Carbon 101: *Carbon Credit Opportunity Overview for First Nations Version 2.*

Sponsored by:

BC First Nations Energy and Mining Council

Carbon Credit Corp
a carbon neutral company

January 27, 2010

Table of Contents

Executive Summary

Carbon Credit Opportunity Overview for First Nations was originally produced by the BC First Nations Energy and Mining Council in October 2007 as an introductory paper to climate change and carbon markets. This updated Version 2 of the report was prepared as part of the BC First Nations climate change strategy in advance of international climate change meetings in Copenhagen in December 2009.

An overview of emission reductions and carbon credits are provided including a discussion of key carbon credit project types. A discussion of Canadian carbon credit market types and international legislation is presented. Opportunities for partnership in climate change mitigation and carbon markets are presented and analyzed. Most importantly, strategies for First Nations to pursue carbon credit opportunities are presented.

Forestry, presents a unique opportunity for First Nations in British Columbia BC First Nations due to the unresolved land question over vast amounts of forests in the province. Through the use of Ecosystem-based management and improved land management techniques is possible to free up millions of tons of environmental attributes such as carbon credits from forests. This presents a unique opportunity for BC First Nations establish an additional asset class revenue streams to support sustainable communities across the province.

Its great because what is happening with our neighbour to the self and with the inclusion of land-based offsets into the international offset being reformulated in Copenhagen. US government espoused climate legislation through Congress now has proposed legislation in the Senate which will focus up to 90% of carbon offset program to be derived from land-based activities such as sustainable forestry in sustainable agriculture. In Copenhagen the inclusion of sustainable forestry practices and sustainable agricultural practices into the world carbon scheme is a major discussion point. Both of these initiatives are creating huge demand for forest-based offsets in an exciting possible future for First Nations who can create and deliver forest offsets into these burgeoning markets.

A recently released report “The Carbon the World Forgot” highlighted the importance of Canadian forests to worldwide greenhouse gas management. Globally land-use change and forestry account for between 20% To 30% of annual greenhouse gas emissions. The Canadian northern boreal forest is the world's largest terrestrial carbon bank and encompasses 50% of the world’s remaining intact wilderness. This forest alone stores over 200,000,000,000 tons of carbon and sequesters carbon at twice the rate of tropical rain forests.

Unique opportunity in time, First Nations can gain control and utilize, leverage, and increased influence over forests and the land. The new asset class of environmental attributes, of which carbon credits are one, below First Nations to develop sustainable economic communities while also furthering preservation of the world's natural capital required for climate change mitigation.

1. Introduction

This report was originally produced by the BC First Nations Energy and Mining Council in October 2007 as an introductory paper to climate change and carbon markets. The International climate change meetings in Bali in 2007, the COP 13 Meeting highlighted the importance of sustainable forestry and agricultural development. It was noted that the conference that one year's deforestation in Brazil, more than negated all the benefits and realize through Kyoto to date. At that point it was decided that there would be focus upon forest carbon agricultural carbon but you got to Copenhagen and the COP 15 Meeting in December 2009. This inclusion of land–based offsets is an important addition to the world's fight to tame climate change, because land use change is the largest component of greenhouse gas in the atmosphere. This has put BC First Nations at the forefront of the climate debate and prompted the need to update this paper.

2. Carbon Credit Overview

This section introduces the concept of carbon credits, also known as carbon offsets. Carbon credits are part of a larger class of assets know as environmental attributes which include water offsets, species offsets, and ecosystem offsets. Different types of carbon credits exist in the market and the following provids an overview of North American carbon credit markets as of November , 2009.

2.1. Emissions Reductions and Carbon Credits

2.1.1. Definition

A carbon credit represents a specified reduction in greenhouse gas (GHG) emissions, and is typically denoted in "tonnes of CO_2 equivalent" or "tCO_2e".

The *Kyoto protocol* is an amendment to the United Nations Framework Convention on Climate Change (UNFCC) and it specifies mandatory emissions reduction targets for greenhouse gas emissions in signatory nations for the period between 2008 and 2012. At the time of writing, although Canada signed the Kyoto Accord, it had not proposed nor enacted legislation that contemplates our commitments under the Kyoto Protocol. Canada has announced a GHG mitigation and regulation plan that is due to be enforced in 2012.

The 6 major greenhouse gases targeted for reduction are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). The first three gases are naturally occurring while the final three classes of gases are generated from anthropogenic activities such as refrigeration and transmission. For a brief explanation of the greenhouse effect and for specific details and characteristics of the six greenhouse gases, please refer to Appendix A9.1.

The "equivalent" or the "e"in the tCO2e unit indicates that carbon dioxide gas (CO2) has been selected as the base unit for carbon credits, and other greenhouse gasses (or GHG's for short) are rated according to the strength of their global warming potential (GWP) or potency when compared to carbon dioxide. For example an equal amount of methane is approximately 20 times the impact of an equal amount of carbon dioxide, an equal amount of nitrous oxide has over 300 times the impact of carbon dioxide. Finally one tonne of CFC-12 (a carbon based fluid commonly called Freon 12, used in refrigerators until its manufacture was banned in the mid 1990's in many countries for its ozone depleting effect) is 10,000 times the impact of CO_2.

The greenhouse gases addressed by the Kyoto Accord (or any form of greenhouse gas regulation) can therefore all be expressed in common terms of tCO_2e or tons or carbon dioxide equivalent. Reductions in any one of the 6 gases are converted to tCO2e and then are potentially eligible to qualify for an equivalent number of carbon credits, given certain pre-conditions.

2.1.2. Purpose

Carbon credits allow a market to develop between entities that are willing to pay money to reduce emissions and entities that are in the position to reduce emissions or sequester atmospheric carbon. Carbon credits therefore channel resources into GHG reducing projects and the development of new global warming mitigation technologies. Simply put , it puts a price on pollution and makes polluters pay to those creating benefits for the environment.

This concept of creating a price on pollution is not new . During the 1970's and 1980's a price was put on pollution from smokestacks to combat the effects of acid rain (i.e. NOX and SOX emissions) . The program was so effective that by the turn-of-the-century , most young people had not heard of acid rain. Carbon credits can also assign economic value to activities which encourage the conservation of forests and rehabilitation of land, through recognition of carbon credits for carbon sequestration. Carbon sequestration (which will be explored in detail in a subsequent section of this paper) refers to the ability of plants and trees to breath CO2 from the air through the process of photosynthesis and to store CO2 . Sequestration can occur in trees, plants, soil and the ocean.

Three ways to create emission reductions: through sequestration, through fuel switching, and through efficiency measures.

2.1.3. Carbon Credits Accounting

There are five major principles for generating carbon credits, which basically state that carbon credits must be:

1. **Additional:** the project must introduce a change that lowers emissions compared to a base-case or "business as usual."
2. **Verified:** assurance by an independent third party that the emissions reductions claimed have genuinely taken place
3. **Adjusted for Leakage:** an unintended change in emissions or removals in another location, resulting from the project, leading to an overall level of emissions that has not been fully reduced.
4. **Permanent**: the emission reduction should be guaranteed over a stated period of time.
5. **Unique or Counted Once:** the credits generated cannot be sold in multiple programs or markets.

These rules form the basis of the various voluntary and regulatory protocols, which are basically definitions of methods by which carbon offset credits are calculated and the rules required to qualify. Projects can generate carbon credits under any of the available voluntary or regulatory protocols. These principles of carbon credit accounting can be found in more detail in Appendix A9.2. The basic rules of carbon accounting have been created by World Resources Institute (WRI) publication entitled "GHG Accounting and Reporting Protocol, version three."

2.1.4. Carbon Credit Types

As stated earlier, carbon credits can be derived from a set of rules or protocols and each yields a different type of carbon credit (i.e. a sequestration credit from agriculture or forestry, an efficiency credit, a fuel switch clean tech credit, a methane capture credit, etc). In general there are two primary classes of carbon credits: Offset credits created from project activities (like those just mentioned) and quota-based credits which are auctioned or given out under regulatory systems such as Cap-and-Trade systems.

Offset credits are verified project-based reductions and are generated by specific projects designed to reduce emissions. An example of offset credits, or project-based credits, are carbon credits that are generated from the use of solar panels or wind farms or run-of-the-river to generate electricity that would otherwise have been produced by the burning of fossil fuels, say in a diesel generator. In 2006, offset credits accounted for approximately 17% of carbon credits traded in the global carbon market. Offsets can be developed to a various certification standards such as the Voluntary Carbon Standard (VCS) , the Climate Action Reserve (CAR),or under emerging standards in Alberta (Alberta Offset System), BC (Pacific Carbon Trust) , Ontario and other States and Provinces.

Quota-based credits are implemented via a system for which a baseline emission level is set and credits are given for achieving emissions less than the baseline quota. This is otherwise known as a cap-and-trade system, and in general is the mechanism of choice for most regulated markets. Under this system, carbon emitters are given a certain allowance based on a specific baseline. If the carbon emitter is able to reduce emissions, the emissions reductions can be sold as carbon credits to other emitters who have exceeded their emissions allowances. A list of the types of carbon credits available can be found in Appendix A9.2.

In the United States, climate legislation know as the Waxman-Markey bill (also known as ACES or American Clean Energy and Security Act or 2009) was approved by Congress in June 2009 and provides for fungibility of offsets developed under voluntary schemes and existing regulatory schemes, with prospective compliance credits for regulated US companies, and foreign companies selling into the future 'capped' US marketplace. This bill now heads to the Senate for approval in 2010 as the Kerry Boxer bill.

The Voluntary Carbon Standard ("VCS") provides a benchmark standard for voluntary greenhouse gas emissions reductions and removals. The VCS provides quality assurance standards for carbon offset projects globally, in order to ensure that offset development projects are real, additional, measurable, permanent, independently verified and unique.

The VCS has created a platform for the development and approval of most project types including technology-based offsets, and, importantly, *Forest Conservation Projects.* The VCS creates a continuum for all types of land management strategies, and includes methodologies for Agriculture, Forestry and Other Land Uses ("AFOLU"). Currently there are following four categories of AFOLU project are eligible under the VCS Program:

1. Afforestation, Reforestation and Revegetation;
2. Agricultural Land Management;
3. Improved Forest Management; and
4. Reducing Emissions from Deforestation and Degradation.

Forest Conservation Projects in British Columbia are eligible under the Improved Forest Management[1] category of the VCS. Projects that are successfully developed according to the VCS Improved Forest Management methodology that are independently validated and verified, will create valuable carbon offsets in the voluntary and pre-compliance marketplaces domestically and internationally in the pre-2012 time-period.

On July 23, 2009 the Voluntary Carbon Standard Association ruled unanimously to allow projects hosted in Canada to issue Voluntary Carbon Units ("VCUs") without the corresponding cancellation of Assigned Amount Units ("AAUs"), the compliance units under the Kyoto Protocol. Prior to this action, projects in Canada wanting to issue VCUs had to demonstrate the units would not be double counted.

The VCS Board concluded that this requirement is not applicable to Canada because there is no regulatory framework to implement the Kyoto Protocol, none is likely to emerge, and the country is unlikely to achieve its Kyoto Protocol reduction commitment. Therefore, implementing GHG emission reduction or removal projects in Canada will not result in double counting vis-à-vis the country's Kyoto Protocol reduction commitment. Forest Conservation Projects in British Columbia that are validated and verified to a VCS standard can be registered with the VCS Registry.

2.1.5. Carbon Credit Valuation

As with most goods, the price of carbon credits depends on supply and demand and on regulation. One of the biggest factors driving the price and the expected price trends in the future is the fact that both the US and Canada are expected to have national-level regulatory markets. As observed with the experience the European Union (EU) has had with implementing regulatory markets, the price of carbon credits are expected to rise once regulatory markets come into existence. In fact, one of the reasons corporations are buying carbon credits now in the voluntary carbon markets is to secure carbon credits at a more moderate price.

Once regulations are put in place that make it mandatory for companies to cap their emissions, the demand for carbon offsets will increase and the prices for carbon credits is expected to be higher than on the voluntary market. This is driven because the cap on companies is reduced over time and there becomes greater need to either change operations to a low carbon scheme or buy more offsets. This is demonstrated by the experience with the European Union Exchange Trading Scheme (EU ETS), where carbon offsets trade from $18.00 to $35.00 CAD.

In North America , individual States may issue allowances (quota based credits) under their own Cap-and-Trade legislation . These quota based allowances issued by California and other states before 2012 will be exchanged for Federal carbon allowances under the coming US climate change legislation. The prospect of fungibility with federal law, among other reasons, has stimulated a domestic offset market, through the California Climate Action Registry (now known as the Climate Action Reserve). The new market generates Climate Reserve Ton (CRT) units, which currently comprise project types from livestock to landfills across the US and forestry project offsets in California.[2] Early transactions for one to 10 year terms forward have been

[1] The project methodology for Reduced Emissions from Deforestation and Degradation is arguably specific to projects in developing nations.

[2] An expanded Protocol for Forest Conservation Projects throughout the WCI is expected to be released by the Climate Action Reserve in Fall 2009.

reported with prices ranging between US$5.00 and US$14.00 depending on the location, project type and volume of supply guaranteed in contracts. The primary buyers of these CRT's have been pre-compliance buyers with an eye to California's AB 32, the emerging Western Climate Initiative (WCI) and potential Federal US Program.

The expectation of regulation creates a new type of buyer in the voluntary market: a pre-regulatory buyer. This is a buyer that wants to buy credits before regulation begins , expecting that these credits will count as "early action" credits that get grand-mothered into the coming regulatory system. So while VCS and CAR voluntary credits have been trading at $6.50/ton during points of 2009, the pre-regulatory favoured CAR credits have risen in price to $9.50 a ton. The regulatory price in Alberta is up to $15/ton and the Pacific carbon trust in BC charges its regulated entities $25/ton.

The range of future prices is expected vary widely, with a study from MIT estimating that based on expected regulation prices could range from US $15 to $55 by 2015 per tCO_2e. An overview of the history on the carbon credit market and pricing can be found in Appendix A9.3.

2.1.6. Intensity versus Absolute Emissions Reduction Targets

Intensity emissions reduction targets are defined by a pre-specified rate of reduction relative to an input or output, while absolute emissions reduction targets are set to reduced emissions to a pre-specified absolute quantity. Intensity limits are the most common method for limiting emissions in the field of environmental regulations, and is the method adopted by the Alberta regulators for the Alberta Carbon Tax.

An intensity based emission reduction limit is a point of controversy among some politicians and environmentalists, in that the absolute amount of emissions reduced is not known at the outset and emissions are therefore viewed as having the unlimited potential to keep increasing. However, as posited by Ellerman et. al. (2003) [3] the two systems are actually equivalent if the future can be known with certainty. For example, if the intensity limit is based on output, then setting the intensity limit for that known output will result in an absolute limit. Because the output of an industry is constrained by market factors, there is in effect a real upper bound to emissions controlled by intensity limits.

The key differences between intensity-based and absolute emission caps concern the amount of abatement required and the costs of control incurred by a constrained party. If GDP growth, and hence output is less than expected, the intensity cap will require greater abatement and incur higher costs; if the GDP growth is high than expected, the absolute cap will require greater abatement and incur higher costs. The relevant market effects are then as follows: when GDP growth is higher than expected, carbon credit prices in an absolute cap system will tend to be higher than that in an intensity cap system; when GDP growth is lower than expected, carbon credit prices in an absolute cap system will tend to be lower than that in an intensity cap system.

2.2. Key Carbon Project Types

[3] A. Denny Ellerman and Ian Sue Wing. *"Absolute vs. Intensity-Based Emission Caps"*. Report No. 100 July 2003, MIT Joint Program on the Science and Policy of Global Change

2.2.1. Forestry

Land-use change, such as the conversion of Amazonian forests to industrial mono-crop agriculture, accounts for approximately 20% of global greenhouse gas emissions – more than the emissions from the transportation sector worldwide. The majority of these land-use change emissions come from deforestation in developing countries, where forests are being cleared for agriculture and timber. Currently, the international climate change community is considering how to create incentives for reducing emissions from deforestation and degradation. Given the magnitude of deforestation emissions and the low cost of abating those emissions, Avoided Deforestation is poised to play a very important role in the global strategy to abate GHG emissions.

More broadly, Land Use, Land Use Change and Forestry (LULUCF), as termed by the UNFCC, activities can provide a relatively cost-effective way of offsetting emissions, either by increasing the removals of greenhouse gases from the atmosphere (e.g. by planting trees or managing forests), or by reducing emissions (e.g. by curbing deforestation).

The Voluntary Carbon Standard ("VCS") has created a platform for the development and approval of Forest Conservation Projects. The VCS creates a continuum for all types of land management strategies, and includes methodologies for Agriculture, Forestry and Other Land Uses ("AFOLU"). Currently there are following four categories of AFOLU project are eligible under the VCS Program:

1. Afforestation, Reforestation and Revegetation;
2. Agricultural Land Management;
3. Improved Forest Management; and
4. Reducing Emissions from Deforestation and Degradation.

Forest Conservation Projects in Canada can be eligible under the Improved Forest Management[4] category of the VCS. Projects that are successfully developed according to the VCS Improved Forest Management methodology that are independently validated and verified, will create valuable carbon offsets in the voluntary and pre-compliance marketplaces domestically and internationally in the pre-2012 time-period.

On July 23, 2009 the Voluntary Carbon Standard Association ruled unanimously to allow projects hosted in Canada to issue Voluntary Carbon Units ("VCUs") without the corresponding cancellation of Assigned Amount Units ("AAUs"), the compliance units under the Kyoto Protocol. Prior to this action, projects in Canada wanting to issue VCUs had to demonstrate the units would not be double counted.

The VCS Board concluded that this requirement is not applicable to Canada because there is no regulatory framework to implement the Kyoto Protocol, none is likely to emerge, and the country is unlikely to achieve its Kyoto Protocol reduction commitment. Therefore, implementing GHG emission reduction or removal projects in Canada will not result in double counting vis-à-vis the country's Kyoto Protocol reduction commitment.

[4] The project methodology for Reduced Emissions from Deforestation and Degradation is arguably specific to projects in developing nations.

Protocols are also emerging under the California legislation (as discussed below) for Avoided Deforestation projects in any territory in the US, and there are signals that this protocol may be extended to include at least British Columbia and other participants of the Western Climate Initiative (as discussed below).

2.2.2. Agriculture

Soils sequester carbon due to the organic matter (biomass) that accumulates and become incorporated into the soil. In agricultural land, soil management practices determine the effectiveness of soils at sequestering carbon. Tillage disturbs the soil and causes rapid oxidation of the organic matter in the soil, and looses sequestered carbon back into the atmosphere. Incidentally, increasing the carbon content in soil increases the fertility of the soil and its ability to support plant growth. Other agriculture opportunity exist to create carbon projects including livestock feeding and manure, beef life-cycle, days on feed and methane management.

2.2.3. Fuel Switching

Fuel switch projects quite simply avoided emissions from fossil fuels by switching the feed stocks to lower emissions fuels. For example large cement plants often uses fossil fuels (coal, coke, natural gas) as the primary fuels for their kilns. High levels of baseline greenhouse gas emissions are directly related to the combustion of these fuels. A fuel switch project would reduce the combustion of these fuels relative to the amount of clinker produced due to the incremental substitution of biomass-based fuels such as a processed engineered fuel (PEF), which is derived from construction and demolition wood waste.

2.2.4. Energy Efficiency

Energy efficiency projects project result in savings of electricity from regional electricity grids. Based on emission factors (i.e. the emissions per unit of electricity), savings in electricity result in emissions reductions. The opportunity for energy efficiency projects is highly depended on the grid emission factors or how 'green' the electrical grid is. For example in BC, approximately 50MWh of electricity conservation is required to generate 1 tCO_2e. In Alberta, the ratio is approximately 1 to 1.

2.2.5. Artificial Sequestration

Artificial carbon sinks are formed through the use of artificial carbon sequestration techniques such as geological sequestration and mineral sequestration. Geological sequestration involves pumping CO_2 into underground chambers, such as depleted oil reservoirs. Mineral sequestration is a process where CO_2 is injected into areas rich in Magnesium or Calcium, which will then react with the CO_2 to form magnetite and limestone, respectively. Currently, artificial carbon sequestration techniques are still under development, as they are energy intensive and impractical for large scale carbon sequestration.

3. Carbon Credit Markets

3.1. Voluntary and Regulatory Markets

The voluntary market consists of companies, governments, organisations, organisers of international events, and individuals, taking responsibility for their carbon emissions by voluntarily purchasing carbon offsets. These voluntary offsets are often bought from retailers or organisations that invest in a portfolio of offset projects and sell the resulting emissions reductions to customers in relatively small quantities.

Regulatory markets exist where companies, governments, organisations, organisers of international events, and individuals are regulated by law to maintain emissions levels bellow a certain level. If they cannot reduce emissions to this level or it is too costly do so, then they must purchase offsets. Pending North American cap and trade systems are regulatory markets. Emissions are "capped" at a certain level and offsets can be traded to meet those emission levels. The Alberta Offset System is the first regulated Market in North America. Under the proposed Waxman-Markey Bill in the US, Allowances issued by California and other states, and credits developed to the Voluntary Carbon Standard before 2012 can be exchanged for Federal carbon allowances, as discussed above.

3.2. Canadian Carbon Exchanges/Markets and Legislation

Carbon credit exchanges were established as carbon credit trading became more prevalent, and are functionally similar to commodity exchanges. The Chicago Climate Exchange or "CCX" is one of the first and probably most well known GHG exchanges in North America. It was founded by Dr Richard Sandor , who was instrumental in pricing the acid rain pollution in the United States. The CCX however is a members only exchange and is not open to the public. Because of this it has historically lower prices and is not the best price reference point. In the western region, the markets are being created for the California-based Climate Action Reserve ("CAR") which is now active across the US and Mexico. Other markets include BC , Alberta and Manitoba offsets systems.

3.2.1. Alberta Offset System

The Alberta offset system (ABOS) is based on a provision in the Alberta provincial carbon emission tax (ACT) that allows the use of offsets that are generated through agriculture based projects. The offset credits are generated based on specified project type protocols that are developed using the ISO[5]/CSA[6] 14064 standards for guidance. Currently the ABOS, has approved protocols in the areas of livestock feeding and manure, no-tillage agriculture, energy efficiency, geological sequestration, methane management, renewable energy, transportation and waste management. A number of other draft protocols in development. Climate Change Central[7] is the ABOS project registry and issuer of protocol.

3.2.2. BC Emission Offset Regulations and the Pacific Carbon Trust

The BC Emission Offset Regulations (BC Reg. 393/2008) of the Greenhouse Gas Reduction Targets Act deposited December 9, 2008 describes the regulations around the creations of BC offsets. The Pacific Carbon Trust, a provincial agency was established to purchase BC – generated offsets to sell to the public sector who are mandated to be carbon neutral in 2010 (Carbon Neutral Government Regulation). In November 2009, PCT is guiding carbon developers and project owners through RFP process to qualify carbon offset projects. BC

[5] International Organization for Standardization
[6] Canadian Standards Association
[7] http://www.climatechangecentral.com/

Emission Offset Regulation has not developed protocols but accepts protocols developed by different registries and jurisdictions if they meet standards. The PCT buys carbon offsets at prices from $8-$18, and sells them to regulated entities at $25.00 per ton.

The Greenhouse Gas Reductions Target Act requires the British Columbia government to produce a biannual inventory of greenhouse gases, while Environment Canada also produces an annual National Inventory Report. British Columbia has also undertaken a Community Energy and Emissions Inventory (CEEI) initiative to provide greenhouse gas inventories to all BC municipal governments.

Under the *Greenhouse Gas Reductions Targets Act* (GGRTA), which came into force on January 1, 2008, the BC Ministry of the Environment has set out the requirements for greenhouse gas reductions from projects or actions to be recognized as emission offsets for the purpose of fulfilling the provincial government's commitment to carbon neutral public sector by 2010. Biological sinks and Forest Based Conservation Projects have not been specifically excluded. In fact the GGRTA makes specific provision for biological sinks and Forest Based Conservation Projects in two ways:

- Where projects involve carbon capture and storage or biosequestration, a proponent must establish a risk mitigation and contingency plan for reversals; and
- A time-limited transition provision allows for ex-ante reductions (recognition of reductions before they have actually occurred).

Though the Pacific Carbon Trust has (PCT) has invested exclusively in technology projects to date in its commitments to purchase 330 000 tonnes of emissions reductions in the 5-year period beginning in June 2009, the PCT not restricted from investing in Forest Conservation Projects. The PCT projects that it will require 700 000 – 1 Million additional tonnes during the same period.

3.2.3. Manitoba Offset System

Representatives from the Ministry of Environment for Manitoba have indicated they will be adopting an approach similar the one Alberta has taken and will also be using Climate Change Central and the CSA GHG Clean Projects Registry.

3.2.4. Montreal Climate Exchange

The Montréal Climate Exchange (MCex) is a joint venture between the Montréal Exchange (MX) and the Chicago Climate Exchange® (CCX). The MX brings to this new market its expertise in leading edge trading systems, clearing, market regulation and financial risk management. The CCX contributes its expertise in operating an environmental market. The CCX is the world's first and North America's only voluntary legally binding rules-based greenhouse gas emissions allowance trading system. The MCeX has launched trading of futures contracts on Canada carbon dioxide equivalent (CO2e) units. These contracts will allow regulated industrial participants to manage their emissions risks at the lowest cost while also creating continuous incentives for technological innovation. The new MCeX contract, traded on the Montréal Exchange's (MX) electronic trading platform SOLA, will give key regulated industrial emitters and other potential stakeholders the price signals needed to measure "the price of a ton of carbon".

3.2.5. Canadian Offset System

On June 12, 2009, Canadian Environment Minister Jim Prentice published to the Canada Gazette two draft guides: *Canada's Offset System for Greenhouse Gases: Program Rules and Guidance for Project Proponents,* and *Canada's Offset System for Greenhouse Gases: Program Rules and Guidance for Validation and Verification Bodies* (the "*Guides*"). The *Guides* follow the publication of the first draft Guide which was published in August 2008, which proposed rules and guidance to quantify greenhouse gas reductions.

The *Guides* propose the rules and guidance on the requirements and processes to verify eligible greenhouse gas reductions from a registered offset project under Canada's Offset System for Greenhouse Gases. The two documents are subject to public comment for a 60-day period. Final versions of the two guides are expected to be published in the fall of 2009.

Under Canada's Offset System for Greenhouse Gases, the Government of Canada will issue credits for greenhouse gas emissions reductions and removals from activities or sectors that are not covered by planned federal regulations of greenhouse gas emissions. To be eligible to receive offset credits, projects must be within the scope of the Offset System, and must achieve real, incremental, verifiable and unique reductions of greenhouse gases.

Forestry Conservation Projects in Canada may be eligible for accreditation under Canada's Offset System for Greenhouse Gases. Eligibility of a project will depend on whether it meets the specific criteria of one of Offset System Quantification Protocols that are under development, or which may be submitted by a Protocol Developer. The *Guides* specifically consider biological sink projects, and provide specific proposed rules for such projects including annual reporting requirements and potential discount factors.

The Protocol Submission Schedule provided publicly by Environment Canada indicates that the Forest Project Protocol developed by the California Climate Reserve will be reviewed for inclusion as the basis of a protocol in Canada by February 1, 2010. Signals coming from Environment Canada and others are that inclusion of Forest Conservation projects under the offset system is unlikely.

3.2.6. Quebec Carbon Tax

Quebec introduced the Quebec Carbon Tax (QCT) which became effective October 1st, 2007. This is a retail tax on carbon based products and for the most part will immediately be passed on to the consumer in the form of higher prices. For example, the tax is $0.008 per litre for gasoline and $0.009 per litre for diesel. It is estimated the gasoline and diesel taxes will net about $200 million dollars per year.

For a more comprehensive list of carbon credit exchanges are markets in North America, and further details on ACT and ABOS, please refer to Appendix A1.5

3.3. Western North American Climate Change Alliances

Two principle climate change alliances are active in Western North America: The Climate Action Reserve (CAR) and the Western Climate Initiative. The WCI has become the predominate North American climate change initiative. Arizona, California, Montana, New Mexico, Oregon, Utah, Washington, British Columbia, Manitoba, Ontario, and Quebec are all partners. WCI also has a number of 'Observer' states.

4. International Regulation and Legislation

4.1. Copenhagen, December 2009

In 2012 the Kyoto Protocol to prevent climate changes and global warming runs out. To keep climate change mitigation on the international agenda there is an urgent need for a new climate protocol. At the conference in Copenhagen in December 2009 the parties of the UNFCCC meet for the last time on government level before the climate agreement needs to be renewed. Therefore the Climate Conference in Copenhagen is essential for the world's climate. UNFCCC hoping the meetings in Copenhagen are a success resulting in a Copenhagen Protocol to prevent global warming and climate changes.

One focus of the upcoming Copenhagen climate discussions, relevant for First Nations is the role of natural ecosystem in reducing emissions, particularly forests. It is said that one year's deforestation in Brazil releases as many emissions as all the Kyoto Protocol reductions. Avoided deforestation has the largest role to play in mitigating climate change forest carbon projects will be fundamental to preserving forests.

4.2. US Waxman- Markey Bill/ ACES/Boxer Kerry

The US House of Representatives has passed the Waxman-Markey bill, or American Clean Energy and Security (ACES) Act was passed in July 2009 by the US House of Representatives' Committee on Energy and Commerce. The proposed Waxman-Markey Bill now awaits Senate and final Presidential approval. It will undoubtedly see more amendments and changes. The Senate version of the bill is know as the Boxer Kerry Bill.

The bill mandates national emissions reductions using economy-wide emissions trading and various other policy measures. The bill is now entering the Senate process and faces more significant hurdles than in the House. However, once passed America could have in place comprehensive and ambitious carbon emissions control in the near future. It would be a momentous change for the US, and it would catalyze action elsewhere.

The Waxman-Markey Bill lays the groundwork for a national cap-and-trade system that covers 85% of the US economy including electricity producers, oil refineries, natural gas suppliers, and energy intensive industries including iron, steel, cement and paper manufacturers. Emissions cuts would begin in 2012 and a cap-and-trade system would be completely phased in by 2016. The cap targets are currently set at 3% below 2005 levels in 2012, 17% below 2005 levels in 2020, 42% below 2005 levels in 2030, and 83% below 2005 levels in 2050.

In addition to domestic offsets, international offsets are likely to qualify as a compliance option in the US. Regulated entities will be able to purchase domestic and international offsets to meet their compliance obligations.[8] The Waxman-Markey Bill allows up to one billion tons annually in international offsets for compliance. The first compliance period (2012 – 2013) will require 140 million tons of reductions each year. US-based Carbon Offsets will not suffice to meet this gap. The third compliance period (2016 – 2018) will have a gap of 550 millions of tons of reductions each year. Forest Conservation Projects in BC may qualify for such compliance purposes.

[8] Eligible offset types will be determined by an EPA Advisory Board, but the bill defines 'additionality' under the program as: a) activities not required under existing regulations; b) projects starting after January 01, 2009 or projects started after January 1, 2001 and issued credits by a voluntary carbon offset program; and c) not exceeding project type baselines established by the EPA.

As the US become more engaged in climate change, regulation development is expected to move toward the inclusion of strong forest protection measures in U.S. climate change legislation. This will benefit Canadian and US indigenous communities and their strong ties to protecting forests and natural ecosystems from Land Use, Land Use Change and Forestry (LULUCF) activities.

5. First Nations Climate Change Partnership Opportunities

First Nations communities have not been included in BC Provincial inventory and thus First Nations community emissions have not been quantified.

5.1. British Columbia Green Energy Task Force

On November 20th, 2009 the BC Green Energy Task Force was announced. It is dedicated to ensuring the Province remains a leader in clean and renewable energy. The task force is group comprised of First Nations, other governments, industries, environmental organizations, and the scientific community.

the Green Energy Advisory Task Force is composed of four advisory task force groups, reporting directly to the Provincial Cabinet Committee on Climate Action and Clean Energy, including:

- **Green Energy Advisory Task Force on Procurement and Regulatory Reform**: This task force will recommend improvements to BC Hydro's procurement and regulatory regimes to enhance clarity, certainty and competitiveness in promoting clean and cost-effective power generation; and identify possible improvements to future clean power calls and procurement processes.

- **Green Energy Advisory Task Force on Carbon Pricing, Trading and Export Market Development:** This task force will develop recommendations to advance British Columbia's interests in any future national or international cap and trade system, and to maximize the value of B.C.'s green-energy attributes in all power generated and distributed within and beyond B.C.'s borders. The task force will assess the market opportunity for B.C.'s clean and renewable electricity, plus any barriers and how they may be addressed, including any future national or international cap and trade system.

- **Green Energy Advisory Task Force on Community Engagement and First Nations Partnerships**: This task force will develop recommendations to ensure that First Nations and communities see clear benefits from the development of clean and renewable electricity and have a clear opportunity for input in project development in their areas. It will work in partnership with First Nations, not only to respect their constitutional right, but to open up new opportunities for job creation and reflect the best practices in environmental protection.

- **Green Energy Advisory Task Force on Resource Development**: This task force will identify impediments to and best practices for planning and permitting new clean, renewable-electricity generation to ensure that development happens in an environmentally sustainable way. The task force will also consider allocation of forest fibre to support energy development and invite input from solar, tidal, wave and other clean energy sectors to develop strategies to enhance their competitiveness.

5.2. BC Government Climate Action Working Groups

The BC Climate Action Secretariat, now housed in the Ministry of Environment, is responsible for the coordination of ministries in their implementation of the Climate Action Plan and the BC Climate Action Team Recommendations. They are also leading eleven sector working groups in the following industries: agriculture, cement, electricity, forestry, manufacturing/small business, mining, oil and gas, transportation, waste, environmental non-governmental organizations and labour. These industry experts represent major emitters and key stakeholders. They provide government with vital recommendations that will enable them to meet the ambitious goals of 33% emissions reductions by 2020. The groups also work with government for mutual learning and information sharing and may be an interesting avenue for First Nations groups to pursue for engagement with government in key sectors.[9]

5.3. Pacific Carbon Trust

The Pacific Carbon Trust is a Crown corporation established by the BC government (also see Section 3.2.2). The PCT's mandate is to deliver high-quality carbon offsets to support the public sector emitters that are included in the Carbon Neutral Government Regulation.

With a growing team the Pacific Carbon Trust issues Requests for Information, Qualifications and proposals in order to identify and purchase offsets from substantial and promising projects.[10] By 2011, the PCT expects to purchase from between 700,000 and 1,000,000 tonnes of carbon dioxide equivalent offsets each year. In October 2009 the PCT began an open solicitation for offsets including agriculture. Forestry projects will be grouped separately. Opportunities exist for First Nations land holders to develop carbon projects to supply the PCT.

Though the Pacific Carbon Trust has (PCT) has invested exclusively in technology projects to date in its commitments to purchase 330 000 tonnes of emissions reductions in the 5-year period beginning in June 2009, the PCT are not restricted from investing in Forest Conservation Projects. The PCT projects that it will require 700 000 – 1 Million additional tonnes during the same period.

5.4. The Climate Registry

The Climate Registry is a collaborative initiative between states, provinces and tribes aimed at developing and managing a common greenhouse gas emissions reporting system with high integrity that is capable of supporting various greenhouse gas emission reporting and reduction policies for its member states and tribes and reporting entities"[11]. Currently 40 US states, 4 Canadian Provinces, 1 Mexican State and 3 US tribes have joined The Climate Registry. **The Climate Registry recognizes First Nations tribes as independent governments.** Information on joining the Climate Registry can be found on the website: http://www.theclimateregistry.org/how-to-join/

5.5. Western Climate Initiative (WCI):

The Western Climate Initiative is a collaboration launched in February 2007 between the Governors of Arizona, California, New Mexico, Oregon and Washington to meet regional challenges raised by climate

[9] http://www.livesmartbc.ca/government/working_groups.html
[10] http://www.pacificcarbontrust.ca/Home/BusinessOpportunitiesCurrentOpportunities/tabid/97/Default.aspx
[11] www.theclimateregistry.org

change. WCI is identifying, evaluating and implementing collective and cooperative ways to reduce greenhouse gases in the region. The WCI has become the predominant North American climate change initiative. Arizona, California, Montana, New Mexico, Oregon, Utah, Washington, British Columbia, Manitoba, Ontario, and Quebec are all partners. WCI also has a number of 'observer' states. In the United States, the state government of Arizona invited the Navajo Nation to join the WCI and the Climate Registry, likely in WCI observer status.[12] No U.S tribe or Canadian First Nation has joined the WCI as of yet.

Through WCI, the partners set an overall regional goal in August 2007 for reducing greenhouse gas emissions. In September, 2008 they released the *Design Recommendations for the WCI Regional Cap-and-Trade Program.* The partners have developed a workplan to guide their work and are seeking public input on the process. The cap-and-trade program is expected to be phased, the first of which will begin on January 1, 2012 and will cover electricity and industrial emissions. The second phase will begin in 2015 in which the program will expand to cover transportation fuels, and residential, commercial and industrial fuels not covered in the first phase. [6]

"Starting in 2009, the WCI Partner jurisdictions will coordinate to review, develop, and approve, as appropriate, protocols for the project types that meet the necessary criteria for inclusion." The *WCI Design Recommendations* go on to establish priority project types for investigation and development, and includes within this list Forest Conservation and Management projects. Thus, Forest Conservation Projects in British Columbia and other WCI participating provinces will likely be eligible for Carbon Offsets under the WCI system.

5.6. International Carbon Action Partnership (ICAP):

ICAP is made up of countries and regions that have implemented or are actively pursuing the implementation of carbon markets through mandatory cap and trade systems. The partnership provides a forum to share experiences and knowledge.

ICAP membership is open to all public authorities and governments that have established or are actively pursuing carbon markets through mandatory cap and trade systems as one approach for reducing greenhouse gas emissions. ICAP also welcomes observers from other states around the world which are considering introducing cap and trade systems for tackling greenhouse gas emissions. Business and environmental stakeholders have key roles to play as we move forward with ICAP.

- European Union Members: (European Commission, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.
- RGGI Members: Maine, Maryland, Massachusetts, New Jersey, New York.
- WCI Members: Arizona, British Columbia, California, Manitoba, New Mexico, Oregon, Washington.
- Other Members: New Zealand, Norway.

[12] http://www.azdeq.gov/function/news/2008/download/0128.pdf

5.7. Avoided Deforestation Partners

Avoided Deforestation Partners[13] (AD Partners) is an international network of leaders in forest carbon policy and project implementation, science, finance, and conservation. AD Partners was founded in 2007, to support international efforts to halt tropical deforestation. AD Partners are active in education and awareness of the role of economic incentive in forest ecosystem conservation and roles of sustainable local communities. AD Partners conduct work in international policy, protocol development and workshop and conference organization.

6. Carbon market opportunities for First Nations

The most logical entry point for the First Nations into the carbon market is as a carbon credit producer. The following section discusses what those various options are and their implications on how the First Nations would have to conduct business.

6.1. Forest Conservation

6.1.1. Avoided Deforestation of First Nations lands

One of the primary ways in which the First Nations will be able to generate carbon credits is through carbon sequestration by protecting forests on their land and designating them as First Nations Protected Areas. By preventing the trees from being harvested, this activity generates a stream of carbon credits equivalent to the amount of carbon dioxide sequestered by the trees.

It should be noted that currently, carbon credits recognized under the Clean Development Mechanism (CDM) for Kyoto apply only to an afforestation or reforestation activity for carbon sequestration, and not carbon retained through the protection of an existing forest[14]. However, there are indications that the protection of forests will be under consideration for inclusion in the CDM. There is considerable momentum for avoiding deforestation, most notably in developing countries; at the UNFCC talks in Bali in 2008 a major decision was made to stimulate action to reduce further emissions from deforestation in developing countries. [15]

It is important to note though, that the European Union Emission Trading System, which began operation in 2005, does not allow the use of credits from carbon sinks (like forests) for its trading scheme. The ETS and the European Parliament site the sheer quantity of potential credits, difficulties in monitoring and reporting and carbon leakage problems as risk factors in their decision to exclude the usage of standing forests for carbon offsets.[16] The EU ETS instead prefers to participate in the development of a Global Forest Carbon Mechanism, which is a financial incentive program to prevent deforestation in developing countries. Because the EU ETS is regarding as a front runner in establishing carbon markets (such as through ICAP, etc.) their stance on this matter is important to consider.

[13] http://www.adpartners.org/
[14] Mashiro Amano, Roger A. Sedjo; *"Forest Sequestration Performance in Selected Countries in the Kyoto Period and the Potential Role of Sequestration in Post-Kyoto Agreements"*, www.rff.org
[15] http://unfcccbali.org/unfccc/news-unfccc/news-unfccc/reducing-emissions-from-deforestation-in-developing-countries-unfccc.html
[16] http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/796&format=HTML&aged=0&language=EN&guiLanguage=en

There are several unique elements of risk that arise when offset project criteria are applied to biological sink projects (including *additionality, leakage*, *permanence* and *reversal* problems). Current regulatory approaches use several mechanisms to address each element of risk in biological sink projects, including imposing requisite reserves, discounting and issuing temporary credits.

The actual amount of carbon dioxide that forests absorb varies greatly depending on the particular characteristics of the forest, e.g. age of the forest, species of trees etc, and a more detailed study will need to be conducted in order to gauge more accurately the amount of carbon credits that can be claimed, but the typical boreal forest is thought to sequester an average of 9.14 tCO_2e per hectare[17] per year. (Comparatively, a temperate rainforest in Canada has the highest carbon per hectare values, at 374.5 tCO_2e). Combined with a conservative expected price of carbon credits once a regulated market comes into force in Canada of $15 per tCO_2e, a typical boreal forest could provide a revenue stream of up to $137.51 per hectare per year of forests protected (temperate rainforests would provide a much higher revenue stream). As long as the forest continues to grow, the biomass continues to increase and rate of carbon sequestration is generally maintained. This means that this revenue will continue annually, and on a practical level would mean that the First Nations would gain an annual amount of carbon credits for each hectare of forests being protected and be able to sell those credits on the carbon markets.

An additional aspect of protecting forests is soil carbon sequestration. There is a large amount of carbon that is sequestered in the soils in a forest. For example, in a black spruce forest, there could be approximately 50tC/ha in living biomass and 400tC/ha in the forest soil, primarily peat moss[18]. Protecting the forest would prevent the release of this carbon stored in the soils as the soils undergo disturbance, erosion and dry up. It should however be noted that while the amount of carbon stored in soils is high, the actual rate of carbon sequestration tends to be quite low. In a study conducted by Wardle et al. boreal forests were found to have a build-up of soil organic matter from decomposing plant litter, resulting in the sequestration of around 65 to 83 kg C/ha/yr[19]. This converts to approximately 0.28 to 0.3 tCO2e/ha/yr, or approximately $4.2 to $4.5 of carbon credits per hectare per year.

6.1.2. Reforestation of cleared land

Planting trees on cleared land can also generate carbon credits. Typically, the land has to have been originally not a forest, deforested through a natural event (e.g. pine-beetle infestation) or cleared by human activity in the past (This qualifier is to prevent the clearing of forests for the express intent of reforesting the land to generate carbon credits).

In some cases timber license holders may not abide by their reforestation obligations, and there is thus opportunity for First Nations whose territory the licensee harvested in to apply to conduct silviculture activities (and obtain carbon credits) for the land.

As the forest grows, the carbon sequestration rates vary depending on the age of the forest, and it can be inferred that a young forest (between 20-50 years old) tends to have the highest carbon sequestration rates[20].

[17] IPCC – Special Report on Land Use, Land Use Change and Forestry
[18] http://berms.ccrp.ec.gc.ca/Overview/e-overview-faq.htm
[19] Wardle, D.A., Zachrisson, O., Hörnberg, G. & Gallet, C. 1997. *"The influence of island area on ecosystem Properties". Science 277: 1296–1299.*
[20] Georgii A Alexandrov;*"Carbon stock growth in a forest stand: the power of age"*, Carbon Balance and Management 2007, 2:4

Conservatively, this would similarly lead to a carbon credit revenue stream of approximately $137.51 per hectare per year of forests replanted. The actual revenue stream would also be shaped by the agreement, since the actual carbon being sequestered would be quite low in the first few years after the trees are planted and consideration might be made to provide some monies up front to aid funding of the tree planting.

6.1.1. Improved Forest Management

By altering the age at which trees are harvested, the total amount of carbon being sequestered over time in the forest can be increased. A study conducted in California found that by increasing the harvest age of trees in the forests from 63 years to 68 years, the average amount of biomass in the forest increased by approximately 8 tonnes of carbon per hectare[21], which translates to 29.41 tCO_2e per hectare of carbon credits and approximately $441.18 per hectare (at a carbon credit price of $15 per tCO_2e). Please note however that this is a one-time carbon credit that is gained, probably claimed the first harvest after the delayed harvest program is implemented, since it affects the average amount of carbon stored in the forests.

Selective harvesting of trees rather than clear cutting sections of forest also increases carbon sequestration of the land by preventing soil erosion and disturbance. A fringe benefit is also reduced impact on the remaining wildlife and vegetation if the majority of the forest is left undisturbed after the harvest. The size of carbon credits generated would probably be in the same range as that of increased soil sequestration listed in Section 3.1.3, i.e. $5.56 per hectare.

6.1.2. Forest Carbon Challenges

One major point to keep in mind especially with regards to the generation of carbon credits through protecting forests is that establishing the ownership of the carbon credits is not a straight forward process, and most likely would involve negotiations with all stakeholders of the land to determine equitable distribution of the credits.

Another aspect of carbon sequestration that needs to be kept in mind is that of liability. Once the carbon credits have been sold, there is the possibility that the carbon might be released into the atmosphere through fire, adverse weather events, diseases etc. In that case it needs to be established if the buyer accepts the loss of the credits purchased or if the seller assumes the responsibility of restoring those credits. This can be negotiated into the contract and valuated accordingly.

There are several unique elements of risk that arise when offset project criteria are applied to biological sink projects (including *additionality, leakage*, *permanence* and *reversal* problems). Current regulatory approaches use several mechanisms to address each element of risk in biological sink projects, including imposing requisite reserves, discounting and issuing temporary credits.

[21] Brown, S., A. Dushku, T. Pearson, D. Shoch, J. Winsten, S. Sweet, and J. Kadyszewski. 2004. "*Carbon Supply from Changes in Management of Forest, Range, and Agricultural Lands of California*". Winrock International, for the California Energy Commission, PIER Energy-Related Environmental Research. 500-04-068F.

6.1.3. Forest Carbon Regulation

A summary of current regulations of forest carbon projects is included in Table 6.1

Table 6.1. Regulations Forest Conservation Carbon Projects

Offset System	Forest Conservation Projects	Regulated Time-period	Limitations	Unique Requirements
British Columbia	Potentially Eligible (will follow WCI)	2010 – public institutions Post-2012	No protocol available (will follow WCI)	Submit Protocol to PCT
Canada	Potentially Eligible	Post-2012 (Projects begin Jan.1, 2011)	California Protocol submitted for review by Environment Canada	"Liability Period" for reversals Discount factor Annual Reporting
California	Eligible (projects in California)	Post-2012	US private & public lands Buffer pool (reversals/ permanence)	100-yr easement; PI Agreement with CAR Annual Reporting
WCI	Recommended (WCI Offset Committee)	Post-2012	No protocol available	Likely to follow CA protocol
Waxman-Markey	Potentially Eligible	Post-2012 (Fungibility of CA credits / post-2001 VCS credits)	Domestic / International	Temporary Credits No fungibility

6.2. Agriculture

6.2.1. Sustainable farming practices

Where farming is currently being conducted, a potential area for generating carbon credits is the adoption of carbon-friendly farming practices. No-till agriculture sequesters carbon through storage of soil organic matter in the soil of crop fields. It is often not economical for individual farmers to monetize emissions reductions; however regional aggregation projects can be made. Agriculture project are relatively easy to implement and are an additional boost to farming income.

The Province of Alberta is fairly advanced in sustainable agriculture projects developing carbon credits. The Alberta Offset System (ABOS) has a number of published protocols in agricultural emission reductions. Opportunities are also now emerging in BC. Agriculture is not typically a major industry for First Nations, however the opportunities exist.

6.3. Fuel Switching

6.3.1. Bio-fuel

The ministry of forests and range estimates that the mountain pine beetle has now killed 620 million cubic metres of timber, the equivalent of 620 million telephone poles. More than 14.5 million hectares, an area more than four times the size of Vancouver Island, have been hit. The dead trees dry out and degrade over time, such that most of the wood would not be suitable for saw logs after approximately 5 years. The wood however could potentially be useable for 15 years and beyond for energy purposes, leaving a practically unlimited supply of biomass in the BC forests for at least the next 15 years or so.

As such, there is an immense opportunity here to make use of this easily available, albeit temporary, resource to jump start a bio-fuel based industry for the First Nations.

Although the production and use of bio-fuels does not in and of itself generate carbon credits, when that fuel displaces another carbon intensive fuel, such as coal or diesel, this creates carbon credits. Bio-fuels are generally considered carbon neutral as the carbon dioxide released during the combustion of these fuels was originally absorbed from the atmosphere, while fossil fuels are thought to introduce "new" carbon dioxide into the atmosphere. Depending on what fuel is being displaced, and what type of bio-fuel is used, anywhere from 0.5 to 1.5 tCO_2e of carbon credits can be generated per tonne of biomass feedstock (raw material that goes into the manufacturing of bio-fuel).

On average, if diesel is replaced by a carbon neutral fuel, each 1000 liters of diesel displaced will generate 2.45 tCO_2e of carbon credits[22] (worth $36.75). Additionally, for a typical small diesel generator, each 1000 kWh of electricity produced will produce roughly 1 tCO_2, which means that each 1000 kWh of clean power produced will produce around 1 tCO_2e of carbon credits.

Additionally, if the production of bio-fuel exceeds the need of the communities, there is a growing local market and large international market in Europe for bio-fuels. Locally, the market rate for fuel-pellets is

[22] Richard Komp. *Reduction of Carbon Dioxide Emissions by using Photovoltaic Modules in Remote Areas.* http://www.thesustainablevillage.com/essays/emissions.html

around $156 per tonne and it is $170 per tonne in Europe. This option is definitely worth a closer look if the wood pellet production plant is located close to transportation routes.

The manufacturing of bio-fuel by the First Nations promises to yield a multitude of benefits:

- The creation of a value generating industry
- The generation of carbon credits through fuel replacement
- The replacement of expensive diesel fuel flown-in to remote communities
- Revenue from the export of bio-fuel
- Potential export of high value chemical byproducts from bio-fuel manufacturing
- Ability to sell green power back into the grid for power generated with bio-fuel
- Renewable energy production might qualify for an incentive payment of one cent per kilowatt-hour under the Renewable Power Production Incentive (RPPI) program.

After the supply of pine-beetle wood is exhausted, bio-fuel manufacturing can continue with lumber, saw mill waste and other bio-mass.

Manufacturing options are presented below:

Pelletizing

Pelletizing biomass requires equipment to de-bark the tree and reduce the wood to small particles through the use of a wood chipper and a hammer mill. The wood particles are then compressed under heat and fuel pellets are produced. This technology is currently commercialized.

Ethanol Production

Ethanol production from biomass starts off in a similar fashion to that of pelletizing, however ethanol reduction reduces biomass to smaller particles. The wood particles are then treated with acid and steam, and subjected to hydrolysis. Yeast is then added to the processes and fermentation is allowed to take place. Finally, ethanol is produced through steam distillation of the fermentation products. This technology is still in early phases of commercialization.

Methanol Production

In menthol production the biomass feedstock is reduced to a suitable particle size and subjected to high pressure and temperature which results in gasification of the biomass. The resulting gas is scrubbed to remove tars and methane, and a catalyst is added to the process. The resulting gas is finally condensed into liquid methanol. This technology is still in early phases of commercialization.

Biogas production

Biogas production uses the same process to gasify the biomass as the methanol production process, but the resulting gas undergoes a clean up through filtration, a quench process, a neutral wash process and finally guard beds. Through this process ammonia, sulphur and halogens are removed. The gas then goes through a methanation unit before finally emerging as Synthetic Natural Gas. This technology is currently only conceptual.

Cellulignin Briquettes

The production of cellulignin briquettes is similar to the pelletizing process, except an additional pre-hydrolysis step is required prior to briquetting. The pre-hydrolysis processes subjects the chipped biomass to steam and a weak acid to break down the wood components, and the material subjected to several washings to remove the byproducts and acid. Furfural, which is a valuable industry chemical, can be extracted from the wash water from the hydrolysis process. The resulting product is dried and briquetted. This technology is currently commercialized.

Small scale CHP

The small-scale Combined Heat and Power (CHP) system uses bio-mass directly to generate electricity and hot water through combustion. Once the pine-beetle wood is harvested, it is cut to the appropriate sizes and fed directly into the CHP system. This concept requires that the CHP system be sited close to the pine-beetle wood supply. This technology is still in early phases of commercialization.

Summary

The results of an in-depth study of bio-fuel technology commissioned by the BC Ministry of Forests and Range, and the BC Ministry of Energy, Mines & Petroleum Resources, are presented in Table 6.1.

Table 6.1. Feasibility of bug-wood to energy technologies[23]

Technology	Cost-effective	Comments
Pellets	Some scenarios work, but not at high feedstock costs.	**Commercial.** Limited domestic market due to concerns about particulate emissions. Potential in UK at high prices, but un-quantified. Coal plant may want to buy pellets for image reasons; biomass is competitive with natural gas as a fuel
Cellulignin Briquettes	Local use works at lower feedstock cost	**Commercial in Brazil.** Depends on whether CL can be accepted as a substitute to natural gas in industrial and residential applications, and on natural gas prices.
CHP	Yes: off-grid, under 2 MW	**Pre-commercial.** Costing depends on technology; small CHP reviewed is a new BC technology.
	On-grid: Yes, at lower feedstock cost; only marginal at $40/m^3$	Depends on emission credits and RPP Incentive, as well as power sales price.
Bio-Liquid	No	**Pre-commercial.** High harvesting costs negate ROI; Bio-liquid market needs to be developed.
Ethanol	Yes, at lower feedstock cost	**Pre-commercial.** High uncertainty with respect to production cost and value of co-products; first demonstration plant in BC expected by 2007.
Methanol	Yes, with H_2 addition	**Conceptual.**
SNG	No	**Conceptual**; requires higher natural gas price to break even.

Pelletizing and small scale CHP are likely the most feasible options for First Nations opportunities. Especially in locations where all supplies have to be flown in, processes that make use of chemicals or ones that rely on the sale of valuable by-products are rendered impractical. Additionally, in terms of low equipment maintenance and ease of operation, the simpler processes definitely come out ahead.

The small scale CHP system ties into the diesel fuel replacement strategy that will be expounded upon in the subsequent sections of this paper. The CHP system will directly displace diesel fuel and heating oil use in the generation of electricity and heat respectively. One large advantage of the CHP system is also that the pine-beetle wood (and other types of bio-mass) can be directly utilized without much processing.

Of all the bio-fuel options listed in this chapter, pelletizing is the most easily implemented option from a technical, capital and operational perspective. As the pellets are more easily transported, pelletizing allow the point of energy use to be further away from the biomass source. Another advantage is that there are local and international markets for the pellets, creating the possibility of selling bio-mass pellets produced that are not consumed by the First Nations communities.

[23] Martin Tampier, Paul A. Beauchemin, Doug Smith, Dr. Eric Bibeau. Identifying Environmentally Preferable uses for Biomass Resources. Envirochem Services Inc.

6.3.2. Renewable energy

Other than using bio-fuel, there are also other opportunities to generate either heat or electrical power in a carbon-neutral fashion. Again, the resulting displacement of diesel used to generate either heat or power would then create carbon credits. On average, the cost of generating electricity using the various systems is listed in Table 6.2 below. This cost takes into account the capital cost necessary to install the system.

Table 6.2. Generation Costs for various fuel types[24]

Fuel	Cents/kWh
Coal	2 to 3
Small Hydro	4 to 6
Natural Gas	5
Biomass	6
Wind	8 to 10
Solar	25 to 50

Geothermal systems on a small scale are only feasible for heating purposes, and in general costs about twice as much as a conventional home heating system to install[25]. They still require electricity to run, so for a geothermal system to be completely carbon neutral the electricity consumed to operate the system should also be generated in a carbon-neutral method.

On a smaller scale, household electricity production will be able to offset the energy costs of First Nations communities. BC Hydro will be installing Smart Meters in all BC homes by 2012, which will be able to provide more information on energy consumption, and provide one component of the infrastructure necessary for a Smart Grid. A Smart Grid would provide energy information in real time and would allow consumers to sell back electricity they produce to the grid to offset their energy costs.[26] This is something that is already occurring in many European cities.[27] Households or other building owners could produce renewable electricity by installing solar panels, wind turbines, etc. For a more in depth discussion on the various forms of renewable energy please refer to Appendix A9.5.

7. Carbon market strategies for First Nations

Strategies for First Nations to participate in the carbon market are proposed in the follow section. Strategies are presented that tie together various factors to achieve the maximum benefit for the First Nations.

[24] http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/cl3019
[25] ibid
[26] http://www.bchydro.com/planning_regulatory/projects/smart_metering_infrastructure_program.html
[27] http://amsterdamsmartcity.com/#/en/home

7.1. Emissions Inventory

BC First Nations should move forward to create emission inventories of their lands and activities occurring on their lands. This is a first and important step that First Nations can make in their commitment to sustainable communities and opportunities for reductions.

An emission inventory of carbon footprint is the crucial first step in a broader carbon management program and provides the basis for further initiatives such as planning, target setting, public reporting on performance and ongoing environmental data management. Inventories effectively identify the most appropriate emission reduction measures. The measures can then be prioritized by the marginal cost of abatement.

A completed GHG inventory would allow First Nations to register a baseline with an established registry (TCR) for the purposes of early action recognition and emissions reduction documentation, identify emission intensity hot spots and develop a management plan and provide business partners and members with a reputable representation of proactive environmental sustainability policy measures.

7.2. Ownership and Resource Sharing

First Nations should continue strategies to pursue ownership of land. Ownership of carbon credits is directly related to property ownership. Joint ownership of land should result in joint ownership of carbon revenues and should be pursued in the Province of BC, and other Provinces. Ownership of resources with land is critically important.

It is possible to create carbon offsets over land that is still under claims discussion with the provincial government. In this case, as long as both ownership parties, either the government or the First Nations, agree to a sharing agreement (sharing either the tonnage or the revenue from the sale) then the carbon offsets can be created and sold. Currently precedent is being set for this type of agreement between the Government of BC and some coastal First Nations.

The advantage of such sharing agreements is that they allow the carbon offset asset streams to be created in advance of the land claim finalization which will take a longer period of time.

7.3. Forestry

The First Nations should focus carbon efforts on forestry. Forest carbon project develop revenue streams from the conservation and longer monitoring of forest properties. Due to the abundance of forests within First Nation lands and the fundamental principles of First Nations peoples in protection forests and forest resources for sustainable communities, carbon credits through forest sequestration can be a powerful tool in meeting these objectives.

An important action is to proactively engage the government in discussions regarding how carbon credits and other environmental attributes (water offsets, ecosystem offsets, renewable energy credits or REC's) are to created and shared . It would also be worthwhile looking for precedence in other jurisdictions in terms of establishing ownership of carbon credits. First Nations strategies to embrace forest carbon project include: active leadership in forest carbon projects, including creating and promoting successful projects, education on the importance of forest carbon projects and strategic relationships with companies and organizations involved in forest carbon.

It is important for First Nations to call upon the federal Canadian government to include Forest Conservation projects under *Canada's Offset System for Greenhouse Gases* (see section 3.2.5). This means ensuring that there is a protocol available to create such offsets under the coming Federal regulatory system. Development of a conservation forestry protocol with CAR for Canada would be a very useful step and would open up the US regulatory market .

7.4. Agriculture

Agriculture is another opportunity and it can be fairly easy to monetize carbon emission reductions for sustainable agriculture practices.

7.5. Fuel Switching

Bio-fuel manufacturing should prove to be a high-value industry to the First Nations. It is one of the core features of a comprehensive carbon-credit strategy for the First Nations and could develop into a long-term industry providing employment and economic value.

The development of bio-fuel manufacturing will build upon and reinforce the various other elements of the carbon credit strategy as outlined in the following sections.

There are many fuel switching opportunities associated with isolated rural communities that use diesel generators for power. These facilities can be switched to biofuel (wood, pellets) , or run-of-the-river, etc and create offsets.

7.6. Sustainable Communities Pilot

A sustainable community's pilot project will act as a concentration point for pilot programs to develop and trial the various elements of the First Nations Carbon Credit strategy. The concept is the creation of a new planned self-sufficient and low carbon community to study, trial and showcase the various carbon-friendly technologies and strategies. A single point of focus could be created for resources and funds from the government to assist the First Nations in reducing their carbon foot print. Once the feasibility of has been established it can then be adopted in other First Nations communities.

Sustainable initiatives could include:

- Land/Forest management practices for generating carbon credits
- Bio-fuel manufacturing
- Clean energy generation to replace diesel generators
- Bio-fuel powered CHP systems

Assistance should be sought from the provincial government in the following areas:

- Funding and assistance in the comprehensive design of the community, including daily life in the community
- Funding the studies of:
    - The feasibility of implementing bio-fuel manufacturing for the First Nations

    - Clean energy generation options for the First Nations
    - Bio-fuel and heating options of the First Nations
- Agreements to buy carbon credits generated by activities undertaken (PCT)

Sustainable communities achieve a win-win situation: the government makes progress towards achieving its GHG reduction goals, and the First Nations implementing programs that will increase the well-being of its people and self-sufficiency of its communities.

7.6.1. Pine beetle damaged wood

The use of Mountain Pine Beetle damaged wood to manufacture bio-fuels should be another major focus for the First Nations, as the current conditions with the pine beetle infestation create a very logical entry point into the bio-fuel industry. The current massive amounts of pine beetle wood available for harvest will most likely result in the implementation of some form of incentive structure by the government in the future to encourage the harvesting of pine beetle wood. Having dead trees left standing in the forests in large quantities constitutes a serious fire hazard, so it is to everyone's benefit that the pine beetle wood is removed quickly and preferably harvested for value generating activities like saw-log, wood pulp and energy production. In order to spur economic development and to decrease the risk of fire, the BC government will most likely engage in programs that will be targeted towards encouraging value generating uses of pine beetle wood.

The one cautionary note regarding an industry built upon the availability of pine beetle wood is of course that the supply is limited. The shelf-life of the dead trees for energy generation is possibly 15 years and beyond, which means that an ample supply of usable pine beetle wood for energy generation likely will be continue past 2035. It is estimated that the peak availability of the pine beetle wood would occur around 2011.

7.6.2. Synergies with Forest Sequestration

One crucial characteristic of a successful strategy is having elements that reinforce each other, and in this context, reforestation and pine-beetle wood harvesting offers a valuable pairing. As the pine beetle wood is harvested, reforestation activities can be undertaken to generate carbon credits. This is a significant incremental value that can be gained with a marginal increase in cost, and further reinforce the "green" philosophy of the First Nations. As established in Section 3.1.1, this could mean a carbon credit revenue stream of up to $137.51 per hectare.

7.6.3. Synergies with Diesel Fuel Replacement

Another element of bio-fuel generation is the ability to replace diesel with a fuel that is manufactured at the source of fuel consumption. The savings from not having to use air-freighted diesel fuel would go a long way towards paying down the capital costs required for bio-fuel manufacturing and equipment to generate heat/power using bio-fuel. Once again, carbon credits add value due to substitution away from a fossil fuel and contributes $36.75 for each 1000 liters of diesel displaced (See section 3.2.1).

7.6.4. CHP opportunities

With the replacement of equipment necessary to switch to bio-fuels, there's also an opportunity to explore Combined Heat and Power (CHP) systems for the communities. CHP is a system where both heat and power are generated at the same time, and generally makes much more complete use of the energy released during the combustion of fuel than power and heat generation being undertaken separately (i.e. its overall energy efficiency is typically higher).

By concentrating the energy content of the feedstock and making the bio-mass much more transportable, the bio-fuel plant allows communities that are located further away from the pine beetle wood supply to still reap the benefits of using pine beetle wood as an energy source.

For local communities located close to the pine beetle wood, and thus the bio-fuel plant, a CHP system could be run on the bio-mass waste (e.g. bark) generated during bio-fuel manufacturing to supply power to the bio-fuel manufacturing plant, and surplus power and heat to the local community.

7.7. Summary

A First Nations carbon strategy should include:

1. Negotiating and establishing ownership of carbon credits generated from forests on First Nations lands;
2. Pursuing the manufacturing of bio-fuel especially in areas where pine beetle wood is readily available;
3. Generation of carbon credits by rehabilitation of land cleared of pine beetle trees and old deforested areas, and through land management/forestry practices;
4. Replacing diesel fuel with bio-fuel or clean energy for power and heating needs for the remote communities; and
5. Pursuing new technologies like CHP that allow more efficient use of the bio-fuel to supply all the communities' energy needs;

The First Nations will ensure that they gain maximum benefits from the carbon credit markets while at the same time securing employment and increased standard of living for its people, and improving self-sufficiency and sustainability for its communities.

8. Aligning First Nations climate change strategy with the Provincial and Federal Governments

First Nations in Canada support an aggressive program action plan to reduce global carbon emissions, with a strong emphasis on assisting those communities most at risk. An effective response to climate change requires a strong commitment by the international community and national governments to reduce our collective reliance on hydrocarbons and to enable our communities to move to renewable energy systems. First Nations deserve and must be encouraged to be active players in climate change solutions in Canada.

First Nations people have firsthand awareness of the dramatic and subtle changes brought by climate change and are grounded in traditions with generations of experience on the land. Indigenous and local knowledge must be incorporated into understanding impacts and effective national and local responses to climate

change. International institutions and national governments should prioritize First Nations affairs to ensure that communities are sustainable and fully capable of responding to changing conditions in a timely way. Effective implementations of adaptation measures are critically important to First Nation communities and livelihoods, but also to the global community because effective adaptation strategies may actually reduce the risk or severity of catastrophic events such as uncontrolled release of large volumes of greenhouse gasses.

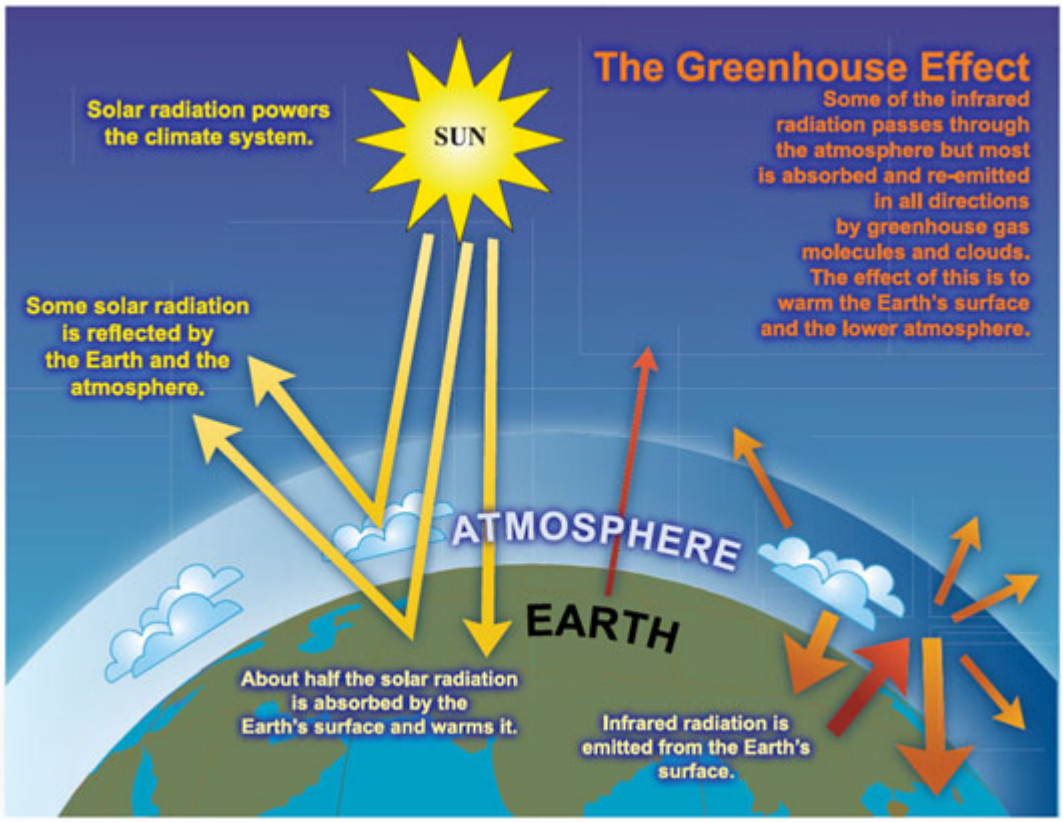
9. Appendices

9.1. Global Warming and Greenhouse gases

This appendix provides a brief review of environment impacts that has prompted people and governments to pay attention to and take action against carbon dioxide (CO_2) emissions.

Greenhouse gases are a group of gases that, when in the atmosphere, causes the "greenhouse" effect of the atmosphere to intensify. The greenhouse effect in the context of climate change refers to the atmospheric absorption of infrared radiation that is generated when sunlight hits the surface of the earth, which leads to an overall increase in the temperature of the atmosphere.

Figure A9.1[28]: The greenhouse effect.



Source: Global Greenhouse Warming

[28] http://www.global-greenhouse-warming.com/what-is-the-greenhouse-effect.html

Human activities have led to the increase in concentration of these greenhouse gases, which causes an intensification of the greenhouse effect and a corresponding increase in the average surface temperature of the earth.

GWP refers to the "Global Warming Potential" of the gas, and denotes the magnitude of the gas's contribution to global warming relative to that of CO_2, most commonly over a 100 year time frame. The timeframe is important as some greenhouse gases decompose with time and absorb differing amounts of radiation as a result.

Table A7.1: Greenhouse gases addressed by Kyoto Protocol

Chemical Name	Name	Common Sources	GWP
CO_2	Carbon Dioxide	Fossil fuel combustion, biomass burning, cement production, etc.	1
CH_4	Methane	Coal mining, production and distribution of natural gas & petroleum, landfills, wetland rice cultivation, incomplete fossil fuel combustion, fermentation in the digestive system of animals etc.	21
N_2O	Nitrous Oxide	Use of fertilizers, nylon production, waste water treatment, fossil fuel combustion, etc.	310
HFC's	Hydrofluorocarbons	Refrigerant, HCFC manufacturing, etc.	140 to 11,700
PFC's	Perflourocarbons	Aluminum smelting, semiconductor manufacturing, etc.	6,500 to 9,200
SF_6	Sulfur Hexafluoride	Electrical transmissions and distribution systems, circuit breakers, magnesium casting, etc.	23,900

9.2. Carbon Credit Basics

Principles of Carbon Credit Accounting

The following are the four main principles of accounting for carbon credits:

- **Additionality:** or baseline analysis: the project must reduce GHG emissions below the level associated with a "business as usual" (BAU) scenario. Common practice is emerging for establishing what BAU means. As an example, with soil tillage it is an open question whether farmers would no-till in a BAU situation just to preserve water or reduce wind erosion. The CCX states that although this may be true, the carbon credits ensure that the farmer won't return to intensive tillage practices, thus satisfying the additionality requirement. The Alberta Offset System and the Canadian Federal Carbon program specifically adjust for additionality by applying a discount factor to their sequestration coefficients. Another perspective on additionality as suggested by the Carbon Trust is to consider if funds received from carbon credits would be used to overcome barriers that might otherwise render an emissions reduction project impractical.

- **Leakage:** all relevant GHG emissions must be considered including negative and positive external effects, i.e. the project cannot reduce emissions by virtue of simply shifting the emissions to another area of business. Leakage primarily deals with emissions outside the project boundary that affect the project's carbon benefit. For example, if a project requires for input a material that causes significant carbon emissions in its creation, those emissions need to be considered for the accounting of the project's carbon credits.

- **Permanence:** the stated project must be able to guarantee the GHG emissions reduction over the stated period of time. This drives the need for verification over multi-year periods to ensure that the farmer maintained reduced tillage practices over the period of the contract.

- **Uniqueness:** the credits generated by a project cannot be claimed under multiple programs or sold to multiple markets.

Types of Carbon Credits

The carbon credits in the following list are all offset credits except for the AAU and the EAU, which are quota based.

Table A7.2: Types of carbon credits

Acronym	Description
VER	Verifiable Emission Reduction Refers to a verified project-based voluntary (versus regulated) carbon credit generated for sale in a voluntary market worldwide. CCX credits are VER's, but only CCX registered VER's can be traded on the CCX and only to CCX members.
XSO	Exchange Soil Offset The particular VER carbon credit created by the CCX for 1 tCO_2e realized under their Agricultural Soil Carbon Offsets Protocol. An XSO is a CCX specific VER. XSO's are bundled together into minimum lots of 100 units to create Carbon Financial Instruments (CFI) for trading. 1 CFI = 100 tCO_2e = 100 XSO
XFO	Exchange Forestry Offset The particular VER credit created by the CCX for 1 tCO_2e realized under their Forestry Carbon Emissions Offsets Protocol. As with an XSO, an XFO is traded in minimum lots of 100 units to create one CFI.
VCU	Voluntary Carbon Unit VCU's represent a project based VER reduction created and certified under the "The Voluntary Carbon Standard". 1 VCU = 1 tCO_2e.
ERU	Emission Reduction Unit ERU's represent a verified, project based, regulatory, GHG emissions reduction achieved through the Kyoto Joint Implementation (JI) mechanism for transitional countries (i.e. previously Soviet Bloc countries) 1 ERU=1 TCO_2e

Acronym	Description
AAU	Assigned Amount Unit AAU's represent GHG emissions allowances (a quota) that are set for an industrialized country under Kyoto Protocol for an assigned amount of time, initially 2008-2012. If a country emits less than its quota it may sell AAU's, if it exceeds its quota it must buy project based offset carbon credits, or other AAU's. These are the base units of the Kyoto Protocol. These credits are an assigned quota and therefore not project based. And not subject to verification. 1 AAU = 1 tCO_2e
EAU	European Allowance Unit EAU's are issued to installations that have a cap on their emissions under the EU Emissions Trading Scheme (EU ETS). EAU are tradable on the EU ETS. An installation must hold and surrender EAU and/or project based carbon credits equal to its monitored carbon dioxide emissions by the annual EU ETS reconciliation date. 1 EAU = 1 tCO2e
CER	Certified Emissions Reduction CER's represent verifiable, project based GHG emissions reductions (offsets) achieved through the Kyoto Clean Development Mechanism (CDM) in developing countries. These reductions are measured against baselines which are approved by the Executive Board of the CDM. CER's are sold through the EU-ETS. 1 CER = 1 TCO_2e

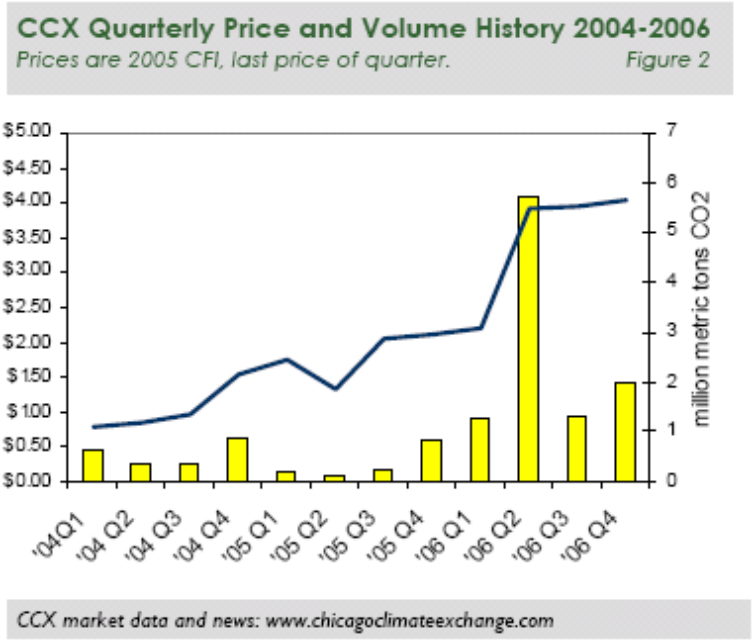
9.3. Carbon Credit Market and Pricing History

The Global Carbon trading business began in 1989 when the first Verifiable Emissions Reduction (VER) was sold. Since then global trade in carbon offsets has grown enormously. For example, in 2006 the total world market for carbon credits increased to over $30 billion – over triple the 2005 level. Although most carbon offset trading thus far has taken place outside of North America, the market is now expected to develop rapidly. A patchwork of voluntary and regulated markets currently exists across North America and convergence of these markets is expected over the next several years.

Carbon Credit Price History

The Chicago Climate Exchange (CCX) is the most readily accessible market for North American agriculture-based carbon credits. The trading region includes the US, Canada, Mexico and Brazil. The customer base for credits traded on the CCX are 240 corporate members, all of whom have committed to achieving annual GHG emission reductions either through internal actions or the purchase of credits on the exchange. The CCX allows trading of credits awarded under their protocols via anonymous posting or via specified party bi-lateral trades. The price and volume history of the CCX to end of 2006 is given in the figure below.

Figure A7.2: Historical price of carbon credits on the CCX



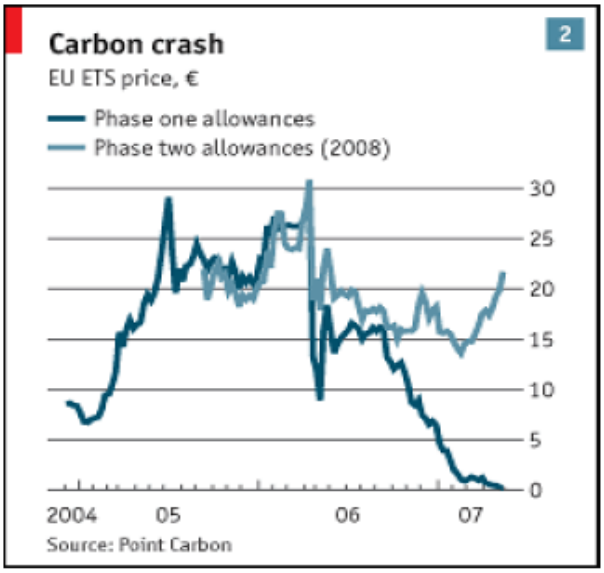
Carbon Credit Price Expectations

Expectations of future prices on the CCX are driven primarily by the expected emergence of regulatory markets. This is driving industries and third party speculators to secure future credit streams now while they are relatively cheap. This effect is supported by evidence of continued increase in price and volume on the CCX since its inception. The range of future prices expected vary widely, with a recent study from MIT estimating that the policy initiatives on the table in the US, which have the intent to substantially reduce GHG emissions, could drive the price of 1 tCO_2e to a range of $30 to $55 by 2015.

Regulatory markets are expected to emerge at the national level in the US and Canada. Recently the power industry, the major source of industrial emissions, joined call for regulatory action, advocating among other things, "Solutions compatible with a market economy that deliver timely and reasonably priced greenhouse gas reductions."

The experience of the EU ETS is that regulation will drive prices substantially higher than what is paid in the voluntary market today. The critical factor determining demand and therefore price of carbon credits is the setting of caps on GHG emissions. The EU regulatory process was too lenient in the setting of caps for its Phase I market (2005 to 2007) which resulted in a price collapse for Phase I credits. Having learned from this lesson, the EU regulators have substantially reduced caps for their Phase II market (2008 to 2012) and prices for Phase II credits have remained stable.

Figure A7.3: ETS carbon credit price for phases 1 and 2



Numerous studies have been made with the purpose of estimating the price of carbon tax that would be required to drive a shift in practice and achieve a specific amount of GHG emissions reductions. For the most part these studies indicate that higher prices than what is currently paid on the CCX will be required to achieve environmentally meaningful reductions in GHG emissions.

A science and policy group led out of MIT recently evaluated the seven US GHG emissions reduction bills on the table in the US. They conclude that "Those proposals with goals of substantially cutting U.S. emissions between now and 2050 would likely generate prices in the range of $30 to $55 per ton of CO_2e in 2015, rising to the range of $120 to over $200 by 2050... Those proposals that would slow or stop the rise in emissions but not substantially cut them from today's levels have somewhat lower costs. A policy that froze emissions at 2008 levels would generate a price of $18 per ton of CO_2-e in 2015, rising to around $70 by 2050. Related proposals specify a safety valve of $6 per ton of CO_2-e rising to $39 by 2050."

Factors Influencing the Offset Purchase Market

Factors that affect the offset market are:

1) Credit quality – includes quality of all process from contract quality, protocol used, verification processes, etc. Climate Change Central surveyed a group of Large Final Emitters (LFE[29]) in Alberta and established that the LFE were willing to pay from $4 to $8 per tCO_2e depending on the quality of the contract.

2) Perceived risk of future regulation – LFE are buying credits as a hedge against future regulation which once enacted, will drive up the cost of the credits. In addition to LFE, GHG emission specific funds are also getting involved in this as speculators. This is exemplified in a quote from Oliver Bussler, EPCOR's environmental portfolio manager, who said the company now banks credits it believes will be needed once the Conservative government introduces short-term emission targets. "We do expect there will be a federal standard, and we are acquiring some tonnes in expectation of that. We are effectively entering the market early, hoping to take advantage of more moderate pricing and market development."

9.4. Carbon Credit Exchanges and Markets

Current Exchanges and Markets

CCX

The Chicago Climate Exchange is a voluntary pilot greenhouse gas trading program for emission sources and offset projects in North America and Brazil. It is a members-only voluntary legally binding exchange, where members commit to reduce their emissions by 6% below a baseline level audited by the NASD.

ECX

The European Climate Exchange is a wholly owned subsidiary of the CCX. The ECX manages the sales and marketing for ECX Carbon Financial Instruments (EXC CFI contracts) in the European Union Emissions Trading System.

Voluntary Bilateral Contracts

Companies and individuals in North America can purchase carbon credits directly from offset providers to offset the GHG emissions from their own operations. Since these contracts are not defined with regards to a specific exchange protocol or regulatory agreement, the nature and quality of the carbon credits varies. Anyone in Canada can create a voluntary credit according to a standard such as the IETA's Voluntary Credit Standard (VCS). The verified emission reduction carbon credits (VER's) can be sold on a bilateral basis (agreement between two parties) to anyone who will purchase them. There is an active international market for such credits. Creating VERs using a voluntary standard is worthwhile pursuit as it allows one to circumvent the low prices of the CCX restricted market or the cumbersome regulatory costs of the Alberta, Kyoto or future Canadian Federal markets, as long as a willing purchaser can be found.

ACT and A BOS

[29] LFEs refer to large industrial emitters of GHGs, like cement manufacturing plants and fossil fuel based power plants

The Alberta Carbon Tax (ACT), which came into force on July 1, 2007 via Bill 3, places a cap on emissions for the province's 101 large final emitters (LFE) and imposes a non-compliance charge of $15/t$CO_2$e. The non-compliance payments will be placed into a Carbon Fund and used for research into GHG emission reduction technology. This tax on production is fundamentally different from the retail tax route that Quebec chose (see below) because it is difficult for the producers to pass on the cost of the production tax to consumers.

The Alberta Offset System (ABOS) was implemented to provide a mechanism for the LFE to purchase carbon credits to offset their emissions and demonstrate compliance with the emissions cap. The ABOS is administered by the Alberta Ministry of the Environment, through an associated private public partnership, Climate Change Central (CCC). CCC announced a series of protocols on July 1st, 2007, most of which relate directly to agricultural practices. For example protocols for tillage practices and manure management are included in the list.

The main difference here is that the ABOS has broken from the North American trend described above. The ABOS protocols are based upon Canada's as yet to be implemented Kyoto protocols and the ABOS is using the Canadian Standards Association GHG Project registry, set up as Canada's Kyoto GHG registry. It is not yet clear how well aligned protocols to be introduced by the WCRAI and RGGI will be with the ABOS protocols.

The ABOS anticipates the use of a similar set of protocols and the same registry being used for Canada's National GHG program to be launched in 2010. It represents a different form of convergence where Alberta and the Canadian Federal Program will be set up for compliance with Kyoto and markets such as the EU ETS, versus the CCX and the burgeoning RGGI/WRCAI market.

The importance of the ABOS is that there is now an alternate set of protocols for creating agricultural carbon credits in Alberta, and this set of protocols and market rules is aligned with the emerging Canadian Federal Carbon program. More importantly it places pressure on the 101 LFE's to purchase offset carbon credits in order to avoid paying the non-compliance penalty. In other words it emphasises the importance of forming large scale bilateral OTC contracts with reputable project proponents and aggregators.

Emerging/Future Exchanges and Markets

MCeX

The Montreal Climate Exchange (MCeX) is jointly owned by the CCX and by the MX, Montreal's financial derivatives market. The MCeX intends to provide market services for the Canadian Federal GHG emissions reduction program when the program becomes active.

Canadian Climate Exchange

Canadian Climate Exchange Inc. (CCE) was created by WCE Holdings Inc., parent company of the Winnipeg Commodity Exchange, to provide market-based solutions for the reduction of GHG emissions in Canada. CCE intends to provide market services for the Canadian Federal program. CCE is working with the CSA and the Province of Manitoba to build a climate change registry for the Province of Manitoba.

Canadian Federal Market (created by the Canadian Federal Offset System)

The Canadian government was instrumental in the set up of the Kyoto process in 1997 but did not ratify the Kyoto accord until 2002. The ratification of the accord however did not bring with it corresponding compliance oriented action, and the failure to act is primarily due to two issues: (1) a grievous miscalculation of the speed of development and carbon impact of the Oil Sands[30], and (2) the failure to include forest sequestration in the accord. As a result of these two factors, Canada would have a much tougher time reaching its Kyoto goals than other industrialized countries. The Canadian Government has balked at the cost of abatement under Kyoto, which would amount to $4.5 billion per year spent to purchase international carbon credits, i.e. payments that would leave the country for abatement elsewhere. The Federal Government is therefore designing a domestic program outside of the Kyoto framework with the goal of channelling carbon tax money into national GHG emissions reduction infrastructure development.

Preparation for Kyoto over the past 10 years has led to the development of infrastructure and science to run a Kyoto-like program in Canada, allowing the Alberta Government to adopt readily available protocols and an existing CSA GHG CleanProjects Registry for the ABOS.

In January 2006 Canada announced a "Regulatory Framework for Air Emissions" which was widely and vehemently condemned by domestic and international pundits as inadequate. As a result, an amended "Regulatory Framework for Air Emissions" was introduced on April 26th of 2007 which calls for a 6% reduction from 1990 levels by 2012, a 20% reduction from 1990 levels by 2020 and an 80% reduction from 1990 levels by 2050. Unlike its precursor, this framework is based upon an existing legislation, the Canadian Environmental Protection Act of 1999, and does not require further parliamentary approval for implementation. The framework is likely to come into effect in the 2010 timeframe, prior to which the government intends to have an offset system operational at the start of 2009.

The program will result in an annual 150 million tons of CO_2e reductions by 2020 and focuses on certain industry segments:

- Oil and gas (upstream and down)
- Forest products
- Smelting and refining
- Iron and steel
- Potash and cement and lime
- Chemicals and fertilizers

The abatement options will be emissions trading with offsets, contribution ($15 tCO_2e tax) to a Technology Fund, or use of certified emissions reductions credits (CER) from Kyoto –based clean development (CDM) projects in developing countries.

The Technology Fund runs from 2010 to 2018 and is to be used by LFEs to meet capital requirements needed to deploy large scale infrastructure projects required to achieve long term GHG reduction targets. LFE's can meet up to 70% of their obligations under the program by contributing to the fund. They receive an

30 The Oil Sands are the world's second largest reserve of oil after that of Saudi Arabia and up to $65 billion will be spent on Oil Sands investment from 2006 to 2016.

allowance of 1 tCO_2e over their cap for every $15 they contribute. The proportion of the fund contribution reduces over time, 40% in 2015, 10% in 2016 and 2017, and 0% by 2018. As well the price per tCO_2e rises in 2013 to $20 and thereafter is indexed to the rate of growth of the national GDP. The GHG emissions reduction infrastructure anticipated is related to carbon capture and storage, clean coal, and east-west integration of electrical grids.

The carbon credit offset market in Canada is likely to experience strong upward price pressure. First, the use of international credits (CDM driven CER's) is limited to only 10% of compliance obligations under the Canadian Federal program. Second, it is unlikely that capped emitters will engage in substantial inter-company trading, as companies that can improve their emissions relative to a baseline, and can apply for credits, will likely "bank" these credits rather than trade them in anticipation of further reductions in future emissions caps. Third, the program has been set-up such that the amount of compliance obligations that can be discharged through contributions to the Technology Fund decreases with time, while the price for contributing to the fund increases with time. And lastly, companies will have unlimited access to domestic trading and offsets. All these factors combine to increase the importance of offsets to companies and will create a steadily increasing demand for carbon offsets.

The final results of the program are that Canada will have a GHG trading system in as early as 18 months and increases in carbon emissions from LFE's will be halted within 5 years. The program can be introduced within the term of the current government without requiring parliamentary approval to implement the plan.

Western Region Climate Change Alliances

The Climate Registry

The Climate Registry is essentially a greenhouse gas emissions reporting system that is capable of supporting various greenhouse gas emission reporting and reduction policies for its members. The registry focuses on establishing accurate, complete and consistent emissions reporting, and requires that emissions data are verified by 3rd party verifiers. The Climate Registry is a powerful facilitator for carbon trading as it utilizes verified emissions data and a common set of protocols for carbon credit accounting, which means that the quality of the carbon credits is consistent, trustworthy and well-understood.

RGGI

The Regional Greenhouse Gas Initiative (RGGI) was formed by ten states in the North Eastern US (Maine, Connecticut, Delaware, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont and Maryland). The Canadian Maritime Provinces (PEI, Newfoundland, New Brunswick, Nova Scotia) have announced they will join this trading block which plans to begin trading by 2009.

RGGI (pronounced "Reggie") is a cap and trade system that has set out to stabilize major GHG emissions. For example emissions from power plants will be capped at current levels to 2014 and then reduced by 10% by 2019. This is significant as states such as NY and Maryland rely on coal fired power. Coal fired plants alone will represent 175 million annual tCO_2 within the RGGI block.

The relevance of RGGI is that this powerful block of States and Provinces, along with the WRCAI (see below), will eventually link or converge (likely by 2009) into one North American carbon market.

WRCAI and AB 32

The Western Regional Climate Change Action Initiative was formed in February of 2007 and comprises 5 states in the western US (Arizona, California, New Mexico, Oregon and Washington) and the province of British Columbia. Manitoba has announced their intention to sign the WRCAI agreement in the near future. Participant states/provinces must set an overall GHG emissions reduction goal by August of 2007. Premier Campbell in BC announced that BC will commit to reduce GHG emissions by 33% of current levels by 2020. WRCAI entities have pledged to develop regional market based emission reduction plans. They have also agreed to set up a GHG registry to track and credit GHG reductions.

The WRCAI agreed to join the Climate Registry for this purpose of tracking credits. The Climate Registry now has 31 States in the US, Two Canadian Province and several First Nations tribes as members. It is the role of the Climate Registry to develop consistent protocols for generating and tracking credits. Initial design of consistent protocols is due to be published in August 2008.

California has been a strong leader of the WRCAI initiative and many protocols and standards have been pioneered by this state (via the California Air Resources Board or CARB) to be used in compliance with the California Global Warming Solutions Act of 2006 (aka "AB32"). AB32 aims to cut emissions to 1990 levels by 2020. CARB is a division of the California Environmental Protection Agency. It will administer AB32 from 2011 forward. Despite the 2011 start date, CARB has highlighted many "early action" measures to take place

immediately. They are currently publishing a list of the same and have committed to a trading of offsets by 2010. The first phase of compliance requirements will run from 2012 till 2020, and will require that California's global warming emissions be reduced to 1990 levels. The 2nd phase requires that GHG emissions are 80% below 1990 levels by 2050.

This western group has an emissions cap of about 350 megatons of annual emissions which is about 17% of the main Kyoto Market exchange, the EU ETS. This will also be a cap and trade based system with full caps set by August 2007 and all rules finalized by 2008.

9.5. Renewable Energy Generation

(The following section is an except from *"Greenhouse Gases Emissions and Renewable Energy"* No.9, Dec 2001, Alberta Agriculture, Food and Rural Development. http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/cl3019)

Wind

Wind turbines capture wind energy and convert it to electricity. Wind energy systems can either be small, stand-alone "off-grid" systems, or connected to the Provincial power grid. Because wind is an intermittent resource, a back-up system is needed. Wind systems require an average annual wind speed greater than 15 kilometers per hour may only be feasible in southern Alberta. Electricity generating costs are reported to have dropped from $0.25 per kilowatt-hour (kWh) in the 1980's to below $0.10 per kWh in 2001. One opportunity for farmers is the potential to lease land to wind energy producers.

Windmill against a sunset

Solar

There are three types of solar heating systems that can be used to generate heat or electricity:

- Passive solar – collect and store energy and distribute it by natural processes such as convection and radiation.
- Active solar – uses solar collectors to heat water or air. A typical system will reduce the need for conventional water heating by about two-thirds. Dairy, swine, and aquaculture operations are examples of agriculture businesses using solar systems in Canada.
- Photovoltaic systems – photovoltaic cells (PV) convert sunlight directly into electricity. Photovoltaic arrays (10 to 20 PV modules, each made up of approximately 40 cells) can provide enough power for a household.

Solar panels

Earth energy systems

Earth energy systems provide heating in winter, cooling in summer and year-round hot water for home use. These systems use heat pumps to extract heat from the earth or groundwater to heat or cool air and water. They cost about twice as much as conventional heating systems to install, but on average the operating cost is about two-thirds less than traditional systems. More than 30,000 earth energy installations in Canada are being used today in residential, commercial, institutional and industrial applications. They are considered to be the most energy-efficient, environmentally clean and cost-effective heating systems available.

Small-scale hydroelectric power

Small-scale hydroelectric power technologies use free flowing water to produce electricity. Most micro - hydros are run-of-stream systems that divert water through a pipe or channel. The water is directed through a turbine, then allowed to flow back to the river or creek. Because they typically don't require a dam, they can be sited, built and operated with minimal environmental impact.

Biomass

Biomass resources are any plant-derived organic matter available on a renewable basis. This includes agricultural and forestry crops, and animal and municipal wastes. Biomass resources can be burned for heat, produce electricity, or converted to liquid or gas fuels.

Biomass resources are derived from three basic crops:

- cellulosic crops (wood, straw from cereals)
- starch crops (corn, cereal grain)
- oil crops (canola, soybeans)

For biomass resources to be renewable, sustainable cropping practices are necessary. Food crops diverted to produce energy, decrease food production for human and animal consumption.

Wood

Burning wood instead of natural gas or propane can substantially lower heating costs if it is readily available. Wood is more labour intensive than fossil fuels, which must be taken into account when doing cost

comparisons. Depending on the efficiency of the stove or furnace, burning wood emits unburned hydrocarbons, smoke and entrained ash.

Straw

Straw can be burned to heat water, buildings or dry grain. It is inexpensive, as most grain farms produce enough to supply a straw-burning system. A straw burning system is economical in meeting demands for large heat loads. Most straw-burning boilers are about 40 percent efficient.

Solar powered recharger in a field

Straw removed for burning and straw residue remaining in the field must be balanced. Alberta Agriculture, Food and Rural Development recommends that 30 percent of the soil surface be covered by crop residue to prevent soil erosion.

Switchgrass

Switchgrass (Panicum virgatum) is a native perennial grass that once dominated the North American prairie. It can grow on marginal lands, and does not require specialized production equipment. A plantation can last from five to 15 years, with an average yield of 10 tonnes per hectare. The grass is harvested annually, then chopped and pelletized for use in specialized stoves and furnaces. Switchgrass is suitable for production in some parts of Alberta

Corn

Corn is a starch crop that can either be used as a heating fuel or converted to bioethanol. Clean, dry shelled corn has a high energy per unit weight. New stoves have been developed specifically for burning dry granular fuels such as shelled corn. However, corn may not be a good fuel source because it diverts needed foodstuffs, and requires large fertilizer, herbicide and pesticide inputs for production.

Biofuels

Biofuels include biogas, alcohols, ethers, esters and other chemicals made from biomass resources. Biofuels can be used as a supplement or an alternative to fossil fuel to produce electricity, heat and transportation fuel.

In the short-term, biofuels can be used as blending agents to dilute CO_2 emissions from fossil-based fuels. In the long-term, technological advances are expected to allow greater use of biofuels in vehicles.

Bioethanol (industrial fuel alcohol) – is made from starch (grain crops, corn), sugar (sugar beet or sugar cane), or cellulose (wood, straw, grass). Bioethanol is the most widely used biofuel today. Ethanol-blended fuels such as E85 (85 percent ethanol and 15 percent gasoline) can reduce net GHG emissions by 37 percent, and E10 (10 percent ethanol and 90 percent gasoline) by four percent.

Biogas – is generated by the anaerobic (no oxygen) digestion of organic material such as animal and municipal waste. It can be burned to produce heat, electricity, or both. The feasibility of on-farm anaerobic digestion depends on type of livestock, manure management system, and heat and electricity requirements. Liquid manure systems work best for anaerobic digestion. The installation and operation of an anaerobic digester requires considerable monetary and manpower investments, and the feasibility must be carefully evaluated before proceeding.

Biodiesel – is manufactured from most vegetable oils such as canola or soybean, animal fats, recycled grease, as well as low quality oilseeds and tall oil produced from wood pulp waste. Biodiesel can be blended with conventional diesel fuel or used 'straight' (100 percent biodiesel).

Biodiesel is typically added to petroleum diesel in 20 percent blends (B20) for diesel engines, and is a direct fuel substitute for #2 petroleum diesel. Biodiesel-fuelled engines deliver similar mileage, torque and horsepower and can be used as a fuel or additive with little or no engine modification. Compared to fossil fuels, biodiesel degrades quickly in the environment and is non-toxic.

10. **Glossary of Terms**

Term	Definition
ABOS	An acronym for the Alberta Offset System is the system set up by the Alberta Government for the origination and registration of GHG emissions offsets.
Additionality	Additionality is an important concept under Kyoto and all offset carbon credit mechanisms which states that project emission reductions must be additional to those that would otherwise occur under a business-as-usual scenario. This concept does not hold for Greentags and REC's.
Aggregated Project	A collection of projects that use the same quantification methodology
Aggregator	An entity acting as the project proponent for a collection of projects that use the same quantification methodology , amassing a number of carbon credits into a program for the purposes of reducing transactions costs, and facilitating trades.
Annex I	Annex I countries are 36 emerging and transitional countries that are a party to the UNFCCC. These are the countries where CER's are generated. Canadian LFE's will be allowed to generate 10% of their required offsets from CER's.
Annex II	Annex II countries are all EU countries plus OECD countries, this includes Canada.
Baseline	The reference point in all carbon credit calculation mechanisms from which to changes in emissions are calculated. It represents the hypothetical reference case with no GHG removal.
Bilateral Contract	An offset trade made directly between a project proponent and an emitter
BIOCAP	Canada's biofuel research agency.
Biofuel	Solid, liquid and gaseous fuels derived from natural processes usually as the by product of agricultural activities.
BMP	Beneficial management practice ... in this context one that leads to either reduced GHG emissions or increased GHG sequestration
Bubble	Is a regulatory concept whereby 2 or more emission sources are treated as if they were one.

Term	Definition
Cap and trade	Refers to emissions reduction trading systems where total emissions are capped at a level and excess permits are traded on an exchange. This applies to the ABOS, RGGI, WRCAI, EU ETS, and the coming Canadian Federal Carbon Program.
CARB	California Air Resources Board
Carbon credit	Carbon credits are an annual GHG emission reduction measured on the basis of tCO2e. They have many forms: under Kyoto mechanisms they are known as a CER's (certified emission reductions) under Clean Development Mechanism (CDM) ,or an ERU (emission reduction unit) under the Joint Implementation (JI) mechanisms, or an AAU (assigned amount unit for Annex B emissions trading (this applies to industrialized countries that have ratified the Kyoto Agreement), or a VER (verified emission reduction unit), for voluntary non UNFCCC reductions. All of these are known as "offset" credits.
Carbon Dioxide Equivalent	A tCO2e or a Co2e, the universal standard of measurement of a carbon credit or of a GHG reduction.
Carbon Futures	Futures contract trading to be initiated by the New York Mercantile Exchange (NyMEX).
Carbon sequestration	The process of storing carbon in a reserve to prevent its release into the atmosphere
CCBA	The Climate, Community and Biodiversity Alliance, an alliance or companies and institutions that implement voluntary standards for multiple-benefit, land-use, projects.
CCB Standards	Climate, Community and Biodiversity project design standards, used for land based projects that
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism, one of four mechanisms for trading carbon credits available under the Kyoto Protocol. It focuses on project based GHG emissions reductions from those emerging nations that are part of Kyoto Annex A.
CER's	Certified Emission Reduction unit; 1 CER = 1 tCO_2e.

Term	Definition
CFI	carbon financial instrument, a minimum lot trading size of carbon credits that may be traded on a carbon bourse, for the CCX a CFI is made up of 100 carbon offset credits
CO_2e	Carbon Dioxide Equivalent: a unit of measure of global warming potential (GWP) where GHG's are measured based on the amount of CO2 that would produce an equivalent amount of global warming.
Cogeneration	The act of generating power and feeding it back to the power grid
CSA	Canadian Standards Association
CSA GHG *Clean-Projects* Registry	A GHG registry system originally developed for Canada to use as part of a Federal level Kyoto compliance program and currently available to be adopted for use under the ABOS and being considered for use by the Province of Manitoba's planned Offset System.
Emitters	Emitters of GHG's or other forms of air pollution.
ERU	Emission Reduction Unit, a measure of GHG reduction associated with Joint Implementation (JI) mechanisms; 1 ERU = 1 tCO2e.
Ethanol	A liquid biofuel derived from sugar (cane), starch (corn) and cellulose (wood and plant fiber) containing materials.
EU	European Union
EU ETS	EU Exchange Trading System, a carbon credit exchange.
Ex-ante & Ex-post Credits	Under ex-ante accounting credits are sold before they are produced: in ex-post accounting they are sold afterwards. Ex-ante entails more risk, hence command more stringent regulations and lower prices.
F-Gases	A type of green house gas: PFC's, HFC's and SF_6, 3 of the 6 GHG's that make up 70% of global warming. They each have very a high GWP: PFC=9500, HFC=11700, SF_6 = 23600.
Final Emitters	GHG emitting entities, typically energy, oil and gas, and "smokestack industry" companies.
GHG	Greenhouse Gas: any one of 6 gasses specified under the UNFCC which when released into the atmosphere change the Earth's radiative balance by absorbing heat. The GHG's are: CO2, CH4, N2O, PFC's, HFC's, and SF6.

Term	Definition
GHG Assertion	The claim put forward to a government (regulatory regime) or exchange about emission reductions made by a project
GHG Registries	Registries are used to identify individual credits and ensure that they conform to common rules or protocols and to ensure that they are not double counted.
Gold Standard	A Switzerland based VER standard which is favoured by NGO's in creating VER's and CER's. This standard has more rigorous rules with respect to additionality than other voluntary standards.
Green Tag	Green Tags or Renewable Energy Certificates (REC's) are another form of carbon credit which represents one MWh of clean energy.
IETA	International Emissions Trading Association: an association which has developed the VCS or Voluntary Carbon Standard.
IPCC	Intergovernmental Panel for Climate Change, WMO and UNEP to assess issues important to understanding Climate Change
IPOG	Industry Provincial Offsets Group, a broad group of industry, NGO and Research stakeholders making recommendations to the AB Ministry of Environment
ISEEE	Institute for Sustainable Energy, Environment and Economy, U of Calgary
ISO	International Standards Association
JI	Joint Implementation mechanism available under Kyoto protocol for industrialized nations in transition (i.e. Russia). JI projects generate ERU's which are Emission Reduction Units measured in tCO2e.
Kyoto Protocol	This agreement originated on December 1997 in Kyoto Japan during a meeting of the United Nations Framework Convention on Climate Change (UNFCCC). It specifies emission obligations for Annex B countries and defines three so-called mechanisms, CDM, JI, and emissions trading. It came into force on February 16th, 2005.
Leakage	An important concept under Kyoto and other carbon credit creation mechanisms. Leakage calculations account for increases in GHG emissions elsewhere (outside of the project) that occur as a result of implementing a GHG emissions reductions project.

Term	Definition
LFE	Large Final Emitters: the largest entities that make up over 50% of the GHG pollution in a given jurisdiction. For example in the ABOS there are 101 LFE's that contribute over 50% of the GHG emissions in Alberta.
Monitoring	A concept under carbon credit emissions reduction calculations where data is monitored to calculate the existing baseline.
Permanence	The notion that a carbon reduction project must be able to assure that the carbon stored will not be reintroduced into the atmosphere. This is important for pre-pay afforestation projects
Protocol	A set of agreed upon rules that determines common procedures for measuring an emissions reduction.
RGGI	Regional Greenhouse Gas Initiative, a coalition of 10 States and 4 provinces to create a common GHG trading block with harmonized rules.
Sequestration	An absorption process where carbon is reabsorbed into soil and biomass.
Sinks	Carbon sinks are processes that remove GHG's from the atmosphere, usually through forest and agricultural sequestration.
Transitional economies	Under the JI mechanism this refers to former planned economies that have become market based.
Triple Bottom Line	Triple bottom line accounting expands the traditional financial reporting framework to take into account environmental and social performance in addition to financial performance. The phrase was coined by John Elkington, co-founder of the business consultancy "SustainAbility". Emerging standards for such sustainability reporting are tracked by groups such as CERES.
VCS	The voluntary carbon standard used to create non-regulated verified emission reduction or VER's.
VCU	Voluntary Carbon Unit: a serialized VCS VER.
VER	Verified Emission Reduction: a voluntary carbon credit.
VER+Standard	A VER standard created by TUV SUD, a Munich-based, national certification agency. .
VGS	Voluntary Gold Standard, a VER standard

Term	Definition
WRCAI	Western Regional Climate Action Initiative: a coalition of 6 States (WA, CA, OR, NM, AZ, NV) and two Canadian provinces (BC, MB) to create a common GHG offset trading scheme with harmonized procedures. The WRCAI will use The Climate Exchange as a GHG registry.
WRI	World Resources Institute.