensity-based approach is that the final level of pollution is not known in advance.[179]

Furthermore, proponents of an absolute cap argue that a scheme based on the emissions intensity approach may be difficult to integrate with other emissions trading schemes. According to Sterk, linking a scheme with an intensity-based cap to a trading system with absolute cap raises equity concerns:

> Companies under the system with relative targets have an incentive to increase output since they will receive more allowances the more they produce, whereas companies in the other system have a fixed cap and thus face higher costs for output increases. The incentive to increase output and thus emissions under the scheme with relative targets may also

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[177] Kuik & Mulder, *supra* note 168 at 740.
[178] Robert Nordhaus & Kyle Danish, "Assessing the Options for Designing a Mandatory U.S. Greenhouse Gas Reduction Program" (2005) 32 BC Envtl Aff L Rev at 112.
[179] Kuik & Mulder, *supra* note 168 at 740.

> compromise the environmental effectiveness of the combined regime because output increases will inflate the number of certificates available in the scheme with absolute targets. While one argument is that these emissions would occur anyway, the other suggests that the emissions will be higher in the combined scheme than if the schemes remained separate.[180]

The Milken Institute also broaches the linking issue:

> An absolute cap has practical consequences as well, as it clarifies expectations and provides direction regarding future targets in both domestic and international settings. Absolute targets are the current model in the EU's ETS and under the Kyoto Protocol. Thus, making a market with an absolute cap would be more compatible with (and easier to link to) those regimes.[181]

Finally, there is an issue within the literature with respect to efficiency. Kuik and Mulder maintain that:

> While [absolute] and [intensity-based] cap-and-trade generate the same, efficient level of abatement at the firm level, total industry output and therefore emissions will be higher under the [intensity-based] cap-and-trade system. In fact, the [intensity-based] cap-and-trade system is shown to be equivalent to the combination of an efficient cap-and-trade system and a production subsidy. To reach the same national level of emission reduction, prices of emission permits, the level of abatement, and the output of goods under a system of [intensity-based] cap-and-trade are higher than under the [absolute] system. This implies that the overall efficiency of the [intensity-based] cap-and-trade system is less than that of the absolute standards system.[182]

With an intensity-based cap, and depending on the methodologies adopted, input or output must also be monitored.[183] According to Gielen, this ultimately will result in a

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[180] Sterk, *supra* note 155 at 18.
[181] Milken Institute, *supra* note 175 at 12.
[182] Kuik & Mulder, *supra* note 168 at 740.
[183] Carolyn Fischer, "Rebating Environmental Policy Revenues: Output-Based Allocations and Tradable Performance Standards" (Discussion Paper prepared for Resources for the Future, July 2001), online: <http://www.rff.org/documents/RFF-DP-0122.pdf>.

high cost of monitoring, and may lead to a number of separate databases being required, especially where a firm produces many different products.[184] Thus, this can lead to a situation where intensity-based caps are more complicated both for government and business.[185] According to Baron and Bygrave:

> The use of relative targets essentially creates the need for two sets of measurement, verification and reporting systems. In addition, under the Kyoto Protocol, governments are committed to a fixed target whereas sectors under a relative cap would not be. While governments will need to ensure that their absolute country emissions target is met, there are risks for business that governments may need to introduce additional regulation at a later stage in order to meet their Kyoto targets which are defined in absolute terms. This is the source of significant uncertainty in the market for emission permits, in many ways offsetting some of the perceived "flexibility" advantages of relative targets. Governments may also have to acquire AAUs on the international market to offset higher emissions from industry, while industry in other countries would face that cost themselves, which would also raise competitiveness concerns.[186]

Under an absolute cap, only the emission output is monitored.

Intensity-based targets "can lead to increased administrative costs both to determine the appropriate metric – unit of output, value added, energy input or other – and to monitor this metric, in addition to GHG emissions".[187]

On the other hand, intensity-based caps are generally more attractive to industry as they allow greater flexibility for individual emitters in meeting their target. In addition, intensity-based caps imply free allocation,[188] which means that emitters essentially have

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[184] Arjen Gielen, Paul Koutstaal & Herman Vollebergh, "Comparing Emission Trading with Absolute and Relative Targets" (Paper presented at the 2nd CATEP Workshop on Design and Integration of National Tradable Permit Schemes for Environmental Protection, hosted by the University College of London, 25-26 March 2002), online: <http://www.ucd.ie/envinst/envstud/CATEP%20Webpage/Papers/Koustaal.pdf>.
[185] Baron & Bygrave, *supra* note 151 at 25.
[186] *Ibid.*
[187] *Ibid* at 24.
[188] Auctioning will only be possible with a fixed level of emissions, i.e. under an absolute cap.

free access to the carbon market.[189] Intensity-based caps allow for entry and expansion at no extra costs to the source as long as the emissions per unit of output or input are below the target.[190]

4.2.3.1 Application of Cap-Setting to CCS

The development of CCS will be directly affected by the design of a regime's emissions cap. There are recurring themes within the discourse between absolute and intensity-based caps, i.e. which cap contributes to the most effective and efficient scheme. From reviewing the literature, effectiveness appears to include emissions certainty, environmental accountability, investment predictability and the ability to link with other emissions trading systems. Efficiency appears to include administrative simplicity, the cost to both government and industry to implement the cap and flexibility for industry within the scheme.

As discussed in this chapter, absolute caps meet all of the effectiveness criteria: emissions certainty, environmental accountability, investment predictability and ability to link with other emissions trading schemes. In an absolute cap scheme, the cap is stable and predictable, which enables both the emitter and the market to accurately predict emissions. All other things being equal, if every cap and trade scheme employed an absolute cap, emission expectations would be relatively stable and so would the price of carbon. This is the reason why linking between absolute schemes is easier than linking with intensity-based schemes. Absolute caps also meet the efficiency criteria of administrative simplicity and lower costs for the government. According to scholars, absolute schemes are administratively less complex and therefore the overall cost to the

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[189] Baron & Bygrave, *supra* note 151 at 24.
[190] *Ibid.* At the same time, under the regime of fixed, absolute targets adopted under Kyoto, any increase in emissions by one sector will need to be compensated by more aggressive and costly reductions in another activity of the country. This discussion must therefore be cast in equity terms looking beyond the sector at stake.

government of administering a scheme with an absolute cap is more affordable. Therefore, due to the high effectiveness and efficiency of absolute schemes, CCS projects are likely to be more easily accommodated. Further, credits earned from CCS projects in an absolute cap regime would likely be more marketable than those in an intensity-based scheme since absolute caps appear to be easier to administer, easier to link into other emissions trading schemes and are able to provide a more accurate measure of pollution abatement.

Intensity-based caps do not meet any of the effectiveness criteria. However, these schemes meet several of the efficiency criteria: lower cost for industry to meet the cap and flexibility for industry within the scheme. An intensity-based cap fosters a vibrant economy by allowing emitters to increase production without being restricted by an absolute cap. Further, credits for avoided emissions and those earned for offsetting are, for the most part, employed within a domestic trading scheme and therefore their international "marketability" is not that important. Also, from a political and economic perspective, it is likely that an intensity-based cap would be easier to sell to industry, thereby making it easier to sell accompanying mitigation technologies like CCS.

The criteria of effectiveness and efficiency were specifically pulled from the literature on cap-setting; however, the criteria are equally applicable to offsetting.

4.2.4 Offsetting

Offsets are certified cuts in emissions that are outside the cap, but that can be counted towards meeting emissions goals by those within the cap.[191] In a mandatory cap and trade scheme, regulated emitters are typically allowed to meet a significant portion of their targeted reductions through purchasing carbon offset credits. According to Trexler,

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[191] Alan Durning et al, "Cap and Trade 101: A Federal Climate Policy Primer" (Paper prepared for the Sightline Institute, July 2009), online: Sightline Institute <http://www.sightline.org/research/energy> at 13.

Broekhoff and Kosloff, "[o]ffsets are emissions reductions that take place outside the domain of regulated activities. Carbon offsets allow GHG emitters to continue to emit GHGs in one place by procuring GHG credits from somewhere else, thus meeting mandatory emission reduction targets".[192] Trexler, Broekhoff and Kosloff further state that, "[a]n offset credit allows emissions from these capped sources to increase with the understanding that this increase is offset by a reduction from a source whose emissions are not capped, leaving net emissions unchanged".[193] Durning uses the following example to describe an offset:

> For example, a cement company in the Northwest that plans to emit 100 tons of carbon dioxide might choose to acquire 90 tons of permits at auction and supplement its obligation by purchasing 10 offsets, perhaps from a dairy farmer in the Midwest who installs a methane-capture system to trap gases created by decomposing manure. The cement company's demand for offsets, and willingness to pay for them, means that the atmosphere is spared the greenhouse gases from the manure that would otherwise have been released. To use the offsets under cap and trade, the cement company would present authorities with documentation of the offsets as a substitute for providing an equal number of carbon allowances.[194]

Offsets enable regulated entities to meet their compliance obligations by purchasing the credits that reduction projects generate. In general, an emission offset is generated when a project results in GHG reductions or removals that go beyond normal business operations and results in lower emissions.[195] The number of tonnes of reductions that result from these projects can be counted, checked by independent third parties, and sold to entities that must meet compliance obligations under a cap and trade system.[196] The money that

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[192] Mark Trexler, Derik Broekhoff & Laura Kosloff, "A Statistically-Driven Approach to Offset-Based GHG Additionality Determinations: What Can We Learn?" (2005-2006) 6 Sustainable Dev L & Policy 30 at 31.
[193] *Ibid.*
[194] Durning et al, *supra* note 191 at 13-14.
[195] Goetz, *supra* note 2 at 402.
[196] Lokey, "Valuation of Carbon Sequestration", *supra* note 141 at 15.

can be earned through sale of these emission reductions often provides the extra revenue necessary for the project to exist.[197]

Additionality, leakage, permanence, and verification and certification are valid concerns in designing an effective offset scheme. Well-designed and properly implemented offsets can reduce the costs associated with meeting the cap and ensuring the system's integrity.[198] The following sections discuss the literature on these important offset design features.

4.2.4.1 Additionality

Additionality is a necessary condition for offsets to perform their intended role. The concept of additionality "is a central, complicated, and controversial touchstone for project-based emissions trading."[199] It is generally agreed that offset projects must prove additionality in order to ensure their legitimacy. According to Goetz, "[t]he central concept in offsetting is additionality, that is, that the reductions are in addition to any that would otherwise occur in the business as usual (BAU) scenario."[200] Trexler, Broekhoff and Kosloff state that "if emissions reductions would have happened regardless of any offset credits, then issuing credits for them would allow global emissions to rise beyond what was intended under the cap. Credited reductions must therefore be additional to reductions that would have occurred in the absence of the trading system".[201]
The difficulty is estimating emission savings relative to a baseline estimate of "what would have happened without the project".[202] Since such an estimate is unobservable, additionality tests have been used to ensure emissions reductions are below the

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[197] *Ibid.*
[198] Brian Murray & Heather Hosterman, "Climate Change, Cap-and-Trade and the Outlook for U.S.Policy" (2008-2009) 34 NCJ Int'l L & Com Reg 699 at 715.
[199] Kyle W. Danish, "The International Regime" in Michael B. Gerrard, ed, *Global Climate Change and U.S. Law* (Chicago: American Bar Association, 2007) 31 at 45.
[200] Goetz, *supra* note 2 at 382.
[201] Trexler, Broekhoff & Kosloff, *supra* note 192 at 31.
[202] Michael Grubb, Christian Vrolijk & Duncan Brack, *The Kyoto Protocol: A Guide and Assessment* (London: Royal Institute of International Affairs, 1999) at 227.

baseline.[203] Trexler, Broekhoff and Kosloff summarize the variety of tests that have been developed in the literature in order to determine whether an offset project meets the criterion of additionality.[204] The tests are: the regulatory test,[205] the technology test,[206] the investment test,[207] the barriers test,[208] the common practice test,[209] the timing test,[210] the performance benchmark test,[211] and the project-in, project-out test.[212]

Unfortunately, it has proven extremely difficult for scholars to agree on which test(s) to apply. Trexler, Broekhoff and Kosloff note that in part, "this is because people disagree about how well different tests perform with respect to the underlying objective of the tests, i.e. judging whether the project would have happened in the absence of an offset

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[203] Trexler, Broekhoff & Kosloff, *supra* note 192 at 31.
[204] *Ibid.*
[205] *Ibid*. "The offset project must reduce GHG emissions below the level required by any official policies, regulations, guidance or industry standards. If it does not reduce emissions beyond these levels, the assumption is that the only real reason for pursuing the project is compliance; the project, therefore, is not additional."
[206] *Ibid*. "The offset project and its associated GHG reductions are considered additional if the offset project involves a technology specified as not being "business as usual". The default assumption is that for these "additional" technologies, GHG reductions are a decisive reason (if not the only reason) for using the technology in a particular project."
[207] *Ibid.* "The most common version of this test (often termed financial additionality) assumes an offset project to be additional if it can be demonstrated that it would have a lower than acceptable rate of return without revenue from GHG reductions."
[208] *Ibid*. "Under some versions of this test, an offset project is assumed to be additional if it faces significant implementation barriers (e.g. local resistance to new technologies, institutional constraints). Under other versions of the test, it must further be shown that at least one alternative (e.g. the "business as usual" alternative) to the offset project does not face these barriers. The underlying assumption is that GHG reductions are a decisive reason that a project is able to overcome the identified barriers (particularly if realistic alternatives do not face these barriers)."
[209] *Ibid.* "The offset project must reduce GHG emissions below levels produced by common practice technologies that produce the same products and services as the offset project. If it does not, the assumption is that GHG reductions are not a decisive reason for pursuing the project."
[210] *Ibid*. "The offset project must have been initiated after a certain date (e.g. the date of initiation of a GHG trading program) to be considered additional. The assumption is that any project started before that date must have had motivations other than GHG reductions. Under most versions of this test, offset projects started after the required date must also establish additionality through a second test."
[211] *Ibid.* "The offset project must demonstrate an emissions rate that is lower than a predetermined benchmark emissions rate for the particular technology or practice. This test is premised on the assumption that most, if not all, projects that beat the specified benchmark are ones in which climate change mitigation is a decisive factor in the decision to exceed the benchmark. The benchmark may also be used to calculate baseline emissions."
[212] *Ibid.* "The offset project must have lower GHG emissions than a scenario in which the project had not been implemented. If GHG emissions associated with the project are lower, then it is assumed that reducing emissions was a decisive reason for the project and that the project is additional."

crediting mechanism (or more generally, without concern for climate change mitigation)".[213] Regardless, "these tests are all trying to answer the same question: would a project have occurred regardless of the existence of drivers created by the trading system, or not?"[214] The reasoning behind the design principle of "additionality" is that if a project would have happened anyway, then issuing offset credits for its GHG reductions will actually allow a positive net increase in GHG emissions over a BAU scenario, undermining the emissions target of the GHG program. The question boils down to whether a "project would have happened in the absence of the offset crediting mechanism (i.e. if it and all other projects were not eligible for offset credits)? If yes, then the project is not additional; if no, then the project is additional".[215]

4.2.4.2 Leakage

The literature defines leakage as occurring "when emissions reductions from an offset project results in activities that increase emissions from a source not governed by the cap or offset program, thereby counteracting the project's emissions reductions".[216] Carbon leakage is the effect that regulation of emissions in one country or sector has on the emissions in other countries or sectors that are not subject to the same regulation.

Stavins suggests that leakage can be avoided within a country by establishing an economy-wide cap:

> A limited scope of coverage can cause "leakage," in which market adjustments resulting from a regulation lead to increased emissions from unregulated sources outside the cap that partially offset reductions under the cap. For example, a cap that includes electricity-sector emissions (and thereby affects electricity prices) but excludes emissions from natural gas or heating oil use in commercial and residential buildings may encourage

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[213] *Ibid* at 32.
[214] *Ibid*.
[215] *Ibid* at 31.
[216] Brian C. Murray et al, "Balancing Cost and Emissions Certainty: An Allowance Reserve for Cap-and-Trade" (2009) 3 Rev Envtl Econ & Policy 84 at 86.

> increased use of unregulated gas or oil heating (instead of electric heating) in new buildings. As a result, increased emissions from greater natural gas and oil heating will offset some of the reductions achieved in the electricity sector.[217]

More generally, any cap and trade scheme that is not economy-wide in scope will encourage emitters that are covered by the cap to exploit this incomplete coverage by seeking ways to avoid regulation.

Leakage can also be defined by an emitter's decision to move its installation to another country which is not as strict in enforcing inefficient operations.[218] Wrake describes the effect of firm relocation as follows:

> The basic argument is simple: given the asymmetries in carbon prices between Europe and the rest of the world, it is rational for European firms, all else being equal, to look for opportunities to shift their activities elsewhere. Empirical evidence suggests that the cost of complying with environmental regulation is generally a small share of a firm's total cost structure...However, on the margin, it would be rational for firms to relocate production in response to environmental stringency.[219]

If industry activities are simply shifted outside of the country, it would make the emissions trading scheme less effective and raise the overall cost of reaching the environmental objective.[220]

According to the IPCC, the leakage rate is defined as the increase in CO_2 emissions outside of the countries taking domestic mitigation action, divided by the reduction in emissions of countries taking domestic mitigation action.[221] The IPCC elaborates as follows:

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[217] Robert Stavins, "A Meaningful U.S. Cap and Trade System to Address Climate Change" (2008) 32 Harv Envtl L Rev 293 at 311.
[218] *Ibid.*
[219] Markus Wrake, "Emissions Trading: The Ugly Duckling in European Climate Policy?" (Report Prepared for the Swedish Environmental Institute, July 2009) at 24.
[220] *Ibid.*
[221] Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Metz, B, et al, eds (Cambridge University Press: Cambridge, 2007), online: IPCC <

> It has been demonstrated that an increase in local fossil fuel prices resulting, for example, from mitigation policies may lead to the re-allocation of production to regions with less stringent mitigation rules (or with no rules at all), leading to higher emissions in those regions and therefore to carbon leakage. Furthermore, a decrease in global fossil fuel demand and resulting lower fossil fuel prices may lead to increased fossil fuel consumption in non-mitigating countries and therefore to carbon leakage as well.[222]

However, the IPCC recognizes the work of Sijm et al who provide a literature review and an assessment of the potential effects of Annex I mitigation associated with the EU ETS and developing countries:

> In the empirical analysis of effects in energy-intensive industries, the modelling studies reporting high leakage rates look at many other factors in addition to price competitiveness. They conclude that, in practice, carbon leakage is unlikely to be substantial because transport costs, local market conditions, product variety and incomplete information all favour local production. They argue that a simple indicator of carbon leakage is insufficient for policymaking.[223]

To ensure that leakage doesn't occur, "a firm would have to establish that the project would not simply shift emitting activities from the project site to another, unregulated site".[224]

4.2.4.3 Permanence

There is an abundance of literature on "permanence" as it is a key component to offset design. Permanence means that emission reductions are not reversible, or if they are, reversals are accounted for and compensated appropriately.[225]

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http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch11s11-7-2.html> , s 11.7.2 [IPCC Fourth Assessment Report].

[222] *Ibid*.

[223] *Ibid*, s 11.7.2.1.

[224] Nordhaus & Danish, *supra* note 178 at 122.

The literature on permanence is usually associated with offsets generated from biological sequestration of carbon in agricultural and forestry projects.[226] The literature maintains that forestry and agricultural soil are subject to a loss of sequestered carbon from natural disturbances such as fires, wind, and disease or pest outbreak, or intentional management actions such as cutting down forests or reversing agricultural management practices from conservation or no-till to conventional tillage.[227] Nordhaus and Danish state that "the capacity of forests to absorb CO_2 emissions is not infinite, and any forest eventually will start to release sequestered carbon emissions back to the atmosphere."[228]

Marland, Fruit and Sedjo ultimately summarize the key question: "[i]f activities succeed in increasing the carbon in the biosphere, will it stay there (the permanence issue)?"[229]

The question can also be framed as whether the project activities result in emission reductions that are "real, measurable and long-term".[230] In the context of CCS projects, this is only possible if the CO_2 is not re-emitted. The issue of permanence as it relates to CCS is discussed at length in chapter three.

4.2.4.4 Verification and Certification

The key question is "if activities succeed in increasing carbon stocks in the biosphere, is it possible to accurately and precisely measure and affirm that it has been done (the verifiability issue)?"[231] Offsets must be verified by a qualified third party certifier to

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[225] International Emissions Trading Association, "Making the Case for a Federal Greenhouse Gas Offsets Program" (International Emissions Trading Association, 2008), online: Climos <http://www.climos.com/misc/IETA_Offset_Whitepaper_Final.pdf> at 4 [International Emissions Trading Association, "Federal Greenhouse Gas Offsets Program"].
[226] *Ibid.*
[227] Choi, *supra* note 60 at 935.
[228] Nordhaus & Danish, *supra* note 178 at 125.
[229] Marland, Fruit & Sedjo, *supra* note 130 at 260.
[230] *Kyoto Protocol*, *supra* note 9, art 12(5)(b).
[231] Marland, Fruit & Sedjo, *supra* note 130 at 260.

confirm that GHGs were reduced or sequestered. Verification provides impartial confirmation to regulators that offsets are truly real and additional.[232] To meet these criteria, a number of market tools known as protocols and certification programs are developed by regulators. These types of tools are a feature of every project-based carbon market in existence. According to Savasta-Kennedy, “offset protocol and certification programs offer various definitions of what constitutes a viable offset, each program employing its own certification standards, which range in degree of complexity”.[233]

The International Emissions Trading Association (“IETA”) suggests that governments should consolidate existing methodologies using a “standards-based approach”.[234] Consolidating existing methodologies assists in streamlining the certification process. The IETA further suggests that a “clear and administratively simple offset program based on a “standards-based approach” reduces transaction costs and broadens the scope of possible reductions, ensuring that its benefits are not outweighed by its costs”.[235] Further, a “standards-based approach can promote quality offsets by reducing the subjectivity of baselines found in a case-by-case approach, balancing the likelihood of false positives and negatives, and subjecting projects within a given category and region to the same assumptions”.[236]

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[232] International Emissions Trading Association, “Federal Greenhouse Gas Offsets Program”, *supra* note 225 at 4.

[233] Maria Savasta-Kennedy, “The Newest Hybrid: Notes Toward Standardized Certification of Carbon Offsets” (2008-2009) 34 NCJ. Int’l L & Com Reg 851 at 866.

[234] “Standardized” approaches to baseline and additionality determinations seek to avoid the administrative overhead of case-by-case methods while maintaining high levels of quantification accuracy and environmental integrity. For a longer discussion of “standardized” approaches to offset crediting, see International Emissions Trading Association, “Expanding Global Emissions Trading: Prospects for Standardized Offset Crediting” (Report prepared for Carbon Forum Asian, November 2007), online: International Emissions Trading Association <http://www.ieta.org>.

[235] International Emissions Trading Association, “Federal Greenhouse Gas Offsets Program”, *supra* note 225 at 8.

[236] *Ibid.*

4.2.4.5 Application of Offsetting to CCS

Offsetting allows entrepreneurs outside the cap to create marketable carbon credits through carbon reduction/avoidance projects which "encourages investment, innovation and wider societal participation in the scheme and thus ensures that a broader range of sectors in the economy benefit from the scheme".[237]

For a CCS project to be approved as an offset, it is necessary to address the key design criteria of additionality, leakage, permanence, verification and certification, and limits on cap eligibility. First, in order to meet the additionality "test", each CCS project would have to be developed for the main purpose of creating offset credits, otherwise, it would be deemed as a "business as usual" project. It has been argued that because there are no incentives to install CCS equipment absent a climate change policy, emission reductions achieved by CCS are clearly "additional".[238] With respect to leakage, CCS projects should be monitored carefully in order to ensure that emitting activities are not simply being shifted from one project to another. While CCS will reduce overall emissions, the CCS chain will also generate emissions including emissions associated with capture and compression, fugitive emissions from pipelines and supplementary compression, and emissions associated with drilling and operating injection wells and associated facilities. Next, permanence requires that CCS projects permanently store CO_2 from the atmosphere. Finally, in order to be certified and verified as a legitimate offsetting activity, each part of the CCS chain must be measurable in order to affirm that CO_2 is permanently taken out of the atmosphere.

Applying the criteria of effectiveness to offsetting, a regime would need to have an offset system in place that would adhere to environmental certainty and accountability, investment predictability and the ability to link with other emissions trading systems. This means that there would have to be a rigorous certification and verification system in

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[237] *Ibid.*
[238] Stavins, *supra* note 217 at 309.

place, and that an offset credit system exists within appropriate legislation and protocols. If a regime recognizes CCS as a valid offsetting activity then this contributes to a regime's effectiveness due to environmental accountability and certainty (offsets have a rigorous certification and verification process) and allows unregulated parties to also participate in the emissions trading regime.

Applying the criteria of efficiency to offsetting, a regime would need to have an administratively simple and cost efficient scheme in place to accommodate the development of offset projects and the creation of offset credits. If a regime incorporates offsets then this contributes to the regime's efficiency because an emitter has flexibility in meeting its emissions target, i.e. either by purchasing offsets or reducing emissions. If a regime incorporates offsets into its trading regime, this will contribute to the development of CCS projects and therefore will be viewed as accommodating CCS.

4.3 Evaluating CCS within Cap and Trade Schemes

I will use the evaluation criteria of effectiveness and efficiency to determine how well each regime accommodates CCS. The criteria of effectiveness and efficiency will be applied to the regime's cap, offset program and emissions legislation. Effectiveness will be determined by certainty, environmental accountability, investment predictability, and ability to link with other trading systems. Efficiency will be determined by administrative simplicity, costs and flexibility. The extent to which a regime meets these criteria, the more successful it will be deemed at accommodating CCS.

As discussed in this chapter, there are two main ways in which a regime can design its emissions cap: an absolute cap or an intensity-based cap. Each type of cap has its advantages and disadvantages. These advantages and disadvantages will become evident when canvassing the emissions trading schemes in the EU, Alberta and New South Wales. In particular, the development of CCS will be affected depending on how a regime decides to design its emissions cap, as discussed within the previous heading of "application of cap-setting to CCS". If a regime chooses to implement an absolute cap, the scheme will meet the criteria of effectiveness and efficiency because of certainty, environmental accountability, investment predictability, ability to link with other trading systems and administrative simplicity. These criteria contribute to the accommodation of CCS within the emissions trading regime. On the other hand, if a regime chooses to implement an intensity-based cap, the scheme will meet the criteria efficiency. Efficiency contributes to the accommodation of CCS, although to a lesser degree.

Similarly, when designing an emissions trading scheme, a regime must decide whether it will incorporate offsets into its scheme and to what extent a regulated party may use offsets to meet its obligations.[239] If a regime incorporates offsets into its trading regime, this can contribute to the development of CCS projects and therefore will be viewed as accommodating CCS. For each regime in this thesis, I will discuss how well a particular scheme accommodates CCS by determining whether offsets form a part of the regime and whether CCS qualifies as an offset within that regime. If a regime incorporates offsets then this can contribute to the regime's efficiency and effectiveness, as discussed above.

Finally, it is important that the legislative structure of the particular emissions trading regime is clear and specifically addresses the treatment of CCS. This significantly contributes to the effectiveness and efficiency of the scheme, and thereby assists in determining how successful a regime is in accommodating CCS.

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[239] For example, can an emitter achieve 100% of its compliance by purchasing offsets or is there a limitation on the amount of offsets that an emitter can purchase?

Chapter Five: European Union Emission Trading Scheme

5.1 Introduction

The European Union ("EU") is an economic and political union of 27 Member States.[240] The EU has developed a single market through a standardized system of laws which apply in all Member States, and ensures the free movement of people, goods, services and capital.[241] Having a legal personality, the EU is able to conclude treaties with countries. Important institutions of the EU include the European Commission,[242] the Council of the European Union,[243]and the European Parliament.[244] The Member States, together with the President of the European Commission, meet as the "European Council". These meetings set overall EU policy and resolve issues that could not be settled at regular meetings.[245]

The European Commission proposes new legislation. The Council and Parliament pass laws. The main forms of EU law are directives and regulations.[246] A directive is "binding on the Member States as to the result to be achieved but leaves them the choice of the

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[240] Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Republic of Ireland, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. The EU was established by the Treaty of Maastricht in 1993, online: Euro Treaties <http://www.eurotreaties.com/maastrichtec.pdf>.
[241] Online: Europa <http://europa.eu/about-eu/index_en.htm>.
[242] The European Commission is the EU's executive organ. It represents and upholds the interests of Europe as a whole. It drafts proposals for new European laws, which it presents to the European Parliament and the Council. It manages the implementation of EU policies and spending EU funds. The Commission also makes sure that everyone abides by European treaties and laws. It can act against rule-breakers, taking them to the European Court of Justice if necessary. Online: European Commission <http://ec.europa.eu/about/index_en.htm>.
[243] The Council is the EU's main decision-making body. It represents the Member States, and its meetings are attended by one minister from each of the EU's national governments. Online: Europa <http://europa.eu/institutions/inst/council/index_en.htm>.
[244] The main job of Parliament is to pass European laws on the basis of proposals presented by the European Commission. Parliament shares this responsibility with the Council of the European Union. Parliament and Council also share joint authority for approving the EU's €130 billion annual budget. Online: Europa <http://europa.eu/abc/panorama/howorganised/index_en.htm#parliament>.
[245] Online: Europa <http://europa.eu/institutions/inst/council/index_en.htm>.
[246] Online: Europa <http://europa.eu/institutions/decision-making/index_en.htm>.

form and method they adopt to realize the Community objectives within the framework of their internal legal order".[247] A directive's main purpose is to align national legislation among the Member States.

The EU has identified climate change as one of its most important objectives. Recognizing that climate change is likely to have major negative consequences for the environment, the "EU has repeatedly confirmed its positions that an increase in the global, annual, mean surface temperature should not exceed 2 degrees Celsius above pre-industrial levels by 2100".[248] The European Parliament has proposed, as a strategic objective, an EU emissions reduction target of 60 to 80% by 2050 compared to 1990 levels.[249] An important step for the EU to achieve its climate change goal is the effective implementation of the Kyoto Protocol's commitments with the EU ETS being the central instrument.[250]

5.2 The European Union Emissions Trading Scheme

5.2.1 Overview of EU ETS

The Emissions Trading Directive,[251] which entered into force on October 25, 2003, establishes a scheme for GHG emission allowance trading within the community. This scheme is called the EU Emissions Trading Scheme ("EU ETS"). In January 2005, the EU ETS commenced operation as the largest multi-nation, multi-sector cap and trade emissions trading program in the world.[252] The ETS is able to function as a regional

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[247] Online: Eur-Lex <http://eur-lex.europa.eu/en/droit_communautaire/droit_communautaire.htm#1.3.3>.
[248] Christopher Egenhofer, "The Making of the EU Emissions Trading Scheme: Status, Prospects and Implications for Business" (2007) 25 Eur Mgmt J 453 at 453.
[249] Tiina Koljonen et al, "The Role of CCS and Renewables in Tackling Climate Change" (2009) 1 Energy Procedia 4323. Note that the EU ETS applies only to CO_2 and not to other GHGs.
[250] Egenhofer, *supra* note 248 at 453.
[251] EC, *Council Directive 2003/87 of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC*, [2003] OJL 275/32 (entered into force 25 October 2003) [ETS Directive].
[252] Jonathan Donehower, "Analyzing Carbon Emission Trading: A Potential Cost Efficient Mechanism to Reduce Carbon Emissions" (2008) 38 Envtl L 177 at 195. "The EU ETS is by far the biggest carbon

program because Article 3 of the Kyoto Protocol allows Annex I Parties to meet their obligations either individually or jointly.[253] The EU ratified the Kyoto Protocol as a collective or "bubble" and then re-allocated the national obligations within the bubble.[254] The EU ETS focuses on emission reduction targets for Member States of the EU and targets for the countries that have linked their trading system to the EU ETS.[255]

According to the Kyoto Protocol, the EU is committed to reducing GHG emissions by 8% below its 1990 level during the period 2008-2012. However, the commitment under the EU ETS extends this obligation. The EU ETS target is a 20% reduction in total GHG emissions below 1990 levels by 2020. The EU has made a commitment to increase this target to 30% for the period beyond 2012. These targets were announced in the ETS Directive which was updated and revised in 2009,[256] when the EU Commission published

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market, encompassing over 80% of the monetary value and 60% of the total volume of global market trades."

[253] *Kyoto Protocol*, *supra* note 9, art 3:

> The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.

[254] See ETS Directive, *supra* note 251:

> (5) The Community and its Member States have agreed to fulfill their commitments to reduce anthropogenic greenhouse gas emissions under the *Kyoto Protocol* jointly, in accordance with Decision 2002/358/EC. This Directive aims to contribute to fulfilling the commitments of the European Community and its Member States more effectively, through an efficient European market in greenhouse gas emission allowances, with the least possible diminution of economic development and employment.

[255] Norway, Iceland and Lichtenstein have linked their trading systems to the EU ETS. Online: Europa < http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1617>.

[256] EC, *Council Directive 2009/29 of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community*, [2009] OJL140/63 [Revised ETS Directive].

"The EU Energy Package",[257] an extensive proposal for a new, integrated climate and energy policy for Europe. The Energy Package contains four elements:

1. A single EU-wide cap on emission allowances will apply from 2013 and will be cut annually, reducing the number of allowances available to 21% below the 2005 level in 2020. The free allocation of allowances will be progressively replaced by auctioning, and the sectors and gases covered by the system will be expanded.[258]

2. An 'Effort Sharing Decision' governs emissions from sectors not covered by the EU ETS, such as transport, housing, agriculture and waste. Each Member State has agreed to a binding national emissions limitation target for 2020 which reflects its relative wealth. The targets range from an emissions reduction of 20% by the richest Member States to an increase in emissions of 20% by the poorest. These national targets will cut the EU's overall emissions from the non-ETS sectors by 10% by 2020 compared with 2005 levels.[259]

3. Binding national targets for renewable energy which will collectively lift the average renewable share across the EU to 20% by 2020 (more than double the 2006 level of 9.2%). The national targets range from a renewable share of 10% in Malta to 49% in Sweden. The targets will contribute to decreasing the EU's dependence on imported energy and to reducing GHG emissions.[260]

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[257] The package contains a number of additional documents, including the CCS Directive, *infra*, new state aid guidelines and Commission communications and impact assessments of the proposals. Online: EUROPA <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:140:SOM:EN:HTML>.
[258] Revised ETS Directive, *supra* note 256.
[259] EC, *Commission Decision 2009/406 of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020*, [2009] OJL 140/135.
[260] EC, *Council Directive 2009/28 of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC,* [2009] OJL 140/16.

4. A legal framework to promote the development and safe use of CCS.[261]

5.2.2 Methods of Achieving Compliance

5.2.2.1 Reducing Total Annual Emissions and Creating Emission Allowances

ETS allows participants to either reduce emissions or to purchase emissions allowances from other participants. The EU ETS allowance system is structured as follows.

The EU ETS imposes mandatory participation of nearly 11,500 installations or about 45% of total CO_2 emissions in the EU, including process emissions.[262] The ETS covers a range of large GHG emitting installations with combustion installations exceeding 20MW thermal input, plus large mineral oil refineries, ferrous metals production or processing installations, mineral industries, and pulp, paper and board industries.[263] Small installations emitting less than 10,000 tonnes CO_2/year make up 32% of all ETS installations and accounting for about 1% of all emissions. Installations emitting under 25,000 tonnes CO_2/year make up about 55% of all installations while emitting only 2.4% of all ETS emissions.[264]

The ETS is an absolute cap scheme with three phases or compliance periods. Phase I of the ETS ran from 2005 to 2007, phase II runs from 2008 to 2012 and phase III will run from 2013 to 2020. In phases I and II of the EU ETS, each Member State is responsible for allocating allowances[265] to the emissions producing installations in its territory.[266] The number of allowances given to each installation is spelled out in a National Allocation

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[261] EC, *Council Directive 2009/31 of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006*, [2009] OJL 140/114 [CCS Directive].
[262] Egenhofer, *supra* note 248 at 453.
[263] Revised ETS Directive, *supra* note 256, Annex 1.
[264] Egenhofer, *supra* note 248 at 453.
[265] One allowance is equal to 1 tonne of CO_2.

Plan ("NAP").[267] Each Member State is required to create a NAP that conforms to each nation's emissions target, which must then be approved by the EU Commission.[268] NAPs must set a cap for each compliance period.[269] Installations must cover their emissions with these allowances every single year.[270] Thus, the total cap in the trading system is the aggregate of all Member State allocation plans. Member States have considerable discretion in deciding allocation methodology, but their NAPs must conform to a number of criteria set by the EU.[271]

Once the NAPs are approved, allowances are issued to each participating installation.[272] At the end of each year, each installation must turn in a number of allowances equivalent to the total amount of emissions. Allowances can be transferred through carbon trading exchanges.

In the first phase of the ETS, each Member State applied different criteria when setting caps on the number of EU allowances to be issued.[273] This led to the over-allocation of EUAs and a subsequent EUA price collapse.[274] By mid-2007, emissions allowances had reached near-zero price levels.[275] This outcome led to the development of standardized

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[266] Wrake, *supra* note 219 at 5.
[267] ETS Directive, *supra* note 251, art 9.
[268] *Ibid.*
[269] *Ibid*, art 11.
[270] Max Fehr, *Market Design for Emissions Trading Systems* (D.Sc. Dissertation, ETH Zurich, 2009), online: <http://www.ifor.math.ethz.ch/publications/2009_diss_fehr.pdf> at 3 [unpublished].
[271] Revised ETS Directive, *supra* note 256, Annex III.
[272] Installation operators have to submit emission allowances ("EUAs") yearly to cover their annual verified emissions. EUAs can be traded on several Energy Exchanges. A system of national registries and a Community International Transaction Log have been created to ensure the smooth trading of allowances. Failure to submit sufficient allowances carries a EUR40 fine (EUR100 in 2008-12) per emitted tonne of CO_2e for which no allowances are submitted.
[273] Rix & Paul, *supra* note 160 at 52.
[274] See Lars Zetterberg et al. "Analysis of national allocation plans for the EU ETS" (Stockholm: IVL Swedish Environmental Research Institute Ltd., 2004), online: <http://www.ivl.se/download/18.360a0d56117c51a2d30800072915/B1591.pdf>; Alyssa Gilbert, Jan-Willem Bode & Dian Phylipsen, "Analysis of the national allocation plans for the EU emissions trading scheme" (London: Ecofys, 2004), online: < http://www.ecofys.com/com/publications/documents/Interim_Report_NAP_Evaluation_180804.pdf >.
[275] Wrake, *supra* note 219 at 7.

allocation criteria and more careful scrutiny by the EU Commission of proposed caps for the second phase of the ETS.[276]

For the third phase, further changes will be made. The most fundamental change is the centralization of the allocation process. The cap will be set at the EU level instead of each Member State drawing up a NAP. This will alleviate the burden of negotiating separate NAPs for each Member State, relieve Member States from industry pressure when proposing NAPs and bring predictability and transparency to the ETS.[277] The cap will be based on the annual average of total EUAs issued in the second phase adjusted to reflect the extension of the ETS to additional sectors and gases. This cap will fall in each year of the third phase by a number of EUAs equal to 1.74% of the 2013 cap.[278] The cap in 2013 will start at the average total quantity of allowances allocated by Member States in 2008-2012,[279] decreasing to a 21% reduction below 2005 levels by 2020.

Another change is that 50% of the allocations in the Revised ETS will be auctioned, up from about 4% in phase II. Electricity producers will receive no free allocation.[280] In other sectors, 20% of allowances will be auctioned in 2013, increasing to 70% in 2020, with a view to reaching 100% in 2027.[281] The specifics of how the auctions will be

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[276] Communication from the Commission on guidance to assist Member States in the implementation of the criteria listed in the ETS Directive, *supra* note 251, Annex III. The EU Commission even developed an explicit formula for the assessment.
[277] Rix & Paul, *supra* note 160 at 52.
[278] *Ibid.*
[279] The cap will be adjusted for changes in the coverage of the system. In 2012, the aviation sector will be included and in 2013 aluminum production and parts of the chemical industry will also be covered. Further, nitrous oxide from fertilizer production and perfluorocarbon emissions from aluminium production will also be included.
[280] Certain Member States are allowed an optional and temporary exemption from the rule that no allowances are to be allocated free of charge to electricity generators, as of 2013. This option is available to Member States which fulfill certain conditions related to the interconnectivity of their electricity grid, the share of a single fossil fuel used in electricity production, and GDP per capita in relation to the EU-27 average. In addition, the amount of free allowances that a Member State can allocate to power plants is limited to 70% of CO_2 emissions of relevant plants in phase I and declines annually thereafter. Furthermore, free allocation in phase III can only be given to power plants that were operational or under construction no later than the end of 2008.
[281] Revised ETS Directive, *supra* note 256 at 14. The original proposal from the Commission went further, phasing out free allocation completely by 2020.

structured are still to be settled; however, the Revised ETS Directive does stipulate that a certain percentage of auction revenues will be distributed among Member States, with poorer countries getting a slighter larger share.[282] According to Wrake, "[t]here are no requirements regarding how Member States make use of revenues, although the Directive recommends that at least 50% be used to promote climate change related activities".[283]

There is one exception to phasing out free allocation. Installations that are exposed to a significant risk of carbon leakage would receive 100% of their allocated allowances for free, i.e. where the costs of auctioning have the effect of shifting economic production from Member States to countries that lack binding emission targets.[284] The Revised ETS Directive does not specify to which industries this provision will apply. Instead, the EU Commission will assess the risk of carbon leakage, based on established quantitative criteria,[285] and other factors, such as future prices of allowances, trade flows, technological development, investment in new electricity-generation capacity, and currency exchange rates will be considered.[286]

5.2.2.2 Emission Offset Credits

The ETS does not recognize the use of domestic offsets for meeting its emission reduction targets. However, the ETS does allow Member States to use CERs and ERUs earned from the CDM and JI to meet their obligations. All allowances are registered in a

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[282] Wrake, *supra* note 219 at 28.
[283] *Ibid.*
[284] Rix & Paul, *supra* note 160 at 53. The share of these industries' emissions is determined in relation to the total of EU ETS emissions from 2005 to 2007.
[285] Wrake, *supra* note 219 at 29. Assessments will be based on whether the direct and indirect additional production costs induced by the implementation of the EU ETS Directive, as a proportion of gross value added, exceed 5%, and whether the total value of its exports and imports divided by the total value of its turnover and imports exceeds 10%. Further, if the result for either of those criteria exceeds 30%, the sector would also be considered as having a significant risk of carbon leakage.
[286] *Ibid.*

Central Transaction Log, which “records the issuance, transfer, surrender and cancellation of allowances.”[287]

Any existing CERs and ERUs from phase II of the ETS can be carried over to meet reduction targets under phase III plus additional credits amounting to a maximum of 55% of the reduction effort in phase II and III together, i.e. from 2008-2020.[288]

5.3 Accommodation of CCS within the EU ETS

In addition to the changes in allocations and offsetting, considerable thought has been given to the inclusion of the CCS in phases II and III of the ETS.

5.3.1 The ETS Directive

In phase II of the ETS, there is no express provision for the inclusion of CCS activities. Therefore, CCS activities are opted-in under Article 24 of the ETS Directive. The procedure for a Member State to opt-in an activity or installation requires: (1) inclusion in a Member State’s NAP; and (2) project specific application to the EU Commission, containing activity definition, effects on market, distortions of competition, environmental integrity of ETS, and specific monitoring and reporting guidelines (“MRGs”) for the activity.[289] According to Groenenberg:

> For the second phase of the ETS, combustion, capture, transport and storage installations would be opted in as a single installation. Up to 2012, the separate elements of any CCS chain would most likely have to be located within a single Member State. European Union Allowances (EUAs) for these chains would have been allocated to the combustion

[287] Online: Europa <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/612&format=HTML>.
[288] Online: CanEurope <http://www.climnet.org/policywork/eu-ets/143-ets-review.html>.
[289] Tim Dixon, “International Regulatory Developments for CCS” (Report prepared for IEA Greenhouse Gas R&D Programme, April 2009), online:
<http://www.ieaghg.org/docs/presentations/PPTPDFs/RegsNZ09.pdf>.

> installation in the National Allocation Plans (NAPs) for the second budget period.[290]

In phase III there is explicit provision for the inclusion of CCS activities in the Revised ETS Directive.[291] Under the Revised ETS Directive, carbon emissions that are captured, transported and stored will be treated as an avoided emission. Thus, a regulated emitter will not be required to surrender allowances for emissions that are transferred out of its facility and stored. Pipelines for CO_2 transport and storage sites for CO_2 injection will have a zero emission allowance and will therefore have to surrender emission allowances equal to monitored and reported emissions from the transportation and storage elements of the chain.[292]

The Revised ETS Directive covers the inclusion of CCS within the ETS, the MRGs[293] and the New Entrants Reserve ("NER").

5.3.1.1 The MRGs

The operation of the ETS is supported by the MRGs which were most recently revised in June 2010.[294] The MRGs are required by Article 14 of the ETS Directive and take into account the IPCC Guidelines and existing industry practice on CCS.[295] The 2010 revisions of the MRGs focus on the capture, transport and storage of CO_2.

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[290] Heleen Groenenberg & Heleen de Coninck, "Effective EU and Member State policies for stimulating CCS" (2008) 2 International Journal of Greenhouse Gas Control 653 at 656.
[291] Revised ETS Directive, *supra* note 256, Annex 1.
[292] Nigel Bankes, "Dealing with Credits for Carbon Capture and Storage Projects within Carbon Emissions Trading Systems: Alberta's Specified Emitters Regulations" (Report prepared for ICO_2N, December 2009) at 14 [Bankes, "ICO_2N Report"].
[293] See Sina Wartmann et al, "Monitoring and Reporting of GHG emissions from CCS Operations under the EU ETS" (2009) 1 Energy Procedia 4459.
[294] EC, *Commission Decision 10/345 of 8 June 2010, amending Decision 2007/589/EC as regards the inclusion of monitoring and reporting guidelines for greenhouse gas emissions from the capture, transport and geological storage of carbon dioxide*, [2010] OJL 155/34 [MRGs].
[295] Raphael Sauter, "CCS in the EU: The CCS and the ETS Directive" (Paper presented to the IEA CCS Regulators Network Meeting, Paris, Jan 20-21, 2010), online: IEA <http://www.iea.org/work/2010/ccs_jan20_21/EU_Sauter.pdf>.

Annex XVI of the MRGs governs the capture of CO_2:

> The activity-specific guidelines contained in this Annex apply to the monitoring of emissions from CO_2 capture activities.
>
> CO_2 capture can be performed either by dedicated installations receiving CO_2 by transfer from other installations, or by installations carrying out the activities emitting the CO_2 to be captured under the same greenhouse gas emissions permit. All parts of the installation related to the purpose of CO_2 capture, intermediate storage, transfer to a CO_2 transport network or to a site for geological storage of CO_2 greenhouse gas emissions shall be included in the greenhouse gas emissions permit. In case the installation carries out other activities covered by Directive 2003/87/EC, the emissions of these activities shall be monitored in accordance with the respective Annexes of these Guidelines.[296]

The remainder of Annex XVI provides the formula for calculating captured emissions from the installation.

Annex I, section 5.7 provides for the transfer of CO_2 from the capture installation:

> Subject to approval by the competent authority, the operator may subtract from the calculated level of emissions of the installation any CO_2 which is not emitted from the installation, but transferred out of the installation:
>
> > as pure substance, or directly used and bound in products or as feedstock, or
> >
> > to another installation holding a greenhouse gas emissions permit, unless other requirements as set out in Annexes XVII or XVIII apply,
>
> provided the subtraction is mirrored by a respective reduction for the activity and installation, which the respective Member State reports in its national inventory submission to the Secretariat of the United Nations Framework Convention on Climate Change. The respective amounts of CO_2 shall be reported for each installation CO_2 has been transferred to or received from as a memo item in the annual emission report of the transferring as well as the receiving installation.

[296] MRGs, *supra* note 294, Annex XVI, s 1.

> In the case of transfer to another installation, the receiving installation must add to its calculated level of emissions the received CO_2, unless other requirements as set out in Annexes XVII or XVIII apply.

Annex XVII governs the transport of CO_2. Annex XVII requires that all CO_2 entering the storage facility through the pipeline is assumed to be stored. Annex XVII requires that all potential fugitive and vented emissions have to be monitored, especially for enhanced hydrocarbon recovery. Allowances are to be surrendered for fugitive and vented emissions.

Annex XVIII governs the injection and storage of CO_2. Annex XVIII, section 1 outlines the boundaries of the storage facility as follows:

> All emission sources from the CO_2 injection facility shall be included in the greenhouse gas emissions permit. Where leakages from the storage complex are identified and lead to emissions or release of CO_2 to the water column, they shall be included as emission sources for the respective installation until corrective measures pursuant to Article 16 of Directive 2009/xx/EC have been taken and emissions or release into the water column from that leakage can no longer be detected.

Thus, release of CO_2 to the water column is assumed to equal an emission.[297]

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[297] CCS Directive, *supra* note 261, art 3(2). A water column is the water in a lake, estuary or ocean which extends from the bottom sediments to the water surface. The water column contains dissolved and particulate matter and is the habitat for fish, plankton, and marine mammals. Preventing the release of CO_2 into the water column is discussed in the preamble of the CCS Directive:

> (14) The Contracting Parties to the OSPAR Convention in 2007 adopted amendments to the Annexes to the Convention to allow the storage of CO_2 in geological formations under the seabed, a Decision to ensure environmentally safe storage of CO_2 streams in geological formations, and OSPAR Guidelines for Risk Assessment and Management of that activity. *They also adopted a Decision to prohibit placement of CO_2 into the water-column of the sea and on the seabed, because of the potential negative effects*.
> …
> (18) This Directive should apply to the geological storage of CO_2 within the territory of the Member States, in their exclusive economic zones and on their continental shelves… *The storage of CO2 in storage complexes extending beyond the territorial scope of this Directive and the storage of CO2 in the water column should not be permitted.*
>
> [Emphasis added]

5.3.1.2 The NER

Under the Revised ETS Directive, 300 million allowances of the New Entrance Reserve are set aside for CCS and innovative renewable energy technology projects:

> Up to 300 million allowances in the new entrants' reserve shall be available until 31 December 2015 to help stimulate the construction and operation of up to 12 commercial demonstration projects that aim at the environmentally safe capture and geological storage (CCS) of CO_2 as well as demonstration projects of innovative renewable energy technologies, in the territory of the Union.
>
> The allowances shall be made available for support for demonstration projects that provide for the development, in geographically balanced locations, of a wide range of CCS and innovative renewable energy technologies that are not yet commercially viable. Their award shall be dependent upon the verified avoidance of CO_2 emissions.
>
> Projects shall be selected on the basis of objective and transparent criteria that include requirements for knowledge-sharing. Those criteria and the measures shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 23(3), and shall be made available to the public.
>
> Allowances shall be set aside for the projects that meet the criteria referred to in the third subparagraph. Support for these projects shall be given via Member States and shall be complementary to substantial co-financing by the operator of the installation. They could also be co-financed by the Member State concerned, as well as by other instruments. No project shall receive support via the mechanism under this paragraph that exceeds 15 % of the total number of allowances available for this purpose. These allowances shall be taken into account under paragraph 7.[298]

Thus, up to 12 CCS projects will be funded by 2015. The first call will be for 200 million allowances, the deadline for which will be December 31, 2011.[299] The second call will be

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[298] Revised ETS Directive, *supra* note 256, art 10a(8).
[299] Sauter, *supra* note 295.

for 100 million allowances, the deadline for which will be December 31, 2013.[300] The second call will be used to adjust geographical and technological underrepresentation.[301]

Some scholars have pointed out that the NER may contribute to large windfall profits for installations as was the case with the free allocation of credits in the first phase of the ETS.[302] In fact, "extra credit systems could pose a double risk – if EUA prices fall, extra credit systems would not necessarily lessen the financial risk in the short-term, and if extremely high prices occur, large windfall profits could result".[303] On the other hand, this would encourage CCS investments. According to Lokey, facilities will receive a bonus allowance for every tonne of CO_2 stored, in addition to not having to surrender allowances for CO_2 they store.[304] Thus, "with many forecasters predicting a CO_2 price of EUR 30 ($39 USD) from 2012 to 2020 and a price in excess of EUR 40 ($52 USD) approaching 2020, facilities which store the gas in a regime with bonus allowances may receive double or triple the allowance price."[305]

5.3.2 The CCS Directive

On June 25, 2009, the CCS Directive[306] entered into force. The CCS Directive "establishes a legal framework for the environmentally safe geological storage of CO_2 to contribute to the fight against climate change".[307] In addition to the CCS Directive, there is further direction in the form of four Guidance Documents prepared by DG Action.[308]

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300 *Ibid.*
301 *Ibid.*
302 Frede Cappelen & Lindsey Corrigan, "CCS in the European Union: Policy Developments to Turn Words into Action" in Kim Carnahan, ed, *Greenhouse Gas Market 2008: Piecing Together a Comprehensive International Agreement for a Truly Global Carbon Market* (Geneva, Switzerland: International Emissions Trading Association, 2008) 62.
303 *Ibid.*
304 Lokey, "Valuation of Carbon Sequestration", *supra* note 141.
305 *Ibid.*
306 CCS Directive, *supra* note 261.
307 *Ibid*, art 1(1).
308 These guidance documents can be found online: EUROPA <http://ec.europa.eu/clima/policies/lowcarbon/ccs_implementation_en.htm >. Guidance Document 1

These Guidance Documents are intended to provide an overall methodological approach to the implementation of the CCS Directive in individual cases. Member States must transpose the CCS Directive into domestic law by June 11, 2011.[309]

The CCS Directive covers CO_2 stream composition, monitoring and verification, closure and post-closure obligations, transfer of responsibility and financial security.

5.3.2.1 Storage Site

According to the CCS Directive, site selection is the crucial stage for ensuring the integrity of a project. A storage site is defined in Article 3(3) as "a defined volume area within a geological formation used for the geological storage of CO_2 and associated storage and injection facilities." A storage complex is defined in Article 3(6) as "the storage site and surrounding geological domain which can have an effect on overall storage integrity and security; that is, secondary containment formations." A site can only be selected for use if a prior analysis shows that, under the proposed conditions of use, there is no significant risk of leakage or damage to human health or the environment. Geological storage of CO_2 will not be possible without a storage permit. According to Article 12, "a CO_2 stream must consist overwhelmingly of carbon dioxide." Article 12 also requires that a composition analysis and a risk assessment of the CO_2 streams is completed before injection and that the operator must keep a register of the quantities and properties of the CO_2 stream delivered and injected.

5.3.2.2 Monitoring and Verification

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discusses the CO_2 storage life cycle approach to risk management"; Guidance Document 2 discusses the specific approaches to key stages of the CO_2 storage life cycle; Guidance Document 3 discusses the transfer of responsibility; and Guidance Document 4 discusses financial security and financial transfer.

[309] CCS Directive, *supra* note 261, art 39.

The operation of the site must be closely monitored to ensure that seepage does not occur. According to Article 13, "Member States shall ensure that the operator carries out monitoring of the injection facilities, the storage complex (including where possible the CO_2 plume), and where appropriate the surrounding environment." The purpose is to compare actual and modelled behaviour of CO_2, detect migration and seepage, assess effects of corrective measures in accordance with Article 16 and assess long-term containment prospects for the stored CO_2 .[310] Article 13(2) requires that the monitoring plan be designed by the operator pursuant to the requirements in Annex II and approved by the competent authority.

5.3.2.3 Closure and Post-Closure

The CCS Directive contains provisions on closure and post-closure obligations. According to Article 17(1), "a storage site shall be closed: (a) if the relevant conditions stated in the permit have been met; (b) at the substantiated request of the operator, after authorization of the competent authority; or (c) if the competent authority so decides after the withdrawal of a storage permit pursuant to Article 11(3)." The operator remains responsible for monitoring, corrective measures, for sealing the storage site and removing the injection facilities. These obligations must be fulfilled on the basis of a post-closure plan designed by the operator.[311]

Where a storage site has been closed pursuant to Article 17, the responsibility for monitoring, measuring and verification costs, all liability including emissions liability, and ownership of the project, will be transferred to the competent authority if:

(a) all available evidence indicates that the stored CO_2 will be completely and permanently contained;

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[310] *Ibid*, art 13.
[311] *Ibid*, art 17(3).

(b) a minimum period, to be determined by the competent authority has elapsed. This minimum period should be no shorter than 20 years, unless the competent authority is convinced that the criterion referred to in point (a) is complied with before the end of that period;

(c) the financial obligations referred to in Article 20 have been fulfilled; and

(d) the site has been sealed and the injection facilities have been removed.[312]

5.3.2.4 Financial Security

Finally, financial security needs to be established before injection commences to ensure that the requirements pursuant to the CCS Directive and the Revised ETS Directive will be met. The financial security is to be periodically adjusted to take account of changes to the assessed risk of leakage.[313] Article 20 puts a financial mechanism in place to cover post-transfer obligations including at least the cost of monitoring for a period of 30 years.

In conclusion, the Revised ETS Directive covers the inclusion of CCS within the ETS, the MRGs and the NER, whereas the CCS Directive establishes the standards that Member States must meet in issuing permits for pipelines and storage sites including monitoring, measurement and verification requirements.[314]

5.4 Conclusion

The legal framework of the EU ETS treats each element of the CCS chain as a separate installation in its own right, and has established appropriate MRGs for each element of the chain. CO_2 captured by a regulated entity and then transported and injected will be treated as an avoided emission. A regulated entity will not be required to surrender allowances to cover the captured CO_2. On the other hand, transporters and storers of CO_2

[312] *Ibid*, art 18(1).
[313] *Ibid*, art 19(2).
[314] *Ibid*, c 3.

will have a zero emission allowance and will therefore have to surrender emission allowances equal to emissions from the transportation and storage elements of the chain. Pipelines and storage facilities are allocated zero allowances in order to incentivise minimal loss of CO_2. This has the advantage of clearly allocating the risk and liability for emissions to each element across the chain of operations and creates a “chain of custody” for the CO_2 from source to storage. In sum, “while the capture entity will not have to surrender allowances for captured emissions that are transferred out of the covered entity, entities downstream in the CCS chain will have to account for any subsequent emissions, thereby ensuring the environmental integrity of the trading system”.[315] Furthermore, “the scheme avoids moral hazard problems since it gives the operating entity for each part of the chain the incentive to reduce emissions for that part of the chain for which it is responsible”.[316]

The ETS has been successful in creating an effective GHG emissions trading framework. In order to determine how successfully it accommodates CCS, it is necessary to apply the effectiveness and efficiency criteria to the EU ETS. First, the EU ETS employs an absolute cap and therefore meets the criteria of effectiveness and efficiency because absolute caps are associated with certainty, environmental accountability, investment predictability, ability to link with other trading systems and administrative simplicity. The ETS provides investment predictability, environmental accountability and certainty because the scheme is guaranteed beyond 2012, with a detailed account thereof in the Revised ETS Directive and CCS Directive. Also, Article 25 of the ETS Directive foresees the linking of the ETS with other national and regional emissions trading schemes via international agreement.[317] Many of the ETS’s weaknesses, including

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[315] Bankes, “ICO_2N Report”, *supra* note 292 at 15.
[316] *Ibid.*
[317] ETS Directive, *supra* note 251, art 25 states that “[a]greements may be made to provide for the recognition of allowances between the Community scheme and compatible mandatory greenhouse gas emissions trading systems with absolute emissions caps established in any other country or in sub-federal or regional entities”.

grandfathering and small fines for non-compliance, are arguably "politically necessary to get the scheme launched".[318]

Second, the ETS recognizes international offsets created by the CDM and JI. However, overall use of CERs and ERUs cannot exceed "50% of the Community-wide reductions below the 2005 levels of the existing sectors under the Community scheme over the period from 2008 to 2020 and 50% of the Community-wide reductions below the 2005 levels of new sectors and aviation over the period from the date of their inclusion in the Community scheme to 2020".[319] This is a significant amount of potential offset credits that can be used towards an emitter's reductions. In chapter three of this thesis, I concluded that CCS would likely be credited under the CDM and JI mechanisms in the near future. Therefore, the EU ETS facilitates the accommodation of CCS through international flexibility mechanisms. In addition, the EU ETS goes a step further by expressly providing for the deployment of CCS through the CCS Directive and Revised ETS Directive.[320]

The legislative structure of the EU ETS is very clear. There are no gaps in the legislation regarding the treatment of CCS. This significantly contributes to the effectiveness and efficiency of the scheme. Thus, I conclude that the EU ETS, due to its high efficiency and effectiveness, is successful in accommodating CCS.

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[318] Mathew Lockwood, "A Rough Guide to Carbon Trading" *Prospect Magazine* 131 (Feb 2007) 47 at 50, online: Prospect Magazine <http://www.prospect-magazine.co.uk/Article_details.php?id=8220>.

[319] Revised ETS Directive, *supra* note 256, art 11(a).

[320] The Revised ETS Directive allows for 300 million allowances to be allocated to new CCS projects.

Chapter Six: Alberta's Specified Gas Emitters Scheme

6.1 Introduction

This chapter focuses on the Alberta GHG emissions framework. The Federal Framework is not yet in force.[321] The first part of this chapter will examine the Alberta framework in detail. The second part of this chapter briefly examines the proposed Federal Framework.

6.2 The Alberta Specified Gas Emitters Scheme

6.2.1 Overview of Alberta SGERs

Alberta emits more GHGs than any other province in Canada, with an estimated contribution of 42% of Canada's total reported GHG emissions.[322] One of the primary reasons for Alberta's large volume of GHG emissions is its dependence on coal-fired generation as its primary source of electricity.[323] Also, with the second largest source of oil in the world, extracting and processing the Alberta oil sands results in large volumes of CO_2 emissions. Oil sands production is expected to at least triple by 2020, and the Alberta Government expects production could reach 3 million barrels/day by 2020 and possibly 5 million barrels/day by 2030.[324] Although only a portion of the oil produced and refined in Alberta is consumed within the province, all of the GHG emissions generated by it are allocated to Alberta.[325] Alberta's regulations reflect the province's desire to manage GHG issues independently and its reluctance to participate in a federally designed GHG regulatory regime.

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[321] Federal Framework, *supra* note 156. The federal regulatory framework was announced in March 2008.
[322] Alberta Environment, *Report on 2008 Greenhouse Gas Emissions* (Edmonton: Alberta Environment, April 2010), online: Alberta Environment <http://environment.gov.ab.ca/info/library/8267.pdf> at 4 [2008 Alberta Report].
[323] Goetz, *supra* note 2 at 391.
[324] *Ibid.*
[325] *Ibid* at 392.

In July 2007, Alberta became the first jurisdiction in North America to regulate GHG emissions. Alberta's Climate Change and Emissions Management Act ("CCEMA")[326] was first introduced in 2002 and came into force as a whole in 2007. The regulations and guidelines under the CCEMA are the Specified Gas Reporting Regulation,[327] the Specified Gas Emitters Regulation[328] and the Specified Gas Reporting Standard.[329] The CCEMA requires Alberta to reduce GHG emissions relative to gross domestic product by 50% of 1990 levels by 2020[330] and the SGER requires large emitters in the province to begin reducing emissions intensity immediately. In January 2008, the Alberta Government announced a plan to reduce GHG emissions by 14% in absolute terms by 2050.[331]

The Alberta framework is an intensity-based scheme and sets a threshold for covered facilities in Alberta.[332] A covered facility is a facility that has direct emissions of 100,000 tonnes or more of specified gases[333] in 2003 or any subsequent year. The threshold level is 100,000 tons of CO_2e. The SGRR defines a facility as:

> (i) any plant, structure or thing where an activity listed in section 2 of the Schedule of Activities to the Environmental Protection and Enhancement Act occurs, and

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[326] SA 2003, c C-16.7 [*CCEMA*].
[327] Alta Reg 251/2004 [*SGRR]*.
[328] Alta Reg 139/2007 [*SGER*].
[329] *SGRS*, *supra* note 154.
[330] *CCEMA*, *supra* note 326, s 3.
[331] See Alberta Environment, "Alberta's 2008 Climate Change Strategy" (Edmonton: Alberta Environment, 2008), online: Alberta Environment <http://environment.alberta.ca/info/library/7894.pdf>, which calls for a 14% reduction in GHG emissions from 2005 levels by 2050. The Strategy anticipates that 12% of the reductions will come from conservation and efficiency improvements, 18% from renewable power generation, and 70% from carbon capture and storage technology. The Climate Change Management Fund will be used in part to fund significant investments in carbon capture and storage.
[332] Commencing in 2003, covered facilities were required to file specified gas reports. A specified gas report must provide information on direct emissions for each specified gas broken down into various categories as well as the total direct emissions expressed as CO_2e.
[333] The specified gases are listed in the schedule to the SGER and include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons and the so-called "F" gases (such as sulphur hexafluoride) with very high global warming potential values.

(ii) a site or one or more contiguous or adjacent sites that are operated and function in an integrated fashion where an activity listed in any of sections 3 to 11 of the Schedule of Activities to the Environmental Protection and Enhancement Act occurs, including all the buildings, equipment, structures, machinery and vehicles that are an integral part of the activity;[334]

Covered facilities must reduce their emissions intensity by 12% for established facilities (facilities that completed their first years of operations before 1 January 2000),[335] below the baseline emission intensity established for the facility.[336] If a regulated emitter fails to comply with the emission reduction limits, the emitter will be subject to a fine of CDN$200 per tonne of GHGs released over the net emission intensity limit.[337]

There were 102 reporting facilities in Alberta in 2008. The utilities sector was the largest emitting source in Alberta, emitting 44.1% of the total reported emissions, followed by oil sands operations at 31.4%, the chemical manufacturing sector at 9.3% and the conventional oil and gas extraction sector at 6.2%.[338] The remaining 9% of emissions "came from the petroleum refining, pipeline transportation, mineral manufacturing, coal mining, forestry products, and waste management sectors".[339]

Under the Alberta SGER, a covered emitter must comply with its net emissions intensity limits which are based in part on the concept of "total annual emissions". The SGER defines total annual emissions as total "direct emissions" and defines a "direct emission"

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[334] *SGRR*, *supra* note 327, s 1(c).
[335] For new facilities (facilities completing their first year of operations after 1 January 2000), no reduction is required in the first three years of operation and then 2% is required for each additional year a facility has operated, up to a 10% reduction requirement for facilities in the eighth year of operation at the end of 2007.
[336] *SGER*, *supra* note 328, ss 3-4. The baseline emission intensity for an established facility is based on the ratio of the total annual emissions of production for 2003-2005. The baseline for a new facility simply uses the third year of emissions divided by the production in the third year.
[337] *Ibid*, s 28.
[338] 2008 Alberta Report, *supra* note 323 at 4.
[339] *Ibid*.

as a “release of specified gases from sources actually located at a facility”. The term release is defined in section 1(d) of the CCEMA as:

> “release”, in respect of a specified gas, includes spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak, seep, pour, emit, throw, dump, place or exhaust, *but does not include the capture and storage of a specified gas in a sink within the meaning of clause (e)(ii).*[340]

Section 1(e) defines “sink” as follows:

> (i) a component of the environment that removes or captures specified gases from the atmosphere through natural processes and includes, without limitation, plants and soil, and
>
> (ii) a geological formation or any constructed facility, place or thing that is used to store specified gases;

Subsection (i) refers to biological sequestration while subsection (ii) refers to geological sequestration. The SGRS defines geologically injected CO_2 as “CO_2 captured at a facility and injected into geological formations. Geologically injected CO_2 is not a direct emission.”[341] Thus, it seems clear that CO_2 that is captured for the purposes of CCS injection will be treated as an avoided emission – at least once it is stored.

While the CCEMA and SGRS refer to geological sequestration of GHGs, the SGER and SGRR do not contain any specific references to CCS. However, according to the CCEMA and the SGRS, the capture and compression part of the CCS chain will fall within the boundaries of a covered facility, the downstream elements of the chain, such as transportation and storage,[342] will not be covered facilities. Furthermore, the operator of

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[340] *CCEMA*, *supra* note 327, s 1(d) [emphasis added].
[341] *SGRS, supra* note 154, s 1(1)(l).
[342] Currently, the storage elements of a CCS project will be regulated by the *Oil and Gas Conservation Act* and the relevant Directives. See *Directive 8, Surface Casing Depth Minimum Requirements* (Alberta: Alberta Energy and Utilities Board, October 1997), online: <http://www.ercb.ca/docs/documents/directives/directive008.pdf>; *Directive 20, Well Abandonment* (Alberta: Alberta Energy and Utilities Board, July 2010), online

those non-covered facilities will hold separate licenses or permits for those downstream elements of the chain.

6.2.2 Methods of Achieving Compliance

This section examines the different methods by which a covered facility may achieve compliance. The regulations contemplate that a facility may meet its net emissions intensity limit in a number of different ways. It may do so by actually achieving the emissions reduction at the specific facility, by applying to the facility any Emission Performance Credits ("EPCs") that it has acquired or accumulated, by purchasing credits under the Alberta Climate Change and Emissions Management Fund ("Fund Credits"), or by purchasing emission offset credits.

6.2.2.1 Reducing Total Annual Emissions and Creating Emissions Performance Credits

The first and most obvious way in which a facility can meet its target is by reducing its "total annual emissions" below its baseline emission intensity.[343]

The second way in which a covered facility can meet its target is by purchasing EPCs. An EPC is created when a covered facility beats its own net emissions intensity limit.[344] An

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<http://www.ercb.ca/docs/documents/directives/Directive020.pdf>; *Directive 51, Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements* (Alberta: Alberta Energy and Utilities Board, March 1994), online: <http://www.ercb.ca/docs/documents/directives/Directive051.pdf>; *Directive 56, Energy Development Applications* (Alberta: Alberta Energy and Utilities Board, June 2008), online: <http://www.ercb.ca/docs/documents/directives/directive056.pdf>; *Directive 71, Emergency Preparedness and Response Requirements for the Petroleum Industry* (Alberta: Alberta Energy and Utilities Board, November 2008), online < http://www.ercb.ca/docs/documents/directives/Directive071.pdf>. Also see ERCB Decision, 2009-073, Alta Gas Ltd, Applications for Two Pipelines Licenses, An Amendment to a Facility Licence, an Approval for an Acid Gas Disposal Scheme Pouce Coupe Field, online <http://www.ercd.ca/docs/documents/decisions/2009/2009-073.pdf>.

[343] Any major change that achieves dramatic reductions will not only allow the emitter to achieve compliance in the reporting year but it will likely also generate EPCs. See Petroleum Accountants Society of Canada, *Interim Accounting Guideline* (April 2008), online: <http://www.petroleumaccountants.com/resource/library/2008/guidelines/AG_GHG_Final_2008April07.pd

EPC may then be used to meet net emissions intensity limits, either at another facility in that same year, or at the same facility or another facility in a subsequent year. EPCs can be traded between facilities owned by the same company or sold to other facilities. The regulations provide that an EPC that is held jointly can only be used by each holder on a *pro rata* basis.[345]

An EPC can be registered with the Alberta Offsets Registry for tracking and trading purposes and the use of an EPC must accord with any Ministerial guidelines issued under s. 62 of the CCEMA.[346] However, to date, there have been no guidelines issued under the Act. It remains uncertain whether the facilities can treat EPCs as having been created when volumes in excess of the reduction requirements of the facility are captured and transported out of the facility boundaries. It is also uncertain whether those parties remain responsible for any emissions downstream from the facility boundaries and if such emissions reduce the EPCs that might otherwise be claimed.

6.2.2.2 Fund Credits

The Fund allows emitters to pay into a fund in order to meet their emission reduction targets. The Fund is to be used to invest in and deploy technologies to reduce GHG emissions, including energy efficiency technologies, alternative and renewable energy sources, and conservation projects.[347] In Alberta, an emitter may purchase Fund Credits in the amount of 1 tonne of CO_2e for every $15 contributed to the Fund. This option effectively sets a ceiling price for offsets under the Alberta scheme and guarantees that an emitter will not be required to pay any more than $15 per tonne in order to achieve

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f> at 16 [PASC Guidelines], suggesting that such credits should be allocated to those intra-facility parties that generate the credit.

[344] *SGER*, *supra* note 328, s 9.

[345] *Ibid*, s 9(2)(d). The regulations do not describe how EPCs come to be jointly owned and presumably this issue is governed by the underlying ownership interests in the covered facility and any relevant construction, operation and ownership agreement. See PASC Guidelines, *supra* note 344 at 44.

[346] *Ibid*, s 9(2)(e).

[347] Goetz, *supra* note 2 at 396.

compliance. The Alberta regulations do not impose any cap on the ability of an emitter to meet its obligations by acquiring Fund Credits.

Fund Credits have some restrictions. A Fund Credit purchased before March 31 can only be used for meeting emission reduction targets for the previous year. A Fund Credit purchased after March 31 can only be used to meet targets for that year.[348] If the credits are not used in the year for which they were purchased then they will expire.

6.2.2.3 Emission Offset Credits

Alberta recognizes the use of domestic offsets for meetings its emissions reduction targets. Emitters may purchase credits for up to 100% of their reduction commitments. However, regulated entities may not purchase offset credits created outside of Alberta, including CERs and ERUs.

In Alberta, an allowable emission offset is a project-based reduction in GHG emissions that occurs at an unregulated facility and that meets the following requirements:

- occurs in Alberta;
- from an action taken that is not required by law at the time activity is started;
- from action taken on or after 1 January 2002 or occur on or after 1 January 2002;
- real and demonstrable; and
- quantifiable and measureable, directly or by accurate estimating using replicable techniques.[349]

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[348] *SGER*, *supra* note 328, s 8(3).
[349] *Ibid*, s 7(1).

Like an EPC, an emission offset credit must be held by the person responsible using it and where such an offset is jointly held each holder may only use a portion of the offset on a *pro rata* basis. As with EPCs, this is a matter to be determined by agreement between the parties.

The Alberta offset system is further described in the Offset Credit Project Guidance Document.[350] In order to successfully implement an offset project, the offset plan must include the following elements: (1) a statement of the project scope and site including project boundaries drawn so as to include sources and sinks connected to the project, (2) a statement of the baseline condition, (3) a determination of equivalent function (of the project vs. the baseline), (4) a quantification plan (measured and estimated), (5) data flow, (6) a monitoring plan, (7) data management and control system, and (8) a declaration of a GHG assertion.[351] The latter takes the form of a claim by the project proponent which is subject to third party verification.[352]

The Alberta offset system is an *ex post* verification system which means that the emission offset is first created and then verified. The project proponent creates the offset by developing a project which results in GHG reductions or removals that go beyond BAU and results in lower emissions (this usually means changing a business practice or installing a technology or control system to reduce emissions, or storing carbon in sinks).[353] The reduction in net emissions is then verified by an independent third party.

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[350]Alberta Environment, *Offset Credit Project Guidance Document* (Edmonton: Alberta Environment, 2008), online: Alberta Environment <http://environment.gov.ab.ca/info/library/7915.pdf>.
[351] *Ibid* at 13-19.
[352] The Offset Credit Project Guidance Document contains a draft form of the assertion.
[353] Goetz, *supra* note 2 at 402. The baseline is calculated before the practice is implemented. The difference between the baseline minus the project emissions equals the offset credit amount, and is measured in tonnes of emission reductions.

An Offset Credit must be registered with the Alberta Offsets Registry before it may be used for compliance purposes. Once registered, the offset credits will be serialized and made available to emitters for purchase.[354]

More detailed guidance is provided for verification and monitoring of offset projects in the Alberta Offset Credit Project Guidance Document, as well as in the Alberta Quantification Protocols.[355] Quantification Protocols are government approved frameworks that have been developed to support the Alberta Offset System. Project developers must use a government-approved protocol to sell compliance-based offsets in the province.[356] A further discussion of Alberta's Quantification Protocols is discussed in the following section.

6.3 Accommodation of CCS within the Alberta SGERs

Alberta Environment has issued several Quantification Protocols[357] but the ones that are most applicable to CCS projects are the Quantification Protocols for Enhanced Oil Recovery ("EOR")[358] and Acid Gas Injection ("AGI").[359] These Quantification Protocols

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[354] *Ibid* at 398. One of the key advantages of emission offset credits in Alberta is that they are less expensive than Technology Fund Credits. The main reason for this is that they are typically discounted for risk.

[355] Alberta has chosen to base offset protocols on the International Organization for Standardization (ISO) 14064-2 Standard as a framework for quantification and development. This framework ensures that a streamlined life cycle assessment is conducted for all sources and sinks upstream, on-site, and downstream of the project, and the baseline condition. *Ibid* at 403.

[356] *Ibid* at 402.

[357] Alberta has Quantification Protocols for afforestation, beef feeding, beef life cycle, biofuel, biogas, biomass, compost, energy efficiency, enhanced oil recovery, acid gas injection, landfill gas, pork, tillage, and waste heat recovery.

[358] Alberta Environment, *Quantification Protocol for Enhanced Oil Recovery* (Edmonton: Alberta Environment, 2007), online: Alberta Environment <http://environment.alberta.ca/documents/EOR_Protocol_V1_Oct_07.pdf > [EOR Quantification Protocol].

[359] Alberta Environment, Quantification Protocol for Acid Gas Injection (Edmonton: Alberta Environment, 2008), online: Alberta Environment <http://environment.gov.ab.ca/info/library/7961.pdf > [AGI Quantification Protocol].

provide details on the development of EOR and AGI projects. The baseline, quantification and monitoring plans for the EOR and AGI Protocols are discussed below.

According to the EOR Quantification Protocol, the baseline condition for an EOR project is:

> [t]he venting or flaring of the greenhouse gases contained within waste gas streams either at the capture point or as part of processing, and where applicable, the operation of the oil production system without injection and geological storage. The baseline condition could include an oil production system using water-flood for enhanced oil recovery.[360]

The quantification and monitoring plans must be provided in the project's development plan which will show that:

> 1. The storage project results in removal of emissions that would otherwise have been released to the atmosphere as indicated by an affirmation from the project developer and project schematics;
>
> 2. The emissions captured under the protocol are reported as emitted at the source facility such that the emission reductions are not double counted;
>
> 3. The enhanced recovery scheme has obtained approval from the Alberta Energy and Utilities Board (AEUB) [now the ERCB] and meets the requirements outlined under *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements* and *Directive 065 – Resources Applications for Conventional Oil and Gas Reservoirs*;
>
> 4. Metering of injected gas volumes takes place as close to the injection point as is reasonable to address the potential for fugitive emissions as demonstrated by a project schematics;
>
> 5. The quantification of reductions achieved by the project is based on actual measurement and monitoring (except where indicated in this protocol) as indicated by the proper application of this protocol; and

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[360] EOR Quantification Protocol, *supra* note 358 at 1.

> 6. The project must meet the requirements for offset eligibility as specified in the applicable regulation and guidance documents for the Alberta Offset System.[361]

According to the AGI Quantification Protocol, the baseline condition is described as follows:

> Processing a raw gas stream for the purpose of producing a saleable natural gas product results in an acid gas waste stream by-product. The acid gas stream may contain significant amounts of both hydrogen sulphide (H_2S), carbon dioxide (CO_2) and other contaminants.
>
> In the baseline condition for projects applying this protocol, the acid gas stream would be processed in a sulphur recovery unit or incinerated to destroy any hydrogen sulphide. The most likely baseline scenarios would therefore be the processing of acid gas in one of the following units:
>
> > In a Liquid Redox Process,
> > In a Multi-Stage Claus unit, or
> > Directly combusted in an incinerator.
>
> Where, in any case, the CO_2 contained in the acid gas stream would be released to the atmosphere from the tail (exit) gas stream of the sulphur recovery and/or incineration process. In the project condition capture and permanent containment of the entire acid gas stream reduces the quantity of CO_2 released to the atmosphere.[362]

The quantification and monitoring plan for AGI is discussed below.

According to the EOR and AGI Quantification Protocols, the project proponent must account for all of the additional GHGs that might be generated and emitted as a result of all of the activities undertaken by the offset project. In the case of an AGI project, these might include emissions associated with fuel extraction and processing, gas compression, upset flaring (when injection is not available), injection operations and any emissions

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[361] *Ibid* at 4.
[362] AGI Quantification Protocol, *supra* note 359 at 1.

from recycled gas where there is continuing production from the reservoir into which injection is occurring. With respect to the latter, the AGI Quantification Protocol recommends that all of the CO_2 contained in raw natural gas produced from the reservoir should be considered as recycled gas for which no offset credit should be claimed.[363] It appears that the AGI Quantification Protocol does not require the applicant to provide and account for any emissions once the substances are injected. At page 2, the AGI Quantification Protocol indicates that "the offsets resulting from Acid Gas Injection projects implemented in conformance with this protocol should be considered inherently permanent as result of the project monitoring and robustness of the injection reservoir mandated by the regulator in the permitting phase". Then at page 21, the AGI Quantification Protocol indicates that it is unnecessary for a proponent to take account of accidental releases since "monitoring of reservoir is highly regulated under H_2S regulation and possibility of occurrence is extremely low". However, if applied to a CCS project, this approach is inconsistent with the strict requirements of the IPCC Guidelines.[364]

Alberta is in the process of drafting a CCS Quantification Protocol.[365] The Draft CCS Quantification Protocol appears to take the view that while leakage is possible "the methodology does not require project proponents to consider GHG emissions from leakage events".[366] The baselines that are listed within the Draft CCS Quantification Protocol are for existing and new facilities. The baseline for existing facilities that are retrofitted for CCS are:

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[363] AGI Quantification Protocol, *supra* note 359 at 2 does not seem to make provision for calculated or measured emissions once the gas is injected (unless the injection reservoir is a producing reservoir).
[364] IPCC 2006 Guidelines, *supra* note 51.
[365] Blue Source Canada, "Draft Carbon Capture and Storage Emission Reduction Methodology" (Report prepared for Alberta Environment, March 2009), online: <http://carbonoffsetsolutions.climatechangecentral.com/files/microsites/OffsetProtocols/ProtocolReviewProcess/5thCycleProtocolDevelopment/Presentations/6%20Carbon%20Capture%20and%20Storage%20Methodology%20Presentation%20Oct29,2009.pdf> [Draft CCS Quantification Protocol].
[366] *Ibid* at 4-5.

- Baseline condition is the facility continuing to operate without carbon capture and storage;

- The quantity of CO_2 that would have been vented to the atmosphere in the baseline may be projected based on the quantity of CO_2 captured in the project condition and sequestered;

- This projection based approach is project and site specific and provides a reasonable estimate of baseline emissions if all project emissions are accounted for.[367]

The baseline for new facilities is defined as the lowest carbon fuel predominantly used as a fuel/feedstock for that type of primary process:

- If regulated under SGER or if regulation has been announced, the baseline would be the operation of the ‘CCS-compatible’ technology without CO_2 capture;

- For facilities not currently regulated under SGER, baseline would be the best available technology that does not incorporate CCS, which may have a higher or lower efficiency.[368]

The Draft CCS Quantification Protocol applies to “all components of CCS projects that occur outside the boundaries of facilities subject to the SGER”; however, the Protocol does not apply to “emission sources already accounted for at the capture site and reported under the SGER (to avoid double counting)”.[369] This means that facilities that are required to reduce emissions under the SGER cannot generate offsets. While this Draft

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[367] *Ibid* at 9.
[368] *Ibid* at 10.
[369] *Ibid* at 6.

CCS Quantification Protocol is designed to ensure that credits are limited to net emission reductions, it does not apply to EPCs.[370] Thus, as it stands, "while a covered emitter will wish to treat captured and compressed CO_2 as an avoided emission once it leaves the facility boundary, questions may arise as to the rules (regulatory or contract) for liability for fugitive and other emissions downstream of the plant gate of the capture facility to the point of injection and through ongoing storage".[371]

In Alberta, CO_2 captured and taken offsite will be treated and reported as an emission. This makes sense where the credit is being claimed as an offset. But what are the implications of this for a CCS project where the injection site is not within the emitter's project boundaries? Does the former statement apply equally to a CCS project with the implications that: credit can only be claimed for a CCS project by way of offsets and that EPCs will not be available? The answer to this question remains unclear due to significant omissions in the current Alberta framework regarding monitoring and reporting of emissions for a CCS project.

First, while the Alberta CCEMA and SGRS refer to sequestration of GHGs, the SGER and SGRR do not contain any specific references to CCS. According to the CCEMA and the SGRS, however, the capture and compression part of the CCS chain will fall within the boundaries of a covered facility, the downstream elements of the chain, such as transportation and storage, will not be covered facilities. In particular, the regulations provide no guidance as to whether: (1) the emitter can treat the volume that is captured as an avoided emission when the CO_2 leaves the facility boundaries and before it is injected, or (2) the emitter is in some way responsible for any emissions downstream from the facility boundaries.

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[370] Bankes, "ICO_2N Report", *supra* note 292 at 3.
[371] *Ibid.*

The current regulatory regime fails to provide a scheme for properly accounting for these volumes (especially downstream of facility boundaries and in the context of EPCs).[372]

There are two main options for dealing with the omissions in the Alberta regulatory regime. The first option would attribute emissions downstream of a facility boundary back to the regulated facility.[373] The second option would essentially mirror the EU ETS model discussed in chapter five.[374] These two options are discussed below.

The first option would require reporting all downstream emissions and have the person responsible for the covered facility treat those emissions as if they were attributable to the covered facility.[375] Calculation of emissions under this scenario should be fairly precise since measurement would occur at the capture facility boundary and at the point of injection, as required by the terms of an ERCB approval scheme.[376] These emissions would then be attributed to the person responsible for the capture facility requiring it to tender EPCs, purchasing offset credits or paying into the Fund.[377]

The second option has all the advantages associated with the first but provides functional separation between the different phases of the CCS chain.[378] The second option would treat each of the licensed operations downstream of the facility boundaries as a covered facility with zero emission allowances. In such a case, the person responsible for that facility would be required to meet its obligations by reducing emissions, by purchasing EPCs, offset credits or Fund credits.

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[372] *Ibid* at 18, "note that there is also some potential for a gap in the context of offsets to the extent that project boundaries do not extend upstream of the project to capture those activities (e.g. a CO_2 pipeline) that would not have been built for the availability of credits."
[373] *Ibid.*
[374] *Ibid.*
[375] *Ibid* at 19.
[376] *Ibid* at 21.
[377] *Ibid*.
[378] *Ibid* at 22.

According to Bankes, implementation of the first scheme would likely require two changes to the existing regulations:

> First, it will be necessary to create and impose GHG reporting obligations on each of the transportation and injection phases of the chain...as the regulations are currently framed, the licensees of such facilities do not owe reporting or emission reduction obligations unless that facility reaches the prescribed threshold and they cannot be expected to do so under any reasonable operating conditions. Second, it will be necessary to prescribe that these emissions are the responsibility of the covered entity – the emitter – so as to trigger the need to tender additional credits or fund contributions to offset these emissions and maintain the environmental integrity of the scheme.[379]

The second option requires even more extensive changes to the legislative framework:

> In particular it would require: (1) the recognition of new categories of covered entities (CO_2 transportation facilities and CO_2 injection facilities), and (2) these new categories would have a zero emissions allocation rather than an intensity-based allocation, and (3) the regulations would have to provide a mechanism by which this new category of covered entities could reach compliance in the event of emissions (i.e. fund contributions and tendering of offset or performance credits).[380]

The following table describes the treatment of emissions downstream of facility boundaries and EPCs.[381]

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[379] *Ibid*.
[380] *Ibid*.
[381] Note that while this table focuses on the "gap" associated with EPCs downstream of a facility boundary, there may be similar gaps upstream of a project boundary for an offset project.

Table 3

	Ignore the gap	**Assign responsibility back to the covered emitter: option 1**	**The EU model: option 2**
Consistency with the Act	No: not a release only when captured and stored	Yes: credits would be limited to net emission reductions	Yes: credits would be limited to net emission reductions
Consistency with the Regulations	Superficially consistent with SGERs (no obligations for non-covered entities)	Leaves the obligation with the covered entity and therefore consistent	Imposes obligations on a broader category of facilities: less consistent
Consistency with IPCC	Inconsistent	Consistent	Consistent
Simple to implement	Simple; because it ignores the problem	Will impose regulatory and contractual costs	Will impose regulatory costs
Environmental integrity	Undermines the integrity of CCS-based credits	Maintains integrity	Maintains integrity
Fungibility of CCS-based credits	Compromises fungibility; other jurisdictions may refuse to accept	Facilitates fungibility (subject to emissions intensity concerns) if there is an auditing capacity	Facilitates fungibility (subject to emissions intensity concerns)
Moral hazard	Pipeline entity and storage entity exposed to moral hazard	Liability for emissions is severed from custody and control, but may use contract to create incentives	Avoided: liability for emissions is associated with custody and control
Sensitive to organizational structure	Neutral	Easier to give effect to within an integrated model	Neutral
Equal rigour between EPCs and offset credits	Inconsistent insofar as offsets based on credit for net emission reductions	Full accounting for all emissions	Full accounting for all emissions
Data collection challenges	No challenge; no need for the data	Capture entity will contract for the data	Data required by regulation

Source: Bankes, "ICO_2N Report", *supra* note 292 at 26.

Each of these options will require amendments to the regulations. The second option is more attractive as it avoids the moral hazard of fugitive emissions, creates fungible credits[382] and is a proven, effective scheme.[383]

6.4 The Proposed Federal Framework

6.4.1 Overview of Federal Framework

In April 2007, the Federal Government announced its Regulatory Framework on Air Emissions,[384] and on March 10, 2008, the Federal Government released the "final" version of its action plan, the Federal Framework.[385] When Canada joined the Copenhagen Accord in December 2009,[386] it committed to reducing its GHG emissions to 17% below 2005 levels or 607 Mt by 2020.[387] Further details will be provided when the promised regulations appear in draft form but that has yet to happen. As such, this discussion will be based on the 2008 Federal Framework which is the only document which has been committed to writing.

The Federal Framework will require existing facilities to achieve an emissions intensity reduction target of 18% below 2006 levels by the beginning of 2010, followed by a continuous annual intensity improvement of 2% thereafter.[388]

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[382] Credits generated in Alberta could be tradeable on the international market if the standards are uniform. As it currently stands, it would be naive to think that credits earned in Alberta could be traded into Europe unless the rules for generating credits in Alberta are just as robust and protective of environmental integrity.
[383]The second option mirrors that of the EU ETS.
[384] Environment Canada, *Regulatory Framework for Air Emissions* (Ottawa: Minister of Environment, 2007), online: Environment Canada <http://www.ec.gc.ca/doc/media/m_124/report_eng.pdf>.
[385] Federal Framework, *supra* note 156.
[386]Online: Government of Canada <http://www.climatechange.gc.ca/default.asp?lang=En&n=DC025A76-1>.The Copenhagen Accord is a critical instrument for addressing such dramatic escalation because it is signed by 140 nations, representing 85% of the world's GHG emissions. For example, the Accord was signed by China, the U.S., Brazil and India, which together account for over 40% of global emissions. In contrast, none of these major emitters had commitments under the *Kyoto Protocol*, an agreement that involved commitments of only 40 nations representing 27% of global emissions.
[387] In 2005, Canada's total GHG emissions were 731 Mt, representing about 2% of overall global GHG emissions. Existing measures announced by Federal and Provincial Governments will reduce GHG emissions in 2020 by about 65 Mt. This represents one quarter of the reductions in emissions needed by 2020 to reach the target level of 607 Mt.
[388] Federal Framework, *supra* note 156 at iii, 3.

The Federal Framework is an intensity-based scheme and sets a threshold for facilities in the chemical, nitrogen-based fertilizer, natural gas pipeline, upstream oil and gas, and electricity sectors.[389] For chemical, nitrogen-based fertilizer and natural gas pipelines, that threshold will be 50,000 tonnes of CO_2e per year. For upstream oil and gas facilities, it will be 3,000 tonnes of CO_2e per facility and 10,000 barrels of oil equivalent per day per company. For power plants, it will be 10 MW per year.

6.4.2 Methods of Achieving Compliance

There are three main compliance mechanisms for achieving compliance under the Federal Framework: Technology Fund Credits, offset credits and credits for early action.

6.4.2.1 Technology Fund Credits

Similar to Alberta's regulations, regulated entities under the Federal Framework, will be able to contribute to the Technology Fund. The contribution rate will start at CDN$15 per tonne of CO_2 for the 2010-2012 period, rising to $20 per tonne in 2013, and increasing at the nominal rate of GDP growth thereafter.[390] The Federal Framework will only allow an emitter to achieve 70% of its compliance by way of Fund Credits. The remaining 30% must be achieved by real intensity reductions from one of two sources: actual intensity reductions at the emitter's facility or through the purchase of offsets. The Federal Framework also provides that the maximum system-wide compliance obligation that can be met through fund purchases will decline from 70% in 2010 to 10% in 2017 before it expires in 2018. The price of the Fund Credits will be $15 per tonne to 2012 and $20 per tonne from 2012 to 2017.[391]

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[389] *Ibid* at 8. This will capture a larger number of emitters than the Alberta framework.
[390] EcoEnergy Carbon Capture and Storage Task Force, "Canada's Fossil Fuel Energy Future: The Way Forward on Carbon Capture and Storage" (Report prepared for Natural Resources Canada, January 9, 2008), online: Natural Resources Canada <http://www.nrcan-rncan.gc.ca/corm/rresoress/publications/fosfos/fosfos-eng.pdf> at 3.
[391] Federal Framework, *supra* note 156.

6.4.2.2 Offset Credits

Similar to the Alberta system, offsets are intended to encourage emission reductions from activities outside of the regulated sphere. Under the federal scheme: (1) a protocol developer creates a quantification protocol for the project type approved by Environment Canada, (2) the project developer applies to have its project registered, (3) Environment Canada reviews, approves, and registers the project, (4) the project developer reports the GHG reductions achieved from a registered project and ensures that a verifier has provided a reasonable level of assurance on the reductions claim, and (5) Environment Canada certifies the reductions and issues offset credits.[392] In 2008, the Federal Government published a draft quantification protocol which provides guidelines for project protocol development and methodologies.[393] The plan is that during the first six months of the operation of the federal offset system, Environment Canada will implement a modified and accelerated process to review and approve "Offset System Quantification Protocols" that are derived from other systems, including: the Clean Development Mechanism, Alberta's Offset System, the California Climate Action Registry, the Greenhouse Gas Abatement Scheme in New South Wales, France's Offset System, and the Northeast States Regional Greenhouse Gas Initiative.[394]

Regulated entities may also be able to purchase credits created through the CDM of the Kyoto Protocol. The purchase of CDM credits will be limited to 10% of each firm's

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[392] Environment Canada, *Turning the Corner: Canada's Offset System for Greenhouse Gases* (Ottawa: Environment Canada, 2008), online: Environment Canada <http://www.ec.gc.ca/doc/virage-corner/2008-03/526_eng.htm>.
[393] *Ibid*. Under this system, the Federal Government would develop quantification protocols for landfill gas capture and destruction, reductions in methane from agriculture, soil management, afforestation, intermodal transportation, biofuels, geological sequestration, non-emitting energy, and energy efficiency. The project cycle would include four stages: registration, validation, verification, and issuance of credits.
[394] *Ibid* at 2.

obligation, with the added restriction that credits earned through forest sink projects will not be available for use in complying with Canadian regulations.[395]

6.4.2.3 Early Action Credits

A one-time credit of up to 15 Mt worth of emissions credits will be awarded to regulated entities for emission reduction activities undertaken between 1992 and 2006.[396] These credits will be both tradable and bankable. Emitters will share the 15 Mt of credits on a *pro rata* basis, based on their emission reduction volumes.[397]

6.5 Accommodation of CCS within the Federal Framework

The Federal Framework will provide incentives for new facilities brought on stream in 2004 or later to adopt CCS.[398] The Federal Government intends to set targets based on the implementation of CCS for in situ facilities and upgraders in the oil sands sectors and for new coal-fired electrical generation plants that begin operating in 2012 or later. Effectively, oil sands and coal-fired generation facilities starting operations in 2012 or later will be expected to incorporate CCS.[399]

The Federal Framework also offers additional flexibility to new projects in certain eligible sectors (oil sands, electricity, petroleum refining, chemical and fertilizer sectors) that seek compliance using CCS. As stated above, new projects (i.e. post 2004 facilities including significant expansions) must meet a continuous 2% improvement requirement after three years in service:

> In those sectors in which carbon capture and storage is a viable option for reducing emissions, for new facilities that do not meet the cleaner fuel standard but that are built capture-ready, the standard would not apply until 2018. This would mean that the 2% annual continuous improvement

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[395] *Ibid* at 18.
[396] Goetz, *supra* note 2 at 408.
[397] Federal Framework, *supra* note 156 at 18, 20.
[398] *Ibid* at 3.
[399] *Ibid* at 10-11; Goetz, *supra* note 2 at 406.

> target would apply to the facility's actual emission intensity. This incentive for carbon capture and storage will apply to the oil sands, electricity, petroleum refining, chemical, and fertilizer sectors.[400]

According to Bankes:

> This seems to offer an additional opportunity to defer the entry into force of the requirement in much the same manner as existing facilities have been put on notice that they must achieve a 6% per annum improvement effective 2007 while understanding that this will not bite until 2010 when the regulations come into force. In the same manner a "new facility" within one of the eligible categories will be subject to the 2% per annum improvement but the cumulative requirement of this improvement will not enter into force until 2018 provided that the new facility is built "capture–ready". The effect of this is to create two categories of "new project" for the purposes of the regulatory framework.[401]

There is also a pre-certified investment option which allows facilities to receive credits for investing directly in large-scale projects, provided they are selected from a menu set out by the Federal Government.[402] The Federal Government intends to pre-certify CCS projects. To encourage investment in CCS projects, oil sands producers and coal-fired generation plants will be able to satisfy 100% of their regulatory obligations by investing in pre-certified CCS projects up to 2018.[403] This pre-certified credit option will be attractive to oil sands producers and coal-fired generation plants to subsidize the construction of their CCS systems.[404]

6.6 Integration of Alberta and Federal Frameworks

This discussion is unique to the Alberta chapter because the Alberta Government and the Canadian Federal Government have separate GHG emissions frameworks. This discussion is not necessary for the EU because the EU ETS already has an integrated

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[400] Federal Framework, *supra* note 156 at 10.
[401] Nigel Bankes, "The Federal Government's Climate Change Policy and the Role of Carbon Capture and Storage" (Article prepared for ABlawg, March 24, 2008), online: ABlawg <http://ablawg.ca/2008/03/24/the-federal-government%e2%80%99s-climate-change-policy-and-the-role-of-carbon-capture-and-storage/>.
[402] Federal Framework, *supra* note 156 at 16.
[403] Goetz, *supra* note 2 at 407.

system in place among its Member States. This discussion is also not necessary for New South Wales because the Australian Federal Government does not have a GHG emissions framework.

First and foremost, the Kyoto Protocol requires Canada and Alberta to use common reporting standards for their annual inventory reporting of anthropogenic emissions by sources and removals of sinks.[405] Federal and provincial regulators recognize the significance of these international norms. This is reflected in the Alberta SGER which provides that specified gas reporters shall, *inter alia*, rely on international standards in reporting under the regulations:

> 7(1) A specified gas reporter shall calculate or determine the amount of stationary fuel combustion emissions, industrial process emissions, venting and flaring emissions, other fugitive emissions, on-site transportation emissions, waste and wastewater emissions and biomass emissions where required by sections 2 and 5 by using one or more of the applicable methodologies, emissions factors, equations and calculations that is:
>
> (a) widely accepted by the industry to which the facility belongs; or
>
> (b) consistent with the guidelines approved for use by the [UNFCCC] for the Preparation of National Greenhouse Gas Emissions Inventories by Annex I Parties (Decision 18/CP.8), and the annex to that decision contained in FCCC/CP/2002/8.[406]

The IPCC Guidelines provide guidance on common reporting standards.[407]

Second, and related to the issue of common reporting standards, is the issue of the broad geographical fungibility of any credits generated by CCS activities. To the extent that trading is confined to a discrete jurisdiction, such as Alberta, the rules on fungibility will

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[404] *Ibid* at 406.
[405] *Kyoto Protocol*, *supra* note 9, art 7.
[406] *SGRS*, *supra* note 154, art 7(1).
[407] IPCC 2006 Guidelines, *supra* note 51, vol 1, s 8.4. See also chapter two of this thesis.

be set by that particular jurisdiction.[408] For example, in the current Alberta system, EPCs, Fund credits and offset credits are treated as completely fungible by the regulations because a covered entity can meets its obligations by tendering any of these credits.[409] However, as soon as trading takes place on a broader basis, it becomes necessary to consider the standards used by other jurisdictions.[410]

Third, the Federal Government has indicated that provinces with equally stringent GHG emission regulations will be exempt from the federal regulations. However, given that Alberta's regulations are less stringent than the federal regulations, it remains to be seen whether Alberta will be required to move toward harmonization with the proposed federal regulations. The Federal Government has indicated that it is aware of Alberta's "special" circumstances with respect to its oil and gas industry and will ensure that those circumstances are taken into account with harmonization between the federal and provincial schemes:

> The upstream oil and gas sector comprises a very large number of facilities with a wide variety of size. The proposed threshold is much more stringent than what is currently used by the Government of Alberta in its July 2007 regulations for emissions from this sector. The government is committed to achieving a common threshold and common reporting regime in Alberta. It will continue discussion with the Government of Alberta on these issues, seeking a common practical approach to

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[408] Bankes, "ICO$_2$N Report", *supra* note 292 at 11.

[409] *Ibid*. While the regulations suggest that EPCs and offset credits are completely fungible, private parties do not see the same degree of fungibility because of the risks associated with both as opposed to compliance by way of contributions to the Fund. Thus the PASC Guidelines, *supra* note 343 suggest that co-owners in a natural gas processing plant that is a covered entity may seek indemnities where one co-owner seeks to meet its compliance obligations by tendering offset or performance credits to the person responsible. PASC originally contemplated reviewing and revising the guidelines later in 2008 but a note on PASC's website advises that it has decided to delay revision until the proposed federal regulations appear. The note also advised that most parties had followed the Guidelines as proposed.

[410] The EU has indicated that it will only provide for mutual recognition of allowances between the EU and "other mandatory greenhouse gas emission trading systems capping absolute emissions" established in other countries or sub-federal or regional entities so as to improve and extend the greenhouse gas emission allowance trading system of the Community, Revised ETS Directive, *supra* note 256 at para 31. Since Alberta's regulatory system is based on the concept of emissions intensity and not absolute emission reductions it is unrealistic to expect that offset or other credits generated in Alberta can be traded into the European market.

> emissions coverage, including the phasing of thresholds and the identification of additional measures that could be implemented to address emissions in the rest of the sector.[411]

However, it remains to be seen whether Alberta's regulatory scheme will be deemed equivalent or whether Alberta will move towards harmonization with the proposed federal regulations. The differences will cause many challenges for harmonization efforts. For instance, the Alberta framework does not allow linkages with the Kyoto Protocol and does not provide for recognition of early action towards emission reductions. Alberta's regulations allow credits generated from 2002 forwards whereas the federal plan allows credits generated from 2008 forward. Alberta's reduction requirements are only 12% for existing facilities versus the federal 18% plus an additional 2% per year. Finally, the applicability threshold for certain sectors is lower in the Federal Framework.

6.7 Conclusion

There are two ways of generating credits in Alberta: EPCs and offset credits. EPCs will tend to accrue to the capture entity and offset credits will tend to accrue to the storage entity. The regulations and associated offset protocols offer a lot of guidance on the question of how to generate and quantify offset credits. However, there is no similar guidance available with respect to EPCs. In particular, the regulations do not prescribe how to account for incremental CO_2 emissions that occur within the CCS chain downstream of the facility boundary of the capture entity. This chapter has suggested two ways of dealing with this apparent gap in the Alberta regulatory framework.[412] One approach requires the transportation and storage facilities to monitor and measure their emissions and to attribute these emissions to the covered facility. The other approach, which is modeled on the EU ETS, is to treat the transportation and storage facilities as covered facilities but with a zero emission entitlement. The Alberta scheme could

[411] Federal Framework, *supra* note 156 at 8-9.
[412] There is always the option to opt for a contractual re-assignment of credits as part of arriving at a reasonable commercial arrangement between the different parties within the CCS chain.

become more successful at accommodating CCS if it implemented one of these two approaches.

In order to determine how successfully Alberta currently accommodates CCS, it is necessary to apply the criteria of effectiveness and efficiency to the emissions regime.

Alberta employs an intensity-based cap which meets the criteria of efficiency due to lower costs and flexibility for emitters. However, since the cap is intensity-based there is less environmental accountability, certainty and ability to link with other trading systems. Related to the cap and discussed at length in this chapter, is the issue of legislative clarity with respect to ways in which an emitter may meet its obligations under the cap. While the legislation is clear regarding the treatment of offsets, it remains unclear with respect to the treatment of CCS as an avoided emission/EPC. As currently structured, the legislation contributes to the regime’s ineffectiveness because it is generally inconsistent: it is inconsistent with the IPCC 2006 Guidelines, it undermines the integrity of CCS-based credits, it compromises fungibility, it is unclear as to its treatment of EPCs and offset credits and there is a potential moral hazard problem regarding downstream entities.

Alberta’s strength is in its sophisticated offset system which is dealt with appropriately in the legislation. In particular, Alberta has developed several protocols which are applicable to CCS, such as the Draft CCS Quantification Protocol, the EOR Quantification Protocol and the AGI Quantification Protocol. This significantly contributes to the effectiveness of the regime. In addition, the Alberta offset system contributes to the efficiency of the emissions trading system because it allows for an emitter to purchase offsets to meet 100% of its obligations, which allows flexibility within the scheme.

Overall, I conclude that the Alberta system scores an average success rate in accommodating CCS. Alberta has turned its mind to the accommodation of CCS and has developed a sophisticated offset system; however, there are some significant gaps in the emissions trading legislation. If the Alberta scheme were to make some slight changes to its legislation, as suggested within this chapter, it would become more successful at accommodating CCS.

Chapter Seven: New South Wales Greenhouse Gas Reduction Scheme

7.1 Introduction

Australia ratified the Kyoto Protocol in 2008; however, it has yet to implement national cap and trade legislation.[413] New South Wales, on the other hand, established a mandatory GHG emissions trading scheme in 2003 which continues to be the only mandatory scheme in Australia.[414]

7.2 New South Wales Greenhouse Gas Reduction Scheme

7.2.1 Overview of the Greenhouse Gas Reduction Scheme

The Greenhouse Gas Reduction Scheme ("GGAS")[415] is a mandatory state-level program designed to "reduce greenhouse gas emissions associated with the production and use of electricity; and to develop and encourage activities to offset the production of greenhouse gas emissions."[416] Launched in 2003, targets have been set until 2021. According to the

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[413] The experiences gained in establishing and administering the NSW GGAS have been used in the development of the proposed Australian Carbon Pollution Reduction Scheme. If implemented, this cap and trade scheme will expand the emissions trading framework beyond NSW and the ACT to include all other Australia States and Territories. Legislation to implement the scheme was introduced to the Australian Parliament in May of 2009 and scrapped in April 2010, shelving the legislation until after the end of 2012. However, in the event that the Australian Government decides to implement a national scheme, to avoid having two schemes operating simultaneously, in 2005 the NSW Government passed legislation extending the GGAS scheme to 2020 or until a national trading scheme is introduced. The GGAS will cease to operate upon the commencement of an Australian national emissions trading scheme. See Jacqueline Peel, "Climate Change Law: The Emergence of a New Legal Discipline" (2008) 32 Melbourne UL Rev 922 at 943; See Nicholas Howarth & Andrew Foxall, "The Veil of Kyoto and the politics of greenhouse gas mitigation in Australia" (2010) 29 Political Geography 167.

[414] On January 1, 2005, the Australian Capital Territory ("ACT"), a separate jurisdiction physically located inside New South Wales, also introduced legislation to become part of the NSW GGAS.

[415] The scheme's name was changed from the Greenhouse Gas Abatement Scheme to the Greenhouse Gas Reduction Scheme in early 2007 but retains the acronym GGAS.

[416] Online: Ecosystem Marketplace < http://www.ecosystemmarketplace.com/pages/dynamic/web.page.php?section=carbon_market&page_name=ggas_market>.

World Bank, outside of the Kyoto markets,[417] the New South Wales GGAS is the world's largest, regulated cap and trade GHG market.[418]

The GGAS establishes an annual state-wide per capita GHG emission target, a "benchmark", for the electricity sector, based on the reductions necessary to achieve the global target set in the Kyoto Protocol of reducing overall GHG emissions to 5% below 1990 emissions. The scheme established an intensity-based cap or benchmark of 8.65 tonnes per capita per year (per head of NSW State population per year), starting in 2003. The benchmark dropped progressively until 2007, when the cap became 7.27 tonnes of CO_2e per head of State population per year, which will continue until 2021.[419]

GGAS is a baseline and credit form of emissions trading in which abatement certificate providers create certificates for actions that abate emissions compared to BAU.[420]

7.2.2 Methods of Achieving Compliance

Regulated entities can meet their emission reduction targets in one of two ways: by directly reducing the average emissions intensity of the electricity they sell or use, or by purchasing accredited offsets and surrendering these to the scheme's compliance regulator.[421] If a regulated emitter exceeds its emissions target and fails to surrender enough abatement certificates to meet its mandatory benchmark, a penalty is assigned in the amount of AU$13.50 per tonne of shortfall in the compliance period of January 1, 2011 to December 31, 2011.[422]

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[417] Kyoto markets are those GHG emissions trading schemes that have been implemented in order to meet obligations under the *Kyoto Protocol*. The GGAS does not exist to meet obligations under the *Kyoto Protocol.*

[418] Ricardo Bayon, Amanda Hawn & Katherine Hamilton, *Voluntary Carbon Markets: An International Business Guide to What They Are and How They Work*, 2nd ed (London: Earthscan, 2009) at 11.

[419] *Electricity Act*, *supra* note 171, s 97B.

[420] Peel, *supra* note 413 at 944.

[421] Donehower, *supra* note 252 at 195.

7.2.2.1 Reducing Total Annual Emissions

Regulated entities can meet their emission reduction targets by directly reducing the average emissions intensity of the electricity they sell or use.

7.2.2.2 Emission Offset Credits

Benchmark participants can achieve compliance by purchasing offset emissions in the form of New South Wales Greenhouse Abatement Certificates ("NGACs"), which are generated by emissions abatement projects carried out within the State.[423] According to Passey, MacGill and Outhred, each NGAC represents "one tonne of CO_2-e of 'avoided' GHG emissions".[424] The surrender of these certificates effectively offsets a portion of the GHG emission associated with their electricity purchases.[425]

Abatement projects can occur through "undertaking low GHG-emission production of electricity, carbon sink projects that result in the removal of GHGs from the atmosphere and activities that result in reductions in the consumption of electricity".[426] Renewable Energy Credits ("RECs") created under a separate national scheme aimed at stimulating renewable energy projects called the Mandatory Renewable Energy Target ("MRET")

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[422] *Electricity Act*, *supra* note 171, s 97CA.
[423] Robert Passey, Iain MacGill &Hugh Outhred, "The governance challenge for implementing effective market-based climate policies: A case study of the New South Wales Greenhouse Gas Reduction Scheme" (2008) 36 Energy Policy 3009 [Passey, MacGill & Outhred, "A Case Study"].
[424] Robert Passey, Iain MacGill & Hugh Outhred, "The NSW Greenhouse Gas Reduction Scheme: An Analysis of the NGAC Registry for the 2003, 2004 and 2005 Compliance Periods" (Discussion paper prepared for the Centre for Energy and Environmental Markets, the University of New South Wales, August 2007), online: University of New South Wales <http://www.ceem.unsw.edu.au/content/userDocs/CEEM_DP_070827_000.pdf> at 3 [Passey, MacGill & Outhred, "Discussion Paper"].
[425] "Introduction to the Greenhouse Gas Reduction Scheme", GGAS Website, September 2008, online: GGAS <http://www.greenhousegas.nsw.gov.au/documents/Intro-GGAS.pdf > at 3 [Intro to GGAS].
[426] Donehower, *supra* note 252 at 196.

can also be used.[427] However, the GGAS does not accept other credits, such as CERs or ERUs.

The GGAS requires individual electricity retailers and certain other parties who buy or sell electricity in New South Wales to meet mandatory benchmarks based on the size of their shares of the electricity market. The GGAS provides for mandatory and elective benchmark participants. Mandatory benchmark participants are all NSW electricity retail suppliers, two electricity generators which supply electricity directly to large customers in NSW and one market customer, which takes electricity supply in NSW directly from the National Electricity Market.[428] In addition, 11 companies which use over 100 GWh of electricity in a year have elected to manage their own benchmarks. These companies are known as elective participants.[429]

The New South Wales GHG benchmark is to be the basis for the calculation of the GHG benchmark for each "benchmark participant".[430] A "benchmark participant" means a person referred to in s. 97BB (1) of the Act who is subject to a GHG benchmark.[431] A

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[427] Peel, *supra* note 413 at 933. The MRET established by the *Renewable Energy (Electricity) Act 2000* (Cth) commenced on April 1, 2001. The MRET requires wholesale purchasers of electricity ("liable entities") to contribute proportionately towards the generation of 9,500 gigawatt hours of renewable energy per year by 2010. Owners of renewable energy generation assets that are accredited under the legislation, earn renewable energy certificates, which may be sold to liable entities or third parties. Regulated entities under the GGAS can comply by purchasing RECs generated under the MRET.
[428] Online: Government of New South Wales <http://www.greenhousegas.nsw.gov.au/benchmark/participant_list.asp>.
[429] *Ibid.*
[430] *Electricity Act, supra* note 171, s 97AB.
[431] *Ibid.*

> (1) The following persons are benchmark participants for the purposes of this Part: (a) a retail supplier, (b) an electricity generator prescribed by the regulations or any other person prescribed by the regulations, being an electricity generator or other person that supplies electricity directly to a customer under an electricity supply arrangement and that is, in respect of that supply, exempted from the operation of section 179 or to which section 179 does not apply, (c) a market customer (other than a retail supplier), but only in respect of an electricity load it has classified as a market load and that is electricity supplied for use in this State, (d) a large customer who has made an election, that is in force, to be subject to a greenhouse gas benchmark, (e) a person who is engaged in carrying out State significant development and who has made an election, that is in force, to be subject to a greenhouse gas benchmark.

“GHG benchmark” for a benchmark participant means the benchmark for a compliance period, in tonnes of CO_2e of GHG emissions, determined for the participant under the Act.[432] A benchmark participant’s individual cap is determined by subtracting the participant’s greenhouse gas benchmark from the number of tonnes of CO_2e of GHG emissions in that compliance period for which the participant is responsible.[433] Section 97BD of the Act allows a participant to abate its emissions by totalling the number “of tonnes attributable to any abatement certificates surrendered by the participant for that compliance period and any renewable energy certificates of the participant counted for that compliance period.”[434] If the result is more than zero (a “greenhouse shortfall”), the benchmark participant has failed to comply with the participant’s greenhouse gas benchmark.[435] If the result obtained is zero or less than zero, the benchmark participant has complied with the participant’s greenhouse gas benchmark. Thus, if the result is less than zero, no credit accrues to the benchmark participant.

The GGAS is established through the Electricity Act[436] which sets out the functions and responsibilities given to the Independent Pricing and Regulatory Tribunal of New South Wales (“IPART”) in its role as Administrator and Compliance Regulator. The administration of the GGAS scheme and monitoring the performance of benchmark participants is undertaken by IPART. The Scheme Administrator assesses abatement projects, accrediting parties to undertake eligible projects and then creating certificates, and monitoring compliance with GGAS. The Scheme Administrator also manages the Greenhouse Registry which records the registration and transfer of certificates created from abatement projects.[437]

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[432] *Ibid.*
[433] *Ibid*, s 97BD. A “greenhouse shortfall” means the amount, in tonnes of CO_2e, by which a benchmark participant fails to comply with the participant’s greenhouse gas benchmark for a compliance period
[434] *Ibid.*
[435] *Ibid.*
[436] *Ibid.*
[437] Online: NSW Government <http://www.greenhousegas.nsw.gov.au/>.

The Electricity Act is supported by the Electricity Supply (General) Regulation 2001[438] which provides further details on the operation of the GGAS, such as eligibility requirements for elective benchmark participants, assessment of compliance of benchmark participants, eligibility requirements for accreditation as Accredited Certificate Providers ("ACPs"),[439] conditions of accreditations that are imposed by either the Regulation or the Scheme Administrator, creation and transfer of abatement certificates, and the conduct of audits.

The Australian Capital Territory ("ACT")[440] Government introduced a Greenhouse Gas Abatement Scheme on January 1, 2005 that mirrors the New South Wales GGAS. IPART has been appointed the Scheme Administrator for the ACT GGAS whereas the compliance regulator function for the ACT scheme will be performed by the ACT's Independent Competition and Regulatory Commission ("ICRC").

New South Wales GGAS and ACT GGAS regulate the emissions of the electricity sector within the jurisdictions of New South Wales and the ACT, respectively. The obligations are imposed by and large on retailers, and the costs for reducing emissions are ultimately borne by residents in these jurisdictions. New South Wales and the ACT are part of a regional electricity grid, the National Electricity Market ("NEM"), which connects the States along Australia's eastern seaboard (Queensland, New South Wales, Victoria, the ACT, South Australia and Tasmania).[441] Projects which achieve abatement at the point of electricity generation in any part of the NEM are eligible to create NGACs; however, projects that create NGACs via measures to reduce electricity demand, sequester carbon

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[438] *Electricity Supply (General) Regulation 2001 (*NSW), online: NSW Government < http://www.legislation.nsw.gov.au/viewtop/inforce/subordleg+468+2001+FIRST+0+N/> [*Electricity Regulation*].
[439] ACPs are the offset project developers.
[440] The ACT is the capital territory of the Commonwealth of Australia and its smallest self-governing internal territory. It is an enclave within New South Wales.
[441] Regina Betz & Anthony Owen, "The implications of Australia's carbon pollution reduction scheme for its National Electricity Market" (2010) 38 Energy Policy 4966 at 4967.

and/or reduce industrial process emissions must be physically located in New South Wales or the ACT.[442]

7.2.2.2.1 Abatement Project Eligibility

Abatement projects are activities that are likely to result in substantial emissions reductions or activities to offset emissions. The GGAS leverages private sector investment in activities or technologies in areas such as co-generation (the use of waste heat or steam from power production or industrial processes for power generation), energy efficiency, travel demand management, alternative fuels, coal mine gas technologies and fuel conversion.[443] The GGAS allows for the creation of abatement credits by ACPs for activities in one or more of the four abatement project types outlined in the Greenhouse Gas Abatement Rules:[444]

- Generation Rule:[445] Covers low-emission generation of electricity including cogeneration and renewable energy production, or improvements in the emissions intensity of existing generation activities;

- The Energy Savings Scheme ("ESS"):[446] The ESS is an energy efficiency scheme based on the trading of Energy Savings Certificates ("ESCs") in New South Wales. ESCs are supplied by ACPs who are able to create ESCs when they undertake eligible activities that improve energy efficiency in residential, commercial and industrial settings;

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442 *Ibid.*
443 Online: CO_2CRC <http://www.co2crc.com.au/aboutccs/response.html>.
444 The Department of Water and Energy develops the policy framework and drafts rules. IPART administers the GGAS through the application of these rules in its role as Scheme Administrator and Compliance Regulator. The Greenhouse Gas Benchmark Rules detail the calculation methodology for benchmark participants to measure their compliance and for accredited abatement certificate providers to calculate the eligible number of abatement certificates they can create.
445 *Greenhouse Gas Benchmark Rule (Generation) 2003* (NSW), online: GGAS <http://www.greenhousegas.nsw.gov.au/documents/Rule-Gen-Sep10-Gazette.pdf> [Generation Rule]; *Electricity Regulation*, *supra* note 438, s 73G.

- Large User Abatement Rule:[447] Covers activities carried out by elective participants to reduce on-site emissions not directly related to electricity consumption. Project examples include increasing the efficiency of on-site fuel use; switching to lower emissions intensity fuels; the abatement of on-site GHG emissions from industrial processes; and the abatement of on-site fugitive GHG emissions; and

- Carbon Sequestration Rule:[448] Carbon sequestration is only available through afforestation or reforestation. For a forest to be eligible to create abatement certificates, it must meet the UNFCCC's definition of afforestation or reforestation.

For the certification of abatement projects, activities must meet the location criteria outlined in the Greenhouse Gas Abatement Rules. Generation projects can be located in any part of the NEM. The ESS, Large User Abatement and Carbon Sequestration abatement projects are only eligible if implemented within New South Wales. The following discussion defines these abatement projects in more detail and how they could potentially accommodate CCS.

7.3 Accommodation of CCS within the GGAS

States and territories in Australia have jurisdiction over CO_2 storage onshore and up to three nautical miles offshore. The Federal Government has jurisdiction from three

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[446] *Energy Savings Scheme Rule 2009* (NSW), online: NSW Government <http://www.ess.nsw.gov.au/documents/ESSRule.pdf > [ESS Rule]. The ESS commenced on July 1, 2009 and replaces the Demand Side Abatement Rule for end-use energy efficiency activities.

[447] These types of activities create Large User Abatement Certificates ("LUACs"), which have the same value as an NGAC and may be surrendered to meet a GHG benchmark, but are not tradeable. *Greenhouse Gas Benchmark Rule (Large User Abatement Certificates) 2003* (NSW) [LUA Rule], online: GGAS <http://www.greenhousegas.nsw.gov.au/documents/Rule-LUAC-Oct03.pdf>, *Electricity Regulation, supra* note 438, s 73GC.

nautical miles offshore to the edge of Australia's continental shelf. Legislation is already in place to regulate CCS activities in offshore Commonwealth waters and onshore Victoria,[449] Queensland[450] and South Australia.[451] Legislation is still being developed in New South Wales and Western Australia.[452] Despite the lack of legislation on CCS, the New South Wales Government clearly supports the development of CCS, having issued policy statements and pledged financial commitments to developing this technology.[453]

In May 2007, the New South Wales Minister for Primary Industries, Energy, Mineral Resources and State Development, the Hon Ian MacDonald MLC, outlined the Government's commitment to clean coal technologies:

> We have a long-term target of 60% reduction in greenhouse gas emissions by 2050. Clean coal technologies in New South Wales will be a key factor in achieving this target, and will help both Australia and New South Wales adapt to a carbon-constrained future. Clean coal research was identified as one of five key actions in the Government's statement on innovation... We cannot have a climate change policy that does not take into account short-term reliance on fossil fuels...In New South Wales about 90% of our electricity needs are met from coal-fired power stations. Burning coal without adding to global carbon dioxide levels is a major technological challenge that must be addressed. A number of technologies can be considered, including the strategy of advancing CO_2 capture and storage,

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[448] *Greenhouse Gas Benchmark Rule (Carbon Sequestration) 2003* (NSW), online: GGAS <http://www.greenhousegas.nsw.gov.au/documents/Rule-CS-May10.pdf> [Carbon Sequestration Rule]; *Electricity Regulation, supra* note 438, s 73GA.

[449] *Greenhouse Gas Geological Sequestration Act 2008* (Vic); Department of Primary Industries, Victorian Government, "A Regulatory Framework for the Long-Term Underground Geological Storage of Carbon Dioxide in Victoria" (Discussion paper, January 2008), online: Department of Primary Industries <http://new.dpi.vic.gov.au/energy/policy/greenhouse-challenge/ccs-regulations/a-regulatory-framework-for-the-long-term-underground-geological-storage-of-carbon-dioxide>.

[450] *Petroleum and Gas (Production and Safety) Act 2004* (Qld).

[451] *Petroleum Act 2000* (SA).

[452] International Energy Agency, "Carbon Capture and Storage: Legal and Regulatory Review" (Paris: International Energy Agency, October 2010), online: <http://195.200.115.136/ccs/legal/regulatory_review_edition1.pdf> at 9.

[453] There are a number of CCS demonstration projects underway and several major commercial CCS projects proposed throughout Australia.

> advanced pollution control devices…coal gasification and advanced coal-fired power stations…[454]

Shortly after this statement, the *Clean Coal Administration Act 2008*[455] was established to provide a fund for research into, and development of, clean coal technologies, including demonstration projects.

The New South Wales Government is also a partner in several national CCS related projects including the Munmorah Post-Combustion Capture Project[456] in New South Wales and the Cooperative Research Centre for Greenhouse Gas Technologies (“CO_2CRC”).[457]

In March 2010, the New South Wales Government announced the allocation of $28.3 million to develop the State’s first large scale commercial CCS facility.[458] New South Wales drafted a Position Paper on proposed onshore CCS legislation, which was released for public comment over a four week period which closed on 15 September 2010.[459] Once the Position Paper is finalised, legislation will be drafted and presented to Parliament. The Position Paper proposes a legislative framework for New South Wales for the injection and geological storage of GHGs from power generation.

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[454] Online: NSW Government: <http://www.parliament.nsw.gov.au/prod/PARLMENT/hansArt.nsf/V3Key/LC20070529030>.

[455] The *Clean Coal Administration Act 2008* (N.S.W.), online: NSW Government <http://www.legislation.nsw.gov.au/viewtop/inforce/act+50+2008+FIRST+0+N>.

[456] This research scale pilot project will investigate the post-combustion capture ammonia absorption process, and the ability to adapt it to suit Australian conditions. Capture of up to 3000 tonnes of CO_2 for the pilot phase began in February 2009. Partners involved in this project are Delta Electricity, the Australian Commonwealth Scientific and Research Organization and the Australian Coal Association. A larger scale demonstration project, incorporating geological storage, is under consideration. See Peter Cook, “Demonstration and Deployment of Carbon Dioxide Capture and Storage in Australia” (2009) 1 Energy Procedia 3859 at 3863.

[457] Online: CO_2CRC <http://www.co2crc.com.au/>.

[458] Online: Reportage Environmental <http://www.reportage-enviro.com/2010/11/carbon-capture-storage-friend-or-foe-of-climate-change/>.

[459] New South Wales Government, “Position Paper: Proposals for a Regulatory Framework for Greenhouse Gas Injection and Storage” (NSW Industry and Investment, August 2010), online: < http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/346763/position-paper-regulatory-framework-greenhouse-gas-injection-storage.pdf> at 23 [Position Paper].

The proposed New South Wales legislative framework will be consistent with the Australian Regulatory Guiding Principles for Carbon Dioxide Capture and Geological Storage[460] and the National Offshore Petroleum Amendment (Greenhouse Gas Storage) Act 2008.[461] This will be achieved by applying existing approval processes under the Mining Regulation 2010[462] and the Petroleum (Onshore) Regulation 2007[463] to GHG related exploration and injection processes, and through amendments to existing legislation, such as:

- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007[464] which provides for the management and development of New South Wales mineral, petroleum and extractive material resources and establishes appropriate planning controls to encourage ecologically sustainable development;

- Environmental Planning and Assessment Act 1979[465] which provides for assessment and approvals for projects;

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[460] Ministerial Council on Mineral and Petroleum Resources, *Carbon Dioxide Capture and Geological Storage: Australian Regulatory Guiding Principles* (Australian Government, Department of Resources, Energy and Tourism, 2005), online: <http//ret.gov.au/resources/Documents/ccs/CCS_Aust_Regulatory_Guiding_Principles.pdf> [Australian Guiding Principles]; See also Ministerial Council on Mineral and Petroleum Resources, Amendments to Offshore Petroleum Legislation to Provide for Greenhouse Gas Transport, Injection and Storage in Commonwealth Waters: Regulatory Impact Statement (2008).

[461] *Offshore Petroleum Amendment (Greenhouse Gas Storage) Act* (Cth), online: <http://www.ucl.ac.uk/cclp/pdf/AustraliaOffshorePetroleumAmendmentAct2008.pdf>.

[462] *Mining Regulation 2010* (NSW), online: <http://www.legislation.nsw.gov.au/viewtop/inforce/subordleg+619+2010+cd+0+N/?dq=Regulations%20under%20Mining%20Act%201992%20No%2029>.

[463] *Petroleum (Onshore) Regulation 2007* (NSW), online: < http://www.legislation.nsw.gov.au/fullhtml/inforce/subordleg+422+2007+cd+0+N>.

[464] *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (N.S.W.), online: <http://www.austlii.edu.au/au/legis/nsw/consol_reg/seppppaei2007924/>.

[465] *Environmental Planning and Assessment Act 1979* (NSW), online: <http://www.austlii.edu.au/au/legis/nsw/consol_act/epaaa1979389/>.

- Protection of the Environment Operations Act 1997[466] which provides for protection of the environment through the management and control of pollution and waste;

- Petroleum (Onshore) Act 1991[467] which provides the titles, environment, royalties and administrative framework for the onshore petroleum industry;

- Petroleum (Offshore) Act 1982[468] which provides for the offshore petroleum industry, and aims to mirror the Commonwealth legislation;

- Mining Act 1992[469] which provides for the titles, environment, royalties and administrative framework for the mining industry other than petroleum products;

- National Parks and Wildlife Act 1974[470] which provides for the establishment, preservation and management of national parks, and the protection of certain fauna, native plants and Aboriginal objects;

- Pipelines Act 1967[471] which provides for the construction, operation, maintenance and licensing of pipelines; and

- Occupational Health and Safety Act 2000 [472] which regulates workplace safety.

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[466] *Protection of the Environmental Operations Act 1997* (NSW), online: <http://www.austlii.edu.au/au/legis/nsw/consol_act/poteoa1997455/>

[467] *Petroleum (Onshore) Act 1991* (NSW), online: <http://www.austlii.edu.au/au/legis/nsw/consol_act/pa1991224/>.

[468] *Petroleum (Offshore) Act 1982* (NSW), online: < http://www.legislation.nsw.gov.au/xref/inforce/?xref=Type%3Dact%20AND%20Year%3D1982%20AND%20no%3D23&nohits=y>.

[469] *Mining Act 1992* (NSW), online: <http://www.austlii.edu.au/au/legis/nsw/consol_act/ma199281/>.

[470] *National Parks and Wildlife Act 1974* (NSW), online: < http://www.austlii.edu.au/au/legis/nsw/consol_act/npawa1974247/>.

[471] *Pipelines Act 1967* (NSW), online: <http://www.austlii.edu.au/au/legis/nsw/consol_act/pa1967117/>.

[472] *Occupational Health and Safety Act 2000* (NSW), online < http://www.austlii.edu.au/au/legis/nsw/consol_act/ohasa2000273/>.

According to the Position Paper, CCS activities will be regulated through a system of licences and permits similar in nature to titles for petroleum and mineral extraction activities in New South Wales.[473] Also, the proposed framework for managing liability is generally consistent with other jurisdictions in Australia.[474] However, the proposed framework is silent on the issue of crediting CCS activities within an emissions trading system. Unfortunately, the GHG emissions trading legislation in New South Wales is also silent on accommodating CCS.

7.3.1 Abatement Projects and Accommodation of CCS

CCS is not expressly provided for within the existing rule structure of abatement projects; however, it is possible that CCS may qualify under some of the Abatement Rules.

7.3.1.1 Generation Rule

A person is eligible to be accredited as an ACP under the Generation Rule if its generation activity meets the following criteria:

- Generates electricity at a lower emission intensity than the New South Wales pool coefficient[475] (the Relative Intensity Approach), or
- Improves the efficiency of its electricity generation to provide an associated reduction in its emission intensity (the Efficiency Improvement Approach).[476]

For Generation Abatement activities, "the baseline is calculated using a variety of methods that depend on whether the generator is new or existing, fossil fuel based, and/or

[473] Position Paper, *supra* note 459 at 15.
[474] *Ibid* at 30. Liability will be transferred to the government post-closure.
[475] The NSW pool coefficient is essentially an average GHG emissions intensity factor for NSW base-load generation. The pool coefficient is determined on an annual basis by the Compliance Regulator.
[476] Intro to GGAS, *supra* note 425 at 12.

covered by a prior NSW voluntary benchmark system".[477] In general, the baseline is set either relative to the regional benchmark intensity indicated above or at the facility's prior emission rate.

Projects accredited to date under this rule include:

- Electricity generation using waste gas from landfill sites, waste coal mine gas and coal seam methane,
- Efficiency improvements at coal fired generators that reduce emissions intensity compared to a benchmark or measured prior performance, and
- Gas fired generation with output above baseline output during the period 1997-2002.[478]

Emissions are not defined in the Electricity Act or Regulation. However, the Generation Rule defines, "total GHG emissions" as the total of:

(a) for each Fossil Fuel used, the sum of:

> (i) CO_2 emissions at the point of combustion (in tonnes), calculated using Equation 7;
>
> (ii) CH_4 emissions at the point of combustion (in tonnes of carbon dioxide equivalent), calculated using Equation 8; and
>
> (iii) N_2O emissions at the point of combustion (in tonnes of carbon dioxide equivalent), calculated using Equation 9; and
>
> (iv) if the Fossil Fuel is natural gas, fugitive CO_2 emissions associated with the production of the Fossil Fuel (in tonnes of carbon dioxide equivalent) calculated using Equation 10; and
>
> (v) if the Fossil Fuel is natural gas, fugitive CH_4 emissions associated with the production of the Fossil Fuel (in tonnes of carbon dioxide equivalent), calculated using Equation 11;

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[477] Online: CORE <http://www.co2offsetresearch.org/policy/NSWGGAS.html>.
[478] Intro to GGAS, *supra* note 425 at 12.

> (vi) if the Fossil Fuel is black coal, the total of fugitive CH_4 emissions associated with the production of the Fossil Fuel for mines from which coal is sourced (in tonnes of carbon dioxide equivalent), where the fugitive CH_4 emissions associated with the production of the Fossil Fuel for each mine are calculated using Equation 12, less:
>
> (vii) if the Fossil Fuel is Waste Coal Mine Gas (whether Waste Coal Mine Gas from the same mining operations was flared or vented prior to its use in the Generating System), fugitive CH_4 emissions avoided directly through the use of Waste Coal Mine Gas (in tonnes of carbon dioxide equivalent), using Equation 13.[479]

The extent to which abatement certificates are created under the Relative Intensity or Efficiency Improvement Approach is dictated by the generating system's assigned Category (A, B, C or D) of generation and its accordant designated New South Wales Production Baseline.[480]

In Category A generating systems, the electricity retailer is eligible for abatement for generation below the resultant baseline figure and the generator is eligible for abatement associated with generation above this baseline figure.[481]

Category B generating systems are unable to use the Relative Intensity Approach to create certificates, but may instead undertake efficiency improvements such as turbine upgrades or fuel switching, to improve its emissions intensity. The extent to which the efficiency improvement is demonstrated determines the eventual numbers of abatement certificates created.[482]

Category C generating systems are those that commenced operations prior to the announcement of GGAS, and in the case of fossil fuel fired generating systems, have a baseline equal to its average annual output during the years 1997-2001. Under the

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[479] Generation Rule, *supra* note 445, s 10.
[480] Online: GGAS <http://www.greenhousegas.nsw.gov.au/acp/generation.asp>.
[481] Generation Rule, *supra* note 445, s 7.1.
[482] *Ibid*, s 7.2.

Relative Intensity Approach, this category of generation creates abatement certificates on the basis of each MWh (of lower emissions intensity generation) above its respective New South Wales Production Baseline figure.[483]

Category D generating systems are representative of newer and cleaner technologies and have a designated New South Wales Production Baseline of zero MWh. This effectively means that using the Relative Intensity Approach, a generator for this category of power station may create abatement certificates for each MWh (of lower emissions intensity generation) above its 0 MWh baseline.[484]

In addition to creating abatement certificates for lower emissions intensity generation, or for improved efficiency of generation, the use of landfill gas, sewage gas, manufactured methane gas, and other eligible waste methane as fuel for generation, creates abatement certificates because the avoidance of methane emissions via combustion of these fuels is a benefit (methane having a global warming potential 21 times that of CO_2). The use of waste heat from cogeneration is also recognised within GGAS, with the total GHG emissions of a generating system (which impacts its emissions intensity) being adjusted downwards in recognition of the notional greenhouse gas emissions avoided through the beneficial capture and use of the waste heat.[485]

Thus, the use of waste heat shows that avoided emissions are recognized with respect to the capture and use of waste heat so it would not be that big a leap to apply it to the capture and storage of GHG (although it currently is not provided for in this rule as an avoided emission).

If CCS were to be accommodated by the GGAS as an abatement project, it would likely fall within the Generation Rule under the Relative Intensity Approach and under Category D. CCS might qualify under Category D as CCS is representative of newer

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[483] *Ibid*, s 7.3.
[484] *Ibid*, s 7.4.
[485] Online: GGAS <http://www.greenhousegas.nsw.gov.au/acp/generation.asp>.

technologies. Using the Relative Intensity Approach, a generator for this category of power station may be able to create abatement certificates for each MWh (of lower emissions intensity generation) above its 0 MWh baseline. The capture of GHG would result in lower emissions intensity. However, there would be an energy penalty (leakage) for capturing the CO_2 – this could be reflected in a lower abatement certificate credit.

7.3.1.2 The ESS

The object of the ESS is to provide specific arrangements for the creation and calculation of ESCs where energy is saved through increased efficiency of electricity consumption, or reduction in electricity consumption where there is no negative effect on production or service levels. The ESS aims to save energy through measures that improve electricity end-use efficiency.[486]

Recognised Energy Savings Activities (“RESAs”) are specific activities implemented by an Energy Saver[487] that increase the efficiency of electricity consumption or reduce electricity consumption, without negative effects on production or service levels, by:

- Modifying End-User Equipment or usage of End-User Equipment (including installing additional components);
- Replacing End-User Equipment with other End-User Equipment that consumes less electricity;
- Installing New End-User Equipment that consumes less electricity than other End-User Equipment of the same type, function, output or service; or

486 ESS Rule, *supra* note 446, s 2.
487 Electricity retailers and certain other parties such as electricity generators who supply direct to a customer and market customers who buy or sell electricity in NSW are “Energy Savers”.

- Removing End-User Equipment that results in reduced electricity consumption, where there is no negative effect on production or service levels.[488]

The ESS Rule recognises three different methods for claiming the energy savings from RESAs:

- The Project Impact Assessment Method is a calculation method best suited to discrete RESAs where the overall reduction in electricity use is a small proportion of total site use;

- The Metered Baseline Method provides calculation methodologies for use where the RESA(s) materially reduce the electricity consumption of a whole site, or discrete part of a site, and the energy savings can be determined by reference to a site baseline; or

- The Deemed Energy Savings Method provides calculation methodologies for use where the RESA(s) involve installing or replacing a range of common End User Equipment types.[489]

CCS would not fall within the ESS because the object of the ESS is to save through increased efficiency of electricity consumption, or reduction in electricity consumption where there is no negative effect on production or service levels. The ESS aims to save energy through measures that improve electricity end-use efficiency. This does not apply to CCS projects. CCS does not improve efficiency of electricity consumption, per se.

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[488] Online: ESS <http://www.ess.nsw.gov.au/activities/activities.asp>.
[489] *Ibid.*

7.3.1.3 LUA Rule

This rule provides for the creation of non-tradeable abatement certificates by large electricity customers who have elected to manage the GHG benchmark associated with their electricity consumption.[490] Once eligibility has been approved by the compliance regulator, activities that can be carried out include:

- Increasing the efficiency of on-site fuel use;
- Switching to lower emission intensity fuels;
- Abating on-site GHG emissions from industrial processes; and
- Abating on-site fugitive GHG emissions.[491]

CCS may fall within the LUA Rule as it could qualify as abating on-site GHG emissions from industrial processes.

7.3.1.4 Carbon Sequestration Rule

Carbon Sequestration means "the process of increasing the carbon held within a specific Eligible Forest or Sequestration Pool".[492] A Sequestration Pool is "an aggregation of Eligible Forests that are managed to provide Carbon Sequestration and over which an Accredited Abatement Certificate Provider exercises control sufficient to enforce Carbon Sequestration Rights".[493] To be eligible under the Carbon Sequestration Rule, sequestration projects must:

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[490] LUA Rule, *supra* note 447, s 5 :Persons who qualify as large users are: (a) large customers, who use more than 100 GWh per year; (b) persons carrying out State significant development as determined by the Minister for Planning in accordance with Environmental Planning and Assessment Act 1979; or (c) market customers whose electricity usage levels pass the threshold applied to large customers (ie 100 GWh per year at one or more sites that they own or occupy in NSW with at least one using more than 50 GWh per year).

[491] *Ibid*, s 7.1.

[492] Carbon Sequestration Rule, *supra* note 448, s 11.

[493] *Ibid*.

- Qualify as either an afforestation or reforestation project as defined by the UNFCCC;[494]
- Take place in New South Wales;
- The Sequestration Pool Manager must own or control the Carbon Sequestration Rights for the land;
- Demonstrate that the carbon sequestration achieved will be maintained for at least 100 years;
- Provide documentation that appropriate procedures are in place to manage risks of carbon loss, such as fire, disease or climate variability; and
- Maintain adequate records of carbon storage. [495]

A Sequestration Pool Manager is required to conduct an uncertainty analysis and demonstrate that a 70% probability exists that the actual net increase in the carbon stocks is greater than the number of offset credits created.[496] A Sequestration Pool Manager is also required to conduct periodic monitoring of the forest to verify carbon storage. If carbon stocks fall below the number of offset credits granted, then forest managers are required to inform IPART and to discontinue registration of additional offset credits. IPART can also decide that the ACP needs to purchase offset credits from the open market to account for the shortfall in carbon stocks.[497]

As it presently stands, CCS does not fit within the Carbon Sequestration Rule as only afforestation and reforestation qualify.

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494 The activity must take place on land that was predominantly non-forest prior to January 1, 1990.
495 A Sequestration Pool Manager must (1) own or control the Carbon Sequestration Rights registered on the eligible land on which the forestry activity takes place; (2) has management arrangements and policies in place that demonstrate the capacity to satisfy clause 73ID of the Regulation in regard to continued storage of the carbon sequestered for 100 years; and (3) has adequate procedures in place with respect to hazards and risks to the eligible forests. Intro to GGAS, *supra* note 425 at 14.
496 *Ibid.*
497 Online: CORE <http://www.co2offsetresearch.org/policy/NSWGGAS.html>.

7.3.1.5 Conclusion

CCS does not expressly fit within the GGAS scheme. While it may qualify under the Generation and LUA Rules, it is uncertain whether the scheme would viably accommodate it. Rather than try to fit CCS into one of the GGAS Abatement Rules, it would likely be easier to credit as an avoided emission.

7.4 Conclusion

The New South Wales GGAS does not address CCS. The Alberta SGERs, at the very least, define an "offset", "direct emission" and a "release". The New South Wales GGAS legislation does not address or define geological storage, sinks, avoided emissions or releases of emissions.

However, the Position Paper seems to suggest that volumes that are captured and injected are to be treated as avoided emissions rather than as abatement credits or offsets.

> Further, *greenhouse gas injection and storage would avoid the need for emitters to purchase emission permits under an emissions trading scheme* (such as the proposed Carbon Pollution Reduction Scheme). While this cost is removed by the capture and storage of these gases, long term storage liability, like the cost of climate change from greenhouse gas emissions, remains an externality of production. There are strong economic arguments that such externalities should be captured in the actual costs of production to ensure that carbon based energy producers are not subsidized relative to lower or zero emission energy sources.[498]

Given this policy position, combined with the fact that CCS is not expressly provided for as an abatement project, it is likely that GHG emissions avoided due to CCS would be treated as avoided emissions.

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[498] Position Paper, *supra* note 459 at 32 [emphasis added].

Further, according to Australia's Carbon Reduction Scheme Green Paper, [499]Australia had determined that CCS would reduce an emitter's GHG liabilities and count as "not emitted" in their cap and trade schemes.[500] Regardless of the fact that the Carbon Reduction Scheme has been stalled, it is still relevant that the Australian Government had determined that emissions avoided due to CCS would be recognized as avoided emissions.

In order to determine how successfully New South Wales accommodates CCS, it is necessary to apply the criteria of effectiveness and efficiency to the GGAS.

First, New South Wales employs an intensity-based cap and therefore scores low on the effectiveness criteria. While the GGAS has been copied in other jurisdictions, such as the ACT, assessments of its effectiveness have been mixed.[501] A particular concern has been the extent to which the scheme produces emissions reductions additional to those that would have occurred in any case.[502] Part of this problem is attributed to the intensity-based cap which raises the potential that "physical emissions may continue to increase even while the declining NSW per capita target is met."[503] Howarth concludes that while the GGAS has had "some success at encouraging the development of the carbon offsetting sector, its use of emissions intensity rules means that carbon emissions have actually increased in its covered sectors casting yet another veil over the issue of rising emissions."[504]

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[499] Department of Climate Change, Australian Government "Carbon Pollution Reduction Scheme Green Paper" (July 2008), online: Department of Climate Change <http://www.climatechange.gov.au/en/publications/cprs/green-paper/cprs-greenpaper.aspx>.
[500] See Lokey, "CCS as an Offsetting Activity", *supra* note 128 at 39.
[501] See Tom Kearney, "Market-based Policies for Demand Side Energy Efficiency: A Comparison of the New South Wales Greenhouse Gas Abatement Scheme and the United Kingdom's Energy Efficient Commitment" (2006) 23 Environmental and Planning Law Journal 113 at 118-122; see Passey, MacGill & Outhred, "Discussion Paper", *supra* note 424.
[502] Passey, MacGill & Outhred, *ibid* at 19-28.
[503] Rosemary Lyster & Adrian Bradbrook, *Energy Law and the Environment* (Cambridge: Cambridge University Press, 2006) at 143.
[504] Howarth & Foxall, *supra* note 413 at 173.

Passey, MacGill and Outhred argue that:

> …it is very likely that emissions have not been reduced nearly as much as is claimed, decreasing the scheme's effectiveness.
>
> Low effectiveness results in low efficiency because if emissions are not reduced as much as is claimed then the cost per unit of real reduction increases. There is a significant impact on both dynamic efficiency (the development of new products, processes or capabilities) and static efficiency (the refinement of existing ones), when a large part of the scheme's cash flow is collected from electricity consumers and delivered to participants who are not actually undertaking genuine, non-BAU, abatement activities. Although the scheme's costs have been distributed amongst electricity consumers, the allocation of cash flow for creation of NGACs has been highly concentrated, and so equity is also low, especially where the abatement would have occurred anyway or has not occurred at all.[505]

Kearny comments that GGAS "is at best a scheme that reduces the greenhouse gas emissions associated with the production of electricity"[506] rather than a mechanism that reduces overall emissions.

Passey, MacGill and Outhred conclude:

> There is no doubt that some projects that created NGACs represent additional abatement, and the scheme may drive some additional investment in activities that have lower emissions than would otherwise have been the case.
>
> However, fundamental design features (which cannot be changed without creating an entirely new scheme) mean that a significant proportion of the NGACs are unlikely to correspond to the claimed emissions reductions. These design features are that:
>
> > (1) The number of NGACs created by most projects is calculated with respect to an imputed and rather abstract NSW pool coefficient. One consequence is that new low-emission projects

[505] Passey, MacGill & Outhred, "A Case Study", *supra* note 423 at 3014.
[506] Kearney, *supra* note 500 at 122.

> built in response to demand growth, and whose emissions are not incorporated into the pool coefficient, will increase emissions while at the same time creating NGACs.
>
> (2) Each NGAC corresponds to an absence of emissions, which cannot be measured but must be estimated with respect to a projection of what would have happened in the scheme's absence. This is inherently counterfactual and means that the scheme's outcomes (NGAC creation) are separated from the physical aim to reduce emissions.
>
> Some design features could be altered to increase the scheme's effectiveness, efficiency and equity. However, to date, the NSW Government has not implemented such changes.[507]

The GGAS in its current form does not provide for the opportunity to correct design faults, as no formal revision requirement was incorporated into the design process as exists in schemes such as the EU ETS.[508] In the EU ETS, there are three distinct phases which allow for revisions of allocations, sectors, and other relevant changes, such as the express accommodation of CCS.

In addition to limitations with the intensity-based approach and the express exclusion of CCS from the GGAS legislation, the GGAS is a trading scheme based purely on offsets. There does not appear to be any flexibility for emitters to meet their emissions target; the options are limited to emitting less or purchasing offsets. Furthermore, only certain projects qualify as offsets within the GGAS. While CCS does not expressly qualify as an offset within this system, it also appears that the current scheme is not set up to treat CCS credits as avoided emissions.

Therefore, given the intensity-based approach, the express exclusion of CCS from the legislation and the limited design of the GGAS, I conclude that the GGAS is unsuccessful at accommodating CCS.

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[507] Passey, MacGill & Outhred, "A Case Study", *supra* note 423 at 3016.

Chapter Eight: Conclusion

Within the EU ETS, injected CO_2 is treated as an avoided emission. Regulated entities will not have to surrender allowances for captured emissions that are transferred out; however, entities downstream in the CCS chain, like the transporters and storers, will have to account for any subsequent emissions, thereby ensuring the environmental integrity of the trading system. I conclude that the EU ETS, due to its efficiency and effectiveness as an emissions trading regime and due to the clear and express treatment of CCS within its emissions trading legislation, is the most successful regime at accommodating CCS.

Within the Alberta framework, it is uncertain whether injected CO_2 is treated as an offset or an avoided emission. The regulations and associated offset protocols offer a lot of guidance on the question of how to generate and quantify offset credits. However, there is no guidance available with respect to EPCs. In particular, the regulations do not prescribe how to account for incremental CO_2 emissions that occur within the CCS chain downstream of the facility boundary of the capture entity. There are two ways of dealing with this gap in the regulatory framework. One approach requires the transportation and storage entities to monitor and measure their emissions and to attribute these emissions in some way to the covered entity. The other approach, which is modeled on the EU ETS, is to extend the regulations to treat the transportation and storage entities as covered entities but with a zero emission entitlement. The Alberta emissions framework could become more successful at accommodating CCS if it implemented one of these two approaches. As it currently stands, Alberta is moderately successful at accommodating CCS.

Within the New South Wales GGAS, the legislation is silent on the accommodation of CCS. Since CCS is not expressly provided for as an abatement project, it is likely that

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[508] *Ibid* at 3015.

CCS does not qualify as an offset. On the other hand, treating injected CO_2 as an avoided emission does not seem to be an applicable option, regardless of the Australian Government's policy statement on treating it as an avoided emission. Thus, I conclude that the GGAS is unsuccessful at accommodating CCS.

After reviewing the treatment of CCS within the GHG emissions frameworks in the EU, Alberta and New South Wales, I conclude that treating injected CO_2 as an avoided emission is a superior method of accounting for CCS projects. This approach clearly accounts for emissions from the capture, transport and storage elements of the CCS chain, as long as each party downstream of the capture entity is a covered entity.[509] However, having a robust offset regime in place also accommodates the development of CCS. Treating CCS as an offset allows entities that are traditionally left out of the market to have an incentive to engage in CCS. In addition, offset projects can play a role in providing cost containment for regulated entities. Regardless of whether a regime chooses to treat injected CO_2 as an avoided emission or as an offset credit, the key is that the CO_2 must be properly accounted for throughout the CCS chain.

[509] Zakkour, *supra* note 55 at 6.

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