Global Climate Change: Risk to Bank Loans

Prepared by:

EcoSecurities
215 Park Ave. South, Suite 190
New York, NY 10003
Telephone (212) 356-0160
Web site: www.ecosecurities.com

With special assistance from:

United Nations Environment Programme Finance Initiative (UNEP FI)
and its North American Task Force (NATF)

UNEP Finance Initiative
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Note to Reader

The UNEP Finance Initiative (UNEP FI) is a unique global partnership between the United Nations Environment Programme (UNEP) and the private financial sector. UNEP FI works closely with over 160 financial institutions, and a range of partner organizations to develop and promote linkages between the environment, sustainability, and financial performance. Through regional activities, a comprehensive work programme, training programmes, and research, UNEP FI carries out its mission to identify, promote, and realize the adoption of best environmental and sustainability practice at all levels of financial institution operations.

A key component of UNEP FI is the work conducted by its North American Task Force (NATF). In preparing the 2005 work programme, the NATF concluded that the North American finance sector required a clear and concise analysis of the major risks posed by climate change to debtors. The group also sought to better understand the macro impact of climate change on financial risk, and the specific debt sectors which would be most impacted. The result is Part I of this study, which looks specifically at climate change risk and lending. Part I was commissioned by the NATF and was funded by Bank of America and the NATF.

The NATF commissioned Part II of the study in cooperation with the NAFTA Commission for Environmental Cooperation (CEC). Part II of the study addresses the impact of future environmental liabilities on specific debt products and reviews the many strategies available to mitigate those risks. In addition, the study makes practical recommendations as to actions that can be taken by financial institutions to address the impact of environmental liabilities on their debt products. Part II was funded by the NAFTA CEC.

Contents

Commonly Used Acronyms

ABS	Asset Backed Securities
Bcf	Billion cubic feet
CAFE	Corporate Average Fuel Economy
CCX	The Chicago Climate Exchange
CDM	Clean Development Mechanism
CDO/ CLO	Collateralized Debt and Collateralized Loan Obligation
CEC	Commission for Environmental Cooperation (In reference to NAFTA CEC)
CEO	Chief Executive Officer
CEPA	Canadian Environmental Protection Act
CER	Certified Emissions Reductions
CERES	The Coalition for Environmentally Responsible Economies
CFO	Chief Financial Officer
CH_4	Methane
CHP	Combined heat and power
CMM	Coalmine Methane
CMOP	Coalbed Methane Outreach Program
CO_2	Carbon Dioxide
DSM	Demand Side Management
EBIT	Earnings Before Interest and Taxes
ENSO	El Nino and La Nina events
EPA	Environmental Protection Agency
EUETS	European Union Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
Hg	Mercury
IET	International Emissions Trading
JI	Joint Implementation
KWh	Kilo Watt Hour
LFE	Large Final Emitter
LNG	Liquefied Natural Gas
MBS	Mortgage Backed Securities
MD&A	Management's Discussion and Analysis of Financial Conditions and Results of Operations
MMT	Million Metric Tonnes
Mpg	Miles per gallon
Mt	Megatonne
$mtCO_2$	million tonnes of Carbon Dioxide
N_20	Nitrous Oxide
NAFTA	North American Free Trade Agreement
NAP	National Allocation Plans
NATF	North American Task Force (In reference to UNEP FI)
NESC AUM	Northeast States for Coordinated Air Use Management
NOx	Nitrous Oxide
P&C	Property and Casualty (Insurance)
Pb	Lead
PFC	Perfluorocarbons
RGGI	Northeastern States Regional Greenhouse Gas Initiative
RGGR	Regional Greenhouse Gas Registry
SAM	Sustainable Asset Management
SEC	Securities and Exchange Commission
SF_6	Sulfur Hexafluoride
SOx	Sulfur Dioxide
SUV	Sport utility vehicle
UNEP	United Nations Environment Programme
UNF CCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
VAIP	Voluntary Aluminum Industry Partnership
WRI	World Resources Institute

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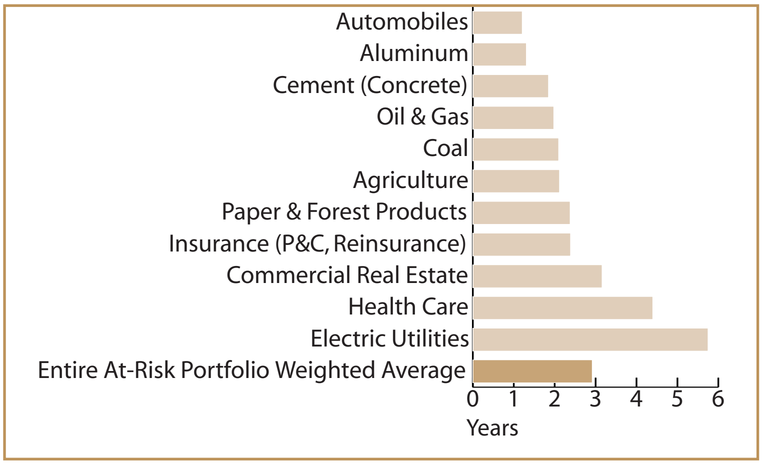
Executive Summary

The purpose of this study is to evaluate the impact of climate change related risks on bank borrowers, utilizing as much data and analysis as possible. The first section of this report reviews the current climate change policies in place in Canada, Europe, and the US, in order to provide a framework for policy implementation in the future. The report then utilizes aggregated loan and lease data from Bank of America, CIBC, Citigroup, Scotiabank, and TD Bank Financial Group, to analyze the impact of climate change related risks on bank loans and leases.

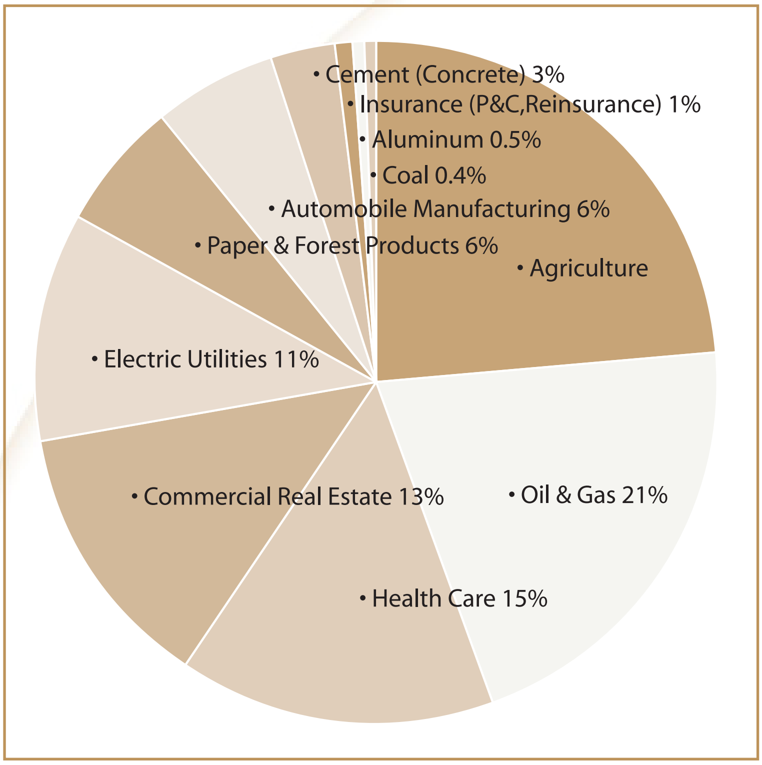
Background & Methodology

For this report, an assumption is made that emissions caps on six greenhouse gases (Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulfur Hexafluoride (SF_6), Perfluorocarbons (PFCs), and Hydrofluorocarbon (HFCs)) will be enacted in the US and Canada. With this assumption, an analysis of the impact of a capped emissions program on bank loan and lease portfolios was conducted. Specifically, the following four areas of risk associated with climate change were analyzed for each of the loan sectors: policy risk, input price increases, output price decreases, and physical exposure. In order to complete this process, loan and lease data from participating banks was compiled. The bank data included total loan and lease portfolio values and average weighted maturities for the eleven sectors that were identified as potential at-risk sectors. The data was aggregated into a climate change "at risk" portfolio to provide an industry-wide study while also protecting individual bank confidentiality. The at-risk portfolio is composed of the following summary data:

Weighted Average Maturity Levels for All Sectors



Loans and Leases Portfolios at Risk to Climate Change



Measuring the impact of climate change on bank loans is challenging because (i) the physical effects of climate change on borrowers will not be evident for many years, and (ii) policies designed to limit emissions of greenhouse gases have yet to be imposed in the US, while Canada's implementation of the Kyoto Protocol remains unclear, and (iii) the relatively short time frame of loans compared to the long-term impact of climate change. In an attempt to overcome these challenges, this study examined "proxy events" associated with climate change. Specifically, this study identified several events related to climate change that have already occurred, and which may have impacted bank borrowers affected by those events. For example, in Europe the EU Emissions Trading System set caps on emissions of CO_2 for approximately 10,000 companies beginning January 1, 2005; examining this event provides a proxy for the potential impact of climate change policy on bank borrowers in Canada and the US.

The methodology employed to study these proxy events was to measure changes in the spreads on bonds issued by companies affected by the proxy event. Bond spread pricing was used in lieu of loan spread pricing, as loan data was unavailable. However, bond spreads generally provide an objective measure of the credit quality of borrowers, and bond spreads move inversely to events that affect credit quality (i.e. bond spreads increase as a borrower's credit quality worsens). This study made the assumption that bond spreads are a reasonable measure of credit quality for borrowers, and that changes in bond spreads for European companies affected by a climate change "proxy event" are a reasonable estimate of how similar US and Canadian companies would be impacted by such an event in a carbon constrained environment.

Results

This study did not find a correlation between climate change related proxy events and spreads on bonds issued by companies in the at-risk sectors. This may have resulted from the following:

(i) Methodology – the use of proxy events is not a comprehensive measure of all risks, and may have missed some climate change related risk. Furthermore, the use of proxy events in Europe may not be appropriate for North American borrowers.

(ii) Short maturity loans - bank data submitted for this report indicated that banks in Canada and the US have short maturity average loan and lease portfolios. This minimizes banks' exposure to climate change and provides future flexibility to adjust to sector-specific risks or policy issues.

(iii) Low cost - the cost of compliance at current prices may not be high enough to have a measurable impact on the credit quality of the sectors studied.

(iv) Static data – this study examined proxy events that have occurred in the past, which may not be an appropriate measure for future events, especially as banks have no prior experience with climate change. Therefore, while this study found no current risk to bank loans and leases, it cannot be concluded that there will not be risk in the future.

(v) No correlation – the hypothesis underlying this study may have been incorrect, and there may be no correlation between climate change related events and spreads on bonds issued by companies in the at-risk sectors.

This study evaluated eleven loan sectors on four risk exposures. The risk rankings, seen in the table below were determined by analyzing the sector characteristics and individual sector exposure to policy risk, input price increases, output price decreases, and physical risk. These rankings represent potential exposure to risk in the future, as this study concluded that none of the sectors listed below has current risk exposure to climate change. Boxes lacking rankings signify no recognizable future exposure to climate change. The electric utility sector was ranked in the high category because of the sector's long loan maturities, while the aluminum and cement sectors were listed as high because of the double greenhouse gas emissions characteristic of their manufacturing processes.

	Policy Exposure	Input Prices Exposure	Output Prices Exposure	Physical Exposure	Potential Overall Exposure
Coal	High		Medium		Medium
Oil & Natural Gas	High		Low	Medium	Medium
Electric Utilities	High	High		Low	High
Aluminum	High	High			High
Cement	High	High			High
Automobile Manufacturing	Medium	Low	Low		Low
Agriculture	Low	Low		Low	Low
Paper and Forests Products	Low	Low		Low	Low
Commercial Real Estate				Medium	Low
Property and Casualty Insurance / Reinsurance				High	Medium
Health Care				Low	Low

Conclusions and Recommendations

This report has concluded that US and Canadian banks are not currently materially exposed to climate change risk in their loan and lease portfolios, but that several loan sectors have the potential for exposure in the future. Specifically, climate change risk could be much more significant when considering a time period that exceeds the 10-year time frame used in this report. This report concludes that North American banks should do further in-depth evaluation of the physical and policy impacts of climate change to ensure that long-term loans and leases made in the future are similarly not exposed to climate change related risks.

Introduction

The aim of this study is to determine whether climate change poses a risk to the loan portfolios of banks in Canada and the US. This study was based on the hypothesis that an objective statistical correlation exists between the creditworthiness of bank loan portfolios and climate change related events. The methodology employed by this study to test that hypothesis was to (i) identify specific sectors that may be at risk from climate change and to collect bank loan and lease data on those sectors, (ii) evaluate each sector on four potential risks – physical risk, input price risk, output price risk, and policy risk – resulting from climate change, and (iii) select "proxy events" to provide a real-life example of climate change related events that may have impacted the credit quality of borrowers.

This study is based on an assumption that some form of policy will be enacted in the United States that caps emissions of greenhouse gases, and that the implementation of the Kyoto Protocol will shortly impose a cap on Canadian companies. This report examines the repercussions and risks associated with climate change policy and with the physical risks likely to result from greater climate variability. Analysis throughout the report is limited to the regulatory risk associated with the following six greenhouse gases: Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulfur Hexafluoride (SF_6), Perfluorocarbons (PFCs), and Hydrofluorocarbons (HFCs). The severity of each greenhouse gases' global warming potential is addressed within the sectors that they affect. Additional issues, not directly addressed in this report, are potential advantages that could be gained from the mitigation of climate change, such as the development of new technologies and services. The cost of mitigating climate change is likely to be significant and has the potential to strain some sectors. The sectors highlighted do not represent the entirety of industries believed to be affected by climate change risks. Rather, they offer a snapshot of industries considered at-risk to climate change, and which represent a significant volume of loans from the Canadian and American banks participating in the study.

When analyzing the risk associated with climate change, the first consideration must be the issue of timeframe; specifically, there are no measurable risks associated with climate change in a time period of less than one year. On the other hand, there are potentially catastrophic risks from climate change when evaluating a time period of one hundred years. For this study, the analysis of each loan sector has focused on (i) the weighted average maturity of loans made to each sector, and (ii) the total monetary value of loans made to each sector. This report is sector specific, not company specific as companies' performance in the face of climate change and/or under an emissions cap regime will largely depend upon factors outside sector-specific challenges. In addition, some companies/sectors may stand to benefit from climate change issues while others will be adversely affected. This strategic advantage is addressed in the relevant sectors throughout the report.

The methodology of the analysis in Part I and Part II of the report is captured in the following diagram:

Report section		Objective
Part I	Policy Review	Establish parameters of likely policy in US + review of Kyoto Protocol in Canada
	Sector Analysis • Risk • Bank loan data • Proxy events	Determine scope of sector exposure to four risks Determine scale of sector exposure Determine impact of risk exposure on loan spreads
	Loan Portfolio Risk	Conclusion regarding overall bank loan portfolio exposure
Part II	Mitigation Strategies	Strategies for borrowers and banks tp mitigate climate change risks
	Recomendations	Practical recommendations for banks and regulators

Proxy events were used in order to evaluate climate change risk using actual market events, as opposed to basing the study on a subjective analysis. However, in doing the study it became clear that the use of actual climate change related proxy events would provide several challenges, which are explained in greater detail further in this report. After several months of analysis, proxy events were identified for five out of the eleven loan sectors identified as potentially at-risk from climate change, but the results were ambiguous and did not support this study's hypothesis of a link between observed climate change related events and risk to bank loans. Therefore, the analysis of proxy events is reviewed in detail in the section describing the methodology of this study, but the proxy events selected are not included in the review of each loan sector.

Part II of this report reviews strategies that can be used by companies and banks alike to reduce the impact of climate change on their businesses. Specifically, Part II of the report provides a brief analysis of lender risk by debt product type, followed by a more detailed examination of specific lender strategies to mitigate environmental risk including climate change related risks. Ultimately, Part II culminates in recommendations for banks and regulators stemming from the report's risk analysis of each loan sector in the US and Canada.

PART I

Identifying Climate Change Risk within Bank Loan Portfolios

1. Review of Greenhouse Gas Regulation

Growing concern over the impact of anthropogenic greenhouse gas emissions has prompted the world community to address this pressing environmental problem. The following review of emissions reductions programs outlines both existing policies that are in place to limit greenhouse gas emissions, and policies that have been seriously considered for implementation in the US.

The purpose of surveying existing and pending greenhouse gas policies at the international, domestic, and regional levels is to provide a framework for measuring the potential policy impact of climate change on the bank loan sector. Today, there are no binding caps on greenhouse gas emissions in the US, and in Canada the Kyoto Protocol does not limit emissions until 2008. However, in order to evaluate risk, it is first necessary to determine what type of climate change policy may be implemented in the US in the near future, and to have an understanding of what is being implemented in Canada, including an indication as to the cost associated with reducing emissions.

1.1 International Greenhouse Gas Regulations

1.1.1 The Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC), signed in 1992, developed into the Kyoto Protocol, which was adopted in 1997. The Kyoto Protocol is a binding international agreement designed to stabilize greenhouse gas concentrations in the atmosphere through International Emissions Trading (IET). IET is a flexibility mechanism that allows international trading of nationally allocated carbon units, known as Assigned Amount Units (AAUs), with other credits created through the Kyoto Mechanisms, to be described below. Signatories of the Kyoto Protocol will delegate the allocation of their AAUs within their individual jurisdictions.

Signatories to the Kyoto Protocol are divided into Annex I countries (developed countries and economies in transition) who are bound to emissions reduction commitments, and non-Annex I countries (developing countries) that are not mandated to achieve emissions targets. The Kyoto Protocol came into force in February 2005, although the first commitment period for Annex I countries technically begins in 2008 and ends in 2012.

Greenhouse gas emissions reductions have the same impact on the global atmosphere regardless of where the reductions are achieved. Therefore, countries may meet their targets through a combination of domestic activities and the use of the Kyoto Mechanisms. The Kyoto Mechanisms, also known as the Flexible Mechanisms, are a more cost-effective way for Annex 1 countries to meet their targets and they assist developing countries in achieving sustainable development. There are three Kyoto Mechanisms: Joint Implementation (JI), the Clean Development Mechanism (CDM) and International Emissions Trading (IET).

Both JI and CDM are project-based mechanisms that involve developing and implementing greenhouse gas emissions reduction projects. Reduction credits created through JI and/or CDM projects are fungible. Joint Implementation (JI), under Article 6 of the Kyoto Protocol, allows Annex I parties to implement projects that reduce emissions in other Annex I parties, in return for emission reduction units (ERUs). These ERUs can be used to meet emissions targets under Kyoto. The Clean Development Mechanism (CDM), defined in Article 12 of the Kyoto Protocol, allows Annex I nations to implement project activities that reduce emissions in non-Annex I nations, in return for certified emission reductions (CERs). The CERs generated by such project activities can be used by Annex I nations to help meet their emissions targets under the Kyoto Protocol. This means that AAUs can be traded equally with ERUs or CERs (from JI and CDM projects, respectively). All of these various units may be bought and sold in the carbon market or banked for future use.

JI allows trades of credits between Annex I countries, whereas the CDM allows trades between an Annex I country and a non-Annex I country. The main benefits to countries hosting Kyoto Mechanism projects are the attraction of direct foreign investment, the transfer of technology, and the contribution the projects make to sustainable development. Finally, IET permits the direct trading of emission allowances between Annex I countries.

1.1.2 The Kyoto Protocol and the International Carbon Market

The Kyoto Protocol covers six greenhouse gases (CO_2, CH_4, N_2O, SF_6, PFCs, and HFCs) for which Annex I Parties have received binding emission caps during the period 2008 to 2012. Each Annex I country has its own reduction target ranging between an 8% reduction to a 10% increase in reference to the 1990 base year. For all Annex I countries, the average reduction commitment is 5.2%. As a result of the Kyoto Protocol mechanisms, an international market for trading emission allowances and credits has developed. Demand for emissions reductions currently exists within Europe, Canada, and Japan, and are projected to increase significantly over time.

1.1.3 Global carbon price forecasts

In the global carbon market, the six greenhouse gases that are primarily responsible for climate change are measured in units equivalent to one ton of CO_2, and are generically referred to as “carbon credits”. The value of one carbon credit at any point in time depends on the source of the credit, the counterparty of the credit, and the overall carbon market. As of May 2006, carbon credits were valued as follows:

Table 1: Carbon Market Prices (as of May 8, 2006)

Carbon Credit	€/tCO_2
EU Allowance Phase 1 (2006)	12.50
EU Allowance Phase 2 (2008)	20.50
CERs (guaranteed delivery)	15.00
CERs (buyer takes project delivery risk)	8.00
JI Allowances	7.00
VERs (Chicago Climate Exchange)	2.40
Average	**9.34**

(Source: Point Carbon, EcoSecurities)

Forecasting carbon prices is challenging, as the future price of carbon depends on several interdependent factors including the severity of policy agreements that cap emissions of greenhouse gases, population and economic growth globally, and technological developments. In addition, the price of carbon credits tends to be highly volatile, as recently evidenced by rapid changes in the price of allowances in the EU Emissions Trading Scheme (see chart below). At present, the most objective measure of future carbon credit prices are the EU Allowance futures prices, which trade on several European Exchanges. These carbon credit prices are relatively liquid, trading a notional volume of close to €100 million per day. As of early May 2006, futures for delivery of carbon credits in the EU Emissions Trading Scheme (EUAs) were trading at €20.50 to €22.00 for delivery between 2008 and 2012.

1.2 European Greenhouse Gas Regulations: EU ETS

In preparation for the 2008-2012 Kyoto Protocol compliance period, the European Union has established its own Emissions Trading Scheme (EU ETS) to help its member states meet their emission reduction targets. The EU ETS is the first large-scale policy implementation to restrict emissions of greenhouse gases. The EU ETS has two initial phases. The first phase started with the system’s inception in 2005 and runs until the end of 2007; the second phase will coincide with the first commitment period of the Kyoto Protocol, 2008-2012 (EU ETS second compliance period).

Under the EU ETS approximately 10,000 companies - representing nearly half the EU's greenhouse gas emissions in a variety of industrial sectors throughout Europe - will be allocated yearly emission allowances in their governments' National Allocation Plans (NAPs). These installations are required to reduce their emissions of CO_2 based on their allowances, or to buy more allowances to make up for shortfalls. In the event that an installation fails to meet its target and does not purchase allowances, it must pay a penalty fee of €40 in the first compliance period and €100 in the second compliance period, in addition to submitting the shortfall allowance in the following year.

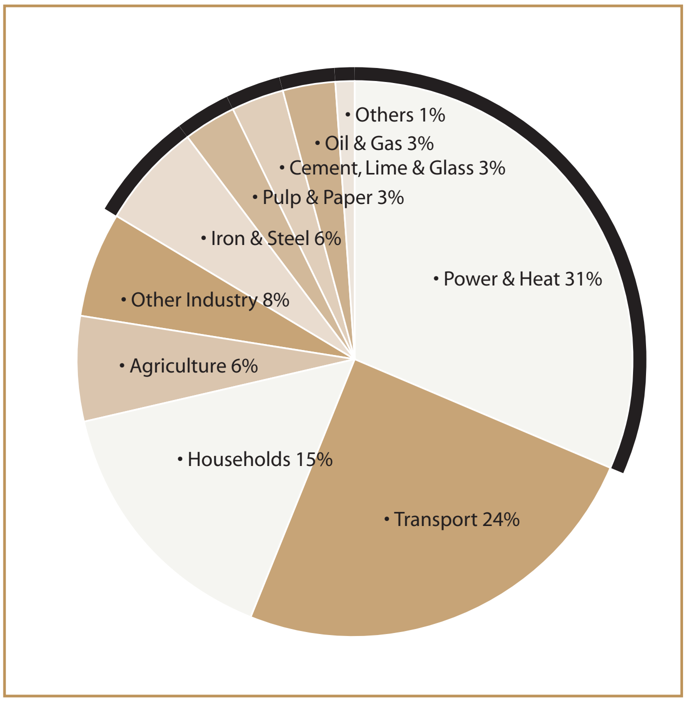
Since the EU ETS came into effect at the beginning of 2005, the price of allowances has been highly volatile, but the volume of allowances traded has grown significantly:

Figure 1.2.1: European Union Allowance (EUA) spot price since December 2004

(Source: Point Carbon)

The majority of the industrialized world is bound by the Kyoto Protocol and therefore will be affected by climate change regulation in one form or another. The EU ETS will be the main policy instrument via which the EU's Kyoto Protocol commitment will be imposed on the EU business community. For the first crediting period until 2008, the EU ETS will only target CO_2, the primary greenhouse gas covered under the Kyoto Protocol. As depicted below, the EU ETS will cover approximately half of the CO_2 emitting sectors, with power and heat being the primary industries targeted. Currently, there are no plans to incorporate the remaining industries into the scheme. Although this could change for the second commitment period it is unlikely that the remaining sectors (transportation and domestic households) will be included due to the complexity of implementing a cap-and-trade system in very decentralized and fragmented sectors.

Figure 1.2.2: EU ETS Sector Coverage



- EU CO_2 emission breakdown in Mt. 2000
- 100% = 3150 Mt
- Sectors included in the Directive

1.3 U.S. Greenhouse Gas Regulations

Although the US is not participating in the Kyoto Protocol, it is the largest global emitter of greenhouse gas, accounting for 28% of global anthropogenic emissions. In the absence of signing an international policy requiring emissions reductions, the US has implemented several "soft" policies at the federal level and select states have adopted more stringent policies within their borders. In addition to mandatory programs, a few US-based voluntary emissions reduction schemes have emerged to facilitate emissions reductions by companies anticipating US greenhouse gas caps in the future.

1.3.1 Climate Policy at the Federal Level

The Administration

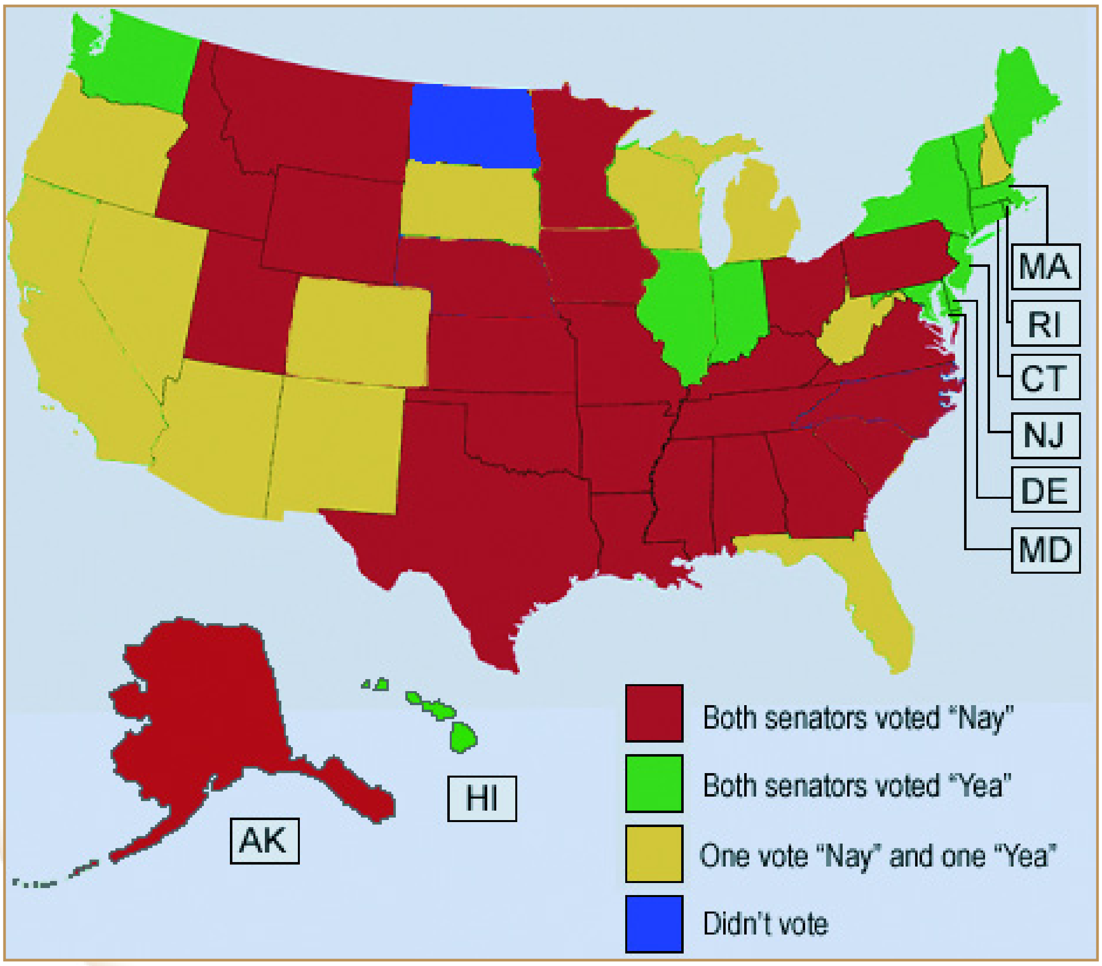
In February 2001, President Bush announced that the US would not be ratifying the Kyoto Protocol and would instead support voluntary emissions reduction plans. President Bush's plan endorses certain forms of greenhouse gas regulation that are based on greenhouse gas intensity metrics rather than absolute targets; the United States Global Climate Change Policy is to reduce the intensity of greenhouse gas emissions 18% from 2002 until 2012. The White House plan supports an emissions trading system, but foresees implementation after 2010, in the case that business does not achieve the desired metrics on a voluntary basis.

It is possible, given the historical precedent that second-term US Presidents act for posterity that the Administration may attempt to execute a mandatory greenhouse gas policy this term, however minimal. Any Administration-driven initiative would likely comprise an intensity target, attempting to make the US more greenhouse gas efficient by using gross economic output as a benchmark. Such a program would probably incorporate the liberal use of emissions trading. It can be expected that the Administration would advocate a very soft target that would not greatly alter the "business as usual" scenario. This is reflective in the recent agreement between the US, China, India, South Korea, Japan, and Australia, called the Asia-Pacific Partnership for Clean Development and Climate. The five-country agreement outlines non-binding emissions reductions intended to be created through efficiency upgrades and technology sharing. The inaugural meeting of the partnership was held in January 2006; eight public-private sector task forces were established to focus on technology and development related to key industry sectors. No future meeting dates have been confirmed.

Congressional Legislation

The number of climate-related legislative proposals has increased from the seven introduced in the 105th Congress (1997-1998) to 25 in the 106th Congress (1999-2000). The 107th Congress (2001-2002) introduced over 80 proposals while over 100 legislative proposals were introduced in the 108th Congress (2003-2004). Of the numerous legislative proposals in the US Congress since 1997, several supported components of an emissions constrained regime. However, none of the proposals for legislation regulating greenhouse gas emissions has passed. At this time, there has been significant – and bipartisan – support for the McCain-Lieberman Climate Stewardship Act. While the McCain-Lieberman bill was rejected in 2003, the relatively close defeat (53-46) demonstrated surprising bipartisan support for a comprehensive domestic climate change policy. The McCain-Lieberman bill was reintroduced in May of 2005 as the Climate Stewardship/Innovation Act and was again defeated, this time by a margin of 60 to 38. It is anticipated that another version of the bill will be proposed in 2006/2007. The following map shows support during the 108th congress (2003-2004).

Figure 1.3.1: US Legislative support or rejection of the McCain-Lieberman Climate Stewardship Act 2004



(Source: National Wildlife Federation)

The McCain-Lieberman bill would have limited greenhouse gas emissions from the electricity generation, transportation, industrial, and commercial sectors, which combined accounted for 85% of overall US emissions in 2000. The bill also specifically provides for the appropriate allocation and trading of emission allowances. The bill would cap the 2010 aggregate emissions level for the covered sectors at the 2000 level, with any sub-sectors exempted only by permission from the EPA Administrator. This target would be re-evaluated bi-annually to determine consistency with the UNFCCC greenhouse gas emissions reductions objectives. In the House of Representatives, an act similar to the McCain-Lieberman bill was introduced in March 2004; the Gilchrest-Olver Climate Stewardship Act presents a greenhouse gas emissions cap-and-trade system, beginning in 2010.

In June 2005, the Senate passed with a vote of 54-43, the Sense of the Senate on Climate Change, a non-binding resolution stating that Congress should enact legislation that would build a national program of mandatory, market-based limits and incentives aimed at reducing the growth in emissions of GHGs. Continuing in the Senate, in November of 2005, Senators Lugar and Biden introduced the Lugar-Biden Climate Change Resolution which calls for US participation in international climate change agreements.

Conclusions on the National Debate

The degree to which climate change moves up in the hierarchy of American political priorities over the next few years is unpredictable. It is not likely that the current Administration will produce climate change legislation that severely restricts emissions of greenhouse gases. However, given the enactment of the Kyoto Protocol, pressure from unilateral state actions (see below) and the increasing evidence of climatic anomalies within the US, it is not inconceivable that a bipartisan coalition could be formed over the next several years to adopt some form of federal climate change regulations. The US signing of the Asia-Pacific Partnership for Clean Development and Climate will not generate the same levels of emissions reductions as the Kyoto Protocol. However, the international agreement will undoubtedly stimulate discussions of further action by the US, and may lead to emissions reducing technologies needed in any future reduction scheme.

1.3.2 Individual State/Regional Activity

In light of minimal federal policy towards climate change, individual states have commenced development of their own initiatives. The majority of US states have already enacted climate change action plans and emissions inventories, an important step towards comprehensive reductions programs. Many of the current state programs are admittedly easy on greenhouse gas emitters in comparison with the Kyoto Protocol and largely represent symbolic dissent against federal non-policy. Nonetheless, a few of the state initiatives constitute substantial efforts. Massachusetts, Minnesota, and California are good examples.

In 2004, Massachusetts released a Climate Protection Plan with ambitious state emission reduction goals. Massachusetts' plan aims to reduce greenhouse gas emissions in the state to 1990 levels by 2010 and to 10% below 1990 levels by 2020. To reach these goals, Massachusetts will regulate emissions reductions in old power plants and create an emissions trading and banking system. Their program has mandated targets for 6 power plants that started on January 1, 2006. Minnesota also released a State Action plan focused on improving efficiency of the state's economy in the use of energy and materials to "slowly wean the economy from its dependence on fossil fuels and their associated greenhouse gas emissions." California passed legislation requiring new passenger vehicles and light duty trucks, beginning with model year 2009, to reduce greenhouse gas emissions. Compared to the 2002 fleet, emissions will be reduced by 22%, near term standards (2009-2012), and by 30%, mid-term standards (2013-2019). A number of states, including New York, Connecticut, Rhode Island, Vermont, Maine, Massachusetts, Washington, and Oregon have since passed or are moving to pass similar standards.

Twelve states launched lawsuits against the Federal government for neglecting to regulate greenhouse gas emissions. The suit by the states was rejected but the three judge panel was split and a number of the plaintiffs have moved for reconsideration. In addition, a separate subset of states (including New York, California, Iowa, and Wisconsin) have sued the five largest emitters - Cinergy Corp., Southern Company, Xcel Energy, American Electric Power Company, and the Tennessee Valley Authority (collectively responsible for about 10% of US total emissions) - under so-called "public nuisance" laws, seeking to force them to reduce their CO_2 emissions over the next ten years. The case was dismissed on the grounds that it was more appropriate for executive and legislative branches but the dismissal is on appeal.

Table 2 below provides an overview of different legislative actions in the various states. Overall, it shows a picture of divided attitude towards greenhouse gas policies. On the one hand, 29 states have a Voluntary Action Plan to fight global warming. On the other, 19 states have passed legislative bills against signing the Kyoto Protocol and/or limiting the state's ability to mandate CO_2 reduction.

Table 2: Overview of legislative actions at the state level

Actions	#	Which States
Passed Legislative Bills Supporting Kyoto Protocol:	1	CA (2002)
Attempted:	3	HI (2000), NM (1999), WI (2001)
Passed Legislative Action Initiating CO_2 Tax or Mandating Direct Reduction of CO_2:	5	CA (2002), CT (1990), MA (2001), OR (1997), WA (2002)
Attempted:	4	MN (1998), NH (2002), NY (2002), VT (1998)
Passed Legislative Action Limiting State's Ability to Mandate CO_2 Reduction:	5	AL (1998), KY (1998), OK (1999), WV (1998), WY (2001)
Attempted:	1	IA (2000)
Completion of Voluntary Action Plans by May 2004:	29	AL, AR, CA, CO, CT, DE, HI, IL, IA, KY, LA, ME, MD, MA, MN, MO, MT, NH, NJ, NM, NC, OR, PA, RI, TN, UT, VT, WA, WI
Passed Legislative Bills Against Signing Kyoto Protocol:	16	AL (1998), AZ (2001), CO (1998), DE (1998), GA (2000), ID (1999), IL (1998), IN (1998), MI (1997), ND (2000), PA (1998), SC (1998), SD (1998), UT (1998), VA (1998), WV (1998)
Attempted:	8	AK (1999), FL (1998), KA (1998), MD (1999), MO (1998), NV (1999), NM (1998,99), OH (1997)

(Source: EcoSecurities)

Regional Greenhouse Gas Registry (RGGR)

The creation of the RGGR marks an important step for the Northeastern States in their effort towards meeting their respective carbon emission reduction goals. A greenhouse gas registry is a necessary precursor to the larger goal of creating a functioning emissions trading system over the entire region. Northeast States for Coordinated Air Use Management (NESCAUM) designed the registry in accordance with the New England Governors-Eastern Canada Premiers Climate Change Action Plan in order to establish a baseline for emissions in the region. The registry works closely with the California Climate Action Registry and the World Resources Institute, from which it draws current information concerning climate change. Its long-term goals include mandatory greenhouse gas emissions reporting and establishing a regional clearinghouse.

Northeastern States Regional Greenhouse Gas Initiative (RGGI)

In April 2003, New York Gov. Pataki prompted a gathering of the eleven Northeastern and Mid-Atlantic states (including New York, New Jersey, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Maryland, and Pennsylvania) to discuss issues surrounding climate change. Specifically, the discussions were geared at creating a regional cap-and-trade program for the CO_2 emissions from power plants. All of the states responded, although Maryland and Pennsylvania only in the capacity of observers. Participants see the Greenhouse Gas Initiative as a mechanism by which they can meet their individual goals of GHG emission reductions, as each member state has independently outlined some measure of future GHG emission reduction. The governors of seven Northeastern states signed the Regional Greenhouse Gas Initiative (RGGI) Memorandum of Understanding in December 2005. Under RGGI, greenhouse gas emissions will be stabilized at current levels from 2009 until the start of 2015 and then reduced by 10% by 2019. RGGI allows for emissions offsets and for the banking of allowances. Additionally, each state has committed to working towards improved energy efficiency, decreasing the use of higher pollution electricity generation and encouraging the development of clean technology, while maintaining economic growth.

Private Sector Initiatives

In addition to State initiatives, there are several private sector initiatives seeking to develop frameworks for future emissions restrictions and transaction systems within the United States, most notably the Chicago Climate Exchange. The Chicago Climate Exchange (CCX) is a clearinghouse that combines elements of both voluntary and mandatory emission caps. Initial participation in the exchange is voluntary and principally aimed at major corporations in the US that seek to demonstrate climate responsibility. However, in order to participate in the CCX, companies must commit to an annual reduction of one percent of CO_2 emissions based on a 1999 baseline. The first "compliance" year was 2003 and the four-year experiment will run through 2006. The aggregate baseline for the current program participants (as of May 14, 2004) was 227 million tonnes, meaning that the annual reduction target is approximately 2 million tonnes per year.

The CCX has attracted a group of well-known US and international corporations, including Ford, American Electric Power, Dupont, IBM, Dow Corning, Rolls Royce, International Paper, and Stora Enso. However, the difficulty with assessing CCX as a market mechanism is that it is fundamentally a voluntary effort. The voluntary nature of the CCX is reflected in the low price and small volume of credits traded on the Chicago Climate Exchange.

1.4 Canadian Greenhouse Gas Regulations

Canada has a distinctly different situation from the US in regards to climate change management, having ratified the Kyoto Protocol. Under the Kyoto Protocol, Canada has set a target to reduce greenhouse gas levels by 6% below 1990 levels between 2008 and 2012. The results of Canadian climate change policy will also be very important for US industry as the US is tied to Canada in business and trade.

In 1990, Canada's emissions amounted to 596 million tonnes, signifying that their 2008-2012 Kyoto target requires that emissions decline to 560 million tonnes. Canada's recent economic growth will make compliance more difficult. Between 1990 and 2003 the Canadian GDP has grown by 43%, while emissions were 24% above 1990 levels over the same period of time. Despite the government's allocation of funds for offsetting reduction initiatives and compliance costs, Canada has stalled on certain aspects of the action plans by moving slowly to implement concrete programs and policies. The Canadian government spent CAD$850 million to address climate change between 1995 and 2000. In addition, between the Action Plan's development in 2000 and 2005, about CAD$1.1 billion has been allocated for climate change.

In 2005, a revised action plan called Project Green was unveiled. The plan outlined federal investments, in addition to those listed above, at CAD$10 billion through 2012. The financing is designed to reduce emissions by roughly 270 million tonnes annually in the period 2008-2012. The proposed funds created by the Canadian government to facilitate emission reductions are as follows:

- Clean Fund (renamed the Climate Fund in the Action Plan): minimum funding of CAD$1 billion;
- Partnership Fund: CAD$250 million, with the possibility that funding could grow to CAD$2–$3 billion over the next decade;
- Renewable Energy: CAD$200 million for the Wind Power Production Incentive, CAD$100 million for the Renewable Power Production Incentive and CAD$300 million for tax incentives for efficient and renewable energy generation;
- Programs: CAD$2 billion for existing climate change programs.

However, a subsequent change in government has put Project Green into question.

1.4.1 Large Final Emitter System

Canada's 2005 climate change plan also offers a revised version of the Large Final Emitter (LFE) system proposed by their 2002 Climate Change Plan. The objective of the LFE system is to secure emission reductions from Canada's largest emitters through a market-based system that is also in line with the government's Smart Regulations. Under the 2005 action plan, Canada's LFEs include 700 companies in the following sectors: mining and manufacturing, oil and gas, and thermal electricity. These industries cover almost 50% of Canada's greenhouse gas emissions, and comprise a substantial component of the Canadian economy.

Under the 2005 Plan, the proposed target reduction for LFEs is 45 Mt (Megatonne), which is equivalent to 39 Mt based on the baseline from the 2002 Plan, which set the target at 55 Mt. The target was revised to account for the emissions of fixed processes, which cannot be curbed using Canada's existing technology. In addition, the 45 Mt goal is a "firm target" backed by a compliance regime, which was not provided for in the 2002 Plan. In percentages, the 2005 Plan proposes that fixed process emissions receive a 0% reduction target, and that other emissions receive a 15% target subject to no sector target being greater than 12%.

Canada's 2005 plan introduces a series of market-based mechanisms aimed at facilitating companies' greenhouse gas reductions at a cost not exceeding the CAD$15 per tonne price cap proposed by the government. The mechanisms through which LFEs could meet their targets include:

- Investment in in-house reductions, e.g., energy efficiency upgrades to companies' operations and technologies;
- Purchase of emission reductions from LFE companies with a surplus;
- Purchase of credits from a non-LFE which implements a project that reduces domestic emissions;
- Purchase of international credits qualifying under the Kyoto system;
- Purchase of permits from the federal government at CAD$15 per tonne. (This $15 cap is known as the "Price Assurance Mechanism" and these permits can be referred to as "PAM Units");
- Investment in domestic offset credits.

In addition to these options, LFEs would be able to receive credits from investments in the recently approved greenhouse gas Technology Investment Fund, whereby investments into technologies that can reduce greenhouse gas emissions will entitle LFEs to permits at the same rate of CAD$15 per tonne.

Canada has committed to a regulatory approach to LFE emissions for a number of reasons. The plan will help place Canada in the emerging carbon markets. It will also increase energy efficiency and encourage greater reliance on renewable energy and less on fossil fuels. Furthermore, the plan will diversify Canada's energy mix and bolster the country's energy security.

Under the 2005 Action Plan, linkage between the LFE system and the flexible mechanisms proposed by Kyoto--CDM and JI--can happen in two ways:

- LFE purchase of Kyoto credits to comply with domestic regulations;
- Climate Fund purchase of such credits to assist with Canada's compliance of the Protocol.

LFEs can obtain Kyoto-qualifying credits by implementing CDM or JI projects and/or purchasing such credits from project developers. Only the international credits obtained by LFEs which are "real and verified emission reductions" will be recognized. The Climate Fund will utilize similar criteria for investment decisions, but will also consider additional factors including whether the project applies Canadian technology or expands Canada's trade.

1.4.2 Permit Trading System

The Canadian government has proposed a trading system to be implemented under the Canadian Environmental Protection Act (CEPA). The following points would be included in the proposed domestic trading system:

- Large Final Emitters with a surplus of credits would be able to sell excess credits to LFEs with a shortfall;
- LFEs would maintain a compliance account;
- Non-LFEs would be able to participate, but would be required to maintain a trading account;
- The federal government would manage a "registry" for the official issuance, holding and transfer of permits for LFEs;
- The registry would not be used to facilitate trading of credits;
- Permits would only be transferred from one account to another;
- The federal government would hold a "LFE Remittance," into which LFEs would remit permits to demonstrate compliance;
- Procedures would be required to link the CDM and JI credits obtained by LFEs with the proposed registry.

1.4.3 Offset System

Canada's 2005 Plan also offers an "Offset System", which encourages the cost-effective domestic reduction or sequestration of greenhouse gas emissions not covered by CO_2 regulations already endorsed by the federal government. Numerous opportunities exist for the implementation of offset projects in Canada, such as:

- Developers who incorporate renewable energy elements in the building of new divisions;
- Farmers who adopt low-till practices which sequester CO_2;
- Electricity or gas utilities that implement demand side management (DSM) programs which result in reductions in energy consumption by their customers;
- Forestry companies investing in reforestation;
- Municipalities that implement methane capture and destruction activities from their landfills;
- Companies that implement programs encouraging employee use of public transportation;
- LFE companies that reduce greenhouse gas emissions from activities not covered by LFE regulations.

Under this system, individuals, businesses and organizations will be able to earn offset credits through the implementation of projects that yield greenhouse gas emissions reductions or removals which are additional to those which would have been achieved under "business as usual" conditions. The offset project cycle is similar to the cycle that occurs within the Clean Development Mechanism of the Kyoto Protocol; validation and registration of the projects, verification of the emissions reductions, and deposition of the credits into the proponent's account in the Canadian Carbon Unit Tracking System (CCUTS). Participants in this offset system can either retire their "verified" offset credits or sell them to companies under the LFE system, to the Climate Fund, or to other domestic buyers.

In August 2005, the Canadian government released and requested feedback on an "Overview Paper", which sets out the overall policy context and the proposed principles and rules for the Offset System, and a "Technical Background Document", which comprises a detailed proposal for endorsing such rules. The release of these documents is part of an open consultation process with all the stakeholders from the range of organizations and sectors that might participate in this Offset System. These open consultations are a critical component of the design process of the offset system.

1.4.4 Policy Uncertainty

Political disagreements and a recent election have put Canada's plan in jeopardy. Conservative Party leader Stephen Harper was elected Prime Minister of Canada in January 2006 and Harper has stated that he would not fulfill Canada's current Kyoto Protocol commitment. On the other hand, the Conservative Party has formed a minority government and the other parties with elected representatives have demonstrated that they will honor the Kyoto Protocol commitments, so it is doubtful that Canada will withdraw from the Kyoto Protocol. In May 2006, the federal Environment Minister, Rona Ambrose, proposed long term goals that look ahead 50+ years and has stated that the government is working on regulations to control greenhouse gas emissions from heavy industry.

1.5 Review of Greenhouse Gas Regulation: Conclusion

The key issue in relation to greenhouse gas regulation in North America is the probability and likely structure of a policy limiting GHG emissions in the United States. Recently, Canada's newly elected government has raised concerns about changes to the Action Plan proposed by the previous government. For the purpose of this study, in which all climate change related risk is the primary consideration, it is assumed that a cap on GHG emissions will be enacted in the US within several years, and that Canada will continue to attempt to meet its Kyoto Protocol obligations. The reason for these assumptions is to allow an analysis of the existing financial structure of loans and leases and the repercussions of climate change. Furthermore, it is highly probable that any system enacted in the US will have the following characteristics:

- Cap and Trade – a US-based emissions policy will almost certainly use a combination of emissions caps and mechanisms for trading among capped entities. This conclusion derives from the success of the cap and trade program for sulphur dioxide under the US Clean Air Act, and the implementation of cap and trade in both the Kyoto Protocol and the EU ETS.
- Multi-Sector and Multi-gas – given the complexity of climate change, and the science demonstrating that multiple gases, not just CO_2, are responsible for global warming, it is highly likely that a US program will cover multiple industrial sectors and several gases, as US industry has already demonstrated significant success at reducing emissions of several greenhouse gases, including methane and PFCs. As with the EU ETS, caps may not be initially imposed on the transportation sector, simply due to the difficulty in enforcing emissions coming from decentralized sources.
- Gradual Phase-In – although the science behind climate change appears increasingly robust, and the emissions of greenhouse gases continue to climb at an accelerating pace, climate change remains a long-term problem that is best tackled with long-term solutions. Therefore, it is highly likely that a US emissions program would allow for a gradual phase-in, to provide industries with the time to adjust without severe economic dislocation. The Kyoto Protocol provides participating countries with several years of phase-in, and this will likely be structured similarly in the US.

In summary, a US-based greenhouse gas emissions program is likely to hold many similar or mirrored aspects of both the Kyoto Protocol and the EU ETS, both of which include mechanisms to reduce the cost for participants. The intricacies of the policy may vary, but the goal of the most cost effective reduction will be present.

2. Study Methodology

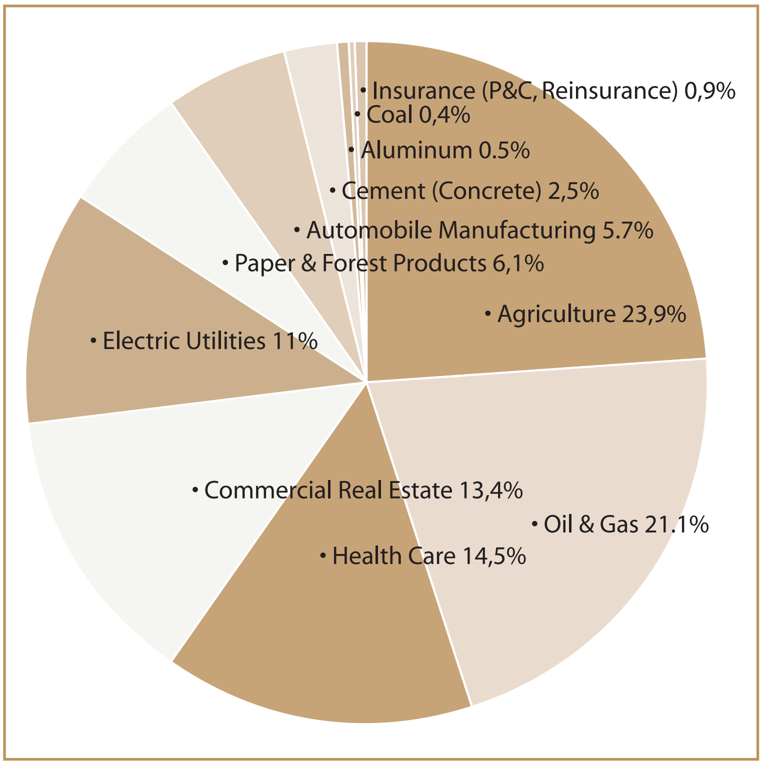
This study was based on the hypothesis that a statistical correlation exists between the creditworthiness of bank loan portfolios and climate change related events. The methodology employed by this study to test that hypothesis was to (i) identify specific sectors that may be at risk from climate change and to collect bank loan and lease data on those sectors, (ii) evaluate each sector on four potential risks – physical risk, input price risk, output price risk, and policy risk – resulting from climate change, and (iii) select "proxy events" to provide a real-life example of climate change related events that may have impacted the credit quality of borrowers. Each of these steps is described more fully below.

2.1 Step One: Loan Data by Sector

The loan sectors analyzed in this report are limited to those at risk in the context of climate change and potential greenhouse gas emissions caps in the US and Canada. The sectors selected are addressed independently because they are each impacted in different ways by the risk variables. Therefore, not all loan sectors will have the same risk variables analyzed. The risk variables outlined are those deemed most important for that sector. This does not indicate that other risk variables might not be affected. Some sectors are dependent on other industries and are therefore vulnerable to risk variables on two levels. To illustrate the cumulative effects of risk variables on specific sectors, this study addresses the energy sectors first, and sectors that utilize energy as an input second. Next, the analysis covers other interdependent sectors like the aluminum and the automobile industry, which uses aluminum to produce vehicles. The at-risk loan sector analysis concludes with sectors that are independently affected by climate change.

The banks participating in the study provided data for each sector analyzed. Specifically, each bank provided the value of their portfolio for loans and leases. Within the value of the portfolio, the banks calculated a weighted average maturity and stipulated the maximum maturity for each sector. References to this data will appear throughout the report. The values have been aggregated to both protect the anonymity of the information and to allow a more accurate analysis of the overall lending risk associated with climate change. The pie chart below represents the breakdown of the total at-risk portfolio determined by data submitted by Bank of America, CIBC, Citigroup, Scotiabank, and TD Bank Financial Group.

Figure 2.1: Breakdown of sectors at risk to climate change by percentage of total at-risk portfolio



2.2 Step Two: Climate Change Risks

This report analyzes 11 loan sectors and the risks of climate change that these sectors face. The risks associated with climate change are divided into four risk variables; policy risk, input price risk, output price risk, and physical risk.

2.2.1 Policy Risk

Policy Risk refers to the risk associated with climate change policy implementation or potential new regulatory actions. As concern over the impact of global climate change mounts, pressure for countries to reduce anthropogenic emissions increases and new policies regulating greenhouse gases may be adopted within the US and Canada. Climate change policies that cap greenhouse gas emissions may adversely affect loan portfolios. A GHG emissions reduction policy implies added costs of compliance associated with either adopting new technology or trading emissions credits. However, the impact of new climate change policies on loan clients will vary considerably.

The impact of climate change policies will depend on several factors. First, the structure and rigidity of the policy itself will determine the level of investment or penalties that borrowers incur. Second, the specific sector within which the borrower operates will also determine their vulnerability to an emissions regime. Finally, the preventative actions, or lack there of, that a borrower has taken prior to the policy's implementation will put them at an advantage or disadvantage accordingly.

With respect to how specific sectors or companies within sectors may respond to an emissions regime, a considerable amount of variability is anticipated, as different sectors will be affected disproportionately. This is especially true in a scenario in which not all consumers of goods are regulated equally. The aluminum sector, for example, will be significantly impacted by any emissions controls because of the processes inherent to aluminum production. Any aluminum plant operating under an emissions cap may be forced to purchase fossil-fuel-generated electricity at a higher cost to reduce the emissions they produce in the smelting process. Conversely, other sectors like health care may only experience adverse effects of emissions caps indirectly and are unlikely to be significantly impacted.

2.2.2 Input/Output Price Risk

The input and output price risks that a sector faces under an emissions cap and trade regime are defined by prices. Under an emissions cap, the prices for specific inputs and outputs are likely to change, impacting the highlighted sectors to varying degrees as well as other sectors not mentioned in this report. Input prices refer to the prices of the input materials that a sector utilizes in order to produce its product. The coal industry, for example, classifies the cost of extracting coal from the mine as its primary input cost, and revenue from the sale of coal to the utilities as the output.

In general, output prices for the energy sector are likely to increase with emissions caps that mandate technological advancement. Because energy is an important input for industrial production, increases in its price will affect manufacturing costs. Changes in both input costs and output revenue present a climate change related risk to borrowers. Likewise, output revenues can catalyze a fall in demand for a specific industry's product. The specific affect of changes in input costs and output revenue because of climate change will be highlighted in the specific sectors that follow.

2.2.3 Physical Risk

Physical risk is a direct product of climate change and often describes the risk associated with extreme weather systems in the form of hurricanes or floods. Physical risk can also refer to less pronounced changes to the physical environment as a result of climate change, such as drier climates in different regions or increased amounts of CO_2 in the atmosphere. While extreme weather systems may have the most immediate impact on borrowers, slower physical changes such as a gradual increase in ocean temperature can also have lasting negative effects.

The sectors that are most vulnerable to extreme weather systems are commercial real estate in high-risk locations and energy companies, which often site oil rigs and refineries off coasts. Slower, less pronounced physical climatic changes may negatively impact agriculture in the Southern US and positively impact it in the Northern US and Canada. However, the time frame within which the physical changes occur, the flexibility of the sector to respond, and the degree of change will affect the sector's ability to absorb the changes or compensate for the variation.

2.3 Step Three: Proxy Events to Measure the Impact of Climate Change

The methodology of this study is to use data from a group of North American banks to evaluate whether bank loan portfolios face risk as a result of climate change. To measure risk, the study evaluated sector risks while also assessing loan data on the amount and length of loans. The researchers also selected several "proxy events", each of which represents an actual climate change related event. However, the use of proxy events turned out to be challenging to identify and to measure, with two specific problems.

The first challenge in employing proxy events was that there were very few events that occurred in North America. Therefore this study primarily examined proxy events in Europe, especially the EU Emissions Trading System, which caps emissions of greenhouse gases on approximately 10,000 companies. Although there are clear differences between European and North American companies, it was felt that the economies are close enough that a climate change policy in Europe may be a reasonable proxy for the impact of a policy on companies in the US and Canada.

Second, loan pricing and spread data is not publicly available for the sectors at risk to climate change. Therefore, this study relied upon bond spread pricing, utilizing data from publicly traded bonds. A company's bond spread is the percentage point differential between the yield on the company's bonds, and the yield on a risk-free bond of the same maturity. Bond spreads generally provide a fair representation of the credit quality of a company, and events that change credit quality will almost immediately be reflected in a company's bond spread (specifically, bond spreads widen, or increase, as credit quality deteriorates, and vice versa as credit quality improves).

An example of the use of proxy events is described below:

2.3.1 Proxy Event: Electric Utilities Sector

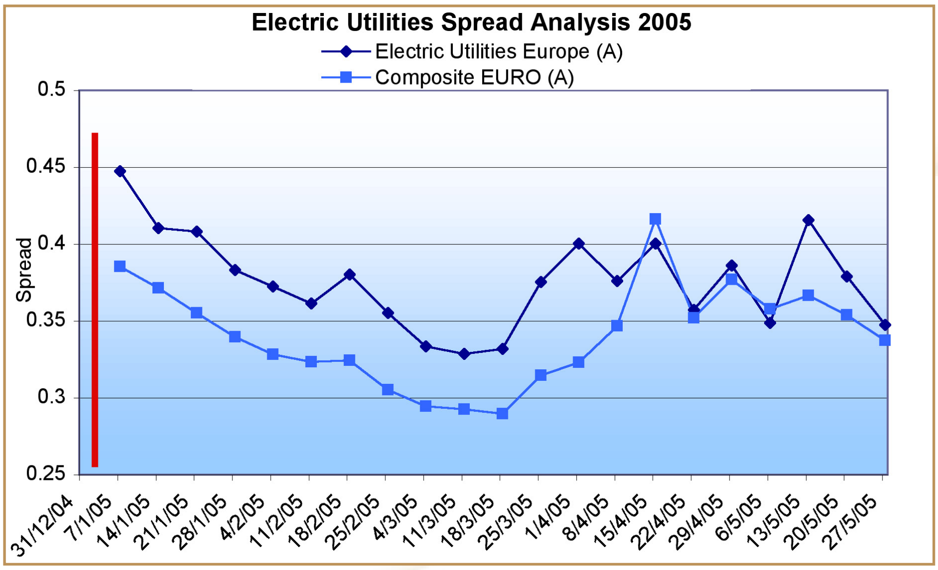
The European Union enacted caps on the emissions of CO_2 as part of the EU Emissions Trading System. Caps were imposed beginning January 1, 2005, and were widely forecasted by market analysts to put a heavy burden on European electric utility companies. This study used the enactment of the EU ETS as a proxy event for the impact of climate change policy on a bank loan sector. Specifically, the following analytical steps were performed:

(i) An appropriate interest rate bond spread was selected to represent the electric utility sector in Europe. This data was obtained from Bloomberg, which maintains a sector composite spread.

(ii) The selected spread was compared to a benchmark index spread, in this case the average spread for 10 year European bonds rated single-A. This index was used because the bonds in the Bloomberg electric utility index have a maturity roughly equivalent to 10 years, and an average rating of single-A.

(iii) A time period was selected for the spread analysis. In this case, the time period selected was the first 6 months of 2005, representing the period during which the price of allowances in the EU ETS climbed from €8.37 to Euro 25.25. Since the European electric utility sector had caps on emissions during 2005, it was hypothesized that a rapid increase in the price of allowances to meet those caps would negatively impact those companies, and that this would be reflected in the bond spreads of European electric utility companies over that period of time. The rapid increase in the price of allowances was not foreseen by analysts when the EU ETS began on January 1, 2005, and the rising price of allowances added to the expected cost of compliance for utilities in Europe. Therefore, this period of rising allowance prices can be viewed as a potentially negative event for European utilities.

Figure 2.3.1: Electric utilities bond spreads calculated using a 10-year European electric utility (A-rated) bond yields over a 10-year European Sovereign Benchmark (AA). Composite European spreads calculated using a 10-year European Composite (A) index over a 10-year European Sovereign Benchmark (AA). Yields were plotted starting from the enactment date of the EU ETS, as indicated by the red line.



(Source: Bloomberg 2005)

In this study's spread analysis, the proxy event is indicated by the red line. The results of the spread analysis, seen in the graph above, indicated there was no correlation between the imposition of the EU ETS and the spreads on electric utility corporate bonds in Europe. In fact, the bond spread of affected electric utility companies narrowed slightly during the period evaluated, contrary to this study's hypothesis. This implies that the bonds in the electric utilities sector were not sensitive to this particular policy implemented to mitigate climate change, or that the risk was not reflected in the bond pricing It is also plausible that the bond pricing did not capture the change in risk during the time period analyzed, and that selecting a longer time period may have demonstrated a change in bond spreads. However, the first six months of 2005 was the period during which the price of emissions in the EU rose at the sharpest pace, thereby significantly increasing the cost of compliance for European utilities.

2.4 Study Methodology: Conclusion

Proxy events were studied for five out of the eleven "at-risk" sectors in this report, covering both policy events and physical events related to climate change. In every case, the results did not find a correlation between bond spreads and the proxy event, and therefore did not support the hypothesis of this report. This does not necessarily indicate that the bank loan sectors identified do not have any climate change related risk, but simply that this study was unable to find a statistically significant link between current climate change related events and bond spreads for those sectors.

In conclusion, the use of proxy events did not provide any insight into climate change risk for each of the chosen sectors. As the proxy event analysis did not provide any conclusive results, it has not been included in each of the following sector analyses. Instead, the following section of this report evaluates each of the 11 at-risk loan sectors by examining several other risk parameters.

3. Loan Sector Risk Analysis

3.1 Coal Industry

3.1.1 Snapshot

Coal is the main source of fuel for US electricity generation and an important component, although to a lesser degree, of Canadian power generation. Its use represents 51% of electricity generated power in the US and 16% in Canada. Coal represents such a large percentage of electricity generation in the US because of the relatively low cost of coal mining, combustion, and facility construction compared to natural gas and other alternative fuel sources. The relative costs of installed capacity as well as the CO_2 emitted for given amounts of electricity generated are illustrated below.

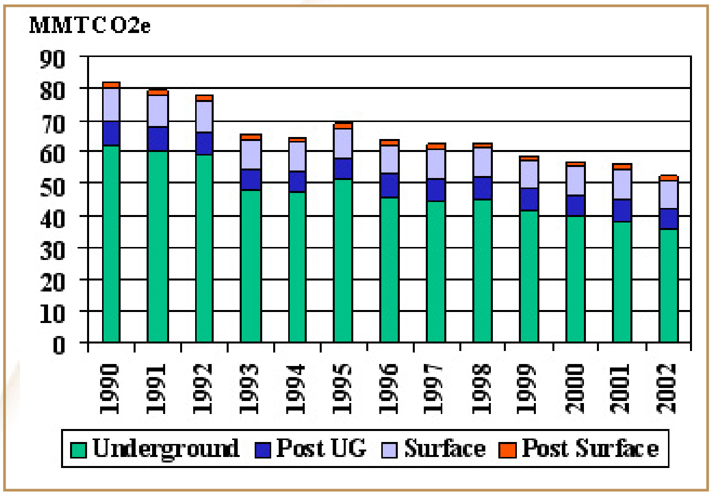
Table 3: US CO_2 emissions created during electricity generation and subsequent costs of installed capacity including government subsidies

Fuel Source	CO_2 per kWh (metric tonnes)	Cost of Installed Capacity per kWh (US$)
Coal	1,020	0.0185
Natural Gas	606	0.0406
Oil	758	0.0441
Nuclear	N/A	0.0171

(Source: EPA, NEI)

Another less recognized greenhouse gas emitted by the coal industry is methane, which is liberated during the mining process. Methane is a hazardous byproduct and must be vented out of the mine, forced into adjacent seams in nearby mines, or captured for use in degasification systems. Although coal sector emissions policies usually focus on the CO_2 generated during combustion, methane gas strongly impacts climate change as it is 21 times more damaging to the atmosphere than CO_2. The chart below illustrates the methane emissions associated with coal mining:

Figure 3.1.1: Total emissions (million metric tonnes of CO_2 equivalent) of methane generated during coal mining



(Source: EPA)

The EPA's Coalbed Methane Outreach Program (CMOP) addresses methane emissions. Since 1994, CMOP has facilitated the capture of 308 billion cubic feet (Bcf) of coalmine methane (CMM). Using the global warming potential of methane, this is equivalent to removing 124 million metric tonnes (MMT) of CO_2 from the atmosphere. The chart above depicts the reductions accomplished from 1990 to 2003. Looking at 2003 levels, CMOP has led to the reduction of coal bed methane by 34%. More research and development of methane capturing technologies could further reduce emissions levels of both operational and abandoned coalmines.

3.1.2 Coal Industry Exposure to Climate Change

Policy Exposure

Capped greenhouse gas emissions may affect the coal industry in two ways. First, caps on greenhouse gas emissions may lead to a decrease in demand for high CO_2 emitting fuels like coal. Second, the need to capture fugitive methane emissions will increase the cost of production. Capped greenhouse gas emissions may become a catalyst for the development of new technologies or fuel switching away from coal. In Canada, the Kyoto Protocol may have less of an effect on the coal industry as it would in the US, because coal is a much smaller component of Canada's electricity generation portfolio.

Fuel switching away from coal towards a cleaner fuel source is a likely scenario under emissions restrictions. Coal's closest substitute, natural gas, is more expensive than coal but the difference in emissions of CO_2 may reduce its price relative to coal in a carbon-constrained world. Increased input costs aside, fuel switching would be relatively easy as natural gas can be burned at coal power stations. Conversely, coal cannot be burned at natural gas stations. This is important as natural gas and coal prices will oscillate with supply and demand. If additional coal facilities seek to buy natural gas in the future, the price of coal may decline significantly and adversely impact the coal industry. However, it is unlikely that the US or Canada will abandon coal plants entirely because natural gas stations do not afford power companies the same luxury of freely substituting coal and natural gas. In addition coal is a cheap fuel source and is very abundant within the US.

Output Prices

The price of coal in a cap and trade regime and the possible technology implementation costs may have a large effect on the industry. In 2004, coal (1.90 cents per kilo-watt hour) was less expensive than natural gas (5.87 cents per kilo-watt hour) but, in the future with added regulations on CO_2 emissions the price of electricity from coal may rise beyond that of natural gas. On the other hand, coal could regain demand within the US if more advanced clean coal technologies become cost competitive. In Canada, to date there has not been any large-scale fuel switching away from coal, following the ratification of the Kyoto Protocol.

3.1.3 Loan Data: Coal Sector

Bank data collected for the coal sector illustrates that the average weighted maturity of 2.10 years was short compared to the entire at-risk portfolio. In addition, coal represents the smallest percentage of sectors in the at-risk portfolio.

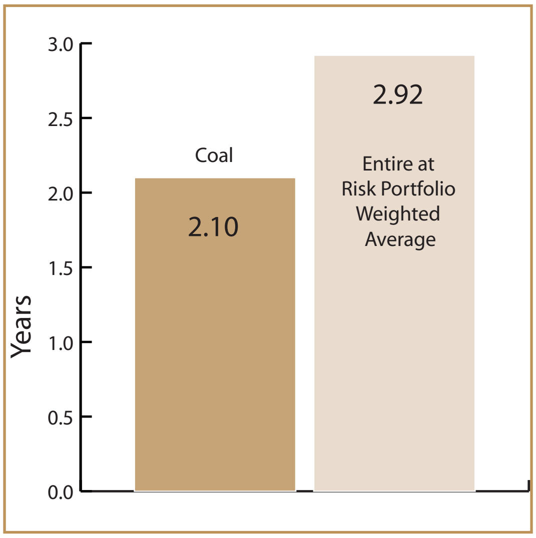


Figure 3.1.2: Maturity comparison of loans and leases for the coal sector and the entire at-risk portfolio

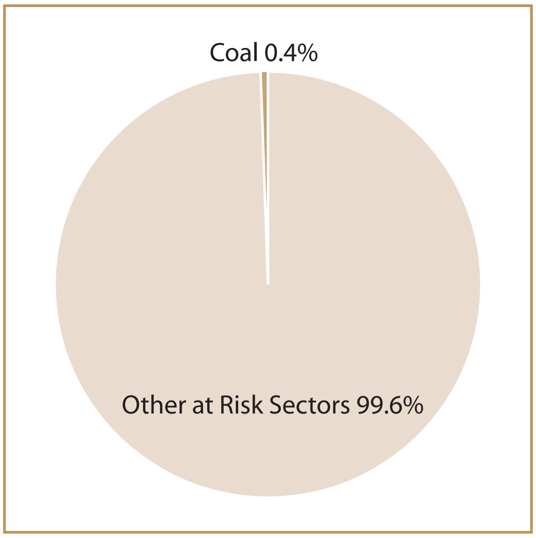


Figure 3.1.3: Loans and leases to the coal sector make up a very small percentage of the total portfolio

Risk to banks making loans to the coal sector appears to be minimal, despite the sector's exposure to climate change related risks. Specifically, the coal sector is clearly exposed to policy risk, as it is a significant source of GHG emissions, and to output price risk, as the price of coal may decline in an emissions-capped environment. However, the weighted average loan maturity to the coal sector is so short and the percentage of loans within the at-risk portfolio is so small, that the overall risk to banks exposed to the coal sector is minimal.

3.2 Oil & Gas

3.2.1 Snapshot

The US and Canadian oil and gas industries are at a crossroads with respect to climate change, as climate change regulation may lead to decreases in oil demand and increases in demand for lower emitting natural gas. The oil and gas industry generates greenhouse gas emissions at several different stages. The chart below outlines the stages during which the oil and gas industry produce greenhouse gas emissions.

Table 4: Greenhouse gas emissions tracked during the refining/drilling processes for oil and gas

Root Process	Emissions Source	GHG
Direct emissions (Exploration / Production operations)	Fuel combustion	CO_2, N_2O
	Fugitive emissions	CH_4
	Flaring	CO_2, N_2O
	Formation CO_2	CO_2
Direct emissions (Oil Products operations)	Fuel combustion	CO_2
	Refinery H_2 production	CO_2
	Other refinery emissions	N_2O_3, CH_4
Direct emissions (Oil Sands operations)	Fuel combustion	CO_2, N_2O
	Flaring	CO_2, N_2O
	H_2 production	H_2
Indirect emissions	Purchased electricity	CO_2

(Source: Shell Canada)

Some crude oil drilling facilities, responsible for vented emissions, are exploring solutions. One method of oil extraction, called advanced oil recovery, can serve the dual purpose of efficiently extracting oil and mitigating greenhouse gases simultaneously. When an oil well is almost exhausted, advanced oil recovery injects gases or fluids into the oil well in order to increase pressure and force out the last drop of oil. During the initial stages of oil extraction, the differential pressure of the well and the earth's surface force oil to flow without any extra/applied pressure. However, once the reserve equalizes with the atmosphere the oil must be pushed out with a denser material or gas to force the oil to surpass gravity and exit the reserve.

By pumping greenhouse gases – most commonly CO_2 – through advanced oil recovery the last retrievable oil can be extracted and the greenhouse gas can be removed from the atmosphere. It is also possible to cap the empty reserves, trapping the greenhouse gas inside. The challenges of employing greenhouse gases in advanced oil recovery include the high cost of converting various forms of CO_2 into the appropriate form and the proximity of the oil wells to the facilities producing gas/liquid CO_2. More research and development is still necessary to make this process more economically attractive and ensure that there are no long-term problems with storing greenhouse gases in the empty reserves.

3.2.2 Oil and Gas Exposure to Climate Change

Policy Exposure

Oil companies in Canada will likely be required to reduce emissions or purchase carbon credits in the market while US companies do not yet face GHG emissions caps. Nevertheless, US companies, with a few exceptions, are becoming less opposed to future emissions regulations. Some see the potential for long-term gains under rules that push technological advancement in both oil recovery and combustion processes. In addition, future constraints on oil and coal could induce consumers to increase their use of LNG and natural gas, both of which are heavily invested in by the oil and gas industry.

Output Prices

Because natural gas emits relatively low CO_2, demand is projected to increase under GHG regulations. The interesting question in this regard is whether the supply of fuel will be able to meet demand, and if the price will make its use unattractive. Conversely, if the price becomes prohibitively high for consumers, it could lead to demand for newer technologies and improvements in efficiency at existing plants. If supply of natural gas does not meet future demand due to greenhouse gas regulations, the price of natural gas may increase significantly relative to the price of oil.

Physical Exposure

The location of much of the infrastructure of the US oil and gas industry may put the sector at significant risk from climate change. A large proportion of US oil and gas rigs as well as refineries are located in the Gulf of Mexico and the South eastern US. Coincidently, these are also the regions that are increasingly susceptible to both climate change induced sea level rise and increased strength of hurricanes and other natural events, although these are long-term risks.

Tropical storms in the South eastern US and their effect on production levels are gaining more attention. Hurricanes in the Gulf have forced the closure of drilling platforms and damaged facilities. Following hurricanes Katrina and Rita, US susceptibility to disruptions in oil reserve refining and drilling has become more evident. Consumer prices spiked as questions of capacity arose. Considering the high risk to refinery and drilling processes in the South eastern US, the safety of planning and constructing future LNG facilities in the same region is questionable. New LNG facilities situated offshore will be susceptible to the same climate change risks of severe weather systems that oilrig platforms face. This could impact lending if facilities are forced to rebuild following storm activity or if their insurance premiums increase.

Yet another physical threat to the US oil industry lies in the projected sea level rise associated with climate change. The locations of existing drilling, refining, and many proposed LNG facilities are within the potential sea level rise regions (Florida, Texas, and Louisiana), even at limited sea level increases. This is a much smaller threat for the Canadian oil and gas industry.

There are also other physical issues that affect the oil and gas industry outside of the tropical regions. One example is the potential melting of the Alaskan permafrost. If the predicted melting levels actually occur, it may cause the collapse of the northern half of the Alaska pipeline through which approximately half of all US production flows.

3.2.3 Loan Data: Oil and Gas sector

Lending information collected for the oil and gas sector revealed that the average weighted maturity was 1.98 years, which is short in comparison to the average portfolio maturity of 2.92 years. Notable was the percentage of the at-risk portfolio that was tied to the oil and gas sector; oil and gas was ranked as the second largest loan sector within the at-risk portfolio.

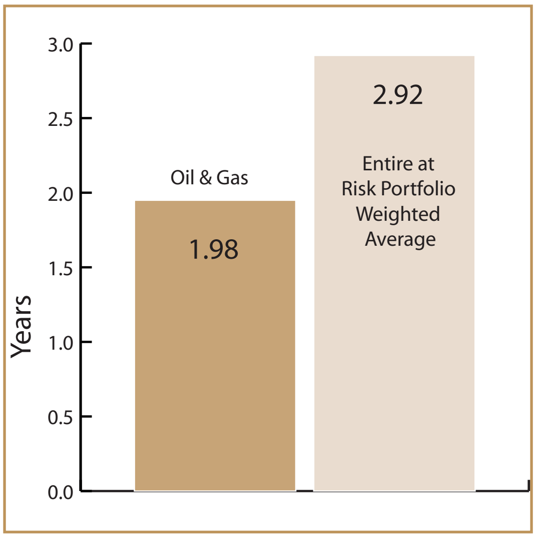


Figure 3.2.1: Maturity comparison of loans and leases for the oil & gas sector and the entire at-risk portfolio

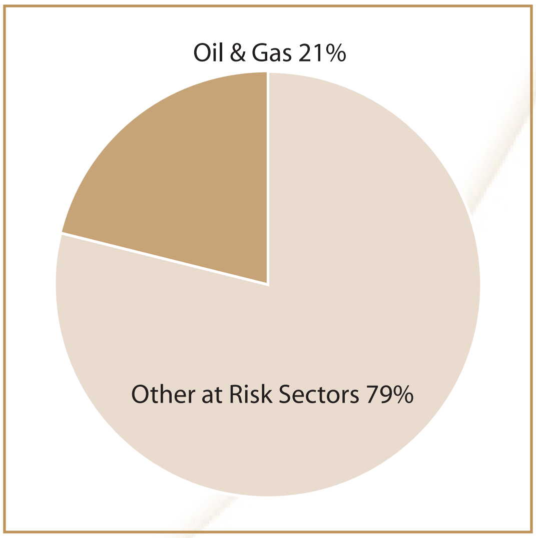


Figure 3.2.2: Loans and leases to the oil and gas sector make up a significant percentage of the total at-risk portfolio

3.2.4 Impact on Loans: Oil and Gas Sector

Although the oil and gas sector comprises a significant portion of the at-risk portfolio used in this analysis, the short average maturity of loans makes the sector much less susceptible to climate change risk. Specifically, the largest risk faced by the sector in the US is physical risk from climate change related events, however physical risks are expected to develop over a long period of time, enabling the sector to adapt.

3.3 Electric Utilities

3.3.1 Snapshot

The electric utility sector, of all the sectors surveyed, is the sector most susceptible to climate change risk. In the US, this stems from the fact that electricity generation is largely dependent on coal and other fossil fuels for energy. Coal is used in the generation of roughly 51% of US electricity. Electric utilities are responsible for approximately 40% of US CO_2 emissions, and 10% of global CO_2 emissions. Canada is less dependent on coal as a fuel source because hydroelectric power accounts for 60% of Canadian electricity generation. Conventional fuels (coal, oil, and gas) account for only 28% of Canadian electricity generation, of which coal accounts for 16%.

Electric utility infrastructure may need to be updated to meet new restrictions on the emissions of greenhouse gases. For the electricity sector, this is especially problematic as power plants are built to operate for 30-50 years. Any initiative to control climate change will have to be phased in order to allow technological innovation. Additionally, US and Canadian demand for electricity continues to grow while alternatives to conventional electricity generation are limited.

3.3.2 Electric Utility Exposure to Climate Change

Policy Exposure

Fossil-fuel powered electric utilities are highly exposed to climate change policy risks. Companies using technologies that generate significant emissions will likely be forced to invest in newer less emissions intensive technologies, or find other ways to reduce their exposure, for example by buying offset credits.

Policy exposures associated with international initiatives, namely the Kyoto Protocol, may determine the Canadian electricity sector's course of action. However, because Canada has significant hydroelectric power generation resources, the electric utility sector may have a greater range of options to switch from fossil fuel to other sources of energy. However, this is true only when expansion of alternative power generating operations is possible, and those expansion plans are not marginally more expensive than other reduction strategies.

Input Prices

The prices of the fuels used to generate electricity are very important because the industry has a small profit margin. In Canada, input prices will be less of a concern as the Kyoto Protocol will create somewhat of an even playing field in which consumers across the board will be forced to pay higher rates to meet reductions. In the US, coal-based utilities would most likely be the first and most heavily regulated energy sector because this fuel generation is more greenhouse gas emissions intense than other fuel sources. The prices per kilo-watt hour of coal (1.90 cents in 2004) and natural gas (5.87 cents in 2004) may become similar or push the price of coal beyond natural gas when regulatory costs of coal's CO_2 emissions are included. However, this is dependent on the cost of emissions reductions, CO_2 emissions per kilo-watt hour, and other costs related to the ability of electric utilities to switch fuels.

Output Prices

The output prices of electricity generated from regulated power plants are normally directly transferred to the consumer. Therefore, if the price of electricity is affected by emissions regulations, consumers may receive the brunt of the added cost. Because coal is more GHG intensive than other fuels, the price associated with its electricity generation may increase. If competition and/or more energy choices become available, consumers may choose to bypass fossil fuel based emitters for cleaner generators.

Physical Exposure

Physical exposure associated with climate change poses minimal risk to much of the electric power generation sector because the exposure is not direct. An exception may be hydroelectric power generation in regions where water supplies decrease due to climate change. As the climate changes and temperatures fluctuate, the demand from consumers also varies. Regional infrastructure has been established to meet the traditional peak loads in demand for both extremely cool and hot days. However, climate variability could disrupt this system, transforming areas that are not typically large peak communities into heavy demanding regions. .

3.3.3 Loan Data: Electric Utilities Sector

Data collected for the electric utilities sector demonstrates that the maturity of loans and leases to this sector are relatively long, with a weighted average maturity of 5.75 years. This significantly exceeds the portfolio aggregate at-risk maturity of 2.92 years. However, the electric utilities sector makes up a modest percentage of the at-risk portfolio.

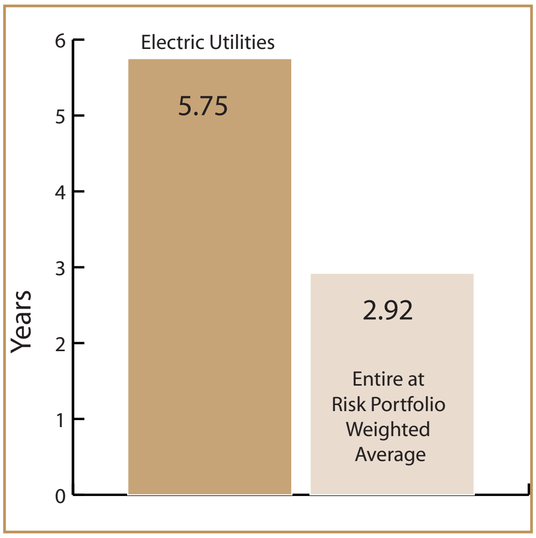


Figure 3.3.1: Maturity comparison of loans and leases for the electric utilities sector and the entire at-risk portfolio

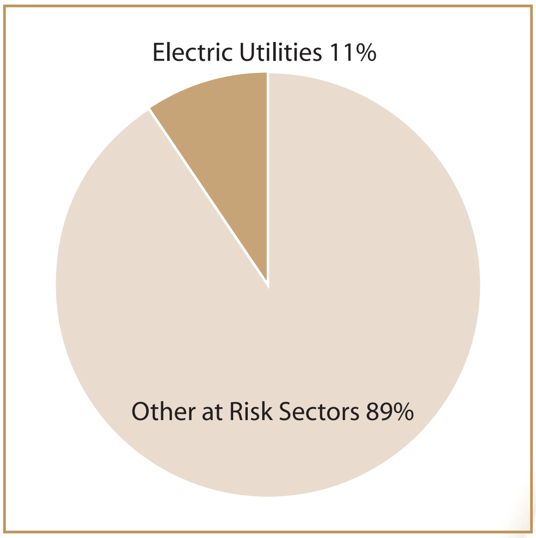


Figure 3.3.2: Loans and leases to the electric utilities sector make up a notable percentage of the total at-risk portfolio

Coal fired electricity generation is susceptible to all four climate change related risks. Furthermore, loans to the electric utility sector in the at-risk bank portfolio have a significantly longer average maturity than the other sectors, and comprise a significant percentage of the overall portfolio. The fact that the electric utility sector is highly capital intensive, with financing needs for plant assets projected to operate for as long as 50 years, clearly makes this sector susceptible to significant risk from climate change related events.

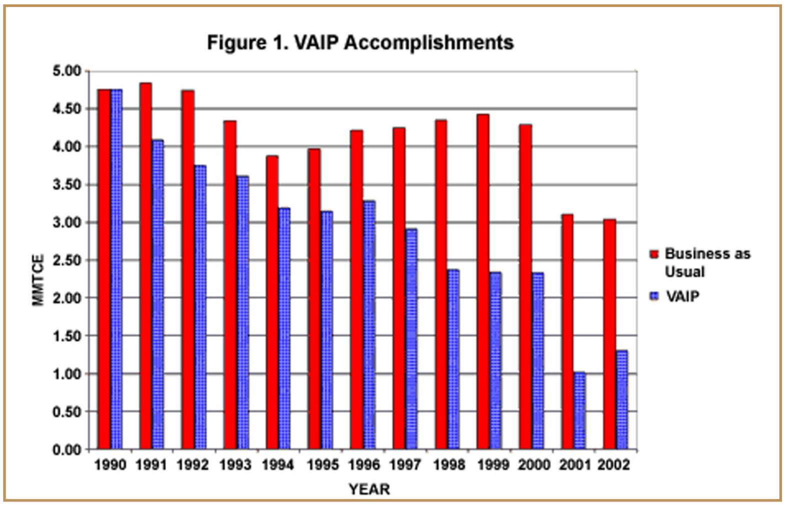
3.4 Aluminum

3.4.1 Snapshot

The Aluminum industry represents one of the two largest global sources of CF4 (tetrafluoromethane) and C2F6 (hexafluoroethane) emissions, otherwise known as perfluorocarbons (PFCs). The aluminum industry also utilizes an enormous amount of electricity, indirectly generating CO_2. The US has consistently been the global leader in the production of aluminum, while Canada is tied with China as the third largest producer. PFCs have a considerable impact on climate change because the global warming potential of a single tonne of CF4 and C2F6 is roughly equal to 6,500 and 9,200 tonnes of CO_2, respectively. Additionally, the estimated atmospheric lifetime for CF4 is 50,000 years while that of C2F6 is 10,000 years. On the other hand, the atmospheric lifetime of CO_2 is roughly 100 years. Therefore, aluminum production is one of the most detrimental industries in regards to climate change, and controlling both its electricity use and production levels is extremely important. However, PFCs are a byproduct of aluminum smelting that is difficult to control and no technology currently exists for producing aluminum without emitting some PFCs.

Reductions in PFC levels, however, are occurring in the US through a voluntary program by the US Environmental Protection Agency called the Voluntary Aluminum Industry Partnership (VAIP). Some of the notable participants include Alcan Primary Metals Group, Alcoa Inc., Aluminum Association, Century Aluminum, Columbia Falls Aluminum, Golden Northwest Aluminum, Kaiser Aluminum, and Noranda Aluminum Inc. Together these organizations have made large reductions from their 1990 baseline PFC emissions. In 2002, emissions were 1.73 MMTCE less per tonne of aluminum produced when compared to1990. This represents a 57% reduction, which is the same as eliminating emissions from over 1.2 million cars (assuming an average of 11,450 lbs CO_2/car/year). The chart below tracks PFC reductions through the VAIP program, indicating that the voluntary program has made large reductions compared to the business as usual projected emissions.

Figure 3.4.1: VAIP's tracked Greenhouse gas reductions 1990-2002



(Source: EPA-VAIP)

Despite being the largest global producer of aluminum, the US has been able to make drastic cuts in the PFCs emitted by the industry. The more PFCs that the US aluminum industry is able to abate, the better situated the industry will be to reduce risk associated with climate change.

3.4.2 Aluminum Exposure to Climate Change

Policy Exposure

Policy initiatives that cap greenhouse gas emissions will affect the aluminum industry on two fronts.

Aluminum is exposed to caps because of the industry's PFC emissions, and because emissions caps are likely to cause electricity prices to increase. Of the two exposures, PFC emissions are of greater concern because they have a high global warming potential and because the emission of PFCs is inherent to aluminum production. This leaves the aluminum sector more exposed to future greenhouse gas caps when compared to other industries, which generate greenhouse gas emissions through single sources. However, emissions caps may stimulate research and development for more efficient, lower PFC emitting processes. The caps' effect on the industry will also be determined by the previous steps that aluminum companies take to reduce PFC emissions pre-regulation.

Input Prices

The input prices for the electricity used to produce aluminum could become more expensive if carbon is regulated in the US. This has not yet been the case in Canada, but as reductions become more restrictive, innovating new technologies for the chemical processes used to generate aluminum are increasingly important.

Additionally, higher electricity prices are anticipated with climate change regulation. For the aluminum sector this could be a very difficult issue. This stems from the enormous amount of energy used in the aluminum smelting process. For example, in Germany, Norsk Hydro ASA recently decided to close two aluminum smelters after failing to negotiate cheaper electricity prices. The high cost of electricity in Germany, partially caused by emissions restrictions, forced the company to seek facilities abroad in lower cost electricity markets.

3.4.3 Loan Data: Aluminum Sector

Aluminum is a sector with short maturities, and the sector represents a small percentage of the at-risk portfolio. This sector's weighted average maturity was 1.31 years, compared to the at-risk average maturity of 2.92 years. Moreover, the aluminum sector makes up the second smallest sector in the total at-risk portfolio.

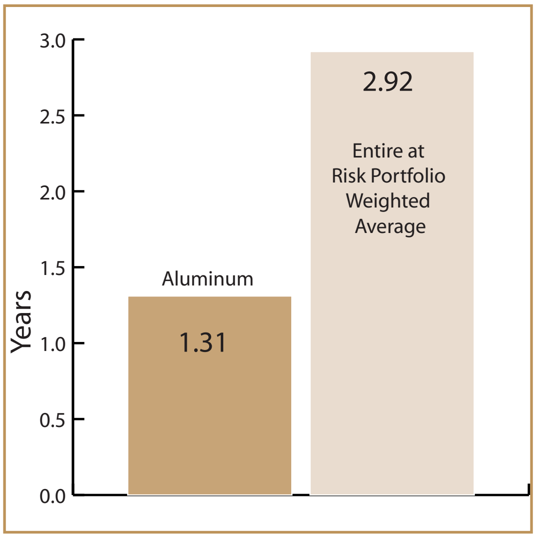


Figure 3.4.2: Maturity comparison of loans and leases for the aluminum sector and the entire at-risk portfolio

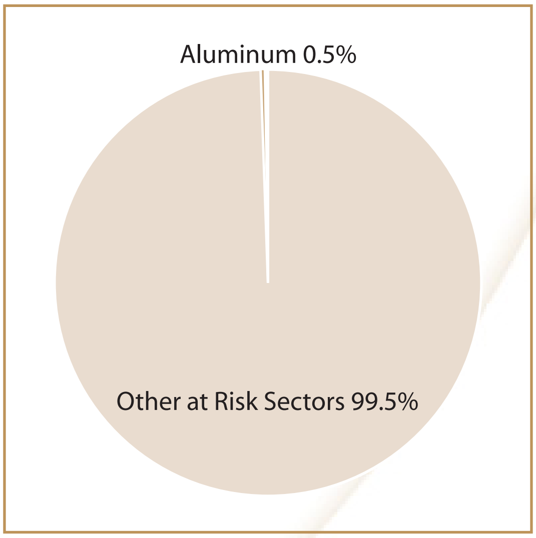


Figure 3.4.3: Loans and leases to the aluminum sector make up a very small percentage of the total portfolio

3.4.4 Impact on Loans: Aluminum Sector

The aluminum sector is significantly exposed to climate change related risks due to the sector's emissions of large quantities of greenhouse gases while simultaneously consuming large amounts of electricity. However, the exposure to bank loan portfolios is minimized due to the short average maturity of loans to this sector, and the small number of loans as a percentage of the at-risk portfolio.

3.5 Cement

3.5.1 Snapshot

Similar to the aluminum industry, there are two aspects of cement production that generate greenhouse gas emissions. Process-related emissions originate from the conversion of mined limestone into calcium oxide, which occurs through a chemical reaction that creates roughly 0.138 tonnes of carbon per tonne of clinker. The second aspect of cement production that emits CO_2 is the combustion-related phase. The primary fuel used in combustion processes for cement is coal. The table below shows that in 2001 54% of CO_2 emissions were process-related and 46% were combustion-related.

Table 5: Million tonnes of CO_2 emissions associated with cement production

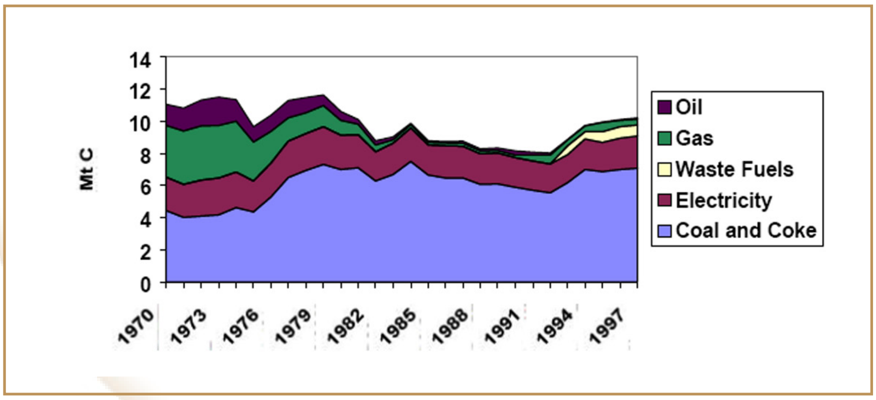
	1994	1995	1996	1997	1998	1999	2000	2001
Combustion-related CO_2	30,6	31,3	31,6	32,1	32,9	36,1	36,5	35,5
Process-related CO_2 (inc. CKD)	36,1	36,8	37,1	38,3	39,2	40,0	41,2	41,4
Total CO_2	66,7	68,1	68,7	70,4	72,1	76,1	77,7	76,9

Source: Minerals Yearbook, Vol 1, Metals and Minerals, 2002. US Geological Survey. US Department of the Interior. July 2003. Draft Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2002. US Environmental Protection Agency. February 2004. ICF communications with Hendrick van Oss, USGS, 15 April 2004.

In 2004, the US was the world's third largest producer of cement (96.5 million metric tonnes), trailing China (850), and India (110). Canada's production levels were significantly lower at 14.4 million tonnes.

Since the energy crisis in the 1970's, the cement industry has been trying improve energy efficiency in order to cut production costs. From the 1970's through 2000, primary energy intensity of cement production was reduced by 30% from 7.9 GJ/t to 5.6 GJ/t. At the same time, CO_2 intensity due to fuel consumption (CO_2 emissions expressed in tonnes of carbon per tonne cement) dropped 25% from 0.16 tC/tonne to 0.12 tC/tonne. CO_2 intensity due to fuel consumption and clinker calcination dropped 17%, from 0.29 tC/tonne to 0.24 tC/tonne.

Figure 3.5.1: CO_2 emissions associated with energy needed in cement production by fuel type



(Source: USGS)

In addition to the energy saving measures that can mostly be attributed to better technologies and fuel switching, the cement industry aims to increase the recycling of coal ash as a cement substitute, thereby reducing CO_2 emissions. Other initiatives are furthering energy efficiency improvements, sequestration of carbon from the flue, advances in cement alternatives (mineral polymers), reductions in the clinker to cement ratio, implementation of another fuel switch back to natural gas, and improving the efficiency of the intermediary process.

3.5.2 Cement Industry Exposure to Climate Change

Policy Exposure

CO_2 emitted through clinker generation makes the cement industry susceptible to policy initiatives that cap greenhouse gases. However, the cement industry is taking some substantial steps to increase efficiency and subsequently reduce CO_2 emissions levels. Ideally, policy initiatives will stimulate research and development and innovation, which will help the cement industry change clinker generation processes and decrease CO_2 emissions.

Input Prices

The need for large amounts of electricity exposes the sector to increases in electricity prices. Capped emissions may adversely affect the electric utility sector. Subsequently, the increased cost per kilowatt-hour of electricity will also affect the cement industry. The increase in input energy costs may significantly affect the cost structure of the industry.

3.5.3 Loan Data: Cement Sector

Cement is another sector to which bank loans are relatively short term, and portfolio size is small. Bank data collected demonstrated that the maturity of loans and leases to the cement sector were very short term at 1.85 years. In addition, the cement industry ranks in the bottom four sectors as far as percentage of the at-risk portfolio.

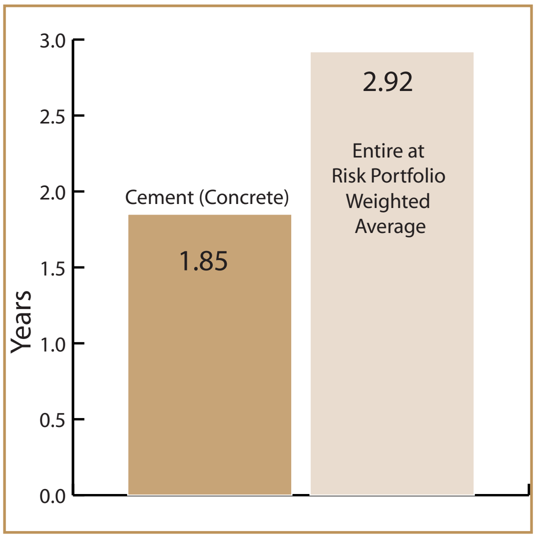


Figure 3.5.2: Maturity comparison of loans and leases for the cement sector and the entire at-risk portfolio

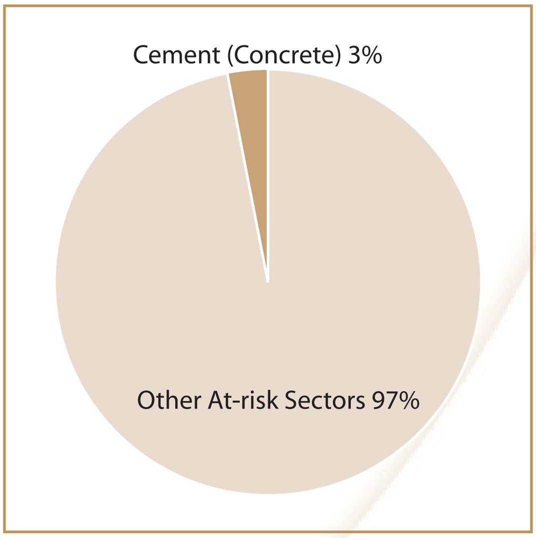


Figure 3.5.3: Loans and leases to the cement sector make up a very small percentage of the total portfolio

3.5.4 Impact on Loans: Cement Sector

Like the aluminum sector, the North American cement industry will be forced to deal with increasing input prices and CO_2 reductions. Both are troubling for the sector, while emissions reductions are especially difficult as the industry generates two large sources of CO_2 emissions. However, because the loans and leases associated with this industry are a small portion of the at-risk portfolio, and the existing loans and leases have short maturities, banks have little climate change exposure to this sector.

3.6 Automobile Manufacturing

3.6.1 Snapshot

CO_2 emissions from vehicles in North America are significant and future regulation will likely require manufacturers to meet reductions in per vehicle emissions. Emissions of CO_2 in vehicles resulting from the combustion of gasoline and diesel accounts for 30% of CO_2 emissions in industrialized economies (including the US) and roughly 20% globally. In Canada, transportation is the largest source of greenhouse gas emissions and represents 25% total emissions. In a business as usual scenario, transportation emissions by 2010 will exceed 1990 levels by 32%. By 2020 transportation sector emissions might exceed 1990 emissions by 53%.

An analysis of the carbon intensity of the entire US vehicle industry indicates that assembly accounts for 2% of emissions, materials for 4%, vehicle use for 75%, and fuel production for 19%. Both directly and indirectly, vehicle use in the US contributes to roughly 94% of total auto industry emissions. Therefore, increasing fuel economy can curb more emissions than reductions in all of the other auto industry sources combined.

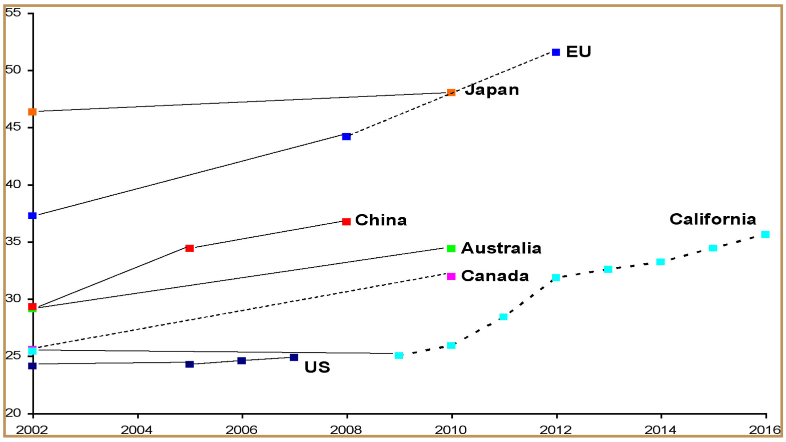
3.6.2 Automobile Manufacturing Exposure to Climate Change

Policy Exposure

To meet emissions targets under the Kyoto Protocol, the Canadian federal government signed a voluntary reduction plan with the Canadian auto industry in April 2005, which will reduce CO_2 emissions from new cars and trucks by 5.3 million tonnes/year by 2010. This reduction target translates into roughly 25% of current emissions by 2010. Canadian automobile manufacturers will likely utilize a variety of fuel-saving vehicle technologies, including hybrid power trains, cylinder deactivation technology, advanced diesel technology and emerging technologies to meet their targets.

US manufacturers may utilize Canada's policy decisions to help prepare them for probable US emissions caps. Although US emissions caps are not yet determined, the industry may be required to make significant investments to successfully meet future regulations. This may force the US auto industry to either buy new technologies or ratchet up their research and development to meet probable emissions caps. The graph below illustrates the relative position of current US regulations, aggregated against vehicle mileage requirements, compared to other developed countries. It also depicts how the California initiative may bring US emissions requirements closer to others.

Figure 3.6.1: Comparison of miles per gallon from the leading market economies and the projected California greenhouse gas emissions standards



(Source: Feng An and WRI Capital Markets Research, Pew Center on Global Climate Change)

Input Prices

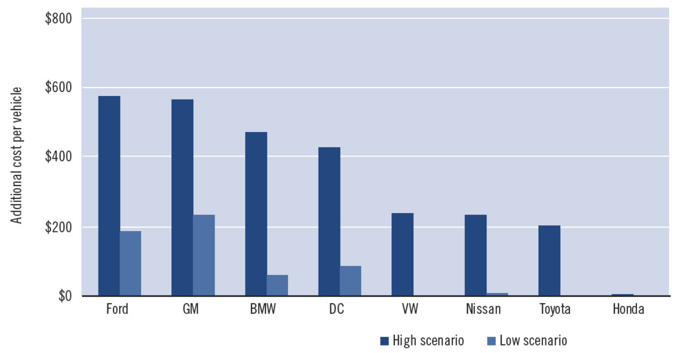
If stricter regulation of greenhouse gas levels is implemented in the US, there may be a trickle down effect within the auto industry. The individual components that are manufactured and shipped to auto assembly plants, including steel, aluminum, and glass, may see increases in prices, as climate change regulation limits CO_2 emissions in those sectors which input to the automobile sector.

Output Prices

The regulation of only CO_2 emissions are unlikely to increase the price of automobiles, but more stringent fuel economy standards are likely to both increase prices and change consumer demand towards smaller, more fuel efficient cars. In the US, examples of this type of pricing structure are apparent in the price differential between buying a car in California versus other less restrictive emissions states. In the case of California, consumers assume the cost difference in the form of higher price tags for vehicles.

A recent study by the World Resources Institute (WRI) and Sustainable Asset Management (SAM) quantifies the cost of compliance to automobile manufactures and its potential affect on Earnings before Interest and Taxes (EBIT) in a carbon constrained scenario. Their analysis modeled (1) a business as usual situation called the "Low Scenario", and (2) fuel economy standards of 33mpg and 25mpg for cars and trucks, respectively, called the "High Scenario". The results of the model depict the projected added cost per vehicle for meeting regulations. Below is a graph that depicts the main added cost per manufacture.

Figure 3.6.2: Cost per vehicle to meet either "Low" or "High Scenario" greenhouse gas reductions

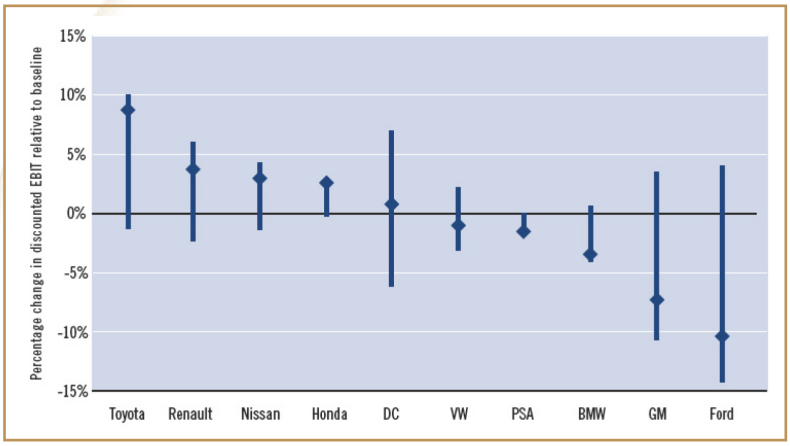


Notes: OEMs not shown do not have sales in the United States. Figures represent the costs of altering today's vehicles to meet the standards assumed for 2015.

(Source: WRI & SAM)

Further analysis by WRI and SAM examined the different manufacturers' exposure and the potential impact of carbon constraints on their company's EBIT. The following schematic depicts the scenario of discounted EBIT projected for the period 2003-2015 under carbon constrained scenarios. For the US, the Low and High Scenarios are averaged to obtain the value used in the analysis. Overall, the results of the study indicate that US automobile manufacturing companies are exposed to a much larger extent when compared to other manufacturers.

Figure 3.6.3: Estimate of change in EBIT value per manufacturer with climate change initiatives



(Source: WRI & SAM)

3.6.3 Loan Data: Automobile Manufacturing Sector

The automobile manufacturing sector holds the shortest weighted average maturity of all the analyzed at-risk sectors in this report. The weighted average maturity of the sector was 1.21 years compared to the portfolio average of 2.92 years. Also, automobile loans and leases represent a modest percentage of the at-risk portfolio, making up 6% of the total at-risk portfolio.

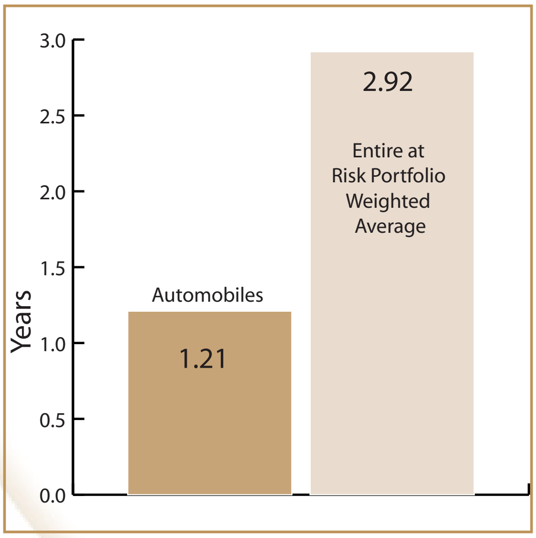


Figure 3.6.4: Maturity comparison of loans and leases for the automobile manufacturing sector and the entire at-risk portfolio

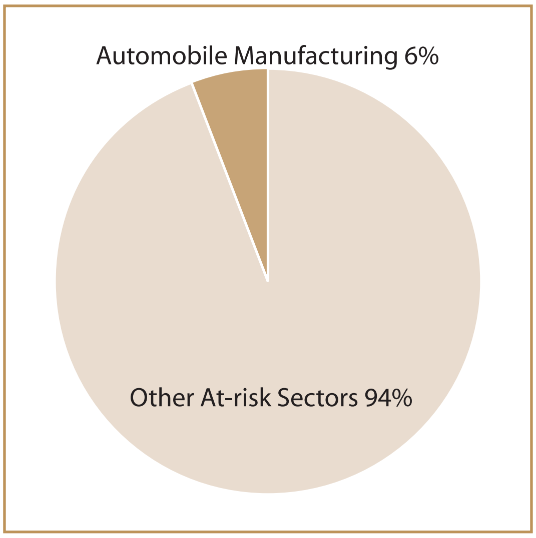


Figure 3.6.5: Loans and leases to the automobile manufacturing sector make up a small percentage of the total portfolio

3.6.4 Impact on Loans: Automobile Manufacturing Sector

The auto industry is in an ambiguous position. The manufacturing of vehicles is dependent on the input costs of both electricity and individual components, such as aluminum. The industry is also susceptible to the policy initiatives associated with an emissions-capped environment. However, many of the costs of meeting future emissions targets and increased input costs may be passed onto consumers - a large portion of the greenhouse gas emissions associated with the automobile industry is generated by consumers after the vehicles are manufactured, thereby transferring risk from the manufacturer to the end-user. In addition, automotive loans and leases are both extremely short-term and a modest portion of the banks at-risk portfolio, indicating that the loans to this sector are at low risk to climate change.

3.7 Agriculture

3.7.1 Snapshot

Climactic models indicate that net agricultural yields in both the US and Canada will most likely benefit from climate change until the global mean temperature increases beyond 4°C (7.2°F). Specifically, increased levels of CO_2 and precipitation associated with climate change could enhance agricultural production to varying degrees. Canada as well as the Northern Great Plains and the Great Lakes areas are projected to see higher yields, while the Southern Plains and Delta states will most likely experience reductions. Reductions may also occur in the Southeast and Corn Belt. The climate change models used to make these predictions also take into account the distribution of pests and pathogens, increased rates of soil erosion and degradation and increased levels of tropospheric ozone from increasing temperatures.

In addition to CO_2, agricultural based nitrous oxide (N_2O) is a potent greenhouse gas. N_2O has a global warming potential 310 times that of CO_2. Nitrous oxide is a gas naturally emitted by soils that may increase with climate change. In 2003, N_2O from agriculture contributed 67% of total US N_2O emissions and was linked to roughly 70% of net N_2O in Canada. Fixed nitrogen (N2) is a nutrient that plants need to maintain healthy growth rates. If climate change creates similar or higher moisture levels and higher temperatures, soil respiration will speed up, rates of organic matter decomposition will increase, and the soil will become more acidic. Nitrogen based fertilizers may be able to offset this problem, but excessive use of fertilizer or soil mismanagement could result in higher N_2O emissions. Emissions of N_2O have historically increased when soil fertility is affected by natural catastrophes.

Scientific modeling of agriculture and the agricultural sector has scrutinized the range and impact of climate change, as well as potential negative impacts following global temperature increases beyond 4°C (7.2°F). Overall, climate change analyses forecast a small net benefit for US agricultural yields as global temperatures continue to rise. In recent research, the benefits of climate change for Canadian agriculture does not suggest substantial economic benefits. Assuming that the scientific research to date is accurate, the overarching results indicate that the Canadian farming sector should be largely unaffected or may slightly improve as climate change occurs. In general, scientific research suggests that Canada and the United States will be able to provide sufficient food for both domestic and global communities for at least the next 100 years despite increases in global mean temperatures.

3.7.2 Agricultural Exposure to Climate Change

Policy Exposure

Policy induced greenhouse gas caps on emissions are a potential risk to the agricultural sector. The agriculture industry's use of nitrogen-based fertilizer emits N_2O into the atmosphere and puts the industry at risk in the context of policies that restrict emissions. N_2O emissions are particularly problematic because of its high global warming potential. Any emissions regulation that constrained N_2O based fertilizer use would probably occur parallel to increased demand for fertilizer in order to combat climate induced soil acidity. This scenario would likely adversely impact the agricultural sector, although it is difficult to predict its magnitude.

Input Prices

The prices of the inputs used in agriculture will be affected when greenhouse gas emissions become regulated in the US and Canada. The prices of commodities such as fuel, fertilizer, transportation, and equipment will increase production costs. For instance, a climate change regulation mandating emissions reductions in the transportation sector will force farmers to internalize the added cost. This will affect the overall cost of production in agriculture, which farmers may or may not be able to pass onto consumers.

Physical Exposure

Farmers may need to increase their levels of pesticide per acre in order to combat the increased pests and pathogens associated with higher precipitation levels resulting from climate change. They may also have to convert their current operations to different types of pesticide/herbicide products, depending on their individual production changes. Without regulatory intervention global greenhouse gas emissions are projected to rise, meaning overall crop yields may also increase in some geographical areas. In areas where precipitation levels are projected to fall, such as the Southeast and Southwest, there may be reductions in crop yields. Therefore, increased precipitation in some regions and decreased precipitation in others will likely generate a net result of equal or greater US yields overall. In the long-term, or in the absence of climate regulations, agricultural producers may be forced to deal with new ecological conditions. They may have to switch the type of crops they plant, change the type or amounts of inputs, or vary their planting processes with the variations in environmental conditions.

Another potential physical risk to the agricultural sector are ENSO events (El Nino and La Nina) on agricultural processes. Each ENSO event is estimated to cost in excess of $320 million in damages. However, the intensity of these events as well as scientists' ability to predict them may increase the associated costs significantly. The increases in temperatures may also intensify tropical storm events, hurricanes, and tornadoes. Changes in the frequency and intensity of droughts, flooding, and storm damage are likely to have significant consequences to the agricultural sector because it is especially vulnerable. Flood risk will increase even in drought-prone regions as precipitation may be concentrated by climate variability. In addition, higher temperatures increase the amount of moisture that the air can carry. Warmer air tends to carry more moisture than cold air. Therefore in drought-prone regions as more rain falls, the run-off could increase because of the sun baked surfaces' inability to absorb the excess water.

3.7.3 Loan Data: Agricultural Sector

Agricultural lending information submitted by the participating banks revealed that the weighted average maturity of loans and leases to the Agriculture sector was not long-term, with an average maturity of 2.12 years. However, the percentage of the at-risk portfolio that was agricultural was significantly large compared to other sectors. Agriculture represents 24% of the at-risk portfolio, ranking it as the largest sector in our analysis.

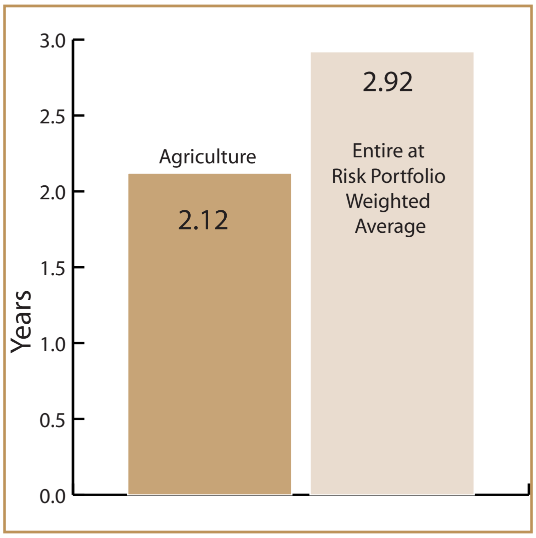


Figure 3.7.1: Maturity comparison of loans and leases for the agricultural sector and the entire at-risk portfolio

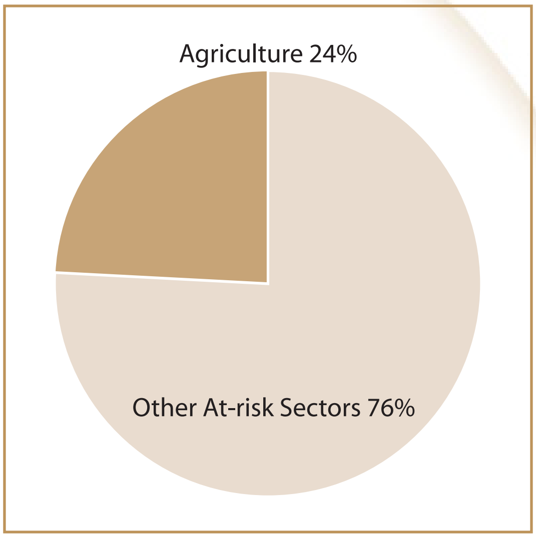


Figure 3.7.2: Loans and leases to the agricultural sector make up a substantial percentage of the total at-risk portfolio

3.7.4 Impact on Loans: Agricultural Sector

Agriculture is a sector that is potentially at risk to climate change in a variety of ways, including input prices, limitations on the use of fertilizer, and physical environmental variations. However, none of the risks are large for this sector, and some agriculture may actually benefit from climate change related events. As the average loans and leases to the agricultural sector are short in maturity, climate change risks to the sector are low for the current portfolio, even though the agricultural sectors makes up a large percentage of the total portfolio.

3.8 Paper and Forest Products

3.8.1 Snapshot

For US and Canadian forests, the net impact of climate change is expected to be small, except for increase in forest fires and new pests. Forest ecosystems are extremely dynamic and have the ability to adapt to ecological variations through evolutionary processes. Nevertheless, climate change poses two main risks for the forestry and paper sectors. First, if climate change occurs rapidly it is unlikely that entire forests will be able to adapt quickly and the loss of numerous trees can be expected. This process is referred to as dieback. Second, the level of biodiversity within a forest ecosystem is subject to decline with increased climate variability and higher temperatures. In this case, climate change will negatively impact species that do not respond well to a wider range of temperatures and conditions, and only the fittest species will survive.

In addition to the risks that all forest ecosystems face under climate change, the paper industry also faces risks associated with the production process. Paper production requires two types of energy: mechanical power and heat. Based on this double requirement, paper mills have historically produced a portion of their own electricity to provide power and use the heat by-product, utilizing combined heat and power (CHP). Therefore the sector uses a significant amount of fossil fuels and electricity. Paper production also produces biomass waste that requires disposal.

The US is the largest global producer of paper products and Canada is second. Three quarters of Canadian paper production is exported to the US while an additional 9% is exported to other countries. On average the US production of 1 ADT (Air dry tonnes) of paper results in 0.67 tCO_2 (tonnes CO_2). In 2004, the US paper and pulp industry emitted approximately 136.7 $MtCO_2$ (million tonnes of CO_2) based on production of 91.6 mtonnes of paper. These emissions accounted for roughly 2.2% of total US greenhouse gas emissions. Canadian paper and pulp, over the same period, contributed 9 $MtCO_2$, or 1.2% of total Canadian greenhouse gas emissions. However, Canada is producing less CO_2 per tonne of paper than is the US. This discrepancy is the result of Canada's limited reliance on coal and use of cleaner technologies such as natural gas and biomass. Biomass provides 57% of Canadian paper and pulp energy needs.

3.8.2 Paper and Forestry Exposure to Climate Change

Policy Exposure

US forestry management will play a pivotal role in a capped greenhouse gas era. If the implemented policy is tied to an international trading system, the US and Canada could be well positioned to use their vast forests for offsetting credits, generated through afforestation and reforestation programs. Canada has indicated that it plans to incorporate more forestry-based offsets and reforestation grants during and preceding the 2008-2012 phase of the Kyoto protocol. Canada's large forests would position them to seek credit for managed forests under Kyoto, thereby increasing their funding for future management.

In paper production, the majority of greenhouse gas emissions are linked to energy consumption. Capped greenhouse gas emissions may adversely affect production costs for the paper industry. However, using alternative fuels like biomass will enable the paper sector to reduce their emissions. This will help offset any negative repercussions capped emissions will inflict on the paper industry.

Input Prices

The input prices of commodities used in paper production could negatively affect the price structure and force higher consumer costs and/or decrease margins. Since the paper industry is largely dependent on fossil fuel based energy sources, fossil fuel prices represent a large percentage of input costs. Changes in the price per unit of thermal energy/electricity would impact production costs. Increasing the use of bio fuels and pulping by-products for energy could mitigate the effect of higher energy costs. In addition to using energy in paper production, the industry also utilizes gasoline in harvesting and transportation, which makes it vulnerable to gasoline price increases as well. Use of alternative fuels in harvesting and transportation could aid in cutting potential risk and yield annual economic benefits.

Physical Exposure

Higher temperatures and moisture levels in the Northern US and Canada, as anticipated with climate change, will likely increase growth and productivity in Northern forest ecosystems. This will positively impact forests in the Northern US and Canada and negatively impact those in the Southern US. Any increase in CO_2 in the atmosphere will also affect forest ecosystems. An experiment observing increased CO_2 levels revealed a positive relationship between the increase in CO_2 and biological growth rates. Increased levels of CO_2 can also improve water use efficiency in plants and trees. The positive reaction of forest ecosystems to increases in CO_2 is termed the "fertilization effect". The fertilization effect could make US and Canadian forests more tolerable to droughts in areas experiencing lower levels of precipitation. However, research has shown that a higher level of CO_2 has a decreasing effect on plants as they mature. If this theory is confirmed, climate change would increase forest productivity for young plants in the Northern latitudes but have minimal effects on mature or old growth trees.

Other physical factors that may impact forests include natural disturbances such as storms, hurricanes, and droughts. With increasing or more severe natural disturbances, which are projected to occur with climate change, forests would sustain higher diebacks and slower recovery times. These incidents could be partially mitigated through more sophisticated forest management depending on the predictability of events. The salvage of affected forests following disturbances could increase short-term supply of timber to the market but could disrupt long-term pricing and negatively affect landowners.

3.8.3 Loan Data: Paper & Forest Products Sectors

Loans and leases data collected for this sector revealed that the average maturity of paper and forest products was short-term. The weighted average maturity of 2.38 years was very similar to the weighted maturity levels for the aggregated portfolio, and the sector represents 6% of the total portfolio.

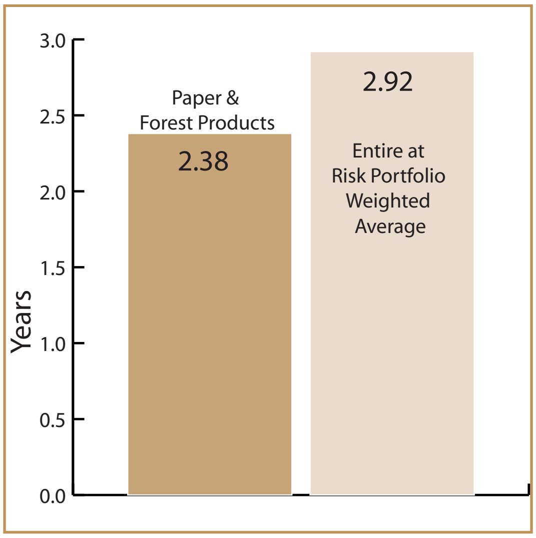


Figure 3.8.1: Maturity comparison of loans and leases for the paper & forestry sector and the entire at-risk portfolio

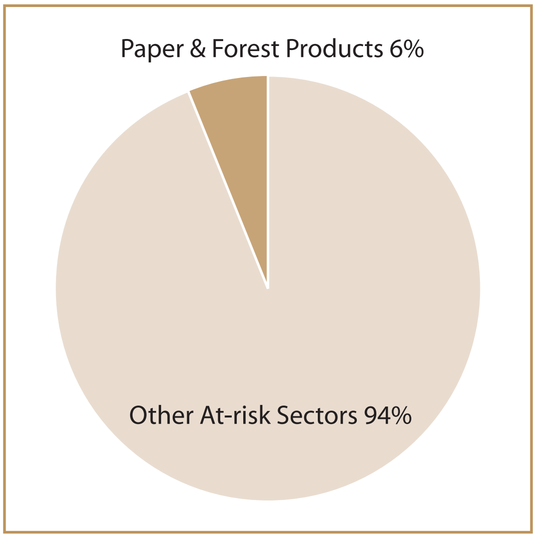


Figure 3.8.2: Loans and leases to the paper & forest product sector make up a notable percentage of the total at-risk portfolio

3.8.4 Impact on Loans: Forest Products Sector

Based on climate change predictions, the overall effects on forest systems of increased temperature, higher concentrations of CO_2, disturbance variance, and generally higher precipitation levels would be minimal. Debate focuses on how biodiversity will be affected by climate change, how efficient forest migration can occur, and how the market and forest management will handle the disturbance variance. Paper and forest products do make up a notable portion of the at-risk portfolio, but with short-term maturities and physical affects that have been projected to be more positive than negative, the sector loans and leases are at low to minimal risk to climate change.

3.9 Commercial Real Estate

3.9.1 Snapshot

Climate change may have an impact on both existing and future commercial real estate developments. However, due to geographic advantages, Canada's commercial real estate is not very susceptible to the risks of climate change compared to the US. For that reason, the following discussion is limited to the US commercial real estate sector.

The difficulty with mitigating the risk associated with commercial real estate is that some of the most desirable properties are those in the riskiest regions of the country. Increasing numbers of developments are being constructed on or near coasts and flood plains. In 1960, about 45 million people lived in hurricane prone coastal areas from Texas to Maine. This number rose to 64 million by 1990 and is projected to increase again to 73 million by 2010. Furthermore, from 1990-2010 the population density in the nation's most hurricane prone region, the coastal counties of Florida, Georgia, South Carolina, and North Carolina, is expected to increase by 23%, outpacing the national rate of increase (14%).

3.9.2 Commercial Real Estate Exposure to Climate Change

Policy Exposure

The US commercial real estate industry may be exposed to the rules and regulations surrounding the federal disaster and flood insurance programs. Recent research has shown a link between temperature increases and hurricane/storm intensity suggesting that at-risk commercial real estate will become more vulnerable with increased temperatures. Real estate developers and residents are able to build in at-risk areas because the federal disaster and flood insurance programs cover weather damage. If natural catastrophes become more frequent and severe, the policies surrounding federal protection could change, thus affecting future development plans.

Physical Exposure

Predictions of the physical risk of climate change with respect to commercial real estate include increases in sea level, fluctuations in the intensity of storms, and lengthening of the hurricane season. Higher amounts of precipitation over shorter periods of time are also predicted. Excessive rain may threaten properties' foundations and increase the likelihood of periodic flooding. Furthermore, demand for properties located in at-risk regions of the US has not decreased with natural events; in fact, the demand for development in these regions has increased. However, because commercial real estate developments are built in a relatively short time frame, compared to the time frame for large-scale environmental changes, physical risk to commercial real estate development is minimal.

3.9.3 Loan Data: Commercial Real Estate Sector

Bank data collected for the commercial real estate sector revealed a weighted average maturity that exceeded that of the average for the aggregated at-risk portfolio. While the weighted average maturity for the sector was 3.16 years the at-risk portfolio averaged 2.92 years. At 13%, the commercial real estate sector makes up a significant percentage of the at-risk portfolio.

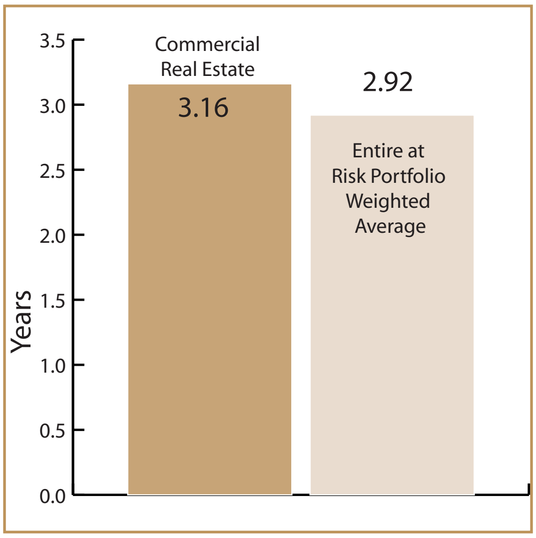


Figure 3.9.1: Maturity comparison of loans and leases for the commercial real estate sector and the entire at-risk portfolio

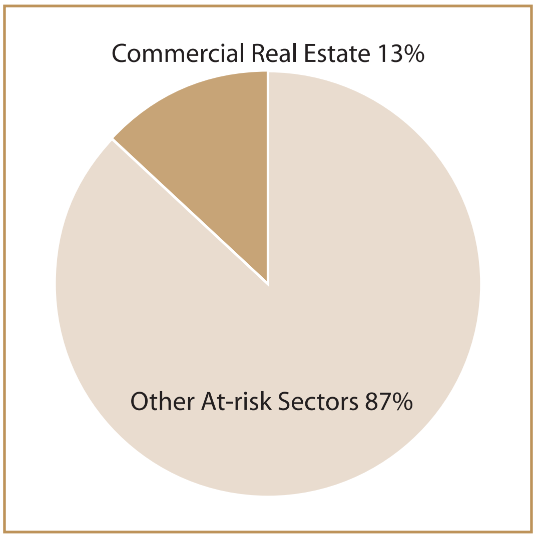


Figure 3.9.2: Loans and leases to the commercial real estate sector make up a moderate percentage of the total at-risk portfolio

3.9.4 Impact Loans: Commercial Real Estate Sector

Despite accounting for 13% of the at-risk loans and leases, commercial real estate is limited in its exposure to climate change risk. This stems from the ability of this sector to adapt to the changes foreseen with climate change. Furthermore, completed buildings are heavily insured through both private and federal insurance programs, additionally reducing their risk exposure. Although insurance can create an incentive to continue to build structures in dangerous regions, it also helps reduce exposure to loans and leases made to sector participants.

3.10 Property & Casualty Insurance/Reinsurance

3.10.1 Snapshot

Risk insurance companies are in an interesting situation. They are extremely susceptible to catastrophic events; however, they may be able to manage their exposure through dynamic insurance policy development. Generally speaking, reinsurance companies such as Swiss Re and Munich Re are highly active in initiatives to mitigate climate change. On the other hand, trade organizations and traditional insurance companies feel that insurance policies can be adjusted or rewritten to capture the added risk as the climate begins to vary. This may be true in some respects, but the occurrence of catastrophic events such as hurricanes, tornadoes, or flooding may prove more expensive than what can be covered through policies. Recent studies show correlations between rising global temperatures and larger, more damaging natural events.

An analysis of insurance claims associated with recent natural catastrophes highlights some of the potential costs associated with larger natural events. To date, 2005 was the most expensive year for natural catastrophes in insurance history due primarily to the devastation wrought by Hurricane Katrina. In 2004, insured losses were roughly US$44 billion, with four hurricanes in Florida accounting for US$30 billion of that total. Other large hurricane claims include Hurricane Isabel in 2003, which incurred losses of US$1.2 billion, and Hurricane Andrew in 1992, which generated enormous losses in excess of US$25 billion. These numbers could easily increase as more people settle in Florida, which is at higher risk to climate change induced weather events.

3.10.2 Physical Exposure

Climate change induced insurance problems are not limited to hurricanes and increased storm strength. Climate change models predict increased precipitation levels in the northern latitudes of Canada and the US. Conversely, there are also indications of reduced levels of precipitation for the Southern portion of both the Eastern and Western U.S, although individual events may provide high precipitation levels. Lower precipitation levels may lead to droughts, thereby increasing the risk of brush and forest fires. Insured fire losses can be significant. For example, Canadian wildfires in 2003 generated losses of US$500 million, half of which were insured losses. In the same year, fires in California destroyed 3,500 homes, killed 20 people, and resulted in 19,000 insurance claims worth over $3 billion.

Consequences of climate change that present risks to the insurance and reinsurance sectors are increased precipitation, the creation of drought like conditions, tropical storms, hurricanes, and periodic flooding from heavier than normal rainfall. Using past extreme events to forecast the monetary cost of climate change induced events demonstrates serious financial repercussions. Additionally, in the northern regions of the US and Canada, increases in the strength of winter storms, another potential byproduct of climate change, could become more serious. Quebec's ice storm of 1999 generated losses in excess of US$1 billion. Hurricane Juan in September 2003 was Canada's most damaging storm in the past 100 years. The unusually warm ocean surface water temperatures during the tail end of September 2003 in the Nova Scotia region has been cited as a potential reason the storm regained strength in an area in which it usually dissipates. These types of natural events could become more frequent in the Northern latitudes if surface water temperatures continue to increase.

If climate variability continues or worsens, the business as usual approach will create considerable challenges for the insurance sector. This stems from the fact that insurance policy risk and the subsequent cost of underwriting is determined by patterns of past occurrences. If accurate storm and flood predictions become less attainable, risk would increase and become less predictable.

Inherently, insurance and reinsurance companies are at risk with respect to natural catastrophes. They hedge their policy underwriting by spreading their vulnerability over a portfolio. In the event that climate change could cause the intensity of natural events to increase, the insurance and reinsurance industry will be vulnerable to the added cost of claims. The physical changes that may alter climate cycles also have an affect on the predictability of catastrophic events. Predictability is needed to underwrite and evaluate the probability of event occurrences. Imprecise predictions may alter the amount of risk that is absorbed by the underwritten policy. The combination of both the susceptibility of current policies and the potential inability to statistically calculate event catastrophes makes the insurance sector at risk to climate change.

3.10.3 Loan Data: Insurance (P&C, Reinsurance) Sector

The insurance sector's weighted average maturity of 2.39 years was very similar to that of the average at-risk weighted average of 2.92 years. The insurance sector made up a rather small percentage of the total at-risk portfolio.

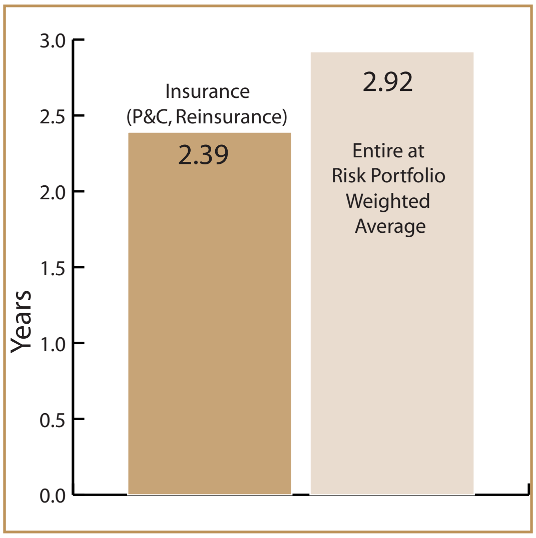


Figure 3.10.1: Maturity comparison of loans and leases for the insurance sector and the entire at-risk portfolio

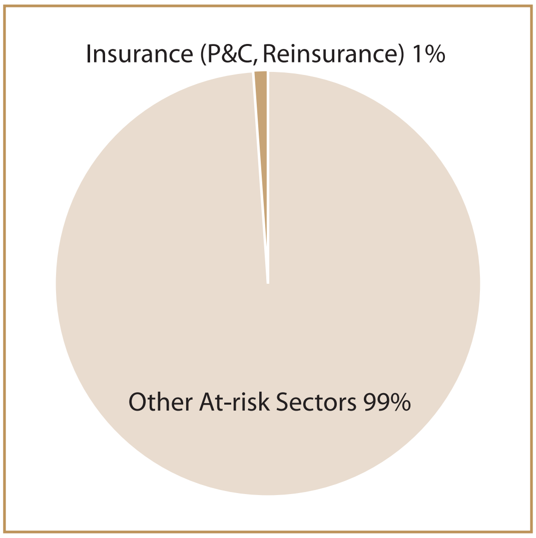


Figure 3.10.2: Loans and leases to the insurance sector make up a small percentage of the total at-risk portfolio

3.10.4 Impact on Loans: Property and Casualty Insurance/Reinsurance Sector

The insurance sector is significantly exposed to the physical risks resulting from climate change, and it may be challenging for this sector to adjust premiums appropriately to compensate for this additional risk. Furthermore, the magnitude of the losses associated with large storms can significantly impair even large insurance companies, and the frequency of events may make it difficult for re-insurers to take on additional risk. However, from the perspective of bank loan portfolios, the Property and Casualty Insurance/Reinsurance sector makes up only a small fraction of the entire at-risk portfolio, and the physical risk of climate change is very long-term in nature, thereby avoiding any significant risk to banks from this sector.

3.11 Health Care

3.11.1 Snapshot

The effects of climate change on the health care industry may be significant over a long period of time, but are highly unlikely to have any short or medium term impact. Furthermore, some health care companies will actually benefit from increased demand for health care services. Therefore, the risk faced by this sector only refers to health care companies and organizations that suffer financially from an increase in health care services. Urban centers will be more vulnerable to climate change than rural regions, which will be compounded by the increase in urban population that the US and Canada are experiencing. Additionally, urban centers are densely populated, and act as a micro-ecosystem that can exacerbate the affects of climate variability.

3.11.2 Health Care Sector Exposure to Climate Change

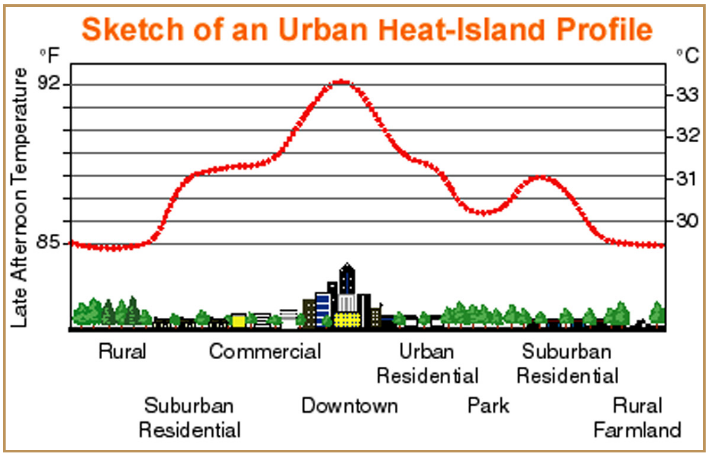
Policy Exposure

The health care sector will not have to manage emissions regulations, but policy decisions may impact human health and thereby impact the sector. Policy decisions regarding the regulation of greenhouse gas emissions will have both direct and indirect affects on the health care sector. Direct effects will mitigate the increase in temperatures that create heat waves and exacerbate some health problems. Indirect effects include the likely reduction in emissions of particulates if coal-fired utilities are forced to switch to natural gas or other cleaner fuels.

Physical Exposure

Increases in greenhouse gases are predicted to raise the temperature of urban regions relative to that of rural regions. Regional temperature increases are more extreme in urban centers because of the type of ground cover present. City centers covered by large amounts of concrete or asphalt have higher mean temperatures than rural areas, which are primarily covered with grass and open green spaces. This phenomenon is called the "urban heat island effect" and it can increase temperatures for urban areas from between 2 to 10°F (1 to 6°C). The schematic below depicts the difference in temperature between a downtown area and that of the rural and suburban regions.

Figure 3.11.1: Urban heat island profile depicting temperature in urban centers



(Source: LLBL Heat Island Group, EPA)

Climate change experiments stimulating CO_2 and temperature increases with additional temperature increases, seen with the urban heat island affect have been shown to stimulate growth rates of both ragweed and poison ivy plants. The same plants also yielded a 60% increase in pollen counts, which adversely impact asthma and other respiratory illnesses within a population. Exacerbating this problem is the increased use of fossil fuels and diesel for transportation in urban areas. Transportation vehicles with poor fuel efficiency contribute soot and ground level ozone also causes respiratory conditions such as asthma, to the densely populated urban setting.

In both urban and rural settings, climate change models have shown both drought and increased precipitation potential in various locations in both Canada and the US. Both situations have the potential to increase health related economic losses. Regions not traditionally subject to droughts are projected to experience drought-like situations. Areas that already have droughts may experience more severe or longer patterns. Additionally, drought susceptible regions may endure extremely dry patterns followed by extreme precipitation events. This would negatively affect both the individuals living in the region and their ecosystems. Droughts themselves have been shown to affect predator species of insects to a larger extent than those of vector classification. Therefore, the levels of vector born diseases, such as dengue or cholera could increase or become prevalent in areas previously eradicated.

Rural and urban settings, to a greater degree, have experienced an increase in the number and intensity of heat wave events over the past decade. These heat waves have contributed to massive amounts of economic and human loss. The heat waves also have a secondary affect of increasing the amounts and severity of wild fires. This has recently been seen in Canada, Europe, and the US and highlighted in the forestry sections above.

While human health may suffer as a result of climate change, health care companies and organizations are not necessarily at risk, as an increase in demand for their services may in fact improve their financial situation. Certainly, the public health care sector may have difficulty coping with an overall decrease in health, but individual health care companies are unlikely to experience additional risk as a result of climate change.

3.11.3 Loan Data: Health Care sector

Bank data collected for the health care sector encompassed both health care equipment and health care providers and services. The weighted average maturity of the sector was the second longest of those analyzed, at 4.40 years. In addition, the health care sector accounted for 15% of the at-risk portfolio, ranking it third in size among all the sectors analyzed in this report.

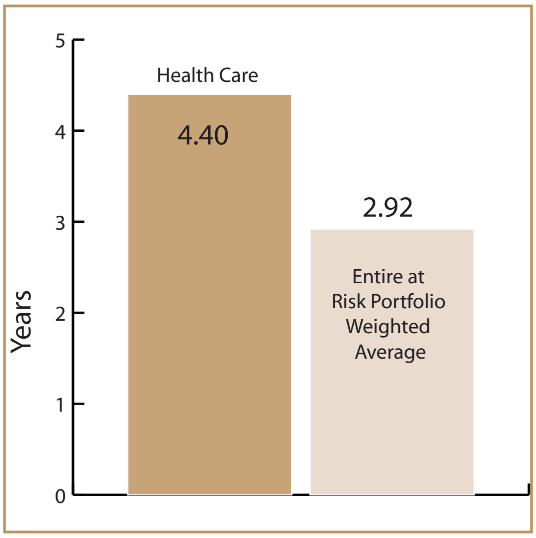


Figure 3.11.2: Maturity comparison of loans and leases for the health care sector and the entire at-risk portfolio

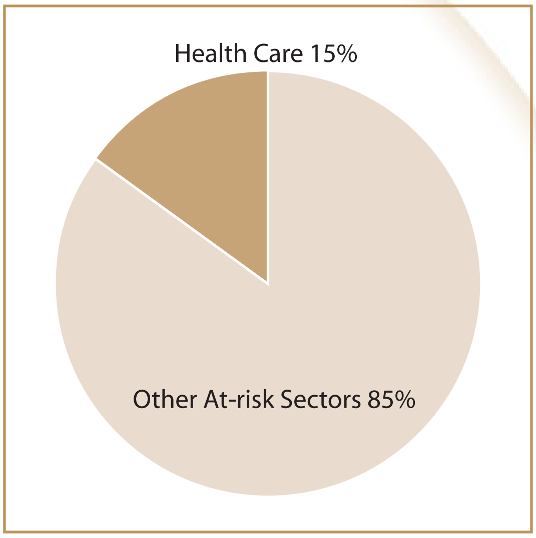


Figure 3.11.3: Loans and leases to the health care sector make up a considerable percentage of the total at-risk portfolio

3.11.4 Impact on Loans: Health Care Sector

While the health care sector accounts for a notable portion of the at-risk portfolio, it is limited in its exposure to climate change risk, especially in the short and medium term. Climate change will likely affect the health of individuals around the world, but the effects will not be quick to occur. Therefore, the health care industry is expected to have the time and resources to meet the challenge of addressing any changes.

4. Conclusion

The following table summarizes the results of this report, by displaying which risks are most significant for each of the eleven loan sectors analyzed. The three sectors with the highest potential overall risk are Electric Utilities, Aluminum, and Cement. Electric utilities are exposed as they are the largest single emitters of greenhouse gases and also are anticipated to be the first affected by regulatory policies. The aluminum and cement sectors are both plagued by the same issue, having both process-related and energy-related sources of greenhouse gas emissions in their manufacturing processes. Therefore, those sectors are more exposed than other sectors and will be increasingly at-risk as emissions restrictions are enacted.

Summarizing Sector Exposures:

	Policy Exposure	Input Prices Exposure	Output Prices Exposure	Physical Exposure	Overall Potential Exposure
Coal	High		Medium		Medium
Oil & Natural Gas	High		Low	Medium	Medium
Electric Utilities (coal based)	High	High		Low	High
Aluminum	High	High			High
Cement	High	High			High
Automobile Manufacturing	Medium	Low	Low		Low
Agriculture	Low	Low		Low	Low
Paper and Forest Products	Low	Low		Low	Low
Commercial Real Estate				Medium	Low
Property and Casualty Insurance/Reinsurance			High	Medium	
Health Care				Low	Low

This report concludes that there is no or very low risk to current bank loans and leases, primarily because the average maturity of current bank loans and leases is relatively short, whereas the physical risks related to climate change are all long-term. Even risks arising from government policy, which may be implemented in the near future in the US and in Canada, appear to have little negative impact on bank loans in the short-term. Furthermore, this is an aggregate analysis of bank loan sectors – there may be company and sub-sector impacts that were not examined in this study.

However, forecasting the effects of climate change is complex and imprecise. For example, it is unclear if the catastrophic affects of Hurricanes Katrina and Rita on the US Gulf Coast are linked to climate change, but some scientific models forecast hurricanes with greater intensity will become more frequent. Banks making loans and leases with long maturities might increase bank exposure to climate variability and related regulatory policies, and banks should carefully consider the sectors most at risk to climate change.

Although limited risk to climate change was found within the parameters of this report's analysis, overall exposure to climate change risk may be present in the long term. Therefore, action can and should be taken to address potential risk resulting from climate change in future long-term loans and leases. Part II of this report will take the findings of Part I and outline actions that can help reduce future risk to banks and borrowers.

Part II

Strategies to Reduce Environmental Risk in Bank Loan Portfolios

Note to Reader

The Commission for Environmental Cooperation (CEC) was established by Canada, Mexico and the United States when these Parties signed the 1994 North American Agreement on Environmental Cooperation (NAAEC). The CEC's broad mandate is to facilitate cooperation and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing trade and social links among our three countries.

The CEC accomplishes this mandate in part though a cooperative work program on finance and the environment since 1999 that focuses on (1) how environmental information affects financial markets, and (2) what are the investment opportunities in the environmental "sector." The flip side of the latter is how to get financing or incentives for environmental conservation and protection such as for shade-grown coffee and renewable energy development.

The CEC is an associate member of the UNEP FI North American Task Force group and Environment Canada's Canadian Network of organizations, experts and practitioners from the finance, business, academic and nongovernmental sectors on financing and the environment and has collaborated with these groups to document the disclosure of material environmental information within the three NAFTA countries and develop a baseline analysis of the current state of the business value case (i.e. the profitable financial performance for specific companies, industries, and the people who invest in and extend credit to these companies) for environmental performance. Though the CEC does not have a mandate to work on climate change, when UNEP FI NATF and Bank of America suggested documenting the financial risks associated with climate change (Part I of this report), the CEC saw an opportunity to complement this work by asking the authors of the report to provide potential mitigating practices or policies available to financial institutions and governments when faced with environmental risk (Part II of this report).

The CEC would like to thank the authors and its partner UNEP FI NATF and Bank of America for this fruitful collaboration.

Chantal Line Carpentier,
Head, Environment, Economy and Trade Program

Commission for Environmental Cooperation
393, rue St-Jacques Ouest, Bureau 200
Montréal (Québec), Canada H2Y 1N9
E-mail: info@ccemtl.org
http://www.cec.org

Introduction

Environmental risk mitigation is currently taking place in many banking institutions. The steps taken in environmentally sensitive areas by the banks are designed to both protect the environment and reduce risk for the lending institution. Furthermore, many of the issues addressed in minimizing environmental risk are the same that would be addressed to reduce climate change risk. Continuing to address environmental protection and mitigation, no matter the source, can be both economically viable and socially advantageous to banking institutions. It can also aid in attracting and retaining socially driven clients.

The focus of this section of the report is on the environmental risk associated with climate change using information from Part I as an example, but the concept can be extended to other environmental risks.

1. Overview of Risk by Debt Product Type

Banks and other lending institutions are typically structured so that debt exposure is created among several business units, based upon specific product types. Since risk is often managed at the business unit level, it is useful to determine which business areas have exposure to environmental risk through their debt products.

1.1 Money Markets

This business unit typically includes commercial paper and other similar short-term forms of debt financing. Money market programs are often very large in size and may constitute the primary source of financing for many companies, but the maturity of these programs is very short. Specifically, the maximum term of a commercial paper program is typically 270 days (365 days for certain private programs), and the average maturity of commercial paper outstanding is typically no more than 30 days. Although money market programs are large in dollar volume, their very short maturity removes banks from any exposure to climate change risk. Even an aggressive climate change policy will have no impact on businesses within a one-year time frame, and there are no input, output, or physical risks associated with climate change that fall within a one-year horizon.

1.2 Corporate Loans, Leases, and Lines of Credit

Part 1 of this report utilized data exclusively from bank's corporate loan and lease portfolios. As described in Part 1, certain sectors of these business units have exposure to climate change related risks, and several sectors may face significant risk in the medium to long-term.

1.3 MBS, ABS and CDO/CLO Securities

Structured debt financing products, which are often found in several related business units, share the characteristics of typically having long final maturities. However, the average life or duration of these products tends to be relatively short. More importantly, the underlying assets in these products are unlikely to be exposed to significant climate change risk. Mortgage backed securities (MBS) products may have minimal exposure to physical risk of climate change in those regions where housing is along the southeast coast line of the United States, but this risk is relatively low. Asset backed securities (ABS) very rarely have exposure to any sectors related to climate change, as the underlying assets tend to be related to consumer loans such as credit card debt. Collateralized debt and collateralized loan obligation (CDO/CLO) products may have exposure when the underlying products include long-term debts or loans from companies in sectors specifically exposed to climate change. As reviewed in Part 1 of this report, CDO/CLO products utilizing assets from the coal, oil & gas, electric utility, aluminum and cement sectors may face exposure. On the other hand, most of these products are diversified across a portfolio of assets, thereby significantly reducing risk exposure to climate change.

1.4 Corporate Bonds

Corporate bonds share many of the same risk characteristics as corporate loans, and both average and maximum maturities can be very long. Furthermore, corporate bond maturities can rarely be shortened or "put" back to the issuer, unlike corporate loans or leases that often include covenants allowing lenders to shorten maturity. Therefore, corporate bonds with medium to long-term maturities (ie > 10 years) issued by the sectors highlighted as having risk in Part 1 of this report do face climate change related risk.

1.5 Fixed Income Derivatives

Fixed income derivatives include a variety of products, two of which create potential exposure for banks – interest rate and currency swaps, and credit swaps. The interest rate and currency swap market includes contracts between banks and corporations with maturities as long as 30 years, although more often 5 to 10 years. The notional exposure of banks in the interest rate and currency swap market to US and Canadian corporations is extremely large, with the total swap market over US$10 trillion. However, the actual value at risk under these contracts is significantly smaller, as many contracts are offsetting. Credit derivatives are a synthetic form of corporate debt exposure, and therefore share similar risks as corporate loans and corporate bonds. The risk associated with fixed income derivatives from climate change issues is present for counterparties with maturities greater than 10 years in the at-risk sectors identified in Part 1 of this report.

In summary, the risk of environmental liabilities to banks, specifically those resulting from the impact of climate change, is determined almost exclusively by the maturity of the bank's financial products. Business units that offer short-term maturity products (eg. commercial paper) or products in which the bank has the option to shorten maturity (eg. credit lines) currently have no exposure to climate change risk.

2. Strategies to Mitigate Environmental Risk

Banks and other financial institutions can mitigate environmental risk in one of two places – at the debtor or at the lender level. For most banks, it is difficult to implement mitigation tools at the debtor, as this is the prerogative of the borrowers themselves (an exception may be with CDO/CLO products, where the bank can essentially choose the portfolio of debtors). However, understanding the opportunities for debtors to mitigate environmental risk is a very useful exercise for banks. This knowledge can assist banks in convincing their clientele to become more active in environmental risk mitigation.

2.1 Mitigation at the Debtor Level

Once a debtor has identified a risk associated with environmental issues, it must determine the most appropriate route to mitigating that risk. For example, four potential routes for companies to reduce or eliminate greenhouse gas (GHG) risk are highlighted in the chart that follows:

Figure 2.1: Risk mitigation flowchart

GHG strategy options	Investments in emissions reductions	Internal reductions	Process emission reductions
			Energy efficiency improvement
		External reductions	Individual offset projects
			Offset project investment fund
	GHG trading options	Project based trading	Individual offset purchase contracts
			Individual offset purchase fund
		Allowance trading	Spot market trading
			Forward contracts
			Financial derivatives
	Production adjustment		Reduce production
			Relocate production
	Liability avoidance		Outsource emissions installation
			Stop/relocate production capacity

(Source: EcoSecurities)

2.1.1 Investments in Emissions Reduction

Companies can become carbon neutral via internal emissions reductions or external reductions. Internal reductions can be achieved through better processes or energy efficiency improvements. Reductions can be met externally through direct participation in offset projects or through investments in offset funds.

2.1.2 Greenhouse Gas Trading Options

Becoming a part of project-based emissions offset generation can be done individually or through a fund-based operation. Gaining experience and knowledge of the greenhouse gas markets allows companies to better assess the market and make sound financial decisions. Trading emissions can be done through spot markets, futures contracts, or financial derivatives.

2.1.3 Production Adjustments

Since greenhouse gas emissions are often directly related to production, companies can reduce them by adjusting the output of their plants. For instance, if a company has more than one facility it can reduce its emissions by allocating its production to those plants that are most carbon efficient, thereby saving allowances in other plants.

2.1.4 Avoidance of Liability

The differences in greenhouse gas policy among various countries can become an important factor when determining the location of a company's new facility. Companies may take advantage of these circumstances by locating a plant in a country that is not covered by an emissions policy. Therefore, companies avoid emission caps and hence the liability to reduce emissions.

2.2 Mitigation at the Lender Level

At the bank level, the tools for mitigating environmental risk are rather different from those available to the debtor. The specific tools to reduce exposure include the following:

2.2.1 Risk Analysis Tools

To manage potential risk associated with climate change and other environmental issues, it is imperative that banks focus research on developing risk analysis tools. Research should focus on the following areas:

Policy research

For debtors, a significant portion of the risk associated with environmental issues such as greenhouse gas emissions is a result of the policies that are implemented by various government entities to tackle climate change. Although these policies are designed to minimize emissions of greenhouse gases at the lowest economic cost, in many cases these costs can end up being born unevenly across sectors, as well as within sectors. As demonstrated in Part 1 of this report, even among the sectors that are considered at-risk from climate change, only a subset is actually exposed to any material policy risk. However, as climate change policy is complex (given the complexity of the underlying problem), and the impacts often overlap regions (given that greenhouse gases are produced locally but impact globally), bank research should focus initially on policy initiatives and the related impact on loan sectors.

Fixed income research

Current research analysis by fixed income analysts covers a wide range of risks faced by debtors, but very rarely does that analysis cover climate change related risks. It is reasonably straightforward for fixed income research analysts to include climate change as a variable in their analysis of sectors that have a material risk. Based on the analysis in Part 1 of this report, analysts should factor climate change into analysis of the coal, oil & gas, electric utility, aluminum and cement sectors, and potentially into the automobile and property/casualty insurance sectors.

2.2.2 Hedging Tools

Part 1 of this report described the many processes by which greenhouse gases are emitted by various commercial sectors of the economy, thereby exposing those sectors to policies that limit those emissions. Significantly, most of the emissions restrictions policies in place today, including the Kyoto Protocol, are what are referred to as "cap and trade" systems. Under a cap and trade emissions reduction program, capped entities such as greenhouse gas emitting utilities have the option to reduce exposure by buying credits or "offsets" from other participants. The ability to reduce exposure in this way is often highly cost effective for participants. For example, banks can alter their existing or future loan agreements to encourage their clients to participate in offset purchases. The actual cost of utilizing this type of hedging activity can be relatively small in comparison to the economic risks. For example, assuming an offset price of € 9.34 (US$11.95) per tonne of greenhouse gas emissions (see figures in Part 1: Review of Greenhouse Gas Regulation), banks and/or sector participants could hedge their exposure to a 10% reduction in emissions for the aluminum and cement sectors at the following approximate costs per annum:

Sector	Total Emissions (million metric tonnes CO2 equivalent) per annum	10% Reduction per annum	Cost of Offset (US$ millions) per annum
Aluminum	2.0	0.20	$2.4
Cement	21.5	2.15	$25.7

Clearly, buying offsets entail an external cost to the buyer of the offset. However, the cost may be small at current market prices for offset projects in relation to the value at risk to a specific industry. Based on the price of emissions reductions and the amount of total emissions, the aluminum sector could in theory be "hedged" against a 10% required reduction in greenhouse gas emissions for an investment of $2.4 million per year. Note that this type of hedge is likely to be very effective in mitigating policy risk, partially effective against input/output price risk, and ineffective at mitigating physical risk.

Offsets can be used even more effectively as part of a loan package prior to making the loan. Specifically, if a loan officer concludes that the risk of climate change in a sector represents a potential spread widening of 25 basis points per annum, the bank and/or sector participants can purchase offsets representing this increased risk, and price that into the interest rate on the loan. Utilizing offsets may be a low cost form of risk protection in comparison to increasing interest rates on loans, allowing banks to remain competitive when lending to sectors exposed to climate change, while keeping risk low.

The other type of hedging tool that can be utilized by banks to address climate change risks is commodity derivatives. As described in Part 1 of this report, many of the risks faced by loan sectors arise because of an increase in input prices, or a decrease in output prices. For example, a significant increase in the price of electricity due to a cap on greenhouse gas emissions may negatively impact the credit quality of aluminum companies. Through commodity derivatives, a lending institution might hedge against this risk by, for example, entering into a contract on the price of electricity that matches the term of the loan to the aluminum company client, in which the value of the contract increases as the price of electricity goes up. Similarly, caps on greenhouse gas emissions may lead to lower demand for coal, thereby hurting the coal sector's output price. Again, a bank may hedge against this risk by entering into a derivative contract that synthetically shorts the price of coal over the term of the loan to the coal sector client, thereby benefiting the bank if the price of coal were to decline.

2.3 Practical Recommendations to Banks

2.3.1 Risk Analysis Recommendations.

On most issues, including climate change, some companies are heavily exposed, others much less so. Without greater transparency and disclosure by companies, it is difficult for lenders to evaluate climate change related risk. It is reasonable to assume that for lenders the first step should be risk analysis and identifying how climate risks are distributed unevenly across sectors and within sectors. But, the reality is much more complex. Ample research has shown that even within sectors that superficially might seem homogeneous (e.g., electric utilities) environmental exposures are highly differentiated across individual companies. Loan officers and fixed income analysts should become familiar with the most important environmental risks and exposures in the sectors with which they deal, then analyze the specific exposures of the companies in those sectors whose liabilities they hold or consider holding. To facilitate this, banks should add their influential voices to those advocating full enforcement of and compliance with existing securities and accounting regulations requiring registered companies to disclose in their financial reports all material environmental liabilities, contingent liabilities, and known environmental risks and uncertainties.

Fixed income analysts and loan officers should factor the risk of environmental liabilities, and in particular the liabilities associated with the impact of climate change, into their analysis of credit risk in the specific sectors that are materially at risk. As identified in Part 1 of this report, fixed income analysts evaluating loans, leases or investments greater than 10 years to the electric utility, aluminum and cement sectors should definitely include the risk of climate change in their analysis, with specific emphasis on policy risk and input price risk. Analysts covering the coal, oil & natural gas, and P&C/reinsurance sectors should also factor climate change risk into their analysis, but in this case the impact is likely to be smaller. Furthermore, for these sectors the focus should be on policy risk, output price risk, and physical risk, especially as it relates to the insurance sectors.

2.3.2 Deal Structuring Recommendations

The risk to lending institutions as a result of climate change and similar environmental liabilities depends on the sector in which the loan is made, and the maturity of the loan under consideration. There is little need for lenders to consider climate change related risks to any sector in which the loan maturity, or the ability of the lender to call the loan, is less than five years. However, loans with maturities of less than five years have a small amount of risk stemming from the uncertainty surrounding climate change policy regulation. Loans in this category should be structured to absorb this small amount of risk. For loans with a maturity out to 10 years in sectors with a medium or high exposure to climate change risks, it is recommended that the lender structure the loan terms to allow for early call in the event of climate change related risks becoming evident, such as implementation of a cap on the emission of greenhouse gases. Loans with maturities greater than 10 years should not be made to sectors with high risk exposure, including the electric utility, aluminum, and cement sectors, unless all of the climate change risks for the sector have been evaluated, and the lending institution has either (i) included a call or similar early maturity provision, (ii) hedged the identified risk exposure, or (iii) priced the loan to adequately reflect the risk exposure. Alternatively, the lender may require the borrower to hedge the identified climate change exposure prior to executing the loan transaction.

2.3.3 Hedging Recommendations

Financial institutions have several options at their disposal to help themselves and their clients reduce their environmentally related risk. By reducing the risk of their clients, banks are able to reduce the associated risk from future loans and leases. The hedging activities listed below provide capability against the risks associated with environmental liabilities, and climate change in particular. Hedging strategies are by their very nature complex, and the specific hedge will vary depending upon the individual institution and the identified risk. However, it is likely that institutions in North America will benefit from considering implementation of the following hedging strategies:

High Risk Debt Sectors		
Medium Risk Debt Sectors		
Sector	High Risk Category	• Hedge Process
Electric Utilities	Policy Risk	• Voluntary offset projects in the U.S. • Kyoto compliant offset projects in Canada • Kyoto compliant CDM offset projects in Mexico
	Input Price Risk	• Commodity derivatives
	Physical Risk	• Insurance coverage
Aluminum	Policy Risk	• Voluntary offset projects in the U.S. • Kyoto compliant offset projects in Canada • Kyoto compliant CDM offset projects in Mexico • Upgrade to Hall-Herault manufacturing process
	Input Price Risk	• Utilize commodity derivatives • Green power purchase contracts
Cement	Policy Risk	• Voluntary offset projects in the U.S. • Kyoto compliant offset projects in Canada • Kyoto compliant CDM offset projects in Mexico • Switch to lower CO_2 emitting fuels • Convert from wet to dry manufacturing processes
	Input Price Risk	• Commodity derivatives • Green power purchase contracts
Coal	Policy Risk	• Voluntary offset projects in the U.S. • Kyoto compliant offset projects in Canada • Kyoto compliant CDM offset projects in Mexico • Lobby for increased use of clean coal technologies
	Output Price Risk	• Streamline mining processes • Initiate coal cleaning before delivery
Oil & Gas	Policy Risk	• Voluntary offset projects in the U.S. • Kyoto compliant offset projects in Canada • Kyoto compliant CDM offset projects in Mexico
	Output Price Risk	• Negotiate more long-term delivery contracts • Increase supply and disruption delivery capabilities
	Physical Risk	• Strengthen or relocate facilities in hurricane/flood prone areas • Higher insurance coverage for hurricane/flood prone areas
Property and Casualty Insurance/ Reinsurance	Physical Risk	• Increase incentives for climate change mitigation • Incorporate carbon management in future policy requirements • Increase participation in voluntary offset projects in the U.S. • Increase participation in Kyoto offset projects in Canada • Increase participation in CDM projects in Mexico • Strengthen/develop delivery guarantees for GHG projects

(Source: EcoSecurities 2005)

2.3.4 Recommendations to Regulators

Financial institutions are faced with two forms of regulatory risk: (i) uncertainty regarding current regulations, especially in the US, where there is a patchwork of state and regional plans in place, and (ii) uncertainty as to future regulations likely to come into place prior to the maturity of loans and leases currently outstanding. Therefore, it is strongly recommended that regulators focus on providing financial institutions, wherever and whenever possible, with regulatory certainty on climate change. The current lack of certainty is creating small but real risk for lenders and is preventing lenders from implementing hedging programs that could insulate them against that risk.

Furthermore, regulatory uncertainty could eventually force financial institutions to limit their exposure to climate change related risks by simply shortening the maturity of loans, leases and related products.

This will significantly reduce the risk exposure of financial institutions, but will provide a great disservice to borrowers requiring long-term financial products. For example, the electric utility sector has by far the longest average maturity loans of any of the debtor sectors analyzed in Part 1 of this report, reflecting the fact that electric utilities develop and own highly capital intensive, extremely long-term assets. If financial institutions find that shortening maturities is the only viable plan for dealing with regulatory uncertainty, then it would likely harm the ability for sectors requiring long-term financing to grow in the future, by limiting their access to long-term capital and/or increasing their cost of long-term capital.

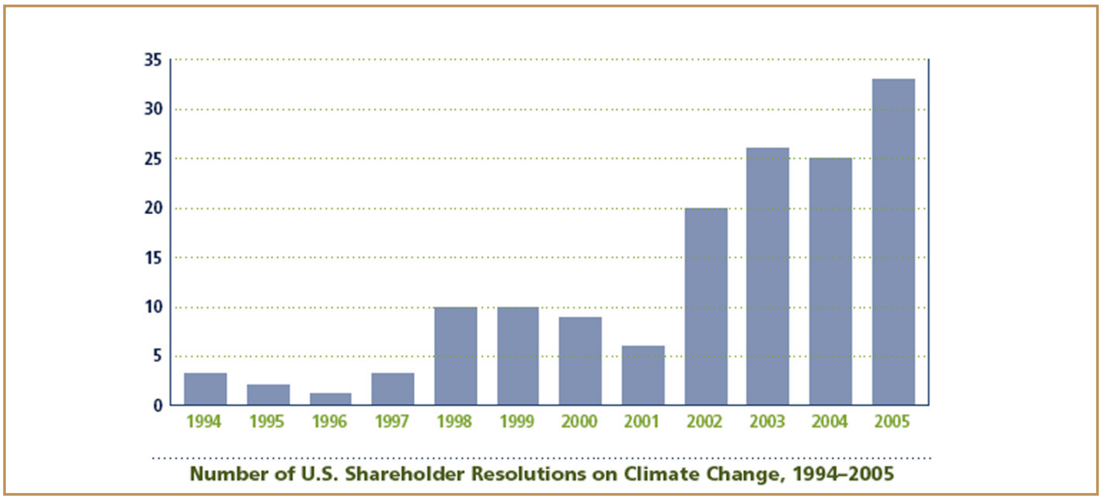
In conclusion, based on the sample of sectors studied in Part I, financial institutions are much less exposed to environmental regulations than they are to uncertainty from a lack of environmental regulations. This is especially pertinent to the issue of climate change risk as the repercussions can be both very large and appear over long periods of time. As demonstrated in Part 1 of this report, implementation of regulations that limit emissions of greenhouse gases will expose a few sectors to some risk, but the impact of this on corporate loan spreads, as measured in Europe where regulations are already in place, is minimal. The risk is not in the regulations, but in the underlying exposure to an ongoing environmental issue that eventually must be addressed and resolved. Financial institutions require regulatory certainty throughout their business, and climate change related risks are no exception; therefore, it is the strong recommendation of this report that regulators work with financial institutions to develop policies that will provide for stable climate change policy over as long a time period as is possible.

Appendix A: Additional Risks

Climate Change Shareholder Resolutions

In recent years, the number of proxy shareholder resolutions regarding climate risk disclosure or emissions reduction plans in the United States and Canada has increased. In 2003, the number of US climate change resolutions totaled 22. In 2004, there were 30 shareholder resolutions filed; 25 were filed in the US and 5 were filed against Canadian companies. Of the 30 resolutions, 13 requested risk disclosures and action plans to reduce greenhouse gas levels. Of those resolutions, 10 were filed with oil and gas companies and 5 were being presented with resolutions for the first time ever. As of February 2005 there were 33 proxy resolutions in the US and 10 in Canada representing companies with market capitalization over US$250 billion. Below is a schematic that reveals the number of shareholder resolutions in the US on climate change over the last ten years:

Figure A.1: Number of U.S. shareholder resolutions on climate change, 1994-2005



(Source: INCR)

Director's Liability

In addition to the growing number of proxy resolutions brought by shareholder organizations, there has been increased pressure to hold company executives liable for the lack of disclosure regarding climate change risk. The Coalition for Environmentally Responsible Economies (Ceres) has led the way in lobbying the federal Securities and Exchange Commission (SEC) to require that all companies provide disclosure of the financial risks they are exposed to from climate change. Both the resolutions and the request to the SEC are designed to attain greater transparency in their plans to address climate change related risk. In a 2003 study, Ceres also highlighted how they believe 20 of the largest carbon-emitting companies are failing to adequately disclose the financial risks they face from global warming.

The rationale for claims that company boards and directors are responsible for meeting climate change disclosures stems from the Management's Discussion and Analysis of Financial Conditions and Results of Operations (MD&A) section of a company's financial filings. This section of SEC filings specifically stipulates: "Specific known trends, events or uncertainties that are reasonably likely to have a material effect on a company's financial condition or operating performance must be discussed in the MD&A."

Management's Discussion and Analysis of Financial Conditions and Results of Operations - Corporate manager disclosure is required for the following situations:

- Item 101 – disclose any material estimated capital expenditures for environmental compliance for the remainder of the current fiscal year, succeeding year, or for such further period as the company may deem material during which the SEC filing is made.

- Item 103 – disclose administrative or judicial proceedings arising under environmental laws if they are material to the firm's business or financial condition, if a claim for damages exceeds 10% of current consolidated assets or the company is subject to proceedings where the government either is a party or may bring a proceeding that involves potential monetary sanctions (not merely civil liability) of more than $100,000.
- Item 303 – disclose currently known trends, events, and uncertainties that are reasonably expected to have material effects. This is required unless the company is able to prove that such events are not reasonably likely or are not reasonably likely to have a material effect.

Legislative language within section 906 of the Sarbanes-Oxley Act has also been brought into question. This regulation requires CEOs and CFOs to certify that the companies' periodic reporting accurately depicts the financial condition and results of operations. Ceres and others believe that the certification should or does cover the environmental information and environmental impact of the companies operations. The cost of non-compliance with Sarbanes-Oxley could include up to US$5 million in fines and up to 20 years in prison.

Getting the reporting of climate change risk included in the SEC filings might require lobbying to get CO2 or the other greenhouse gases classified as pollutants. Considering the disagreements surrounding climate change, getting greenhouse gases listed as pollutants may be difficult. For this reason, the proxy resolution forces the companies to impose the requirements as opposed to requiring government intervention. Time will tell how the issue of climate change will be addressed by corporate America, but if powerful shareholders continue to collectively push for corporate disclosure rules, both corporate transparency and mitigating plans in the US and Canada may indirectly be mandated.

Consumer Boycotts

Initiatives for curbing greenhouse gas levels do not only come from shareholders and federal/state entities. Consumer groups and advocacy organizations have considerable power to force corporations to consider their grievances. For example, Greenpeace, among other organizations has been criticized many multinational oil and gas companies. These campaigns are not unlike others that have attacked multinational corporations around the world in relation to their environmental stewardship, or lack there of. In many cases the campaigns have been very successful and led to further analysis and cooperation. In addition, the banking sector in the US has been the latest to be targeted with campaigns against their environmental records and holdings by organizations such as the Rainforest Action Network (RAN). Either because of these initiatives or in an attempt to head them off, some of the largest international banks have stepped up the assessment of their lending practices and become much more active in the management of their environmentally sensitive holdings.

Appendix B: Additional Background Information

Greenhouse Gas Emissions and Process Related Greenhouse Gas Emissions

Process-related emissions are those occurring as a result of non-energy use in a particular process. On-grid electricity generation plants might also lead to emission reductions if displacing more carbon-intensive electricity generation from other plants connected to the grid. The first table below provides an overview of most prevailing GHG emitting industries and other project activities in the energy industry. Each is further elaborated in the subsequent document. For example, a waste gas emitted in the flue gases during the production of nitric acid (HNO_3) is nitrous oxide (N_2O). The list is indicative, and not designed to be definitive, that is these are not the only processes in the world producing GHG emissions. The second table shows the Global Warming Potential (GWP) of N_2O relative to CO_2. The point to note here is that for every tonne of N_2O abated as a result of flue gas scrubbing, 310 tonnes of emissions reductions 'credits' (expressed as tCO_2 equivalent) can be generated. This makes non CO_2 gas reduction particularly valuable in a carbon context.

Potential Emissions from Industrial Processes

Process/Greenhouse Gases	CO_2	CH_4	N_2O	PFC	SF_6	HFC
Metal Production						
Aluminum	●	●		●	●	
Other metals, magnesium	●	●			●	
Iron, steel and ferroalloys	●	●				
Chemical Industry						
Nitric & adipic acid	●		●			
Ammonia	●					
Urea, fertilizers & petrochemicals	●		●			
Mineral Products						
Cement, lime & aggregates production	●					
Energy Industry						
Oil and gas industry	●	●				
Electricity Generation Plants	●	●	●			
Coal mining	●	●				
District heating	●					
Other						
Pulp and paper	●	●				
Charcoal production	●	●				
Production and use of halocarbons and SF6				●	●	●
Water services	●	●				
Palm oil, cassava starch and other agricultural products	●	●				
Sugar mills and alcohol distilleries	●	●				
Municipal and other waste management	●	●				

Relative Global Warming Potentials Factors

Emissions	GWP Conversion Factor (in tCO_2 equivalent)	Emissions	GWP Conversion Factor (in tCO_2 equivalent)
CO_2	1	HFC- 245ca	560
Methane	21	HFC- 32	650
Nitrous Oxide	310	HFC- 41	150
HFC- 125	2,800	HFC- 43- 10mee	1,300
HFC- 134	1,000	Perfluorobutane	7,000
HFC- 134a	1,300	Perfluromethane	4,800
HFC- 143	300	Perfluropropane	7,000
HFC- 143a	3,800	Perfluropentane	7,500
HFC- 152a	140	Perflurocyclobutane	8,700
HFC- 227ea	2,900	Perfluroethane	9,200
SF_6	23,900	Perflurohexane	7,400
HFC- 23	9,800		
HFC- 236fa	6,300		

(Source: IPCC 1996)

Sector	Onsite Emissions Sources	Offsite Emissions Sources	Abatement Options
Metal production			
Aluminum	• Stationary combustion CO_2 emissions (generation of energy on-site, predominantly electricity) • Process related CO_2 emissions • Process related PFC emissions	• Stationary combustion CO_2 emissions (purchase of energy, imports of electricity) • Transportation CO_2 • HFC use (air-conditioning)	• Reduction of electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Scrubber installation to remove PFCs emitted during the electrolytic aluminum production process
Other non ferrous metals (Magnesium and others)	• Generation of heat (blast furnaces etc) and electricity on site CO_2 (Use of reductive energy such as coke or coal) • Electrolytic process (magnesium etc) SF6 etc	• Imports of electricity CO_2	• Efficiency in the use of reductive fuels • Cleaner coke production • Reduction of electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Scrubber installation to remove GHGs emitted during the electrolytic production process • Utilization of furnace and kiln waste gases to generate heat and power
Iron and steel	• Generation of heat (blast furnaces etc) and electricity on site CO_2	• Imports of electricity or heat CO_2	• Efficiency in the use of reductive fuels • Cleaner coke production • Reduced electricity use • Utilization of furnace and kiln waste gases to generate heat and power
Chemicals			
Nitric & Adipic acid production (Precursor in fertilizer production and other chemicals & nylon production respectively)	• Generation of heat and electricity on site CO_2 • Fugitive flue gas emissions of N_2O	• Imports of electricity or heat CO_2	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Installation of CHP units • Destruction of fugitive N_2O emissions

Sector	Onsite Emissions Sources	Offsite Emissions Sources	Abatement Options
Ammonia Production	• Stationary combustion CO_2 emissions (purchase of energy, generation of energy on-site) • Process related CH4 emissions	• Stationary combustion CO_2 emissions (purchase of energy, imports of electricity) • Transportation • HFC use (air-conditioning)	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Installation of CHP units
Urea, Fertilizers and Petrochemicals	• Generation of heat (steam etc) and electricity on site CO_2	• Imports of electricity or heat CO_2	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Installation of CHP units
Mineral products			
Cement, Lime & Aggregates Production	• Generation of heat (steam etc) and electricity on site CO_2 • Process related emissions from limestone roasting in clinker production	• Imports of electricity or heat CO_2	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Switching of fuels (to natural gas for example) or use of renewable energy, biogas, waste derived fuels etc as a primary energy source • Refined production techniques requiring reduced clinker in the final cement mix, such as finer clinker crushing and blending with power station fly ash- reduced energy and process emission per tonne of cement produced
Energy industry			
Oil and gas industry	• Heat and power • Fugitive methane from associated gas production • Flaring of associated gas	• Electricity use	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid- energy efficiency • Utilization of associated gas to avoid flaring
Electricity	Use of energy on site		• More efficient production of electricity • Generation by other producers through less carbon intensive or renewable sources (fuel switching) • Sequestration of CO_2 in coal beds, saline aquifers or abandoned oil wells

Sector	Onsite Emissions Sources	Offsite Emissions Sources	Abatement Options
Coal mining	• Heat and power • Fugitive methane from mining operations	• Electricity use	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Mitigation of fugitive methane production (for example through use of captured gob gas for power generation and utilization of VAM in micro turbines
District Heating	• Use of fossil fuels, coal, fuel oil or natural gas	Generally no offsite emissions sources	• Energy efficiency through pipe and heat and electrical generation system upgrades • Fuel switching
Renewable Energy	• Generally no onsite emissions sources	• Generally no offsite emissions sources	• Reduction of emissions in national, regional, local and island grid systems • Reduction of emissions where direct onsite energy production was previously utilized • Mitigation of fugitive methane emissions where agricultural, sewage and municipal wastes are utilized and other disposal routes avoided
Combined Heat and Power	• Direct o site use of energy to raise steam or generate electricity	• Electricity taken forma grid	• CHP to reduce take of electricity from a grid or improve on site energy production efficiency
Other			
Pulp and paper	• Generation of heat (steam etc) and electricity on site CO_2 • Generation of waste biomass and land filling giving rise to fugitive methane production	• Electricity use	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Use of waste biomass to generate energy • Installation of CHP units
Charcoal production	• Charcoal kiln fugitive methane production		• Utilization of fugitive gases from charcoal kilns for energy purposes • Improved charcoal production, reducing methane production
HFC, PFC, SF_6, HCFC-22 production		• Emissions of fugitive gases	• Mitigation through scrubbing these fugitive gases

Sector	Onsite Emissions Sources	Offsite Emissions Sources	Abatement Options
Water service company	• Waste CH_4 emissions (waste water) • Stationary combustion CO_2 emissions	• Stationary combustion CH_4 and N_2O emissions (premises)	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Use of anaerobic digesters to produce biogas for on site energy use (reduced fugitive methane production from waste treatment) • Alternative waste treatment methods to reduce fugitive emissions
• Palm oil production • Cassava starch production • Agricultural food production (tea, coffee etc)	• Fugitive methane from waste water production • On site heat and electricity use	• Electricity use	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Use of anaerobic digesters to produce biogas for on site energy use (reduced fugitive methane production from waste treatment) • Alternative waste treatment methods to reduce fugitive emissions
Sugar mills & distilleries	• Fugitive methane from waste water production • On site heat and electricity use	Electricity use	• Reduction of heat and electricity either produced on site (and hence reduced on site energy use), or reduced electricity taken from the off site sources such as a national grid • Use of biogas for electricity generation and export • Use of anaerobic digesters to produce biogas for on site energy use (reduced fugitive methane production from waste treatment) • Alternative waste treatment methods to reduce fugitive emissions
Municipal and other waste production sources (Land filling)	• Fugitive methane production		• Capture and flaring, or use of LFG captured • Diversion of waste for other sources (such as fuels in energy production)

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Appendix B:

EcoSecurities and Standard Bank: Carbon Facility

About the UNEP Finance Initiative

UNEP FI is a unique global partnership between UNEP and the private financial sector. UNEP FI works closely with over 160 financial institutions to develop and promote linkages between the environment, sustainability and financial performance. Through task forces, working groups, training programmes and research, UNEP FI aims to address the opportunities that sustainable development can provide to the financial and subsequently the larger stakeholder community.

UNEP **Finance Initiative**
Innovative financing for sustainability

United Nations Environment Programme
UNEP Finance Initiative
International Environment House
15, Chemin des Anémones
CH-1219 Châtelaine, Genève
Switzerland

Tel: (41) 22 917 8178 Fax: (41) 22 796 9240
email: fi@unep.ch website: www.unepfi.org

About EcoSecurities

EcoSecurities is one of the world's leading companies in the business of originating, developing and trading carbon credits. EcoSecurities structures and guides greenhouse gas emission reduction projects through the Kyoto Protocol, acting as principal intermediary between the projects and the buyers of carbon credits.

Working at the forefront of carbon market development, EcoSecurities has been involved in the development of many of the global carbon market's most important milestones, including developing the world's first CDM project to be registered under the Kyoto Protocol. With a network of offices and representatives in 20 countries on five continents, EcoSecurities has amassed one of the industry's largest and most diversified portfolios of carbon projects. Today, the company is working on 213 projects in 26 countries using 17 different technologies, with the potential to generate more than 130 million carbon credits. EcoSecurities' consultancy division has been at the forefront of all the significant policy and scientific developments in this field. EcoSecurities Consult has been recognised as the world's leading greenhouse gas advisory firm over the last five years by reader surveys conducted by Environmental Finance Magazine. EcoSecurities Group plc is listed on the London Stock Exchange AIM (ticker ECO.L).

ECO SECURITIES

215 Park Avenue South
Suite 1903
New York, NY 10003, USA

Tel: +1 212 356 0160
Fax: +1 212 780 0941
email: us@ecosecurities.com
website: www.ecosecurities.com