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Alberta's 2008 Approach to Climate Change: A Step Forward?

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Executive Summary

Climate change is upon us and it poses considerable challenges. In January 2008, Alberta released its new action plan (*Alberta's 2008 Climate Change Strategy*) to address the problem of climate change. This paper analyzes whether the Alberta approach is adequate to the challenge.

The paper is in five parts. Part 1.0 introduces the paper and Part 2.0 provides an overview of the problem of climate change from an Alberta perspective. The overview focuses on the scientific realities and the economic challenges inherent in addressing climate change including a review of the expected impacts of climate change, both globally and closer to home, for different stabilization paths and a discussion of climate change economics. This Part concludes with a summary of Alberta's current emissions profile and projected future greenhouse gas emissions.

Part 3.0 provides a review of the Alberta approach to the problem of climate change. The review starts with summary of Alberta's prior approach in addressing climate change. This is followed by an analysis of the *2008 Climate Change Strategy* including an evaluation of whether the action wedges highlighted by the province are capable of achieving the expected results. Finally, this Part considers how the *2008 Climate Change Strategy* interacts with Alberta's existing climate legislation. Key deficiencies in the Alberta approach are identified including ambivalent targets, undeveloped actions and a lack of integration with existing climate legislation.

Part 4.0 looks at whether Alberta's approach is likely to be successful in addressing the underlying problem of climate change. This includes an imaginary projection into the future to ask first, what contribution Alberta would make to resolving the global problem if the *2008 Climate Change Strategy* were successful and second, what is the likelihood of success. The final section of this Part examines the potential consequences of Alberta's approach concluding that even if the *2008 Climate Change Strategy* achieves its goals, it may not be aggressive enough to avoid sanctions from the province's trading partners. Part 5.0 provides conclusions.

Table of Abbreviations

BAU	business-as-usual
CCEMA	*Climate Change and Emissions Management Act*
CCS	carbon capture and storage
CCS Task Force	Canada-Alberta ecoENERGY Carbon Capture and Storage Task Force
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
EU ETS	European Union Emission Trading Scheme
GDP	gross domestic product
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
Mt	megatonne
N_2O	nitrous oxide
SGER	*Specified Gas Emitters Regulation*
SGRR	*Specified Gas Reporting Regulation*
UNFCCC	United Nations Framework Convention on Climate Change

1.0. Introduction

Global climate change[1] has taken centre stage in the international environmental arena as reports from the Intergovernmental Panel on Climate Change (IPCC), other scientists and economists outline the impacts. The already observable global impacts include decreases in mountain glaciers and snow cover, changes in arctic temperatures and ice, widespread changes in precipitation patterns, ocean salinity, wind patterns and extreme weather events such as droughts, heavy precipitation (resulting in flooding), heat waves and intensity of tropical cyclones. These changes, in addition to others, are expected to become more prevalent as the world warms in response to increasing atmospheric concentrations of anthropogenic greenhouse gases (GHGs).[2]

The primary source of anthropogenic GHGs is the combustion of fossil fuels. In that sense, climate change is an energy issue as the links between the availability of secure energy, economic growth and the resulting environmental affect on the atmosphere become clearer. The challenge of addressing climate change in a province whose economic growth is strongly linked to the production of fossil fuels is a complex one and in an effort to do so Alberta recently released a new climate policy, *Alberta's 2008 Climate Change Strategy*.[3]

Foundational policy documents such as the 2008 Strategy need to include enough key policy components to clearly communicate the policy and to provide direction for the necessary decision making required to support and implement the policy.[4] This paper

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[1]The term 'climate change' is used rather than 'global warming' as the impacts are much greater than simply an increase in global temperatures. Climate and weather are different, but related. Climate is generally defined as average weather. Weather is chaotic in nature which makes it unpredictable beyond a few days. Projecting climate change (*i.e.*, long-term average weather) due to changes in atmospheric composition or other factors is a very different and much more manageable issue: IPCC AR4 WGI Report, *infra* note 5, Frequently Asked Question 1.2, at 104-105.

[2]GHGs are the gaseous constituents of the atmosphere, both natural and anthropogenic (caused by human activity), that contribute to the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary GHG in the Earth's atmosphere. Other GHGs including sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are also an issue in climate change. There are a number of entirely human-made GHGs in the atmosphere, such as the halocarbons (a group of gases containing fluorine, chlorine and bromine) that are dealt with under the Montreal Protocol on Substances that Deplete the Ozone Layer, as either adjusted and/or amended in London 1990, Copenhagen 1992, Vienna 1995, Montreal 1997, Beijing 1999, United Nations Environment Programme.

[3]Government of Alberta, *Alberta's 2008 Climate Change Strategy: Responsibility/Leadership/Action* (January 2008) (hereinafter "2008 Strategy"), online: <http://environment.alberta.ca/2430.html>.

[4]Effective policy consists of several key components and while not every policy document will contain all of these components it is necessary that they occur within a larger framework, Michael M. Wenig & Jenette Poschwatta, *Developing a "Comprehensive Energy Strategy" with a Capital "C"*, Occasional Paper No. 22 (Calgary: Canadian Institute of Resources Law, 2008) at 6-11. The components include: (a)

attempts to answer the question of whether the 2008 Strategy will act as an effective guide for addressing climate change in Alberta by integrating the issues of science, economics and climate policy.

The paper proceeds as follows: Part 2.0 summarizes the underlying problem of climate change. This Part looks at three issues. First, it presents a brief overview of the current scientific understanding of climate change including a review of the expected impacts both globally and closer to home for different stabilization paths. This is followed by a discussion of climate change economics and a review of Alberta's current emissions profile and projected future GHG emissions.

Part 3.0 provides a review of the Alberta approach to climate change. The review starts with an examination of 2008 Strategy in comparison to the province's previous climate plan. This is followed by an evaluation of the particular actions outlined in the Strategy in order to determine whether they are capable of achieving the expected results. Finally this Part considers how Alberta's climate legislation interacts with the 2008 Strategy.

Part 4.0 looks at whether Alberta's approach is likely to be successful in addressing the underlying problem of climate change. This includes an imaginary projection into the future to ask first, what contribution Alberta would make to resolving the global problem if the 2008 Strategy were successful and second, what is the likelihood of success. The final section of this Part examines the potential consequences of Alberta's approach. Part 5.0 provides conclusions.

Before proceeding, a note about the timing of this paper is required. Climate change is an evolving area of research. Both scientific information and governmental position and policy are rapidly developing. The information provided in this paper is current through April 2008.

2.0. Climate Change — The Underlying Problem

Alberta's approach in addressing the problem of climate change, as presented in the 2008 Strategy, should include a logical link to the underlying problem. To that end, this Part analyzes the problem of climate change from two perspectives: science and economics. The focus is on Alberta to the extent information is available. This analysis provides an opportunity to step back and ask what we know today about climate change, its impacts on Alberta and the costs of climate change. This is followed by a review of Alberta's

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identification of the problem or reason for policy development; (b) providing a hierarchical basis for decision-making and implementation; (c) providing clarity and precision; (d) acknowledging risks and uncertainties; (e) exposing and assessing underlying assumptions; (f) identifying incidental effects and providing a strategy for dealing with them; (g) using equivalent methods for considering cumulative costs and benefits; (h) outlining linkages to other policies; and (i) outlining linkages to decision-makers.

current and projected emissions. An effective climate policy must squarely face the province's emissions profile.

2.1. The Science of Climate Change

In early 2007, Working Group I of the IPCC released its Fourth Assessment Report entitled Climate Change 2007: The Physical Science Basis.[5] The report states that, since the release of the IPCC Third Assessment Report[6] in 2001, improvement in scientific study and observation removed any remaining doubt on the direct observations of recent climate change and concludes that warming of the climate system is "unequivocal".[7]

The earth's average global temperature has increased 0.74°C over the past 100 years.[8] The IPPC reports that it is *likely* (over 66 percent chance of occurring[9]) the temperatures observed in the last half century are the warmest in the last 1,300 years.[10] The last time polar regions were significantly warmer than the present for an extended period of time (about 125,000 years ago, when the earth's temperature was 3 to 5°C warmer than the present due to a difference in the Earth's orbit), the reduction in polar ice resulted in sea levels 4 to 6 m higher than today.[11]

Climate change is driven by changes in the concentrations of atmospheric GHGs and aerosols, land cover and solar radiation. These drivers affect the absorption, scattering and emission of radiation in the earth's atmosphere and at the surface, and each of the drivers contributes warming or cooling influences.[12] A pressing issue is whether the

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[5]S. Solomon *et al.*, eds., Climate Change 2007: The Physical Science Basis — Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (New York: Cambridge University Press, 2007) 996 pp. (hereinafter "IPCC AR4 WGI Report"). All IPCC reports are available online: <http://www.ipcc.ch/>.

[6]J.T. Houghton et al., eds. Climate *Change 2001: The Scientific Basis — Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001) 881pp. (hereinafter "IPCC TAR").

[7]IPCC AR4 WGI Report, *supra* note 5 at 5. This based on increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

[8]*Ibid*. at 5. The global temperature increase has a variability of ±0.18°C. The rate of warming over the last 50 years is almost double that over the last 100 years.

[9]*Ibid.* at 3. The IPCC uses the following terms to indicate the assessed likelihood, using expert judgement, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%, *ibid*. at 3.

[10]*Ibid*. at 9.

[11]*Ibid*. at 9. The likelihood for the level of the sea at that time is "likely".

[12]R.K. Pachauri & A. Reisinger, eds., *Climate Change 2007: Synthesis Report — Contribution of Working Groups I, II and III to the Fourth Assessment, Report of the Intergovernmental Panel on Climate*

observable change in climate is due to natural or anthropogenic drivers. If human activity is causing the change, then there is an opportunity and responsibility for humans to make an effort to address both the change and the resulting impacts.

In 2001, the IPCC in TAR concluded that the observed warming over the last 50 years is *likely* due to an increase in GHG concentrations and that anthropogenic gases were part of the cause.[13] In 2007, just 6 years later, but following considerable additional studies, the IPCC stated:[14]

> Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations. … Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns. [Emphasis in original]

In short, many of the world scientists are now more than 90 percent certain that the increase in global temperatures is due to human influence and activity.[15]

The primary human activity impacting global temperatures is the release of anthropogenic GHGs into the atmosphere. Anthropogenic caused GHG emissions are mainly due to the combustion of fossil fuels, with CO_2 emissions from fossil fuels accounting for over 80 percent of the total emissions in developed countries.[16] Fossil fuels make an even greater contribution to Alberta's GHG emissions. Alberta's economy is dominated by the production and use of fossil fuels; as a result, 86 percent of the

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Change (Geneva, Switzerland: IPCC, 2008) at 37-38 (hereinafter "IPCC AR4 Synthesis Report"). The positive or negative impact of the drivers on the earth's energy balance is expressed as 'radiative forcing' which is used to compare warming and cooling influences on the climate system.

[13]IPCC TAR, *supra* note 6 at 10.

[14]IPCC AR4 WGI Report, *supra* note 5 at 10. Since 1750, the affect of GHG is positive (warming), the affect of aerosols (sulphates, organic carbon, black carbon, nitrate and dust) is negative (cooling), the affect of cloud cover is negative and the affect of solar activity is only slightly positive, far less that what is required to explain the increase in the observed temperatures, IPCC AR4 Synthesis Report, *supra* note 12 at 37-38. A more recent report shows that the affect of anthropogenic black carbon (soot) emissions may actually be a positive contributor to current global warming, V. Ramanathan & G. Carmichael, "Global and regional climate changes due to black carbon" (April 2008) 1 Nature Geoscience at 221-227, online: <http://www.nature.com/ngeo/index.html>.

[15]The IPCC is not the only scientific body stressing human activity in climate change. See, for example, the joint statement issued by 11 scientific bodies throughout the world including the National Academy of Sciences and the Royal Society of Canada, *Joint science academies' statement: Global response to climate change*, online: <http://nationalacademies.org/onpi/06072005.pdf>.

[16]B. Metz *et al.*, eds., *Climate Change 2007: Mitigation — Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2007) at 12.2.1.3 (hereinafter "IPCC AR4 WGIII Report").

province's total GHG emissions come from the energy sector.[17] As the largest contributor, carbon dioxide (CO_2) is the most important anthropogenic GHG.[18]

It is not simply increased temperatures that are the problem. It is also the speed at which the temperature is changing. While current warming is unusual for the past several thousand years, it is not unheard of on much longer time scales. What is exceptional is the rate of warming, which appears to be unprecedented in the last 50 million years.[19] The result is that humans, animals and plants have very little time to adjust to the changing conditions. For example, at a temperature increase of around 2°C above pre-industrial levels, up to 30 percent of all species will have an increasing risk of extinction (including the possible extinction of arctic species such as the polar bear due to loss of sea ice), all coral reefs will be bleached and there is a projected loss of 28 percent of all freshwater fish habitat in the Rockies.[20]

There is an additional issue to take into account when considering climate change: the chemical action of CO_2 in the atmosphere and the challenge it brings to addressing emissions.[21] The concentration of some GHGs decrease fairly quickly in response to emission reductions but atmospheric CO_2 will continue to increase for centuries even

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[17]Environment Canada, *National Inventory Report, 1990-2005 — Greenhouse Gas Sources and Sinks in Canada* (April 2007) at 546 (hereinafter "National Inventory Report"), online: <http://www.ec.gc.ca/pdb/ghg/inventory_e.cfm>. The Energy Sector is defined at p. 44 as emissions of all GHG from the production of fuels and their combustion for the primary purpose of delivering energy. Emissions in this sector are classified as either fuel combustion or fugitive releases. Alberta provided 64% of Canada's primary energy production in 2005.

[18]IPCC AR4 WGI Report, *supra* note 5 at 2.

[19]*Ibid*., Frequently Asked Question 6.2, at 465. The largest temperature change of the past million years occurred during the glacial cycles where the mean global temperature changed by 4-7°C. The evidence suggests that the temperature change was a gradual process taking around 5,000 years. If temperatures increase by 5°C this century (which is toward the upper end of projections), the Earth will have experienced about as much global warming as it did in the last ice age but the change will have occurred over a period of 100 years not 5,000.

[20]M.L. Parry *et al.*, *Climate Change 2007: Impacts, Adaptation and Vulnerability — Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK: Cambridge University Press, Cambridge, 2007), Table 4.1 at 242 and Box 4.3 at 231 (hereinafter "IPCC AR4 WGII Report"). Levels of global mean temperature change are variously presented in the literature with respect to: pre-industrial temperatures; pre-industrial temperatures in a specified year, *e.g.*, 1750 or 1850; or the average temperature within the 1990-2000 period. The best estimate for the increase above pre-industrial levels in the 1990-2000 period is 0.6°C, so that a 2°C increase above pre-industrial levels corresponds to a 1.4°C increase above 1990-2000 levels: Box 19.2, at 783. Unless otherwise specified, this paper refers to global mean temperature change above 1990-2000 levels.

[21]IPCC AR4 WGI Report, *supra* note 5, Frequently Asked Question 10.3, at 824-825. A lifetime of a gas in the atmosphere is defined as the time it takes for a perturbation to be reduced to 37% of its initial amount. The lifetime of methane is about 12 years; nitrous oxide has a lifetime of about 110 years and the halocarbon, HCFC-22 has a lifetime of about 12 years. A lifetime for CO_2 cannot be defined. This is due to how CO_2 is exchanged between the atmosphere, the ocean and the land.

with reduced emissions. Practically this means that even if CO_2 emissions are held constant at current levels, atmosphere CO_2 will reach even higher levels than today within a couple of centuries. Only complete elimination of emissions will result in atmospheric CO_2 stabilizing at current levels. Small to moderate reductions in CO_2 emissions will only result in a reduction in the rate of growth of atmospheric concentrations. An immediate global stop to CO_2 emissions is not possible and consequently the planet will continue to warm. The long life span of atmospheric CO_2 both increases the pressure for immediate emissions reductions and guarantees further warming.

Both the rate of warming and the chemical action of CO_2 in the atmosphere are significant issues in determining an effective response to climate change. Small to moderate reductions in emissions will not result in stabilization of atmospheric CO_2 but will only result in reducing the rate of its growth.[22] For example, a 10 percent reduction in global CO_2 emissions would likely reduce atmospheric growth rates by 10 percent, just as a 30 percent reduction in emissions would similarly reduce the growth rate of atmospheric CO_2 concentrations by 30 percent. A 50 percent reduction in CO_2 emissions would stabilize atmospheric CO_2 for less than a decade; after which atmospheric CO_2 would be expected to rise again. Today's emissions will have an affect for hundreds and thousands of years. Real change in atmospheric levels of CO_2 requires a significant reduction in emissions.

The consequence is that warming is inevitable to some extent. Even if emissions of all GHGs and aerosols were frozen in time at 2000 levels, the earth would continue to warm about 0.1°C per decade for the next several decades.[23] According to the IPCC, the continuing increase in atmospheric GHG concentrations is projected to result in additional warming of the global climate by 1.1 to 6.4°C (compared to global temperatures between 1980 and 1999) by the end of this century depending on the emission scenario.[24]

If warming is inevitable, so are impacts. In Alberta the idea that the climate could be a few degrees warmer than today may bring pleasant thoughts of warmer summers and gentler winters. Sadly, increased global temperatures are neither uniform nor benign — even in Alberta.

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[22]*Ibid.*

[23]*Ibid.*, Summary for Policy Makers, at 12.

[24]*Ibid.*, Summary for Policy Makers, Table SPM.3. Emissions scenarios are the plausible descriptions of how emissions in the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Some scenario families used by the IPCC include a world with very rapid economic growth, a very heterogeneous world focused on self-reliance and preservation of local identities, a world where with rapid change in economic structure and an emphasis on global solutions to economic, social and environmental sustainability, and a world where the emphasis is on local solutions to economic, social and environmental sustainability, *ibid*., Summary for Policy Makers, at 18.

Since Canada is a high latitude location with a large land mass, it is projected to experience greater rates of warming than many other regions, as much as double the global average.[25] The impacts of climate change will vary across the country with the Arctic and the southern and central prairies projected to warm the most.

For the prairies, including Alberta, climate change is expected to bring lower summer stream flows, falling lake levels, retreating glaciers and increasing soil- and surface-water deficits.[26] Water scarcity will affect all sectors and communities and it may constrain economic and population growth in Alberta. The change in water availability is expected to result in prolonged droughts that will affect ecosystems, agriculture and municipalities as well as affecting development in the energy sector.[27] Other impacts projected for Alberta include shifts in ecosystems, including increased stress on forests from insects and fire, stressed aquatic habitats and the introduction of non-native plants and animals. Different communities will be affected differently, with Aboriginal and rural communities affected the most. Alberta is expected to become increasingly urbanized as people move to cities and away from areas most affected by climate change.

Much of the temperature increase will occur in the winter and spring. A gradual increase in winter temperature could bring some benefits to Alberta, such as longer growing seasons, reduced energy demand for heating and fewer deaths from extreme cold.[28] But there are advantages to cold winters: recreation, transportation, and storage of water as ice and snow. As temperatures warm, some winter operations in the energy sector (for example, access to exploration and drilling sites) may be reduced or lost. In addition, climate change is not a simple gradual increase in temperature. The changes to the climate mean an increase in the frequency and/or intensity of extreme climate events.

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[25] A key source is D.S. Lemmen *et al.*, eds., *From Impacts to Adaptation: Canada in a Changing Climate 2007* (Ottawa: Government of Canada, 2008) (hereinafter “Adaptation 2007 Report”), online: <http://adaptation.nrcan.gc.ca/assess/2007/index_e.php>. In the past 50 years, the average temperature in Canada increased 1.3°C.

[26] *Ibid*. at 277. The western US will also be impacted by water scarcity. For example, a recent report stated that there is a 50% chance Lake Mead, a key source of water and electricity for millions of people in the south-western US (Las Vegas, Los Angeles, San Diego, and other communities), will be dry by 2021 if the climate changes as expected and future water usage is not curtailed, Tim P. Barnett & David W. Pierce , “When will Lake Mead go dry?” (29 March 2008) 44 Water Resources Research.

[27] *Ibid.* at 278 and 311. Also see D.W. Schindler, W.F. Donahue & John P. Thompson, “Future Water Flows and Human Withdrawals in the Athabasca River” in *Running out of Steam? Oil Sands Development and Water Use in the Athabasca River-Watershed: Science and Market based Solutions* (Edmonton: University of Alberta and The Munk Centre for International Studies, Environmental Research and Studies Centre, 2007).

[28] Adaptation 2007 Report, *supra* note 25 at 312.

There is a moderate to high level of adaptive capacity in the prairies but it is unevenly distributed.[29] The water scarcity issues alone are likely to exceed the adaptive capacity of many communities and industries in the prairies.[30] It is not possible to say that climate change will not affect Alberta. It is currently affecting the province and a response is needed.

Climate change can be addressed by mitigation (the slowing, stopping and reversing GHG emissions) and adaptation (responding to the current and future impacts of climate change). Responses range from no mitigation (relying entirely on adaptation) to full-out mitigation efforts, regardless of cost or impact. It is no longer possible to rely only on mitigation since the climate is already changing. Adaptation alone, however, particularly over the long run, is not expected to cope with all the projected effects of climate change and even the most stringent mitigation efforts will not avoid all further impacts over the next few decades.[31] The reality is that a response to climate change must take into account both adaptation and mitigation. The IPCC's latest report summarizes the interrelationship between adaptation and mitigation as follows:[32]

> There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change.
>
> Adaptation is necessary in the short and longer term to address impacts resulting from the warming that would occur even for the lowest stabilisation scenarios assessed. There are barriers, limits and costs, but these are not fully understood. Unmitigated climate change would, in the long term, be likely to exceed the capacity of natural, managed and human systems to adapt. The time at which such limits could be reached will vary between sectors and regions. Early mitigation actions would avoid further locking in carbon intensive infrastructure and reduce climate change and associated adaptation needs.

A response to climate change is one of choices. Planned adaptation is necessary to deal with unavoidable change and to the extent the impacts are unacceptable, rapid, strong mitigation leading to stabilization of atmospheric GHGs is required.

The objective of stabilizing GHGs was accepted by the world, including Canada, in the United Nations Framework Convention on Climate Change (UNFCCC).[33] The parties

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[29]*Ibid*. at 320. For a discussion of adaptive capacity as part of adaptation to the impacts of climate change, see p. 29. For a review related to energy systems, see Wenig & Poschwatta, *supra* note 4, Appendix A.

[30]*Ibid*. at 319.

[31]IPCC AR4 WGII Report, *supra* note 20, Summary for Policy Makers, at 19-20.

[32]IPCC AR4 Synthesis Report, *supra* note 12, Executive Summary, at 19.

[33]United Nations, *United Nations Framework Convention on Climate Change* (New York: 1992), online: <http://unfccc.int/resource/docs/convkp/conveng.pdf>. The UNFCCC was adopted in May 1992 and was open for signatures at the Rio Earth summit the same year. It entered into force in March 1994 and has

to the UNFCCC committed to adopt national policies and take corresponding measures on the mitigation of climate change with the aim of reducing GHG emissions to 1990 levels.[34] These commitments were intended to support the ultimate objective of the UNFCCC as outlined in Article 2 as follows:

> The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent *dangerous anthropogenic interference* with the climate system. Such a level should be achieved *within a time-frame sufficient* to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner [emphasis added].

While the UNFCCC did not set mandatory limits on emissions,[35] it provides a rational way of considering how to address emissions stabilization. While the concept of "dangerous anthropogenic interference" is easily understood on a basic or threshold level, developing a precise definition is more difficult. The interpretation of the UNFCCC objective is part scientific and part ethical, cultural, political and economic.[36] Developing a definition for "dangerous anthropogenic interference" requires both the selection of an indicator (the impact) and a determination of how much change is too much. The latter depends on the level of scientific certainty of the impact, the potential magnitude of the impact, the timing of the impact (an impact that will happen sooner rather than later is considered more dangerous), the persistence and reversibility of the impact (irreversible impacts being considered the most dangerous), the ability to adapt to the impact, the distribution of the impact (sea level increases are considered more dangerous in coastal areas) and the importance of the vulnerable area (for example, the reduction of mountain

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received almost universal ratification by UN member states (including the United States, China and India). Canada ratified the convention on 4 December 1992.

[34]*Ibid*., Arts. 4.2(a)-(b).

[35]The UNFCCC did not set mandatory limits on GHG emissions and it contains no enforcement provisions. Article 17 includes provisions for protocols to be developed under the UNFCCC. The *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (the "Kyoto Protocol"), with its binding emissions limits, was adopted to deal with the continuing rise of greenhouse gases worldwide. Canada ratified the Kyoto Protocol on 17 December 2002 where it assumed the obligation to achieve a 6% reduction in greenhouse gas emissions below 1990 levels during the first commitment period of 2008-2012. The Kyoto Protocol can be found online: <http://unfccc.int/kyoto_protocol/items/2830.php>. For a review of Kyoto Protocol in the Alberta context, see Nigel D. Bankes & Alastair R. Lucas, "*Kyoto*, Constitutional Law and Alberta's Proposals" (2004) 42:2 Alta. L. Rev.

[36]IPCC AR4 WGII Report, *supra* note 20 at 19.2. The scientific considerations include scientific knowledge combined with factual and normative elements. Factual elements include things such as the scale, magnitude, timing and persistence of the harmful impact while normative elements included things such as the perception of risk (which depends on the cultural and social context including the uniqueness and importance of the threatened system), equity considerations regarding the distribution of impacts, the degree of risk aversion and assumptions regarding the feasibility and effectiveness of potential adaptations.

snowpack that provides a city's water system will be considered more important than a similar loss of snowpack that provides water for a small population).[37] These considerations, which vary from one region or culture to another, make it difficult to determine exactly how much climate change is tolerable at a global scale as well as at local scales. These considerations in defining "dangerous" apply to Alberta as well. While sea level increases may not be considered dangerous in Alberta, the response may be different for deglaciation and significantly reduced snowpack.

Global indicators, or impacts, such as global temperature, sea level rise, loss of biodiversity, ocean acidification or risk of extreme weather events, are often used to measure "dangerous interference" in scientific studies. Early work suggested that an increase of 2°C above pre-industrial temperatures was the upper limit beyond which there would be risks of severe damage to ecosystems and the risk of non-linear responses (positive feedback cycles leading to increasing temperatures).[38] More importantly, this early work showed that the risks associated with the impacts of climate change are best measured both by the actual global temperature increases *and* by the rate of change. More recent work lowered the estimate by suggesting dangerous climate change (based on sea levels and extermination of species) will occur at global temperatures of 1°C above 2000 levels (the equivalent of 1.6°C above pre-industrial levels).[39]

In order to help make sense of the barrage of information, the IPCC developed summaries of the possible impacts at different temperature increases along with stabilization models which can be used to provide a rough guide for policymaking. This information is summarized in Table 1 as an aid in answering the question of what is dangerous anthropogenic interference with the climate system.

Many impacts can be reduced, delayed or avoided by mitigation. Mitigation efforts and investments over the next two to three decades will have a large affect on opportunities to achieve lower stabilization levels. Delayed emission reductions

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[37] *Ibid*. Examples of climate impacts that are irreversible, (over many generations) include changes in regional or global biogeochemical cycles and land cover (such as the Amazon rain forest becoming a savannah), the loss of major ice sheets, the shutdown of the meridional overturning circulation, the extinction of species, and the loss of unique cultures (submergence of small island nations and the necessity for the Inuit to cope with recession of the sea ice that is central to their socio-cultural environment. For a description of possible future abrupt climate change and irreversible changes, see IPCC AR4 WGI Report, *supra* note 5, Box 10.1, at 775.

[38] IPCC AR4 WGIII Report, *supra* note 16 at 1.2.2. A 2°C increase above pre-industrial levels corresponds to a 1.4°C increase above 1990-2000 levels, see *supra* note 20. These scientific findings are behind the European Union goal of limiting global mean temperature increase to a maximum of 2°C above pre-industrial levels in order to meet the ultimate objective of the UNFCCC, European Commission, Council of the European Union, *Presidency Conclusions — Brussels, 22-23 March 2005* at IV, online: <http://www.eu2005.lu/en/actualites/conseil/2005/03/23conseileuropen/ceconcl.pdf>.

[39] IPCC AR4 WGIII Report, *ibid.* at 1.2.2 and J. Hansen *et al*., "Dangerous human-made interference with climate: a GISS modelE study" (2007) 7:9 Atmospheric Chemistry and Physics at 2287.

Table 1: Stabilization Models with Associated Vulnerabilities and Impacts[40]

Stabilization Temperature[a]	Emissions peaking[b]	Emissions change – 2050[c]	Resulting equilibrium[d]	Predicted Key Vulnerabilities and Impacts from Climate Change
1.4 to 1.8°C	2000-2015	50 to 85% less	445-490	Observed impacts from climate change to date include increases in human mortality, loss of glaciers and increases in the frequency and/or intensity of extreme events. Stabilization at this level will result in loss of some Arctic ice and permafrost. Extinctions likely at 10-40% of species. Changes global food production (improved in north). Global sea level increase by 0.4-1.4m.[e]
1.8 to 2.2°C	2000-2020	30 to 60% less	490-535	Global food production peaks. Local deglaciation continues. Serious freshwater scarcity. Sea level increase by 0.5-1.7m.[e] Stabilization at this level avoids widespread disturbance to habitats and constrains species loss.
2.2 to 2.6°C	2010-2030	30% less to 5% higher	535-590	Global food production begins to decline. Deglaciation increases. 20-50% of all species at risk of extinction. Severe freshwater scarcity affecting millions.
2.6 to 3.4°C	2020-2060	10 to 60% higher	590-710	Serious impacts including the addition of widespread loss of biodiversity, possible irreversible commitment to deglaciation of Greenland and West Antarctic ice sheets. Sea level increases of 0.6-2.4m.
3.4 to 4.3°C	2050-2080	25 to 140% higher	710-855	Commitment to wide-spread deglaciation resulting in 2-7m sea level rise over centuries. Increased salinization, decreasing freshwater.
4.3 to 5.5°C	2060-2090	25 to 140% higher	855-1130	Near total deglaciation, loss of Arctic ice cover and permafrost. Large scale transformation of ecosystems with at least 35% of species committed to extinction. Increased frequency of fire in forests. Severe floods, droughts, erosion and water quality deterioration. Decline in food production. Change will exceed the adaptive capacity of many systems.

Notes
[a] Best estimates of temperature increases as compared to 1990-2000 levels (note 20).
[b] Emissions peak is the year that emissions reach their highest point at which point they remain stable or reduce.
[c] Compared to 2000 levels.
[d] ppmv CO_2e[41]
[e] Sea level increases due to *thermal expansion only* which will not reach equilibrium for centuries. It does not include sea level increases due to melting ice sheets, glaciers and ice caps.

[40] Adapted from IPCC AR4 WGIII Report, *supra* note 16, Tables 3.10 and 3.11, at 229-230. These table gives temperature as a range as “above pre-industrial”. These have been changed to “above 1900-2000 levels”: see *supra* note 20. Some vulnerabilities and impacts obtained from IPCC AR4 WGII Report, *supra* note 20 at 781. Thermal sea level increases obtained from IPCC AR4 Synthesis Report, *supra* note 12, Table 5.1.

[41] CO_2e, or carbon dioxide equivalent, is used to express either the concentration of CO_2 that would cause the same amount of radiative forcing as a given mixture of CO_2 and other GHG or the warming potential of a GHG over 100 years (the global warming potential). For example, methane has a global warming potential of 21. Every tonne of methane is the equivalent of 21 tonnes of CO_2.

significantly constrain the opportunities to achieve lower stabilization levels and increase the risk of more severe climate change impacts.

There is an acute need for policy makers and society at large to accept and address climate change — both mitigation and adaptation. The policy response to climate change must address the question of "dangerous" climate change and must take into account the particular challenges and timing required to reduce atmospheric CO_2 levels. The discussion above addressed a key part of this task, which is the question of when climate change becomes "dangerous" both globally and for Alberta. The following Part addresses the next questions climate change policy makers must face, which are: (a) How much will it cost to reduce GHG emissions?, and (b) What levels of cost are acceptable?

2.2. Climate Change Economics

The risks associated with climate change are economic as well as scientific and environmental. Alberta has not provided an economic analysis of either the cost of climate change on the province or a cost analysis of the 2008 Strategy.[42] As a result, national and international economic analysis will be used. This Part is not meant to provide a comprehensive review of climate change economics, but rather to highlight a few key economic findings surrounding mitigation and adaptation costs for various GHG emissions-reduction scenarios. The last part of this section includes a review of recent estimates of the cost of carbon, a critical component for any climate change policy.

Article 2 of the UNFCCC states stabilization of GHG concentrations should be at a level that allows economic development to proceed in a sustainable manner.[43] The tension between GHG stabilization and economic growth is a focus of debate for many countries. The impacts of unmitigated climate change may exceed the ability to adapt, so some level of mitigation is necessary. At the same time, costly mitigation measures could have an adverse affect on economic development, so full mitigation (within physical and technical constraints) may not be desirable. Debate surrounds the appropriate scale of intervention and the balance between climate policy (mitigation and adaptation) and economic development. Action to mitigate climate change is expensive, but inaction may result in even higher adaptation costs. The question is whether it is more cost effective to take no mitigation action (relying entirely on adaptation), to take immediate, strong mitigation action or to implement a slow ramp-up of climate-policy action.

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[42]The province has provided an estimate of the cost to comply with one part of the climate legislation. The annual cost to comply with the Alberta's *Specified Gas Emitters Regulation*, (see Part 3.3) is estimated at $177 million — or less than 1/10 of 1% of Alberta's nominal gross domestic product ($242 billion in 2006): Alberta Government, *Climate Change Alberta's Strategy for Reduced Emissions: Facts at Your Fingertips* (12 September 2007), online: <http://www3.gov.ab.ca/env/Climate/docs/Strategy_for_Reduced_Emissions.pdf>.

[43]UNFCCC, *supra* note 33.

In 2005, the British government commissioned economist Sir Nicholas Stern to provide a comprehensive study of the economics of climate change.[44] The Stern Review attempted to identify the economic risk of addressing climate change compared to the risk of not responding. The review states that GHG concentrations need to be stabilized between 450 and 550 ppm CO_2e in order to avoid the most harmful economic consequences of climate change.[45] Stern estimates that the annual cost of stabilizing between 500 to 550 ppm CO_2e is 1 percent of global gross domestic product (GDP).[46]

In comparison, the Stern Review estimates that the cost for unmitigated climate change will be between 5 and 20 percent global GDP per year, "now and forever".[47] The Stern Review finds that stabilizing below 550 ppm CO_2e will result in the least harmful economic consequences but this will require immediate action. Consistently, the Stern Review stresses the high cost of delay and that weak action over the next 20-30 years will make it very costly, or perhaps impossible, to achieve stabilization even at 550 ppm CO_2e.[48]

Not all economists agree with Stern's findings. The main basis for the disagreement is not whether global temperatures are rising or that human activity is the cause. Rather the disagreement is over whether Stern overstated the case that any delay in reducing emissions would be dangerous and much more costly than a more immediate mitigation effort. This debate centers on the appropriate method of 'discounting', which is a tool used by economists to assess costs and benefits that arise in the future in terms of present dollars.[49] One critic, Nordhaus, argues that other economic analyses, using a different method of discounting, support a slower 'ramp up' of climate mitigation.[50] Other

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[44]Sir Nicholas Stern, *The Stern Review: The Economics of Climate Change*, (London, UK: HM Treasury, 2006) (hereinafter "Stern Review"), online: <http://www.hm-treasury.gov.uk./independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm>.

[45]Stern states that for stabilization to occur below 550 CO_2e, emissions must peak within the next 20 years and that global emissions must be between 25 and 75% lower than current levels by 2050: *Ibid*. at 300.

[46]*Ibid*., Summary of Conclusions, at vii.

[47]*Ibid*., Summary of Conclusions, at vi and vii.

[48]*Ibid*. at 284.

[49]William D. Nordhaus, *The "Stern Review" on the Economics of Climate Change*, Working Paper 12741 (Cambridge, MA: National Bureau of Economic Research, 2006) at 2 and 6 (hereinafter "Nordhaus 2006"), online: <http://www.nber.org/papers/>. The IPCC recognized that the results in the Stern Review are based on the ethical framework of intergenerational equity: IPCC AR4 WGIII Report *supra* note 16 at 1.2.2 based on Sir Partha Dasgupta**,** *Comments on the Stern Review's Economics of Climate Change* (2006), online: <http://www.econ.cam.ac.uk/faculty/dasgupta/STERN.pdf>.

[50]Nordhaus 2006, *supra* note 49 at 2 and William Nordhaus, *The Challenge of Global Warming: Economic Models and Environmental Policy*, (New Haven, CT: Yale University, 2007) at 16 (hereinafter "Nordhaus 2007"), online: <http://www.econ.yale.edu/~nordhaus/homepage/dice_mss_091107_public.pdf>.

economists have waded into the debate. Weitzman, while sceptical about Stern's method of analysis, states that the Stern Review may be more right than wrong.[51]

In order to simplify matters, the remainder of the discussion will compare the findings of Nordhaus and Stern. While the two economists disagree in method, the economic debate is not over whether climate change should be addressed but rather over the speed and extent of emissions reductions.

Nordhaus developed a mitigation strategy to achieve the optimal economic response to climate change based on a slower ramp-up of climate mitigation.[52] Nordhaus' optimal model does not promote stabilization of GHG emissions but rather a future where emission increases slow compared to current rates.[53] Nordhaus projects this will cost $2 trillion for mitigation costs with a savings of $5 trillion from reduced climatic damages — the equivalent to a global benefit of $3 trillion relative to a business-as-usual (BAU) scenario.[54] Under Nordhaus' model there are substantial residual damages (further adaptation costs) from climate change estimated at $17 trillion, but he does not recommend additional mitigation, on the premise it would cost more than the additional adaptation costs. Like Stern, Nordhaus projects the cost of unmitigated climate change as the most expensive option. The projection for BAU emissions is 3 percent of global output in 2100 and close to 18 percent of global output in 2200.[55]

Underlying some of the difference in cost estimates (for unmitigated climate change) is the risk of extreme climate events. Nordhaus based his optimal model on a "best guess" policy which assumes no genuinely catastrophic outcomes will occur.[56] The Stern

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[51]Martin L Weitzman, "A Review of the Stern Review on the Economics of Climate Change" (2007) 3:2 J.E.L. at 45.

[52]Nordhaus 2007, *supra* note 50 at 16 and 49. "Optimal" is defined as a policy in which all countries join together to reduce GHG emissions in an efficient manner across industries, countries and time. Nordhaus use CO_2 rather than CO_2e. Under his optimal model, the emissions-reduction rate of CO_2 relative to baseline (or business as usual) is 15% in the first policy period (2010-2019), 25% by 2050 and 45% by 2100. This is a different system than used under Kyoto in which emissions are calculated relative to a historical baseline. For example, a global emissions reduction of 50% relative to 1990 is the equivalent of an 80% cut relative to Nordhaus' baseline.

[53]The optimal model projects atmospheric concentration of CO_2 (not CO_2e) climb from 586 ppm in 2100 to 659 ppm in 2200 which would result in global temperature increases of 2.6°C in 2100 and 3.4°C for 2200 over 1900 temperature levels (1900 temperatures are similar to pre-industrial), Nordhaus 2007, *ibid.* at 166 and 167. This may be optimistic. According to the IPCC, temperatures at those CO_2 levels will range between 4.0 to 4.9°C over pre-industrial (3.7 to 4.9°C 1990-2000 levels). As the optimal model is not one of stabilization, CO_2 concentrations will increase above 660 ppm which will result in global temperatures increases between 4.3 to 5.5°C above 1900-2000 levels which may well exceed the adaptive capabilities of many systems, see Table 1.

[54]Nordhaus 2007, *ibid.* at 17.

[55]*Ibid*. at 16.

[56]*Ibid*. at 25.

Review, on the other hand, indicates higher damages from climate change due to large (and more speculative) damages in the future.[57] The different approach highlights the difficulty in accounting for climate change impacts. Some impacts are more certain but less significant with respect to costs, while others, especially the catastrophic ones, are more uncertain but carry more significant costs — all of which makes estimating the costs of climate change uncertain and challenging.

While Stern and Nordhaus disagree on the appropriate level of response to climate change, they agree that reducing emissions through mitigation is less costly than BAU. The two economists agree on other points as well. Nordhaus states that the Stern Review is "fundamentally correct in sign if not in size", agreeing with Stern that climate change policies must be linked to both environmental and economic objectives, and that carbon prices must be raised to transmit the social costs of emissions to the everyday decisions of people and business.[58]

The cost of addressing climate change has been an issue in Canada as well as globally. A recent report looked at the possible magnitude of climate mitigation on the Canadian economy.[59] Canada's economy is expected to more than double between 2007 and 2050. The cost to reduce national emissions to 65 percent below 2006 levels by 2050 is expected to be the loss of between one to two years of economic growth. The report states, "the likely impact on economic growth is limited and not significant …."[60]

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[57]*Ibid*. at 12. Weitzman, *supra* note 51, holds that the magnitude of risk associated with climate disasters requires a different type of economic analysis.

[58]Nordhaus 2006, *supra* note 49 at 4. Weitzman, *ibid.*, applauds the Stern Review's handling of the issue surrounding the cost of carbon — as an externality that must be taken into account as part of climate change policy. Carbon price is defined and described later in this Part.

[59]National Roundtable on the Environment and the Economy, *Getting to 2050: Canada's Transition to a Low-emission Future* (Ottawa: 2007) at 36-38 (hereinafter "NRTEE Report"), online: <http://www.nrtee-trnee.ca/eng/publications/getting-to-2050/intro-page-getting-to-2050-eng.html>.

[60]*Ibid*. at 37. Economic analysis of proposed US climate change legislation shows similar results. A report by the Energy Information Administration (EIA) considered the economic impact of United States' Bill S. 280: *The Climate Stewardship and Innovation Act of 2007*. Bill S. 280 uses graduated allowance caps, based on actual emission reductions — not intensity targets — that reach an emissions cap of 60% below 1990 levels by 2050. The report concluded that real US GDP will be lower by 0.3% in 2020 and by 0.5% in 2030 under the bill (the EIA did not project costs past 2030): Energy Information Administration, *Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007* (Washington, DC: Office of Integrated Analysis and Forecasting U.S. Department of Energy, July 2007). Another report by the EIA looked at Bill S. 1766. S. 1766 establishes a mandatory GHG allowance program that also has a target of 60% below 1990 levels by 2050. S. 1766 increases the cost of using energy, which reduces real economic output, reduces purchasing power, and lowers aggregate demand for goods and services. The report concluded that real US GDP will be lower by between .02 and .07% in 2030 and by 0.5% in 2030: Energy Information Administration**,** *Energy Market and Economic Impacts of S. 1766, the Low Carbon Economy Act of 2007* (Washington, DC: Office of Integrated Analysis and Forecasting U.S. Department of Energy, January 2008). Both reports are available online: <http://www.eia.doe.gov/oiaf/service_rpts.htm>.

These projections match the latest word on the global economic cost of mitigating climate change from the IPCC. The AR4 Synthesis Report states that stabilizing emissions between 445-535 ppm CO_2e will reduce the average annual GDP growth rate by less than 0.12 percent by 2050.[61] In comparison, the cost to stabilize between 535-590 ppm CO_2e will reduce the global average annual GDP growth rate by less than 0.1 percent by 2050 — if action is taken now.

Regardless of the response chosen there is a cost to climate change. The Stern Review states, "[c]limate change is the greatest market failure the world has ever seen …."[62] Here in Canada, a report by the TD Bank repeats the sentiment stating that "market failure is the root of the problem".[63] Whether the cost is recognized as part of a mitigation policy or whether the cost is absorbed in adaptation, there will be an economic cost and the highest cost option is unmitigated climate change.

The second key concept in the economics of climate change is the cost of carbon. Mitigation that relies on market forces must address the cost of carbon. The cost of carbon can be expressed either as the "social cost of carbon" or as a "carbon price". Because of market failure there is a current cost for emitting GHGs into the atmosphere. This is often called the 'social cost of carbon' and has been defined as "the present value of additional economic damages now and in the future caused by an additional ton of carbon emissions."[64] The social cost of carbon is a useful measure in a situation where there are no limits on emissions.

Where emissions need to be limited it is more useful to think of the cost of carbon as a market signal or 'carbon price'.[65] The carbon price is the market price (as seen in a cap-and-trade system) or penalty (such as a carbon tax) paid on GHG emissions. To be effective, the carbon price must be raised to the point that it affects behaviour. Raising the carbon price will achieve four goals: (1) it will signal to consumers which goods and services are high-carbon and should be used sparingly; (2) it will signal to producers which inputs use more carbon, inducing firms to substitute low-carbon inputs; (3) it will give market incentives for inventors and innovators of low- or no-carbon technologies; and (4) it will simplify the information required by all responsible parties to choose low- or no-carbon options.[66]

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[61]IPCC AR4 Synthesis Report, *supra* note 12 at 69.

[62]Stern Review, *supra* note 44, Summary of Conclusions, at viii. Market failure occurs, *inter alia*, when the market does not provide a link between the person who creates an external cost or "externality" and the person affected by it.

[63]TD Bank Financial Group, *Market-Based Solutions to Protect the Environment*, TD Economics Special Report (7 March 2007), Executive Summary, at i, online: <http://www.td.com/economics/special/bc0307_env.pdf>.

[64]Nordhaus 2007, *supra* note 50 at 14.

[65]*Ibid.* at 15.

[66]*Ibid*. at 20.

There are a variety of estimates for the carbon price required to achieve the desired change in behaviour (and the corresponding reduction in emissions). Some of these estimates are described below. The carbon price can be expressed either as the cost per tonne carbon or per tonne CO_2. The prices here will be expressed as dollars per tonne CO_2 unless otherwise noted.[67]

The IPCC recently stated that an effective carbon price signal has significant mitigation potential in all sectors.[68] Studies show that global carbon prices rising to US $20-80 per tonne CO_2 by 2030 are consistent with stabilization at around 550 ppm by 2100. The price signal may induce technological changes which may lower the carbon price to US $5-65 per tonne CO_2 in 2030.

Nordhaus provides estimates for the price of carbon under the various climate policy strategies. The carbon price (as a carbon tax applied to all aspects of society) under his optimal model is estimated at US $9 in 2010 increasing to $27 in 2055 and reaching US $55 in 2100.[69] The carbon tax that would be required to stabilize emissions at 560 ppm CO_2 is estimated to be US $11 in 2010 increasing to US $33 in 2055 to US $121 in 2100.

The Energy Information Administration projected the carbon price as an allowance price (from trading) necessary to achieve the objectives under the proposed US Bill S. 280; this was approximately US $22 per tonne CO_2 in 2020 and $48 in 2030 for the model which has limited international trading.[70] If sufficient international offsets are made available, the price of carbon was estimated to be lower, at around US $14 per tonne CO_2 in 2020 and US $31 in 2030.

For Canada, the NRTEE Report states that the carbon price would have to reach the range of $190 to $240 per tonne (in 2003 Canadian dollars) in order to attain an emissions reduction of 45 percent from 2005 levels by 2050, provided Canada relies only

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[67]All prices have been converted to Mt CO_2 (which is the same for CO_2e) for consistency. Because of the different molecular weights conversion from Mt carbon to Mt CO_2 requires multiplying the Mt of carbon by 3.67. To convert a tax on carbon to a tax on CO_2 divide by 3.67.

[68]IPCC AR4 Synthesis Report, *supra* note 12 at 18.

[69]Nordhaus 2007, *supra* note 50 at 160 and 163. All prices are given in 2005 dollars. Nordhaus gives his estimates in $/tonne carbon. The price for the optimal model is estimated at US $34 in 2010 increasing to $98 in 2055 and reaching US $202 in 2100 per tonne carbon. The price for stabilization at 560 ppm CO_2 is estimated to be US $40 in 2010 increasing to US $122 in 2055 to US $445 in 2100 per tonne carbon.

[70]*Energy Market and Economic Impacts of S. 280*, *supra* note 60 at viii to x. The price of carbon is given as 2005 dollars. Bill S. 280 includes: (1) a mandatory emissions reporting system for covered entities; (2) a national GHG database and registry of emissions reductions; (3) a program to encourage innovative emissions reduction technologies; (4) a program to facilitate financing for climate technology projects, and (5) provisions to mitigate adverse economic impacts of the bill on consumers and communities and to fund climate change adaptation programs. The specific S. 280 allowance caps are: for 2012 to 2019 — the 2004 emissions level; for 2020 to 2029 — the 1990 emissions level; 2030 to 2049 — 22% below 1990 emissions level; and 2050 and beyond — 60% below 1990 emissions level.

on domestic actions.[71] A slow start to emissions reductions will require a significantly higher emission price in later years to compensate for the low price at the start (which allows emissions to continue to increase) while a "fast" start will require a higher emission price in the medium-term (2020), but this will result in a lower emission price over the long term with greater emission reductions in the earlier period.[72] The conclusion is that a delay in taking action to reduce emissions, and limiting it to only domestic options, will likely require a higher carbon price to achieve the desired emissions outcome.

The final comment on the price of carbon is the performance of the carbon markets which are designed to achieve set limits on emissions through cap-and-trade. The European Union Emission Trading Scheme (EU ETS) is by far the largest carbon market with over 97 percent of the traded volume.[73] The average EU ETS allowance price was US $24.70 per tonne CO_2 for 2005 and $22.10 for 2006.

In conclusion, while there continues to be debate on how much to mitigate, and when to mitigate, even the most conservative recommendations show that the cost of not mitigating is the most expensive option of all. Effective economic mitigation must link tools from both the environmental and economic disciplines, and carbon prices must be raised to a level that ensures that the costs of emissions are factored into the everyday decisions of people and business. A climate policy that relies on market forces but does not address the economic issues of market failure and the cost of carbon is unlikely to achieve real reductions in emissions.

2.3. Alberta's Current and Projected Emissions

The final background component is Alberta's emissions profile. Alberta is the largest producer of GHGs in Canada with total GHG emissions of 233 Mt in 2005.[74] Alberta's GHG emissions are dominated by energy-related activities with the energy sector accounting for 86 percent of the province's emissions.[75] This sector includes emissions from the production of fuels and their combustion for the primary purpose of delivering energy.[76] Table 2 shows Alberta's total GHG emissions for 2005 by sector and emissions

[71]NRTEE Report, *supra* note 59 at 16.

[72]*Ibid.* at 18.

[73]The World Bank, *State and Trends of the Carbon Market 2007* (Washington, DC: May 2007) at 11, online: <http://www.ieta.org/ieta/www/pages/>. The emissions cap is based on the Kyoto Protocol.

[74]National Inventory Report, *supra* note 17 at 546.

[75]*Ibid*. at 546.

[76]*Ibid*. at 41-42. Fuel combustion emissions are divided into stationary combustion sources, transportation and fugitive sources. Fugitive emissions are defined as intentional or unintentional releases of GHG from the production, processing, transmission, storage, and delivery of fossil fuels.

Table 2: 2005 GHG Emissions Summary for Alberta[77]

GHG Source Category	GHG Emissions, Mt				% of Total	% Change from 1990
	CO_2	CH_4[a]	N_2O[b]	Total		
TOTAL	179	42	12	233		37.1
ENERGY	168	30	2	200	85.8	30.6
a. Stationary Combustion Sources	126	2	.9	129	55.4	19.5
Electricity and Heat Generation	53	.034	.3	53.3	22.9	7.7
Fossil Fuel Industries	42.1	2	.3	44	18.9	7.1
Mining & Oil and Gas Extraction	10.9	.0004	.08	11	4.7	5.1
Manufacturing Industries	7.18	.008	.07	7.26	3.1	-1.3
Construction	.16	.00006	.002	.166	0.1	-<.1
Commercial & Institutional	5.42	.002	.04	5.46	2.3	.3
Residential	7.33	.04	.05	7.4	3.2	.5
Agriculture & Forestry	.245	.0001	.002	.247	0.1	-.1
b. Transportation	32.6	.1	1	34	14.6	6.5
Domestic Aviation	1.49	.002	.04	1.5	0.6	.2
Road Transportation	19.6	.029	.45	20.1	17.9	3.5
Railways	2.25	.003	.3	3	1.3	.6
Off-Road Gasoline/Diesel	6.2	.026	.71	1.4	0.6	-1.5
Pipelines	3.05	.064	.03	3.14	1.3	1.1
c. Fugitive Sources[c]	9.3	28	.002	37.1	15.9	4.7
INDUSTRIAL PROCESSES	11	—	1.12	12.2	5.2	2.8
SOLVENT & OTHER PRODUCT USE	—	—	.018	.018	<.1	<.1
AGRICULTURE	—	9.6	8.3	18	7.7	2.9
WASTE	—	2.6	.07	2.7	1.2	.5

Notes
[a] CH_4 or methane has a global warming potential of 21. The numbers shown here have been converted to CO_2e.
[b] N_2O, or nitrous oxide, has a global warming potential of 310. The numbers shown here have been converted to CO_2e.
[c] Fugitive emissions associated from refineries and the bitumen industry are reported only at the national level.
Totals may not add up due to rounding

type and shows the percentage change from 1990. Since 1990, Alberta's emissions have increased a total of 63 Mt, and the majority of the increase — 83 percent — was from the energy sector.[78] Emissions from electricity and heat generation accounted for the

[77]National Inventory Report, *supra* note 17 at 574-575. The information in the table was extracted from the summary of emissions for Alberta.

[78]*Ibid*. at 574.

majority of emissions increases, followed by fossil fuel industries, mining, and fugitive sources from the oil and natural gas industry and transportation.

This profile is not unexpected as Alberta and energy, particularly fossil fuel energy, are often synonymous and this relationship is not expected to change based on projections for Alberta's future energy development. While conventional crude oil production is expected to decline, oil sands production is expected to triple by 2020 — more than offsetting any decline in conventional crude oil.[79] In the same way, conventional natural gas production is also declining but coalbed methane is poised for strong growth. Alberta is changing from a conventional energy producer to a non-conventional fossil fuel producer. Alberta's economy is expected to reflect the change by continuing to grow at 2.7 percent annually between 2005 and 2020.[80]

Under the current development path, Alberta's will continue to be the largest emitter of GHGs in Canada but will claim a higher percentage of the whole. Natural Resources Canada estimates the province's emissions will reach 305 Mt in 2020.[81] Other projections of Alberta's GHG emissions in the future are even higher. The National Energy Board in a more recent report projects Alberta's emissions will reach 327 Mt by 2020 (and 344 Mt by 2030) under BAU conditions.[82] Predictions from the federal government are higher

[79] Natural Resources Canada, *Canada's Energy Outlook: The Reference Case 2006* (Ottawa: 2006) at 98 (hereinafter "Canada's Energy Outlook"), online: <http://www.nrcan.gc.ca/com/resoress/publications/peo/peo-eng.php>. This projection is based on oil sands production increasing to 2,900 MBOPD in 2020 (at 36). The National Energy Board predicts oil sand production will reach 2.79 million barrels per day by 2015: National Energy Board, *Canada's Energy Future: Reference Case and Scenarios to 2030* (Calgary: 2007) at 24 (hereinafter "Canada's Energy Future"), online: <http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/nrgyftr/nrgyftr-eng.html#s6>.

[80] Canada's Energy Outlook, *ibid.* at 96. In contrast, Canada's overall GDP growth is expected to average 2.3% between 2010 and 2020.

[81] Canada's Energy Outlook, *ibid.* at 141. Alberta's portion will increase to 34% of Canada's emissions up from 31% in 2005, at 58. The energy sector's percentage share of emissions is expected to remain the same through the projection period, at 57. The share of the combustion component is expected to increase while the emissions associated with non-combustion use of fuels are expected to decline slightly owing to lower projected fugitive emissions associated with lower production of conventional natural gas and heavy crude oil.

[82] Canada's Energy Future, *supra* note 79 at 35 and Appendix 7, Table A7.1 based on the continuing trends scenario. The NEB predicts that Alberta's proportion of Canada's emissions will climb to 35% by 2015, at 35. The report provides results on three possible future trends. The 'Continuing Trends' scenario is based on a projection of the reference case (business as usual). The 'Triple E' scenario balances economic, environmental and energy objectives with well-functioning energy markets, cooperative international agreements and the most rigorous energy demand management policies. The 'Fortified Island' scenario projects a world where security concerns dominate with geopolitical unrest, a lack of international cooperation and trust, and protectionist government policies.

yet at 331 Mt by 2020.[83] These projections are the equivalent to a 31-42 percent increase in emissions by 2020 and a 48 increase by 2030 compared to 2005 emissions levels. In the fifteen years after 1990 Alberta's emissions increased by 63 Mt, while the next fifteen years are projected to result in increased emissions of between 72 and 98 Mt. Emissions are not only expected to increase, but are expected to increase at an even faster rate.

The National Energy Board projection is interesting in that it takes into account all energy and environmental programs in place at the time of the publication, including Alberta's *Climate Change and Emissions Management Act*.[84] The conclusion is obvious. At the time of the National Energy Board report, Alberta's projected fossil fuel development plans overwhelm the province's ability to control or limit emissions through the climate policy and legislation in place at that time. Since then, the province has released an updated climate policy — the 2008 Strategy. Is Alberta's new climate policy capable of achieving a different result?

3.0. The Alberta Approach

Alberta's first response to climate change was in 2002 with the release of the policy entitled *Albertans & Climate Change: Taking Action*.[85] In the 2002 Plan, the province recognized that global climate change is real and further action was warranted. The target outlined in the 2002 Plan was to cut emissions, relative to GDP, by 50 percent below 1990 levels by 2020. This emissions-intensity target was expected to result in about 60 Mt fewer GHG emissions compared to BAU levels. The 2002 Plan also set an interim target that by 2010, Alberta would achieve an emissions-intensity improvement of more than 20 percent which would be the equivalent of about 20 Mt fewer emissions below BAU levels. Although there was no commitment to absolute reductions under the 2002 Plan, it projected that the Plan would result in emissions stabilization and a reduction in emissions compared to 2000 levels.[86]

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[83]Government of Canada, *Canada's Energy and GHG Emissions Projections, Reference Case: 2006-2020, Provincial and Territorial Tables* (Ottawa: March 2008) (unnumbered) at 41 (hereinafter "Federal Emissions Projections"), online: <http://www.ec.gc.ca/default.asp?lang=En&n=75038EBC-1>.

[84]Canada's Energy Future, *supra* note 79 at 36. The *Climate Change and Emissions Management Act* is discussed in Part 3.3.

[85]Government of Alberta, *Albertans & Climate Change: Taking Action* (October 2002) (hereinafter "2002 Plan"), online: <http://environment.gov.ab.ca/info/posting.asp?assetid=6123&searchtype=asset&txtsearch=Albertans%20&%20Climate%20Change:%20Taking%20Action>.

[86]Without the 2002 Plan, the projected levels of emissions for 2010 and 2020 were 257 and 278 Mt CO_2e respectively while under the 2002 Plan, Alberta's emissions were projected to be 238 Mt for 2010 and dropping to 218 Mt by 2020, *ibid*. at 11. Alberta's GHG emissions were 223 Mt in 2000, at 11. The Plan did project emissions growth compared to 1990 levels (218 Mt is 28% above 1990 levels).

In 2003, Alberta enacted the *Climate Change and Emissions Management Act* (*CCEMA*)[87] to provide the legislative framework for the implementation of the 2002 Plan. In line with the 2002 Plan, the *CCEMA* codified the 2020 emission-intensity target. Originally the *CCEMA*, through the *Specified Gas Reporting Regulation* (*SGRR*), required facilities with an annual release of specified gas at, or in excess of, the level prescribed in the *Specified Gas Reporting Standard* to submit a specified gas report.[88] This changed in July 2007 when Alberta imposed emissions-intensity reductions on large industrial facilities through an amendment of the *CCEMA* and the enactment of the *Specified Gas Emitters Regulation* (*SGER*).[89] This legislation remains in effect and is part of the Alberta approach to climate change. In January 2008, Alberta released its new climate change strategy entitled *Alberta's 2008 Climate Change Strategy*. The Strategy replaces the 2002 Plan.

This Part of the paper looks at the Alberta approach to the problem of climate change in three ways. The first is a review of the 2008 Strategy with special focus on the 'targets' as compared to the 2002 Plan. This is followed by a discussion of the wedges and actions outlined in the Strategy. It concludes with an analysis of the interaction between Alberta's climate change legislation and the Strategy.

As a preliminary point, it is important to note that the focus of the 2008 Strategy is mitigation. Adaptation is only briefly discussed in the Strategy.[90] The actions for adapting to climate change include the development of an adaptation strategy, the co-ordination of policy and research, communication to Albertans on potential impacts and the development of appropriate responses to adapt to climate change. The Strategy does not include dates or other targets and, as a result, it is unable to provide clarity or guidance as to the province's approach for adaptation. Consequently, the remaining discussion of the Strategy will focus on the province's planned mitigation efforts.

3.1. Alberta's 2008 Strategy

In the 2008 Strategy, the province accepts that "climate change is real" and the planet is warming "at a faster pace than at any other time in our recorded history."[91] The Strategy states that, as a leading energy producer, "Alberta has both a responsibility and an

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[87]S.A. 2003, c. C-16.7.

[88]*Specified Gas Reporting Regulation*, Alta. Reg. 251/2004, s. 3. The *Specified Gas Reporting Standard* is incorporated as regulation under s. 2 of the regulation and is available online: <http://environment.alberta.ca/631.html>. For 2007, the threshold level for submission of a specified gas report is the release of 100,000 tonnes of CO_2e.

[89]Alta. Reg. 156/2007. The *SGER* expires on 1 September 2014, unless repassed or amended, s. 30.

[90]2008 Strategy, *supra* note 3 at 21.

[91]*Ibid*. at 9.

opportunity to take decisive action to reduce GHG emissions."[92] According to the Strategy, the demand for fossil fuels will continue (with Alberta's emissions expected to increase by a third within the next five to ten years) and, as most of the province's emissions are tied to energy, the first priorities in addressing climate change should "focus on making more efficient use of energy and greening our energy production, creating fewer GHG emissions."[93]

One of the key criticisms of the 2002 Plan (and by reference the *CCEMA*) is that the targets set by the province were emissions-intensity targets (an efficiency measure) rather than targets requiring absolute reductions in GHG emissions.[94] The conflict between measuring improvement through efficiency measures compared to absolute measures was addressed by the IPCC:[95]

> Whether part of integrated indicator systems or developed separately, climate change indicators on the mitigation side may focus on absolute or efficiency measures. Absolute measures help track aggregate emissions, thus quantify the direct pressure of human activities on the climate system. Efficiency measures indicate the amount of energy or materials used or GHG emitted in order to produce a unit of economic output, or more generally, to achieve a degree of change in human wellbeing. Depending on the policy context, both absolute measures and efficiency measures may be useful. *But from the climate system perspective, it is ultimately indicators of absolute emission levels that matter* [emphasis added].

The 2008 Strategy does not set emissions-intensity targets (relative to GDP) as done in the 2002 Plan. In fact, the Strategy is ambivalent on whether it establishes any binding targets or goals for emissions reduction. The relationship between goals and emissions reductions under the 2008 Strategy is described as follows:[96]

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[92]*Ibid*. The Strategy is built on five principles: (1) all Albertans have a shared responsibility for managing and reducing emissions; (2) Albertans will be leaders in energy efficiency; (3) Albertans will have the necessary information and knowledge to participated in mitigation; (4) Alberta will be a leader in developing and implementing technology to reduce GHG emissions; and (5) Alberta will work collaboratively (within the province, nationally and internationally) to address climate change, *ibid.* at 14.

[93]*Ibid.*

[94]Bankes, *supra* note 35 at 368.

[95]IPCC AR4 WGIII Report, *supra* note 16 at 12.2.3.1.

[96]2008 Strategy, *supra* note 3 at 7. It is difficult to determine whether firm targets where intended. For example, actions taken within the three wedges are expected to achieve "anticipated reductions" (14); the 'wedges' approach is in place of "establishing arbitrary emissions reduction targets" (23) and actions taken on the wedges are "expected to achieve" reductions. On the other hand, the Plan is "committing to results" (7); states there is a commitment to achieve real reductions (23); and the Premier's message declares the "renewed plan has set emission reduction targets that are practical and achievable"(4). In addition, the Strategy's wording suggests binding targets at times, *e.g.*, "By 2020, *we will stabilize* emissions and begin to see substantial reductions in greenhouse gas emissions [emphasis added]" and "Alberta's *target* of a 200 megatonne reduction … [emphasis added]" at 23.

> The Alberta Approach … Establishes practical, achievable goals for real reductions in greenhouse gas emissions. Instead of setting arbitrary targets, Alberta's approach breaks the problem down into manageable "wedges" for action with corresponding reductions in emissions set for each wedge.

Each theme or wedge has a goal with a list of major actions to be taken to help achieve the goal. The "major actions" taken under each theme "determine[s] the "wedge" of *anticipated reductions* in greenhouse gases [emphasis added]."[97] The three themes with their corresponding goals are as follows:[98]

- *Conserving and using energy efficiently* with a goal to "reduce greenhouse gas emissions by transforming how we use energy, applying energy efficient solutions, and conserving energy";

- *Implementing carbon capture and storage* with a goal to "store quantities of CO_2 in Alberta's geological formations rather than releasing it into the atmosphere"; and

- *Greening energy production* with a goal to "transform the way we produce energy and to introduce cleaner, more sustainable approaches to energy production".

None of the "goals" include a commitment for specific emissions reductions or emissions levels. The connection between goals and emissions reductions is linked by the major actions taken under each wedge. These actions are "expected to achieve" the following reductions in greenhouse gas emissions:[99]

> • By 2010 — Meet the intensity target from the 2002 plan — 20 megatonne reduction
>
> • By 2020 — Stabilize greenhouse gas emissions — 50 megatonne reduction
>
> • By 2050 — Emissions reduced 50 percent below business as usual level — 200 megatonnes … bringing Alberta's emissions to 14 per cent below 2005 levels

To avoid confusion, 'targets' and 'anticipated reductions' will be referred to by the term 'expected results' throughout the paper.

Further difficulties in the 2008 Strategy appear when the expected results are reviewed in relation to the 2002 Plan, and to actual and projected emissions at the different milestone years. This comparison is provided in Table 3. The comparison in Table 3 highlights four points that require further discussion. First, the expected result for

[97]*Ibid.* at 14.

[98]*Ibid.* at 15, 17 and 19.

[99]*Ibid.* at 23.

2010 is to simply meet the emissions-intensity target from the 2002 Plan.[100] Since this objective is only two years away, it seems sensible to avoid setting too stringent a challenge. What is less obvious is that the 2002 Plan emissions-intensity-improvement

Table 3: Comparison of 2008 Strategy and 2002 Plan

Milestone Year	2002 Plan[a]	2008 Strategy[b]	Comments
2010			
• target/results	Emission intensity target: more than 20% below 1990 levels	Meet 2002 intensity target from 2002 Plan	2010 intensity target met in 2005. 2005 emissions were 233 Mt.[e] BAU projections for 2010 range between 270 and 282 Mt.[f]
• expected reduction	20 Mt below BAU	20 Mt reduction below BAU	
• expected emissions	238 Mt (258 BAU – 20)[c]	Neither BAU or expected levels of GHG emissions are provided	
2020			
• target/results	Emission intensity target: 50% below 1990 levels	Emissions stabilization	The actual expected reduction in the 2008 plan is 10 Mt less than the 2002 Plan. BAU projections for 2020 range between 305 and 331 Mt.[f]
• expected reduction	60 Mt below BAU	50 Mt reduction below BAU	
• expected emissions	218 Mt (278 BAU – 60)[c]	Neither BAU or expected levels of GHG emissions are provided	
2050			
• target/results	N/A	50% fewer emissions compared to BAU	BAU expected to be 400 Mt.[i]
• expected reduction	N/A	200 Mt reduction below BAU	
• expected emissions	N/A	200 Mt (14% below 2005 levels)	

Notes:
[a] 2002 Plan, *supra*, note 85 at 10-11.
[b] 2008 Strategy *supra*, note 3 at 23-24.
[c] See note 103 for calculation of expected emissions under the 2002 Plan.
[d] 2006 GHG Report, *infra* note 101 at 55.
[e] National Inventory Report, *supra*, note 17 at 546.
[f] Canada's Energy Outlook, *supra*, note 78 at 141, Canada's Energy Future, *supra*, note 78 at Table A7.1 and Federal Emissions Projections, *supra*, note 83 (unnumbered) at 41.
[i] Alberta Government, *Alberta to cut projected emissions by 50 per cent under new climate change plan: Backgrounder*, News release (24 January 2008), online: <http://alberta.ca/home/NewsFrame.cfm?ReleaseID=/acn/200801/22943ACC446ED-ED74-6A1E-6CF263E59920969B.html>.

[100] *Ibid*. at 23.

target for 2010 (emissions intensity improvement of more than 20 percent below 1990 levels) was met in 2005.[101] The 2010 intensity target objective in the 2008 Strategy is not so much a 'target' but a foregone conclusion.

Second, the ambivalence as to whether the expected results are actually targets is of particular importance when considering the expected results for 2020. To the extent the expected result of GHG stabilization is a firm commitment, it represents the first non-efficiency based target for Alberta.[102] If however, stabilization is only an 'expected result' that depends on the actions under each goal, it is a significant step back from the commitment in the 2002 Plan. Although there was no commitment for emissions stabilization under the 2002 Plan, it is clear from the projections that the Plan was expected stop emissions increases sometime around 2010 and that absolute emissions would be below 2000 levels by 2020.[103] The 2008 Strategy moved the anticipated time for stabilization back roughly ten years.

Consequently, even if stabilization is a 'firm' target, the 2008 Strategy effectively lets emissions grow unrestricted for a further ten years. This is significant since projections for 2020 range between 305 and 331 Mt — far above current levels.[104] The 2008 Strategy projects a reduction of 50 Mt of emissions by 2020 — compared to a commitment to reduce emissions by 60 Mt in the 2002 Plan. The conclusion is that the 2008 Strategy is less onerous compared 2002 Plan for the 2020 milestone year.

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[101] *Alberta Environment Report on 2006 Greenhouse Gas Emissions* (2007) at 55 (hereinafter "2006 GHG Report"), online: <http://environment.alberta.ca/631.html>. Alberta met this target in 2005, when Alberta's emissions intensity decreased from 2.07 to 1.64 for a reduction of 20.8% over 1990 levels. Interestingly, Alberta Environment in the 2006 GHG Report, states that Alberta has an interim target of a 30% reduction in GHG emissions intensity by 2010. There is no mention of this more onerous target in the 2008 Strategy nor does the Strategy mention the current emissions intensity results.

[102] The Strategy states: "By 2020, the essential steps will be in place and new technologies will be tested and implemented. The result is that, while we may not see substantial reductions in the early stages of this strategy, we are planting the seeds today to see substantial reductions over the longer term. *By 2020, we will stabilize emissions and begin to see substantial reductions in greenhouse gas emissions* [emphasis added]", 2008 Strategy, *supra* note 3 at 23. All targets in the 2002 Plan were emissions-intensity targets, 2002 Plan, *supra* note 85 at 10.

[103] The 2002 Plan projected that actual emissions would climb to 238 Mt of CO_2e by 2010 and then drop to 218 Mt of CO_2e by 2020 due to the actions in the Plan based on projected BAU levels of 258 and 278 Mt for 2010 and 2020 respectively, 2002 Plan, *supra* note 85 at 10-11. The Plan did project emissions growth compared to 1990 levels (218 Mt is 28% above 1990 levels).

[104] Canada's Energy Outlook, *supra* note 79 at 141, Canada's Energy Future, *supra* note 79, Table A7.1 and Federal Emissions Projections, *supra* note 83 (unnumbered) at 41. The 2008 Strategy expects emissions to increase by another third over the next five to ten years, at 9.

Third, the 2008 Strategy uses reductions in emissions from BAU levels as evidence of "real reductions".[105] But are they? Targets based on a comparison to BAU levels are a type of efficiency target in much the same way as emissions-intensity targets (which compare emissions to GDP) are efficiency targets. In both cases, the efficiency target can be met while actual emissions increase. An efficiency target based on a comparison to BAU is even more ambiguous than emissions intensity as it is not tied to any easily ascertained objective measure.[106]

While showing reductions compared to BAU can play a role in climate policy, that role is most effective at communicating effort — not as a measure of "real reductions". Real reductions from a climate perspective can only be measured in terms of absolute emissions of GHGs into the atmosphere.

Finally, there is the issue of the expected results for 2050. The expected results for that year are described in a variety of inconsistent ways in the 2008 Strategy and involve a combination of measurements. The following are the various descriptions of the expected results for 2050 found in the 2008 Strategy:

• By 2050 — emissions reduced 50 per cent below business as usual level — 200 megatonnes.

> By 2050, substantial reductions in emissions can and will be achieved. Alberta's target of a 200 megatonne reduction is the largest identified and published by any provincial jurisdiction in Canada bringing Alberta's emissions to 14 per cent below 2005 levels.[107]

• The plan focuses on three-prongs — carbon capture and storage, increasing energy efficiency and greening our energy production. Together these initiatives will deliver a 50 per cent reduction in emissions by 2050, compared to business as usual, or a 14 per cent reduction below 2005 levels by 2050.[108]

• By 2050 — Reduce emissions by 200 megatonnes.

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[105]2008 Strategy, *supra* note 3 at 23. The reductions compared to BAU are 20 Mt by 2010, 50 Mt by 2020 and 200 Mt by 2050. The 2008 Strategy neglects to provide any projections for BAU emissions.

[106]Measurement of BAU can be either based on projection or, preferably, by avoided emissions. The first option is fraught with difficulties, *i.e.*, whose projection should be used, at what date in should it become the binding measurement and when should the projection be adjusted. The second option has the advantage of being objective but adds a significant layer of accounting and debate on the measurement of avoided emissions.

[107]2008 Strategy, *supra* note 3 at 23. The baseline in the 2008 Strategy is the 2005 emissions level. In comparison, the parties to the UNFCCC committed to the aim of reducing greenhouse gas emissions to 1990 levels in support of the ultimate objective to avoid dangerous interference with the climate system, see *supra* note 33. The 2002 Plan also used the 1990 base year, 2002 Plan, *supra* note 85 at 10.

[108]2008 Strategy, *supra* note 3, Minister's Message, at 5.

RESULT — Emissions reduced by 50 per cent below business as usual level and 14 per cent below 2005 levels while maintaining economic growth.[109]

• 2050 — 200 Mt reduction or 50 per cent below projected business as usual and 14 per cent below 2005 levels.[110]

What then is the real measurement for emissions reductions achievement in the year 2050? It is only possible to have a 200 Mt reduction *and* a 50 percent reduction in emissions compared to BAU, *and* achieve an emissions level that is 14 percent below 2005 levels if the actual BAU emissions for 2050 are exactly 400 Mt. Otherwise, various levels of actual emissions could result even when an individual measurement scenario is met. Table 4 illustrates the problem by calculating the emissions that would result under several hypothetical BAU levels for each measurement scenario.

Table 4: Comparison of Different Measurements Scenarios on Emissions in 2050

	Measurement Scenario					
	50% Reduction[a]		**200 Mt Reduction[b]**		**14% Below 2005 Levels[c]**	
BAU	Actual emissions	Percent above/below 2005 emissions	Actual emissions	Percent above/below 2005 emissions	Mt reduced from BAU	Percent reduction from BAU
300 Mt	150	36% below 2005	100	57% below 2005	100	67%
350 Mt	175	25% below 2005	150	36% below 2005	150	57%
400 Mt	200	14% below 2005	200	14% below 2005	200	50%
450 Mt	225	3% below 2005	250	7% above 2005	250	44%
500 Mt	250	7% above 2005	300	29% above 2005	300	40%

Notes:
[a] This scenario is based on a 50% reduction from business-as-usual levels
[b] This scenario is based on a consistent emissions reduction of 200 Mt
[c] This scenario is based on achieving an emissions level of 200 Mt, the equivalent of 14% below the 2005 emissions level

Since it is very unlikely that the prediction in the 2008 Strategy that 2050 BAU emissions will be exactly 400 Mt, the question arises as to which of the measurements is

[109] *Ibid*. at 7.

[110] *Ibid*. at 24.

paramount under the Strategy. Of course, the simplest explanation is that none of the measurement scenarios is paramount because none are binding goals or commitments. If this conclusion is correct, then the 2008 Strategy allows the selection of the measurement that will be the easiest to achieve.

In summary, the 2008 Strategy suffers from several key deficiencies. The most significant shortcoming, and one that affects many of the others, is the Strategy's ambivalence over targets. It is unclear which, if any, results outlined are binding targets or goals that can be used to evaluate the Strategy's success or whether they are merely achievements that will *hopefully* occur. The ability of the 2008 Strategy to deliver reductions of GHG emissions will not come from its approach to setting targets, and the question then becomes whether reductions can be achieved through the wedges and actions.

3.2. Wedges and Actions

The use of wedges is based on the concept of "stabilization wedges".[111] Stabilization wedges are used to evaluate the potential of various options as mitigation strategies as compared to BAU levels.[112] For example, the wedge approach can be used to compare re-forestation of an area versus fuel-efficient cars versus coal plants with carbon capture and storage (CCS). The strategies available under the wedge approach are grouped into five categories: energy conservation, renewable energy, enhanced natural sinks, nuclear energy, and fossil carbon management (including CCS). The wedge approach was used by the National Roundtable on the Environment and the Economy to evaluate the technology deployment necessary to achieve deep emission reductions.[113] The 2008 Strategy uses the wedge approach to quantify the mitigation potential of various technological approaches.

Underlying Alberta's strategy on climate change is the link between fossil fuel development and the economy. The approach to climate change outlined in the Strategy

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[111]S. Pacala & R. Socolow, "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies" (13 August 2004) 305:5686 Science at 968-972, and Robert Socolow *et al.*, "Solving the Climate Problem: Technologies Available to Curb CO_2 Emissions" (December 2004) 46:10 Environment at 8-19. Both available online: <http://www.princeton.edu/~cmi/resources/stabwedge.htm>. A wedge is defined as an activity that is capable of reducing emissions by 1 Gt (gigatonne) within 50 years. The approach advocates using the wedges to allow countries to keep emissions flat for the next 50 years at which point they can then work to reduce emissions in the second half of the century. To achieve this flat trajectory, low- or no-carbon energy strategies are required across all sectors of the economy (and across all countries regardless of development stage).

[112]The approach uses a BAU level for evaluation purposes — not as a measure of its overall objective which is emissions stabilization, Socolow *et al.*, *supra* note 111 at 10.

[113]NRTEE Report, *supra* note 59 at 31.

is to anticipate a large increase in GHG emissions (an increase of one-third over the next five to ten years) due to increased development and to address the issue by focusing on energy issues. The focus on energy supports the choice of the three wedges as an approach to addressing GHG emissions. Each of these wedges will be discussed in turn.

3.2.1. Conserving Energy and Using Energy Efficiently[114]

This wedge focuses on gains that can be made through energy efficiency (doing more work with less energy) and energy conservation (using less energy). The target group includes all Albertans in all sectors of society and the economy. The emphasis under this wedge will be placed on the use of energy in homes, businesses, transportation, municipalities, heath regions and educational institutions. Efforts under this wedge are to contribute a 24 Mt reduction in emissions by 2050.

Actions under this wedge include items such as the development of an Energy Efficiency Act, incentive programs for consumers, energy efficient building codes, government leadership and increased public awareness. Three of the actions are linked to Alberta's current climate change legislation.[115]

Energy efficiency and conservation are internationally recognized as the most economical and environmentally sensitive way of addressing sustainable development, strengthening energy security and avoiding dangerous interference with the climate system.[116] The potential role for energy efficiency and conservation in reducing energy use is significant. Worldwide energy consumption since 1973 would be 50 percent higher without the affect of energy efficiency policies.[117] The choice of a wedge focused on energy efficiency and conservation is important, but history has shown that projected

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[114]*Ibid*. at 15-16.

[115]These actions are (1) the development of offset and sequestration opportunities in the agriculture and forestry sectors; (2) the development of protocols for facilities that emit over 50,000 tonnes of GHGs to report emissions; and (3) the fostering of continued development of the carbon offset market in Alberta.

[116]See for example, Expert Group on Energy Efficiency, *Realizing the Potential of Energy Efficiency: Targets, Policies, and Measures for G8 Countries* (Washington, DC: United Nations Foundation, 2007) at 1, online: <http://www.unfoundation.org/energyefficiency/index.asp>; Department of Trade and Industry, *UK Energy White Paper: Our Energy Future — Creating a Low Carbon Economy* (2003) at 11, online: <http://www.berr.gov.uk/files/file10719.pdf>; California Energy Commission, *2007 Integrated Energy Policy Report, Commission Final Report* (2007) at 15, online: <http://www.energy.ca.gov/2007_energypolicy/index.html>; and Council of Energy Ministers, *Moving Forward on Energy Efficiency in Canada: A Foundation for Action* (2007) at 4, online: <http://www.nrcan-rncan.gc.ca/com/resoress/publications/cemcme/index-eng.php>.

[117]International Energy Agency, *Mind the Gap — Quantifying Principal-Agent Problems in Energy Efficiency* (Paris: 2007) at 11.

gains in this area are often overestimated, weakening the effect of such efforts on emissions reductions.[118]

As the province fleshes out the actions under this wedge, a few cautions should be kept in mind to address potential inefficiencies. First, one study showed that a significant proportion of the energy efficiency improvement potential is not realized due to barriers in the energy market.[119] Information and behavioural barriers identified in the Canadian context include price distortion, lack of information on efficiency measures, perception of risk and high transaction costs.[120] Market organization barriers include lack of financing (including competition for capital and equity), inefficient market organization and insufficient/excessive/inefficient regulation. Technological barriers include capital stock, turnover rates, uncompetitive market price and technology-specific barriers. Policy and actions to promote energy efficiency should address these barriers; however, the 2008 Strategy is mostly silent on the market barriers associated with energy efficiency and conservation efforts.[121] It is important that the proposed Energy Efficiency Act and incentive programs address the market barriers that limit the effectiveness of energy efficiency and conservation efforts.

A second caution is that improvements in energy use due to policy are often over-estimated because they do not take autonomous energy efficiency improvement into account.[122] Autonomous energy efficiency improvement is the improvement that occurs without a policy promoting such a course. Without taking autonomous energy efficiency improvement into account, predictions of future energy use are implausibly high. This is an important issue in predicting improvement compared to a BAU baseline. If the BAU

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[118] *Ibid*. at 14.

[119] *Ibid*. at 22-26. The market barriers that inhibit energy efficiency include low priority of energy issues, inadequate access to capital and incomplete markets for energy efficiency. Market failures include split-incentives (when participants have different goals or incentives), insufficient and inaccurate information and isolation from price signals.

[120] *Moving Forward on Energy Efficiency in Canada*, *supra* note 116 at 9-10. For a discussion of the barriers that limit the use of renewable energy in Alberta, see Michael M. Wenig *et al*., *Legal and Policy Frameworks for Renewable Energy in Alberta*, Alberta Energy Future's Project Paper No. 12 (Calgary: Institute of Sustainable Energy, Environment and Economy, University of Calgary, 2007).

[121] 2008 Strategy, *supra* note 3 at 17. One action to establish a team to raise public awareness of energy efficiency and conservation may address some of the information and behavioural barriers. Other barriers are mentioned in the Strategy under the wedge for greening energy production. The barriers listed are the challenges facing small electricity producers to access the grid and the development and marketing of bio-energy products, at 19.

[122] Ian Sue Wing & Richard S. Eckaus, "The implications of the historical decline in US energy intensity for long-run CO_2 emission projections" (2007) 35 Energy Policy 5267-5286 at 5268. The impact of technology and autonomous energy efficiency improvement in climate policy continue to be the subject of debate. For example, see Roger Pielke, Jr., Tom Wigley & Christopher Green, "Dangerous assumptions" (April 2008) Nature 452 at 531-532, online: <http://www.nature.com/nature/journal/v452/n7187/full/452531a.html>.

predictions in the 2008 Strategy do not take into account gains in efficiency that will occur in any event, it overestimates the impact of the policy on energy use — and, inferentially, on avoided emissions. The Strategy is not transparent as to whether it takes autonomous energy efficiency improvement into account.[123]

A third caution applies to the role of technology in energy efficiency improvements. Energy efficiency is impacted by several factors, such as technological change, structural change (change in the types and/or distribution of business and industries), environmental policies that restrict the use of fossil fuels, removal of market barriers and the diffusion of energy-efficient technologies.[124] A recent study showed that structural changes are more important than technological change in improving energy efficiency and in moderating the growth of CO_2 emissions.[125] A final conclusion in this study is that increased technological change could even increase emissions, and the conventional approach to predicting energy efficiency improvement may overstate potential reductions, biasing emissions projections downward.[126] The province should not rely solely on technological improvement to drive energy efficiency but should encourage structural change toward low-carbon business and industry. The opportunity to address energy efficiency through structural change is not addressed in the 2008 Strategy.

The final caution is the so-called “efficiency paradox” or “rebound effect”.[127] The rebound effect argues that improvements in energy efficiency will result in increasing energy demand. The standard theory is that a reduction in energy cost (from increased energy efficiency) will free up income so that more energy will be used. History has proven that the rebound effect leads to increased consumption of energy. For example, energy efficiency improved dramatically after the oil shocks (as measured by oil per unit of GDP) in high-energy consuming countries, but total energy consumption increased even more dramatically.[128] It is unclear whether the expected emission reductions in the 2008 Strategy take the rebound effect into account.[129]

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[123]In contrast, the 2002 Plan set a goal of 50% reduction in emissions intensity by 2020 and showed that 28% of the improvement is expected even under BAU conditions. Consequently, the changes under the Plan were expected to generate an additional 22% in emissions intensity, 2002 Plan, *supra* note 85 at 11.

[124]Wing & Eckaus, *supra* note 122 at 5268-5269.

[125]*Ibid*. at 5281.

[126]*Ibid*. at 5281.

[127]Jeff Rubin & Benjamin Tal, *Does Energy Efficiency Save Energy?* (Toronto: CIBC World Markets, 27 November 2007) at 4, online: <http://research.cibcwm.com/economic_public/download/snov07.pdf>.

[128]*Ibid*. at 1.

[129]The National Round Table on the Environment estimated emissions reductions (of the federal plan) are overestimated by between 5 and 20% as a result of the rebound effect, NRTEE Report, *supra* note 59 at 4.

The rebound effect should not be used as an argument against promoting energy efficiency, but any policy promoting energy efficiency as a method to reduce emissions must deal with the issue. It is important to remember that, in addressing climate change, energy efficiency is not the goal. A reduction in high-carbon energy use that results in reduced emissions is the objective. For efficiency measures to be effective in a climate policy they must curb total high-carbon energy usage — as opposed to improving energy efficiency. To do this, consumers must be kept from reaping the benefits of energy efficiency by increasing energy consumption.[130] The approach under the 2008 Strategy needs to ensure that, whatever benefits accrue to consumers from increased energy efficiency, they are not rewarded through the opportunity to use more carbon-intensive energy.

One of the difficulties in assessing this wedge is that many of the actions are not directed at energy efficiency and conservation. For example, requiring facilities that emit over 50,000 tonnes of GHGs to report emissions and fostering the carbon market in Alberta are not energy efficiency or conservation measures. Perhaps a more helpful way to think about this wedge is as a set of complimentary policies.

The NRTEE Report addressed complementary policies in the context of an emissions reduction system that includes an overall carbon price signal.[131] When a broad price signal forms the core of an emissions reduction policy, complementary policies (in the form of regulatory standards, subsidies and infrastructure investments) are required to address hard-to-get-at emissions. The hard-to-get-at emissions occur where market barriers limit the responsiveness of certain sectors, and in sectors not covered by the broad price signal.

Market barriers exist in sectors that don’t respond well to a carbon price signal such as the transportation and building sectors, and some consumer markets such as vehicles, houses and appliances. The 2008 Strategy addresses some of these (for example, the building sector, and appliances and home improvements) but misses others (for example, the transportation sector). According to the NRTEE, complimentary policies are also required for sectors not covered by the broad price signal (including agriculture, forestry, waste and portions of upstream oil and gas extraction — such as fugitive emissions from oil and gas wells, coal mines and gas leaks). The 2008 Strategy addresses some emissions from the agriculture and forestry sectors but does not address waste or fugitive emissions. In many ways the energy efficiency and conservation wedge in the 2008 Strategy is better characterized as a group of complementary policies than as a wedge of energy efficiency

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[130]Jeff Rubin, *The Efficiency Paradox* (Toronto: CIBC World Markets, 2007) at 1, online: <http://research.cibcwm.com/economic_public/download/snov07.pdf>.

[131]NRTEE Report, *supra* note 59 at 27-28.

measures. The problem is the 2008 Strategy does not employ a broad carbon price signal as the core of its emissions reduction policy.[132]

In conclusion, energy conservation and efficiency can play an important part in Alberta's climate policy. As actions that promote energy efficiency are developed, the province must apply proper safeguards so that the efficiency efforts results in actual GHG emissions reductions. Actions under this wedge that are not directed at energy efficiency or conservation will likely require a different approach and may require additional support (such as an effective carbon price signal) to be effective.

3.2.2. Implementing Carbon Capture and Storage[133]

This wedge focuses on reductions in emissions through the storing of CO_2 in geological formations — a process commonly called carbon capture and storage (CCS). CCS describes the process of capturing, compressing, transporting and storing of large volumes of CO_2 to avoid emissions into the atmosphere.[134] There are a variety of storage options for CCS, but Alberta, as a result of its location on the Western Sedimentary Basin, is uniquely suited for geological storage.[135] There are four main types of geological storage sites: (1) depleted oil and gas reservoirs, (2) deep saline formations, (3) (unminable) coal beds and (4) salt caverns.[136] Each has different characteristics and potential.

There are two primary actions under the CCS wedge: to establish a Carbon Capture and Storage Development Council, which is to build on the work of the Canada-Alberta ecoENERGY Carbon Capture and Storage Task Force (CCS Task Force), and to support

[132]Alberta's climate legislation effectively sets a carbon price in Alberta (see Part 3.3), but the 2008 Strategy does not directly endorse this approach. In addition, the carbon price set by the legislation is limited in nature and does not make up the core of Alberta's omissions reduction policy.

[133]2008 Strategy, *supra* note 3 at 17-18.

[134]B. Metz et al., eds., *IPCC Special Report on Carbon Dioxide Capture and Storage — Prepared by Working Group III of the Intergovernmental Panel on Climate Change* (Cambridge, UK: Cambridge University Press, 2005) (hereinafter "IPCC CCS Report").

[135]Canada-Alberta ecoENERGY Carbon Capture and Storage Task Force, *Canada's Fossil Energy Future: The Way Forward on Carbon Capture and Storage*, Report to the Minister of Alberta Energy and the Minister of Natural Resources Canada (Ottawa: 2008) at 12 (hereinafter "CCS Task Force Report"), online: <http://www.nrcan.gc.ca/com/resoress/publications/fosfos/fosfos-eng.php>. Other storage options include ocean storage (direct release onto the deep seafloor), mineral carbonation and other potential industrial uses.

[136]In addition, there are considerable opportunities for CO_2 injection as part of enhanced oil recovery and perhaps enhanced gas recovery and enhanced coalbed methane recovery.

research and demonstration projects of CCS.[137] There are no specific actions under this wedge in the 2008 Strategy — only a commitment to plan for, and support, CCS. Since the plan is to build on the work of the CCS Task Force, some comments can be made about the role of CCS in Alberta using the findings of the Task Force as a reference.

The CCS wedge of the 2008 Strategy has an objective of achieving an emissions reduction of 139 Mt by 2050 — a reduction potential amply justified by the amount of storage space available. The CCS Task Force states that the available storage in deep saline formations alone is on the order of one million Mt in Canada, and much of this storage potential exists in Alberta.[138] CCS has the potential to significantly reduce GHG emissions in Alberta while allowing the province to continue to use fossil fuels as its primary energy (and economic) resource. Despite this potential, there is currently little CCS activity in Alberta.[139] The causes for this discrepancy are outlined by the CCS Task Force Report.

Technology is not a barrier to implementing CCS. The necessary technology required to implement CCS at the industrial scale is currently available. The two barriers that prevent immediate implementation of CCS are the cost of CCS and the lack of a regulatory framework.[140] These two barriers will be discussed in turn.

In most CCS systems, the main cost component is the capture and compression phase, which the IPCC estimates will range between US $5-115 per tonne of CO_2 net captured, depending on the type of project.[141] The CCS Task Force states that CCS will not

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[137]2008 Strategy, *supra* note 3 at 18. The Development Council is to recommend timelines, policy and regulatory requirements for a series of sub-actions such as requiring new large industrial facilities to be designed and built to enable CCS, requiring existing large industrial facilities to have plans to be capture ready, developing milestones to achieve emissions reductions, developing a policy for financial resources to build CO_2 infrastructure, and proposing tools and incentives to ensure Alberta industry maintains a leadership role in CCS.

[138]CCS Task Force Report, *supra* note 135 at 12.

[139]A University of Calgary led CCS demonstration project in the Wabamun area was recently announced. Another study is being conducted in the Redwater area (jointly by ARC Energy Trust and the Alberta Research Council). In addition, a consortium of companies led by Enbridge is also conducting a major CCS review: University of Calgary, News & Events, "Large-scale CO2 storage study launched" (27 March 2008), online: <http://www.ucalgary.ca/news/march2008/CO2storage>.

[140]CCS Task Force Report, *supra* note 135 at ix.

[141]IPCC CCS Report, *supra* note 134 at 11. See also, David W. Keith, *Towards a Strategy for Implementing CO2 Capture and Storage in Canada*, Environmental Protection Series EPS/2/IC/1 (Ottawa: Oil, Gas, and Energy Branch, Environment Canada, December 2002) at 7, online: <http://www.ucalgary.ca/~keith/papers/46.Keith.2002.StrategyForCCSinCanada.e.pdf> who suggests that the cost of CCS for coal-fired electricity plants will range between US $30-38 per ton of CO_2 depending on the speed of implementation. Another study shows the current price for precombustion CCS at roughly $40 per tonne of CO_2, Benjamin Tal, *How Alberta Can Win the Carbon War*, Occasional Report #64 (Toronto: CIBC World Markets, 2007) at 3, online: <http://research.cibcwm.com/economic_public/download/occrept64.pdf>.

progress without public support since a project will not be viable in the current market, which is being driven by carbon prices in the $15-20 per tonne range.[142] To overcome this barrier, the CCS Task Force recommends that the federal and provincial governments should "allocate $2 billion in new public funding to leverage the billions of dollars of industry investment in the first CCS projects."[143] The 2008 Strategy does not commit to the funding outlined by the CCS Task Force. It only requires the Development Council develop a "policy approach and secure the necessary financial resources required to build the CO_2 infrastructure", and provides a general statement of support for "research and demonstration projects" without a commitment to help fund these projects.[144]

Moreover, the actions under this wedge do not mention the potential integration with the current legislative scheme for reducing emission intensity, in spite of the legislation targeting the large industrial facilities best suited for CCS. In particular, one of the components of Alberta's legislative approach is the Climate Change and Emissions Management Fund (the "Fund").[145] The money in the Fund is not targeted for developing CCS projects or infrastructure under the Strategy but is expected to fund research and technology development under the third wedge: Greening Energy Production. While it is possible that the Development Council may recommend a change to Alberta's legislative approach to generate the needed funds to cover the financial gap, the Strategy's approach may also be a signal that the province prefers to use new funding initiatives to overcome the financial gap associated with CCS. A separate source of funding to support CCS seems unnecessarily complex and confusing in the longer term.

The second primary barrier, the lack of a regulatory framework, has two main aspects. The first relates to the regulatory clarity required to initiate and manage a CCS project. This aspect raises three major themes: pore-space ownership and disposition rights, long-term liability and the regulatory process.[146] The second aspect of an adequate regulatory framework relates to the necessary measurement and crediting protocols which

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[142]CCS Task Force Report, *supra* note 135 at 26. In Alberta, the market for carbon is determined though the province's climate change legislation, which is covered in detail in Part 3.3. David Keith, Director of the Institute for Sustainable Energy, Environment and Economy's Energy and Environmental Systems Group at the University of Calgary stated that a carbon tax of $30 to $50 per tonne on CO_2 would be enough to drive CCS in coal-fired electrical power generation but that this price would not be enough to drive the technology in the oil sands due to the current high price of oil, (3 March 2008) 17:15&16 EnviroLine at 15.

[143]*Ibid*. at 23.

[144]2008 Strategy, *supra* note 3 at 18.

[145]See Part 3.3 for a discussion of the Fund. *CCEMA*, s. 10.3 allows money from the fund to be used for CCS.

[146]CCS Task Force Report, *supra* note 135 at 23. For a full analysis of the legal issues surrounding CCS, see Nigel Bankes, Jenette Poschwatta & E. Mitchell Shier, "The Legal Framework for Carbon Capture and Storage in Alberta" [forthcoming in (2008) 45 Alta. L. Rev. 1-46].

would allow a CCS project to be a qualifying emissions option under GHG legislation.[147] There is no mention of these legal barriers to CCS in any of the actions outlined in the 2008 Strategy. Although they are not identified in the Strategy, the Carbon Capture and Storage Development Council may be charged with resolving the issues.[148] It is imperative that it do so as several of them (particularly the ownership of the pore space, long-term liability and crediting for CCS) could prevent the application of CCS beyond the project phase.

What is critical for CCS is timing. The 2008 Strategy anticipates that a significant part of the province’s 2020 50 Mt emissions reduction will come from CCS, but this will require immediate, committed action. The CCS Task Force states that an annual target of 5 Mt storage for all of Canada by 2015 is “ambitious”.[149] Achieving much more than that by 2020 is even more ambitions. Delay will make the achievement of stabilization by 2020 an impossibility.

Alberta’s energy resource in the intermediate future will likely come predominately from carbon-based fuels and CCS is one of the few technologies available to allow the use of fossil fuels while simultaneously reducing GHG emissions. The technology can play a significant part in a low-carbon future but this will require that the financial and legal barriers are removed through effective concrete actions by the province.

3.2.3. Greening Energy Production[150]

The final wedge focuses on emissions reductions available through low-emissions energy production. The low-emissions energy sources can be fossil-fuel-based (for example, clean coal) or can be found in the expansion of renewable and alternative energy sources such as wind, solar, hydrogen and geothermal.[151] This wedge is very short on specific actions. The province only commits to three actions. First it commits to using the money from the Climate Change and Emissions Management Fund (coupled with government funding) to drive innovation and technology in order to achieve greener energy production. Second the province commits to removing barriers (and to considering incentives) to the use of renewable and alternative energy sources and third, it commits to

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[147] CCS Task Force Report, *supra* note 135 at 23.

[148] The Development Council is charged with recommending appropriate regulatory requirements for the set of sub-actions, at 18. None of the sub-actions specifically address these legal issues.

[149] CCS Task Force Report, *supra* note 135 at 19.

[150] 2008 Strategy, *supra* note 3 at 19-20.

[151] *Ibid*. at 20. Interestingly, the list of renewable and alternative energy sources outlined in the Strategy does not include nuclear energy.

increasing investment in clean energy and value-added technologies.[152]

The conclusion with respect to this wedge is that it is more a hope that greener energy sources will appear in Alberta's future rather than a commitment to ensure that they do. The few actions that are listed are not measurable, and there is no requirement to develop specifics. The Strategy attributes an emissions reduction of 37 Mt under this wedge by 2050, but it is difficult to see how the actions listed, without more specifics, can be expected to achieve such a result.

In conclusion, the wedges chosen in Alberta — as categories — have the potential to reduce Alberta's greenhouse emissions, but they are significantly underdeveloped as strategies. While some do include specific commitment to plan by certain dates, others are simply too general to be of real import in GHG emissions reductions. Without either market encouragement or government regulation, there is little incentive for companies, or consumers, to make significant investments in GHG mitigation. While some actions under the wedges — such as the development of an Energy Efficiency Act, the implementation of energy efficiency standards in building codes and the requirement that new large industrial facilities to be built 'capture-ready' — may provide some incentive for innovation, most of the actions are volunteer based. Significantly, no actions in the Strategy address the issue of market failure or establish a broad carbon price signal. The only action that addresses the carbon market is found in the energy efficiency wedge, where there is a commitment to "[c]ontinue to foster the carbon offset market in Alberta."[153] Without specifically saying so, the 2008 Strategy relies on the existing legislative approach to address the market issue.

Alberta's climate legislation was enacted under the 2002 Plan but the emission-intensity reduction requirement did not go into effect until July of 2007 and any impact it will have on emissions will fall under the 2008 Strategy. The 2008 Strategy, however, does not deal directly with Alberta's climate change legislation as part of the Alberta approach to climate change. The next Part looks at Alberta's current legislative approach to climate change and how it interacts with the 2008 Strategy.

3.3. Alberta's Climate Legislation

In 2003 Alberta enacted the *CCEMA* to provide the legislative framework for implementing the 2002 Plan. In line with the 2002 Plan, the *CCEMA* sets the "specified gas emission target" for Alberta as a reduction (by 31 December 2020) of emissions of specified gases relative to GDP to an amount equal or less than 50 percent of the 1990

[152] The barriers mentioned in the Strategy are the challenges facing small electricity producers to access the grid and the development and marketing of bio-energy products, *ibid*. at 19.

[153] *Ibid*. at 16.

level.[154] The 2008 Strategy does not mention this particular legislated goal, and its role in the current climate approach is unclear. The only clear role for the legislation that is related to achieving any expected results is with respect to the 2010 milestone year. The Strategy states, "By 2010, implementing the 2002 plan will have resulted in emissions reductions. A major factor in achieving these reductions will be the requirement for large industrial emitters to reduce their emissions intensity by 12 per cent starting in July 2007."[155]

Originally the *CCEMA*, through the *SGRR*, required facilities with an annual release of specified gas at or in excess of the level prescribed in the *Specified Gas Reporting Standard* to submit only a specified gas report.[156] This changed in July 2007 when Alberta imposed GHG emissions-intensity targets on large industrial facilities through an amendment to the *CCEMA* and the enactment of the *SGER*.

The *SGER* applies to facilities that have "direct emissions" of specified gases totalling 100,000 tonnes or more in 2003 or any subsequent year.[157] The regulation sets different targets for established facilities (those who started commercial operation before 1 January 2000 or have completed 8 years commercial operation) and new facilities (those who started commercial operation after 1 January 2000 and have completed less than 8 years commercial operation) based on an emissions intensity benchmark, defined as the quantity of specified gases released by a facility per unit of production from that facility.[158] For an existing facility, the net-emissions intensity is not to exceed 88 percent

[154] *CCEMA*, s. 3. "Specified gas" is defined in s. 1(g) as "any gas that traps heat near the earth's surface and includes, without limitation, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride." This is essentially the equivalent to the typical definition of GHG.

[155] 2008 Strategy, *supra* note 3 at 23.

[156] *SGRR*, s. 3. The *Specified Gas Reporting Standard* is incorporated as regulation under s. 2 of the regulation and is available online: <http://environment.alberta.ca/631.html>. For 2007, the threshold level for submission of a specified gas report is the release of 100,000 tonnes of CO_2e. Emissions are based on the sum of direct emissions of CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6: *Specified Gas Reporting Standard*, s. 2(1). As of the 2006 reporting year, 103 facilities in Alberta reported GHG emissions under the *SGRR* for total reported greenhouse emissions of 115 Mt or just under 50% of the province's total emissions. CO_2 made up 96% of the total reported Alberta GHG emissions, or 110 Mt (as CO2e). The ten largest emitting facilities in 2006 were five power plants, two oil sands facilities, two heavy oil facilities and one chemical facility which account for 75.6 Mt or 66% of all 2006 reported emissions, 2006 GHG Report, *supra* note 101 at 9 and 19.

[157] *SGER*, s. 2. Subsection 1(1)(g) defines "direct emissions" to mean the "release of specified gases from sources actually located at a facility, expressed in tonnes on a CO_2e basis" where CO_2e is defined in s. 1(1)(d) as the "100 year time horizon global warming potential of a specified gas expressed in terms of equivalency to CO_2" as set out in the Schedule.

[158] *Ibid*., ss. 1(1)(h)(i) and (p). The designation of a facility is subject to s. 1(2) which gives the director considerable subjective discretion to designate an established facility as a new facility. Note that the intensity measure is per unit production compared to GDP under the 2002 Plan.

of the baseline-emissions intensity for the facility starting in July 2007.[159] For new facilities, the net-emissions intensity ranges from 90-98 percent of baseline depending on the years of operation.[160] Under subsection 4(1), the net-emissions intensity remains at the same target for 2008 forward.[161] No further requirements to decrease emissions intensity are required by facilities under the regulation.

Under the *SGER* a facility must determine its baseline-emissions intensity for past emissions and its net-emissions intensity for current emission. Part 4 of the *SGER* establishes the system for setting baseline-emissions intensity for a facility. For an established facility the baseline-emissions intensity is calculated by average emissions intensity (total annual emissions divided by production for the year) for the years 2003, 2004 and 2005.[162]

When establishing the baseline emission intensity for a facility, the director may use the baseline-emissions intensity as requested in the application or establish a different one.[163] In setting the baseline-emissions intensity the director may consider "factors the director considers relevant, including, but not limited" to technologies in use at comparable facilities and the best available technology. Written notice must be given for the decision. At any time, the director may review the baseline-emissions intensity for a facility and may establish a new baseline-emissions intensity if the old one is inaccurate, the facility has undergone an expansion or significantly changes, or for any other reason making the baseline intensity inappropriate.[164] Finally, the director may exempt a facility from compliance with net-emissions-intensity limits and reporting for a period of time if there has been shutdown or unusual conditions.[165]

Net-emissions-intensity is determined by a formula consisting of the annual emissions for the facility for a time period minus the sum of emissions offsets (s. 7), fund credits (s. 8) and performance credits (s. 9), divided by the production for the same period.[166]

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[159]*Ibid*., s. 3(2).

[160]*Ibid*., s. 3(3).

[161]*Ibid*. Under s. 4(2) the Minister may, by order, substitute or make additional net-emissions intensity limits for a facility. No further direction for this is provided in the regulation and while it could result in a more demanding target, it seems more likely to allow for a facility to obtain a relaxed standard.

[162]*Ibid*., s. 21. The baseline for a new facility is based on the total emissions divided by production for the third year of commercial operation.

[163]*Ibid*., s. 22. The "director" is a person designated by the Minister, s. 2.2.

[164]*Ibid*. at 23.

[165]*Ibid*. at 24.

[166]*Ibid*., ss. 3(4) and 4(3). The initial year is calculated on a half year basis (1 July to 31 December 2007). After the initial year, the net-emissions intensity limit is calculated on annual emissions and annual production. "Production" is defined in s. 1(1)(r) as a unit of production either as the end product (if the facility produces an end product) or any input, output or other thing as a standard as measurement. The unit

Consequently, a facility can meet its emissions-intensity target through actual reductions or through one of the options in the formula. Each of these options is briefly described below.

An emission offset is an action taken after 1 January 2002 in Alberta, where the emissions reduction also occurred after 1 January 2002.[167] The action taken cannot be one that was otherwise required by law (not a project to meet the requirements under the *SGER*); it must be real, demonstrable, measurable and quantifiable; it must be owned by the person using it; and it can only be used once.

The ability to use emissions offsets under the *CCEMA* allows a "compliance-based carbon market" to develop in Alberta (the "Alberta Offset System").[168] Under the Alberta Offset System, regulated firms can "buy verified emission reductions and/or removals of greenhouse gases (*i.e.*, offsets) from voluntary actions arising from unregulated activities (*i.e.*, offset projects) in Alberta."[169] The market-based approach is designed to offer a flexible and cost-effective method to achieve climate change objectives under the *SGER*. The 2008 Strategy supports the offset market. Under the energy efficiency and conservation wedge it proposes to "foster the carbon offset market" and to expand the offsets available to include GHG reductions from the agriculture and forestry sectors.[170]

A facility can also contribute to Alberta's Climate Change and Emissions Management Fund to help meet the emissions-intensity limit.[171] Each $15 contribution to the Fund (a Fund Credit) is credited for a one-tonne reduction in CO_2e. Fund Credits cannot be banked by a facility. After 2008, a Fund Credit obtained on or before March 31 in a year may only be used in meeting net-annual-emissions-intensity limits for the previous year. The proceeds gathered by the Fund may be used only for purposes related to reducing emissions of specified gases or improving Alberta's ability to adapt to

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of production must be approved by the director in establishing the baseline-emissions intensity for the facility: s. 1(1)(w).

[167]*Ibid*., s. 7.

[168]Alberta Environment, *Offset Credit Project Guidance Document* (Edmonton: 2007) at 1 (hereinafter "Offset Guidance Document"), online: <http://www.environment.alberta.ca/1238.html>. The Offset Guidance Document is one of a series of guidance documents available to provide some certainty about where investments can be made in the Alberta Offset Market, *ibid*. at 1. The CCEMA does not create a cap-and-trade system but a compliance credit-trading system. A cap-and-trade system is a closed system which involves the trading of allowances that are issued in aggregate at the outset of the program. A compliance credit-trading system is an open system where credits are generated by regulated entities that reduce emissions below baseline (performance credits) or by non-regulated entities (offsets).

[169]*Ibid*. at 1.

[170]2008 Strategy, *supra* note 3 at 17.

[171]*SGER*, s. 8. CO_2e is defined in s. 1(1)(d) as the 100 year time horizon global warming potential of a specified gas expressed in terms of equivalency to CO_2 set out in column 3 of the Schedule. The Fund is established under *CCEMA*, s. 10(1).

climate change.[172] As mentioned in Part 3.2, the 2008 Strategy does not allocate the money in the Fund to the CCS wedge, although CCS is the most viable alternative for large industrial emitters to reduce GHG emissions. Under the 2008 Strategy, the money generated by the Fund will "drive innovation, test and implement new technologies, and achieve the goal of greening energy production" under the greening energy production wedge.[173]

The final method for meeting emissions-intensity limits is through performance credits. A performance credit arises when a facility regulated under the *SGER* achieves actual emissions intensity for a period that is less than the net-emissions-intensity limit. The reduction in emissions that were not used to meet the net-emissions-intensity limit is the available performance credit(s). A performance credit can be used by another facility in the year it was created or by the creating facility in a subsequent year.[174] An emission performance credit may only be used once.

Alberta's climate change legislation is an intensity based approach and is subject to the criticisms outlined in Part 3.1. In addition, the effectiveness of the intensity based approach itself is hampered by inefficiencies. These are the emissions-intensity target, the baseline-setting method, the Fund contribution price and the narrow focus of the legislation. Each of these is disused below.

The *SGER* is designed to slow the rate of emissions but not to stop, and certainly not to reverse, GHG emissions from targeted facilities. Once a facility reaches the emissions-intensity target of 88 percent of baseline, it is no longer required to continue reducing. This approach is contrary to the 2008 Strategy goal of achieving continuing reductions over time. The large industrial facilities regulated under the *SGER* account for approximately 50 percent of all of Alberta's emissions, and it seems unlikely that the emission-reduction objectives outlined in the 2008 Strategy can be met without requiring further reductions from these facilities.[175] This is particularly true for the CCS wedge which is only feasible for the larger industrial emitters.

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[172]*CCEMA*, s. 10. The allowable uses include energy efficiency, technological innovations, CCS, agricultural sinks, GHG measurement and adaptation.

[173]2008 Strategy, *supra* note 3 at 19.

[174]*SGER*, s. 9.

[175]As of the 2006 reporting year, 103 facilities in Alberta reported GHG emissions under the *SGRR* for total reported greenhouse emissions of 115 Mt or just under 50% of the province's total emissions. 2006 GHG Report, *supra* note 101 at 9 and 19. A 12% reduction in emissions (from 2006 reported emissions) is 13.8 Mt, far less than 20 Mt reduction expected for 2010. The actual GHG reductions for the first reporting period (July 2007 through December 2007) were 2.6 Mt, Alberta Government, News Release, "Alberta industries comply with pivotal climate change legislation" (30 April 2008), online: <http://alberta.ca/home/NewsFrame.cfm?ReleaseID=/acn/200804/23421A13065B8-02F7-B8BB-28C7FACB086E54EE.html>. Alberta's emissions are expected to increase to between 270 and 280 Mt by 2010 (see Table 3) but any increased emissions from new facilities would be exempt from the emissions-intensity target.

The second issue noted above is the method for setting baselines. For established facilities operating close to their maximum production (and assuming the facility makes improvements to its operations that result in reductions) the net-emissions target may result in an actual decrease in greenhouse emissions for that facility. The picture is different for new facilities whose baseline-emissions intensity is measured only in the third year of their commercial operations.[176] Calculating the baseline based on a new facilities actual performance creates a perverse incentive to operate at the highest level of GHG emissions through the third year of commercial operations, so that as little effort and expense as possible is required to meet the net-emissions targets under the *SGER*. There is no requirement that the facility be built to best available technology or that other generally desired minimum standards be met by new facilities.[177] Since the *SGER* also allows established facilities to be classified as new facilities if they are undergoing an expansion or other significant change, the same incentive to over-emit may exist for these facilities.[178]

In short, the method used for setting the baseline can encourage unnecessary emissions for new facilities or established facilities undergoing expansion or renovation. While facilities need to have a certain amount of grace during start-up operations, they should still be held to a minimum starting standard for emissions. The 2008 Strategy does not address these concerns. It only states that "emissions intensity targets will continue to be the approach for large facilities"[179] and that new large industrial facilities will be "designed and built to *enable* the capture of CO_2", while existing large facilities must have "*plans* in place to be capture ready [emphasis added]."[180]

A third difficulty with the *SGER* is the price mechanism for the Fund contribution. The price of the Fund contribution effectively sets a cap on the carbon price in Alberta —

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[176]*SGER*, s. 21(2).

[177]The Director is allowed to consider best available technologies in setting the baseline but is not required to do so, see s. 22(4). The federal climate change approach addresses this issue by requiring new facilities meet a "cleaner-fuel standard " for determining targets for new facilities Government of Canada, *Regulatory Framework for Industrial Greenhouse Gas Emissions* (March 2008) at 4.5, online: <http://www.ec.gc.ca/default.asp?lang=En&n=75038EBC-1#m10>. For further information on the federal climate plan including its role with CCS, see Nigel Bankes, *The Federal Government's Climate Change Policy and the Role of Carbon Capture and Storage* (2008) 101 Resources.

[178]*SGER*, ss. 1(2)-(3).

[179]2008 Strategy, *supra* note 3 at 23.

[180]*Ibid*. at 19. One company, announcing the approval for the construction, operation and reclamation of an upgrader to in the Industrial Heartland area (a project involving eight proposed upgrader developments in an area near Edmonton) stated the facility will be built to a "capture-ready" design, Northwest Upgrading, News Release, "North West Upgrading Project Approved: Alberta Environment issues Final Approvals under Environmental Protection and Enhancement Act and Water Act" (20 February 2008), online: <http://www.northwestupgrading.com/upload/news_item/31/01/080220_aenv_approvals_final_feb_20_release.pdf>.

one that affects the Alberta Offset System. The role of the Fund price is described in the Offset Guidance Document as follows:[181]

> Further, there is a carbon price 'signal' in the Alberta system provided by the cost for compliance through payments into the Climate Change and Emissions Management Fund. Regulated entities can choose to buy into this fund as means of achieving partial or full compliance with their emissions targets. *As such, buyers [of offsets] will likely pay less than $15/tonne* (the price currently set for payments into the fund) for offsets given the additional risks they would be assuming [emphasis added].

The Fund contribution options allows a company facing high costs in reducing its own emissions to pay the Fund price rather than reducing emissions or purchasing offset credits. There are advantages to setting a carbon price in an emerging carbon market to help prevent market volatility but the approach taken in the *SGER* has several potential problems.

First, at $15 per tonne, the Fund contribution is unlikely to be effective as a long-term market-price-signal limit since it is too low to act as an incentive for facilities to reduce emissions. The 2008 Strategy relies on the use of CCS as its main method for reducing GHG emissions in Alberta over time, yet the legislated market price for carbon is well below what will be required to implement CCS or other emission reduction options such as biomass or wind.[182] The low carbon price allows the market failure associated with GHG emissions to continue. Implementing additional and unrelated mechanisms to fund CCS (and other) projects creates a false picture of the real cost of carbon in Alberta.

In addition, neither the *CCEMA* nor the *SGER* contain a mechanism to increase the cost of a Fund credit over time. An approach based on a 'locked-in price' for carbon, as set out in Alberta's legislation, is inconsistent with the view of the economists surveyed in Part 2.2. Nordhaus addresses the need for increasing the price of carbon emissions as follows:[183]

> Carbon prices must be raised to transmit the social costs of GHG emissions to the everyday decisions of billions of firms and people. This simple yet inconvenient economic insight is virtually absent from most political discussions of climate policy.

The price of carbon, and accordingly the price of energy, makes a difference. According to the International Energy Agency (IEA), the rate of improvement in energy efficiency since 1990 has been about half of what it was in the 1970s and 1980s and had

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[181]Offset Guidance Document, *supra* note 168 at 26. The risks are listed as ownership of the offset, delivery of the offset, policy changes including the development of a federal offset policy, receiving government approval for projects, and the risk that result because offsets are intangible commodities that become real only after verification and pricing, *ibid*. at 24-26.

[182]The CCS Task Force states, "[a]s is the case with other emission reductions options, such as biomass or wind, these [CCS] projects simply will not proceed in the current market which is being driven by carbon prices in the $15 to $20 per tonne range", CCS Task Force Report, *supra* note 135 at 26.

[183]Nordhaus 2006, *supra* note 49 at 5.

the earlier rate been sustained there would have been almost no increase in energy consumption in IEA member countries.[184] The IEA then concludes:

> These findings confirm the conclusions of previous IEA analyses — that the changes caused by the oil price shocks in the 1970s and the resulting energy policies did considerably more to control growth in energy demand and reduce CO_2 emissions than the energy efficiency and climate policies implemented since the 1990s.

The 2008 Strategy does not address any market or carbon price issues embedded into the climate legislation. It sidles away from the issue by suggesting other forms of funding to achieve emission reductions.

Finally, the narrow focus of the *SGER* limits its effect. The *SGER* puts all the weight for emissions reduction on a small portion of the emitters.[185] Although the facilities that must reduce emissions-intensity under the *SGER* account for close to 50 percent of Alberta's emissions, the other half of the province's emitters have limited incentives to reduce emissions. While non-regulated emitters can participate in the Alberta Offset System, the price of carbon (set by the Fund contribution) is too low to be effective. The NRTEE Report showed that a strong, economy-wide price signal is required to achieve sustainable GHG emissions reductions. For example, a downstream cap-and-trade system (which caps emissions from large industrial emitters) with broad offsets is the least effective system of reducing emissions.[186] This is because it provides incentives for technology and behaviour that would likely to have occurred in the absence of the offset system (free-riders) and that the policy signal needs to be broader in scope.

The 2008 Strategy addresses this shortfall to some extent. In the energy efficiency and conservation wedge there are actions to require facilities that emit over 50,000 tonnes of GHGs to report (but not reduce) their emissions; to include emissions reductions in agricultural and forestry as off-sets; to implement energy-efficiency building codes; to establish an incentive program for consumers; and to support municipalities in emissions reductions.[187] While these efforts recognize the need to broaden the approach to other

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[184]IEA, *Energy Use for the New Millennium: Trends in IEA Countries* (Paris: 2007), Executive Summary, at 16, online: <http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1906>.

[185]Regulatory efficiency prevents all emitters from being included in a cap-and-trade system. The Alberta approach is set up to involve other emitters through the offset trading system. Once again the low cap price of $15 interferes setting the price so low that other emitters may not find it cost effective to participate.

[186]NRTEE Report, *supra* note 59 at 25-26. The report concludes that this type of offset system is a feasible short-term strategy but that an economy-wide price signal is necessary to promote significant emissions reductions.

[187]2008 Strategy, *supra* note 3 at 16. In contrast the federal Government's proposed regulatory framework will be applicable to chemical, fertilizer and natural gas pipeline operations that emit more than 50,000 CO_2e per year, to electricity generators of more than 10 MW and to upstream oil and gas facilities with minimum emissions of 3,000 CO_2e and 10,000 BOE/day/company, *Regulatory Framework for Industrial Greenhouse Gas Emissions*, *supra* note 177 at 8.

players beyond the largest industrial emitters, the efforts remain piecemeal and disjointed.

In summary, Alberta's climate legislation is positive in that it provides several mechanisms for compliance but it contains several shortfalls that limit its effectiveness. The 2008 Strategy does not directly address the existing legislative approach or the legislated target. In addition, it does not address the shortfalls other than potentially expanding the base beyond the largest industrial emitters. In particular, the 2008 Strategy does not address the price of carbon, market failure or any economic cost. The result is a climate policy divorced from the enacted legislation in the same area. This is an approach that prolongs and promotes market failure and adds to the confusion over targets.

4.0. The Effect of Alberta's 2008 Strategy

Alberta and energy are often synonymous; leading to the province's declared ambition to be a "global energy leader" — a role the province plans on continuing for the foreseeable future.[188] Alberta's role as an energy producer has two main affects on the province. First, it fuels a significant part of Alberta's economy, and second, it makes the single biggest effect on the province's GHG emissions. Without intervention, the continued development of Alberta's fossil fuel resources will result in continued increasing emissions. The tension between continuing development of fossil fuel energy and reducing emissions is a poignant one in Alberta — so much so that it can be said that a policy to address climate change is equally a policy on energy development.

The 2008 Strategy clearly recognizes the tension between energy development (and consequently economic growth) and emissions. The 2008 Strategy states:[189]

> Alberta's strong and vibrant economy is founded on resource extraction and value added upgrading, so our strategy ensures we build on this strength — we are not prepared to forgo the opportunities our strong and vibriant [sic] economy provides. Our greenhouse gas emissions profile is strongly linked to the production and use of fossil fuels. Our policy approach to climate change is mindful of this reality and in fact helps strengthen our current economic structure.

The tension is apparent but this statement implies that the balance is tipped in favour of energy development and economic growth. Does the 2008 Strategy go far enough in addressing the need to respond to climate change so as to avoid dangerous interference with the climate? This question will be answered in three parts.

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[188] Alberta Energy, *Alberta's Integrated Energy Vision* (August 2006) at 18, online: <http://www.assembly.ab.ca/lao/library/egovdocs/2006/aleo/156134.pdf>. The 2008 Strategy states that Alberta is an "energy supplier to the world" at 7.

[189] 2008 Strategy, *supra* note 3 at 13.

The first issue to be addressed is whether the expected results address the underlying problem sufficiently. In other words, assuming the actions under the three wedges are successful and the expected results are achieved, is Alberta's approach sufficient to its responsibility in addressing global climate change? Second, is the 2008 Strategy capable of achieving the expected results it puts forward? Finally, are there any consequences to Alberta for deficiencies in its approach?

4.1. Alberta's Contribution to Reducing Global Emissions

What if the 2008 Strategy delivered exactly what it promises in GHG emissions reductions? In the best-case scenario, Alberta would achieve stabilization of GHG emissions in 2020, and by 2050 Alberta's emissions would be 200 Mt, the equivalent of 14 percent below 2005 levels. A slight conversion is necessary to allow comparison to the IPCC stabilization scenarios outlined in Table 1: emissions of 200 Mt per year are 11 percent below 2000 levels.[190]

If the world followed a similar pattern of emissions reduction to that outlined by the 2008 Strategy, the result would be emissions stabilization between 535 and 590 CO_2e, with a temperature increase of 2.2 to 2.6°C over 1990-2000 levels (2.8 to 3.2°C compared to pre-industrial levels). This is a middle of the road stabilization scenario. On a global basis, the expected impacts are serious, including declining food production, increased deglaciation, an increase of between 20 and 50 percent in species at risk of extinction and severe freshwater scarcity that will affect hundreds of millions of people. On the positive side such a scenario lowers the risk of near-total deglaciation, avoids widespread ecosystem disturbance which constrains further species loss, and lowers the risk of further declines in global food production.

Closer to home, it must be recalled that Canada's temperature increase is expected to be at least double the global average — and the higher the temperature increase the greater the impacts.[191] A global temperature increase of 2.2 to 2.6°C will mean temperature increases of between 4-6°C for Alberta. For example, Fort McMurray has already undergone a temperature increase of more than 2°C while Fort Chipewyan has experienced a temperature increase of more than 3°C.[192] At an average warming of 3°C the average projected declines in streamflow for the Athabasca River catchment area are in the range of 8-26 percent (17-71 percent for the driest years). For an average warming of 6°C the streamflow is projected to decline by 24-68 percent, and up to 52-100 percent for the warmest, driest years. The effect on the environment and energy production —

[190] Alberta's 2000 emissions were 224 Mt, National Inventory Report, *supra* note 17 at 546.

[191] See *supra* note 25.

[192] Schindler, Donahue & Thompson , *supra* note 27 at 8.

and the economy — would be enormous. Certainly, by any measure, the effect of climate change on Alberta's water system at that level would be 'dangerous'.

Globally, Alberta is a minor contributor of emissions and the province's efforts alone could do little to stabilize atmospheric concentrations of GHGs.[193] Global action is required, but since Alberta will be impacted more than many other parts of the world it is in the province's interest to demonstrate leadership. This leadership can be demonstrated not only through emissions reductions but also through providing leadership and innovation to other countries heavily dependent on fossil fuels for energy. In the 2008 Strategy, Alberta accepts responsibility for reducing GHG emissions and goes so far as to claim that the Strategy puts Alberta in a "leadership role in reducing GHG emissions and adapting to climate change."[194] However, the evaluation of the best-case scenario clearly shows it to be a strategy that will achieve only moderate results. In addition, these moderate results are only possible if the province takes immediate and decisive action to implement the approach in the Strategy. Any delay will result in higher emissions and delayed stabilization. If that occurs, Alberta's contribution to climate change will be equivalent to accepting dangerous interference with the climate system.

4.2. The Potential Effectiveness of the 2008 Strategy

Policy is not equivalent to results. For example, the 2002 Plan set clear emissions targets. The Plan projected that in achieving its emission intensity goals it would also achieve emissions levels peaking in 2010 at 238 Mt CO_2e and then falling to 218 Mt of CO_2e by 2020.[195] Under the Plan, Alberta's emissions intensity decreased significantly and Alberta was on track to meet its goal for emissions intensity. But actual emissions are a different story. Total actual GHG emissions from all sources increased by 63 Mt, or 37.4 percent, between 1990 and 2005 (from 170 Mt to 233 Mt), just slightly below the 2002 Plan's projections for 2010 — some five years early.[196]

[193]Canada emits a small portion, approximately 2% (747 Mt CO_2e in 2005), of the total global GHG emissions; however it is one of the highest per capita emitters at 23.1 tonnes per capita, National Inventory Report, *supra* note 17 at 17 and 41.

[194]2008 Strategy, *supra* note 3 at 10. The Strategy does recognize some opportunities. Under the CCS wedge, the Development Council is responsible for examining and proposing tools and incentives to ensure Alberta industry maintains a leadership role in implementing CCS, *ibid.* at 19.

[195]2002 Plan, *supra* note 85 at 8 and 11. See Table 3 for a summary of the 2002 Plan.

[196]National Inventory Report, *supra* note 17 at 615. Part of the discrepancy between the results for emissions intensity compared to actual emissions can be explained a GDP increase of 72.5% compared to GHG output increase of 37.4% for the period of 1990-2005, *ibid.* at 546. The dynamic of faster economic growth compared to emissions rates is expected to continue through 2020. Canada's Energy Outlook, *supra* note 79 at 78 and 141.

Emissions are projected to increase by 72 percent between 2005 and 2050 in Alberta under a BAU scenario.[197] The question is whether the 2008 Strategy will fare better in dealing with the problem. There are significant challenges. First is the confusion as to whether the ‘expected results’ are targets merely the hoped for results of taking certain actions. If the first, then there may be pressure from the public and/or other governments to take action in order to meet these targets. If the latter, then the province is required only to take the steps outlined in the listed actions in order to meet its obligations. In short, the province may not be accountable for any particular emissions result, and consequently no particular achievement may be attained.

Secondly, while all three wedges have the potential to affect emissions, only the CCS wedge is capable of achieving significant reductions while permitting the continued production and use of fossil fuels — a development path to which the province is committed. CCS has the capability to achieve large reductions in emissions, and the province’s projections for reductions from CCS are achievable. The larger problem is that the 2008 Strategy only commits to make a *plan* for CCS rather than committing to implementing CCS. Once the Development Council reports to government (in the fall of 2008), the only remaining commitment resting on the province is to “support research and demonstration projects” on CCS.[198] This level of commitment is unlikely to drive results. The ability of CCS to drive the emissions reductions required to achieve stabilization by 2020 is dependent on action — not planning to act. Immediate demonstration projects and investment in research are critical.

Thirdly, behind the 2008 Strategy is Alberta’s climate legislation. The legislation has the only clear target but suffers from being directed at emissions intensity. The *CCEMA* and the *SGER* do provide a variety of mechanisms to meet net-intensity targets, such as the technology fund, emissions offset market and performance credits. These components are critical for efficient, effective climate change mitigation. There are inefficiencies, however, and these inefficiencies are not adequately addressed by the 2008 Strategy. Further, there is no guidance as to the integration of the legislation into the 2008 Strategy, which only increases the inefficiencies.

In conclusion the 2008 Strategy, as it stands, is unlikely to achieve real reductions in emissions. The Strategy concludes with a commitment to outline the “specific implementation plans for moving ahead with the actions outlined in this strategy as well as additional actions that could be taken to support the directions outlined in this strategy.”[199] The actions themselves are inadequate to bring change, further increasing the need for specific, binding “additional actions” to address the problem of GHG emissions in Alberta.

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[197]Based on the provincial projections of 400 Mt by 2050, see Table 3, note i. Other projections are for a 31-42% increase in emissions by 2020 and a 48 increase by 2030, see Part 2.3.

[198]2008 Strategy, *supra* note 3 at 18.

[199]*Ibid*. at 29.

4.3. Potential Consequences of Alberta's Approach

Beyond the obvious environmental and social impacts, there may be more immediate consequences to Alberta's approach to climate change, particularly if the 2008 Strategy does not result in concrete actions or results. For example, as climate change increases as a global issue, Alberta's approach to emissions reductions, and its position as a major producer of non-conventional fossil fuels, may have a negative effect on Alberta's global and national reputation. There is evidence of this phenomenon occurring in both the national and international press.[200] The possible cost to Alberta as a result of a poorly managed environment was summed up by the province as follows:[201]

> Potential declines in environmental quality could affect economic investment and development in the province in several ways. The public may withdraw companies' 'social licence to operate' and apply market pressure or political pressure for regulatory action. Secondly, workers and companies are attracted to locate and stay where there is a high quality of life, and that attraction could be compromised.
>
> The uncertainty, cost and delays associated with considering the same issues repeatedly for each regulatory application does not benefit economic activity or the environment. Alberta's economy, largely dependent on developing its natural resources, will remain healthy only if the environment remains healthy.

There is a second possible economic consequence of Alberta's approach, particularly if emission reductions do not occur. As stated in Part 2.2, underlying climate change is the issue of market failure. States are reluctant to move first as it could easily mean an economic penalty compared to other states that are not limiting emissions. This concern

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[200]See for example, Jack Fairweather, "Shifting oil sands" *Telegraph.co.uk.* (15 September 2007), online: <http://www.telegraph.co.uk/arts/main.jhtml?xml=/arts/2007/09/15/sm_oilsands.xml&page=1>. The article stresses both the health impacts and GHG emissions associated with oil sands development. With regard to Fort McMurray, the articles state, "This is not a town for tourists."; Karla Adam, "The world's energy reserves: Where the buffalo roam …" *The Independent* (10 February 2006), online: <http://news.independent.co.uk/world/americas/article344480.ece>. The author describes the pollution and greenhouse emissions from mines as follows: "Giant smoke-stacks billow steam, sulphur dioxide, nitrous oxide, and carbon dioxide, and are lit up at night to allow around-the-clock work. Bison roam nearby on reclaimed land, while cannons are fired over tailings ponds to frighten off migratory birds that might land in the toxic pools of sludge."; James Harding, "It's a dirty business but it pays" *Timesonline* (27 July 2007), online: <http://business.timesonline.co.uk/tol/business/columnists/article2148313.ece>. The author states that oil sands development "makes little sense unless you are an American motorist in need of cheap petrol or a US Congressman enraged about America's dependence on Arab oil." Shawn McCarthy, "Oil sands seen as 'threat No. 1', as U.S. may target dirtier fuels" *Globe and Mail* (30 October 2007), online: <http://www.theglobeandmail.com/servlet/story/LAC.20071030.RALTAOILSANDS30/TPStory/Business>; and Nicholas Köhler, "Doomsday: Alberta stands accused. A huge fight between East and West — over the oil sands — is just starting" *Macleans.ca* (8 October 2007), online: <http://www.macleans.ca/article.jsp?content=20071008_110103_110103&source=srch>.

[201]Alberta Environment, Towards Environmental Sustainability: Proposed Regulatory Framework for Managing Environmental Cumulative Effects (November 2007) at 5, online: <http://environment.alberta.ca/1931.html>.

over free-ridership underlies the debate between the US and China as to who must move first in addressing climate change. Similar hesitancy was clearly reflected in Alberta's 2002 Plan with regard to the US response to climate change.[202] The NRTEE Report, referring to the federal climate change approach, observed that there are possible competitive risks that might emerge from unilateral action on climate change and that it is critical that whatever "policy framework Canada puts into place, it is comparable to its competitors and trade partners, predominantly the United States."[203]

While the US has been a reluctant player in addressing climate change in the past, there are signs that the approach south of the border may be changing.[204] Currently there are several economy-wide cap-and-trade bills before Congress.[205] All employ absolute caps on emissions, with emissions peaks on or before 2012 followed by significant reductions in emissions. Most of the bills have caps between 60-80 percent below 1990 levels to be achieved by 2050. Alberta's commitment to stabilizing emissions in 2020 is 8-10 years later than the proposed US bills and its commitment to reducing emissions by 14 percent below 2005 levels by 2050 is significantly less onerous.

As aggressive as these bills are, they fall short of the recommendation by the powerful US House of Representatives Committee on Energy and Commerce. The committee has issued a series of white papers concerning climate change legislation. The first in the series deals with cap-and-trade policy (the "US White Paper").[206] The US White Paper states that the US should reduce its GHG emissions between 60 and 80 percent by 2050 to contribute to an atmospheric stabilization of between 450 and 550

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[202]The 2002 Plan stated as a core principle that "[a]ny actions we develop must be compatible with our largest trading partner — the United States — to ensure we maintain a competitive economic advantage." And that the reason behind Alberta's approach based on intensity targets is because the United States "has not adopted an absolute emission reduction target but is instead focusing on improvements in emissions intensity", 2002 Plan, *supra* note 85 at 8 and 12. The 2008 Strategy simply states that Alberta will "work collaboratively with others both within the province and nationally and internationally to address climate change for present and future generations", 2008 Strategy, *supra* note 3 at 14.

[203]NRTEE Report, *supra* note 59 at 14.

[204]Shawn McCarthy, "Cap-and-trade push grows in U.S." *Globe and Mail* (9 April 2008), online: <http://www.theglobeandmail.com/servlet/story/LAC.20080409.RPOWER09/TPStory/?query=cap-and-trade>.

[205]The Pew Center provides a short summary of some of the bills. Pew Center, *Economy-wide Cap-and-Trade Proposals in the 110th Congress* (January 2008), online: <http://www.pewclimate.org/docUploads/110th%20Congress%20Economy-wide%20Cap&Trade%20Proposals%2001-30-2008%20-%20Chart.pdf>. Two of the Bills (S. 280 and S. 1766) have been previously discussed, see *supra* note 60. Bill S. 280 is co-sponsored by all three of the remaining presidential candidates: J. McCain, B. Obama and H. Clinton.

[206]US House of Representatives, Committee on Energy and Commerce, subcommittee on Energy and Air Quality, *Climate Change Legislation Design White Paper: Scope of a Cap-and-Trade Program* (October 2007), online: <http://energycommerce.house.gov/Climate_Change/index.shtml>. The Committee on Energy and Commerce is the oldest standing committee of the U.S. House of Representatives and is one of its most important committees.

ppm.[207] The cornerstone of the effort is an economy-wide cap-and-trade program supported by complementary measures such as a carbon tax or other tax-based incentives, efficiency or other performance standards, and research and development.[208] The US White Paper supports cap-and-trade with absolute caps as a way of providing certainty that emissions will occur, and rejects relying on performance standards which "generally limit the rate of emissions … but would allow emissions to increase".[209]

Not only may Alberta find itself out of step on a policy level, there may be a direct economic effect. In December 2007, the US enacted the *Energy Independence and Security Act of 2007*, which contains a provision that restricts the purchasing of transportation fuel, including a fuel produced from nonconventional petroleum sources, unless the fuel supplied under the contract has life-cycle emissions equal to, or less than emissions from conventional fuel.[210] The Act applies to all government operations including the military and postal services — both high users of gasoline. Several of the proposed climate bills have similar penalty provisions for energy sources.[211] In addition, California has enacted a "low carbon fuel standard" for transportation fuels that requires fuel providers to reduce the carbon intensity of transportation fuels sold in California.[212]

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[207]*Ibid*. at 3.

[208]*Ibid*. at 3-4. The basis for the economy wide approach is to use different "points or regulation" for different sectors: at 21-22. For example, the electricity generation sector would be regulated at the facilities using a trading system based on the Acid Rain Program. The transportation sector would be regulated at the level of refiners and importers with supporting regulation on performance standards for vehicle, a low carbon fuel program and a tax on fuel. Representative John D. Dingell (Michigan) chairman of the committee recently announced he will soon introduce a bill based on a carbon tax: Representative John D. Dingell, "Summary of Draft Carbon Tax Legislation", online: <http://www.house.gov/dingell/carbonTaxSummary.shtml>. The bill is structured as to allow it to act in a complementary manner to an economy-wide cap-and-trade program. The proposed legislation includes a tax of $50/ton phased in over 5 years on carbon content, a 50 cent tax on gas, jet fuel and kerosene phased in over 5 years and a phase out of the mortgage interest deduction on large homes.

[209]*Ibid*. at 3.

[210]*Energy Independence and Security Act of 2007*, 42 U.S.C. §17142 (2007) which reads, "No Federal agency shall enter into a contract for procurement of an alternative or synthetic fuel, including a fuel produced from nonconventional petroleum sources, for any mobility-related use, other than for research or testing, unless the contract specifies that the lifecycle GHG emissions associated with the production and combustion of the fuel supplied under the contract must, on an ongoing basis, be less than or equal to such emissions from the equivalent conventional fuel produced from conventional petroleum sources."

[211]McCarthy, *supra* note 200.

[212]Office of Governor Schwarzenegger, News Release, "Gov. Schwarzenegger Signs Executive Order Establishing World's First Low Carbon Standard for Transportation Fuels" (18 January 2007), online: <http://www.gov.ca.gov/index.php?/press-release/5174/>. The low carbon fuel standard requires fuel providers to ensure that the mix of fuel they sell into the California market meets, on average, a declining standard for GHG emissions measured in CO_2e per unit of fuel energy sold. By 2020, the low carbon fuels will produce a 10% reduction in the carbon content of all passenger vehicle fuels sold in California. For a discussion of the effectives of low carbon fuel standards, see Stephen P. Holland, Christopher R. Knittel & Jonathan E.

The concern over trade sanctions is a growing one and may include action from counties beside the US.[213] These existing or potential trade restrictions are critical for Alberta since oil sands production generates higher emissions than conventional fuel. Pressure from the US and other trading partners may require an adjustment to Alberta's approach.[214]

In conclusion, Alberta's approach to climate change may not be sufficient to address concerns by the US and other trading partners. Underlying this reluctance is the fundamental economic problem of market failure. Effective climate change is a long-term transformational issue and the chosen policy must send a consistent signal to consumers, business and industry, so as to allow effective mitigation at the lowest cost. To the extent there is a mismatch in policy between Alberta and its trading partners, it puts the province at a disadvantage. There needs to be a balance. On one hand, if the province is too aggressive it may face a competitive disadvantage. On the other hand, if it moves too slowly and there is a policy disconnect, the province may find itself at a competitive disadvantage with regard its emissions-intensive fossil fuel production.[215]

5.0. Conclusion

Climate change is upon us; the only doubt lies in its speed and extent. Policy approaches to climate change need to address both adaptation and mitigation. Climate change cannot be avoided but its impacts can be constrained. In order to do so, effective, rapid mitigation action is required. The chemical action of CO_2 in the atmosphere guarantees future warming and makes weak, slow mitigation efforts almost irrelevant. The policy approach for climate change must address two realities: the need to stabilize emissions in order to avoid changes that are serious and costly or that will exceed adaptive capacity, and the need to account for market failure as the root problem in addressing climate change.

Alberta's response to the climate challenge is the 2008 Strategy, but the policy suffers from several key deficiencies. The deficiencies concern the province's approach to both

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Hughes, *Greenhouse Gas Reductions Under Low Carbon Fuel Standards?*, Working Paper 13266 (Cambridge, MA: National Bureau Of Economic Research, 2007), online: <http://www.nber.org/papers/w13266>.

[213]Scott Simpson, "Baird says government action will prevent tariffs" *The Vancouver Sun* (28 March 2008), online: <http://www.canada.com/vancouversun/story.html?id=6fe09259-4f89-424f-9f27-9e2a9d22c196&k=67072>.

[214]One economic commentator stated, "Look not to Kyoto but, instead, south to the United States to find where the real carbon pressures on the Canadian economy will come from.", Jeffrey Rubin, "There's a better way to cap carbon emissions" *Globe and Mail* (21 February 2007) A21.

[215]CCS Task Force Report, *supra* note 135 at viii.

adaptation (which is undeveloped) and to mitigation. The most significant mitigation shortcoming, and one that affects many of the others, is the Strategy's ambivalence over targets. It is unclear which, if any, results outlined are binding targets or goals that can be used to evaluate the Strategy's success or which are merely achievements that will *hopefully* occur. The wedges, while correctly targeting energy production and use, contain little concrete action. Primarily they are plans to plan. Finally, the Strategy is mute on its interaction with the province's existing climate legislation. The result is confusing with regard to both targets and cost (including funding). At no time does the 2008 Strategy address the price of carbon or market failure. It is not clear that the province's approach to climate change will result in stabilization, let alone a reduction, of the province's emissions. Even if the 2008 Strategy achieves its goals, it may not be aggressive enough to avoid sanctions from the province's trading partners.

Alberta's approach to climate change needs to be long-term, broadly applied to all sectors and directed toward a definable end result with sufficient price signals to foster change and innovation. Effective and efficient mitigation requires not only that there is a 'good' policy choice made at a certain point but that the policy is sustained for a long period, often as long as several decades. Industries, particularly energy-intensive industries, have long planning horizons for large capital investments such as the incorporation of CCS. In the same way, consumers need time to replace carbon-intense choices with low-carbon choices for appliances, cars and buildings. New infrastructure to change from carbon-intensive transportation takes time as well. Research into methods to reduce the carbon intensity and the environmental effect of hydrocarbon production is a critical part of the solution, yet effective research and development requires a focused long-term support. To effectively promote a low-carbon future, the province will need to reduce regulatory and financial barriers, promote cooperation between stakeholders and improve certainty for developers.[216] None of this can happen effectively under a policy that is inadequate for the task. Climate change policy is a critical component of provincial action needed to begin to eliminate market failure and to inform stakeholders of the long-term target for emissions. Both are necessary to help guide development toward a low-carbon future.

Alberta's 2008 Strategy avoids dealing directly with either targets or the price of carbon. Too much time has been wasted in the past in avoiding and debating these realities. The debate has detracted from the urgency to take action today and move toward a long-term, sustainable position on climate change. Without a conscious choice to take meaningful action, the province's approach to climate change is likely to leave more marks on paper than in the atmosphere.[217]

[216] Wenig *et al., supra* note 120 at 79.

[217] This last statement is a variation of the phrase "leave more marks on paper than on the landscape", IPCC AR4 WGIII Report, *supra* note 16 at 12.2.3.1., quoting S. Rayner & K.R. Richards, 1994: *I think that I shall never see … a lovely forestry policy. Land use programs for conservation of forests.* In Workshop of IPCC WGIII, Tsukuba.

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