Getting it Straight

A Guide to Economic Policy Instruments for Addressing Climate Change

Erin Mullinger
Canada West Foundation

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1. Introduction

The public policy discussion around strategies for designing energy and climate change policy is rife with technical jargon. To help simplify the complex set of policy options available, *Getting it Straight* provides a layperson's guide to the main economic policy instruments available for addressing climate change, with a focus on energy production, and greenhouse gas emissions reduction.

This primer is part of the *Getting it Right Project,* which seeks to address the energy policies needed in Canada in an era of carbon constraint. The primer begins by defining and explaining some of the general terminology within the climate change policy portfolio and then explains a number of policy instruments available to decision-makers. Understanding the language of climate change is an important first step in the wider discussion of climate change and energy policy in Canada.

2. General Terminology

2.1 Climate Change and Global Warming

Climate change refers to the shift in the average weather of a given region while global climate change refers to a shift in the average weather of the entire world. Global warming refers to the warming of the Earth's surface and rise in average temperatures.

Climate change occurs naturally as part of a global climate feedback loop and as a result of human activities that increase emissions of greenhouse gases (GHGs). There is some debate over whether recently observed climate change is human-induced or part of natural global heating and cooling cycles. However, the current scientific consensus is that the climate change we are experiencing today is primarily human-induced.

2.2 Greenhouse Effect, Greenhouse Gases and CO_2 Equivalents

The greenhouse effect refers to the atmospheric mechanism that insulates the Earth from heat loss. The presence of GHGs allows solar radiation to enter the atmosphere and reach the surface of the Earth. The radiation heats the Earth's surface and some radiation is reflected from the surface back to the atmosphere. Not all of the radiation escapes, as it is absorbed by GHGs or reflected back to the Earth's surface.

GHGs are those compounds found in the Earth's atmosphere that allow incoming solar radiation to enter the atmosphere, while absorbing some of the radiation (heat) reflected by the Earth's surface. These gases are important for regulating the temperature of the Earth, however, when in excess, can contribute to what is known as the "enhanced greenhouse effect." This can increase the temperature of the Earth's surface.

GHGs include both natural and human made gases such as water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NO_x), chlorofluorocarbons (CFCs), and hydrochloroflurocarbons (HCFCs). The most prevalent GHG is carbon dioxide.

To compare how much heat these GHGs trap in the atmosphere, they are converted into carbon dioxide equivalents (internationally) or carbon equivalents (USA). This is done through a calculation that accounts for both the mass of the GHG being emitted and the global warming potential of the gas (which accounts for the ability of the gas to trap heat and how long it stays in the atmosphere, referenced to carbon dioxide). For example, the global warming potential of the gas methane (CH_4) is 21, meaning that 1 million tonnes of methane is approximately equivalent to 21 million tonnes of carbon dioxide. It is common to see GHG emissions reported in terms of carbon dioxide equivalents (CO_2eq.) or carbon equivalents (CE). Additionally, carbon dioxide equivalent emissions are often shortened to simply "carbon emissions."

2.3 Kyoto Protocol

The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC) that was signed in Kyoto, Japan on December 11, 1997 and implemented February 16, 2005, after ratification by Russia. The Protocol adapted the language of the original UNFCCC to commit developed countries to emissions reductions of 5% below 1990 baseline levels.

In order to meet the targets set by the Kyoto Protocol, countries must take steps to curb emissions. To facilitate this, there are

three market mechanisms (Clean Development Mechanism, Joint Implementation, and Emissions Trading—see below) built into the agreement. The Kyoto Protocol has been criticized heavily on many points, such as its focus on developed nations, while excluding developing nations from binding targets.

The Kyoto Protocol is set to expire in 2012. At that time, a new framework agreement will be required to move forward on the issue of international climate change policy.

2.4 Clean Development Mechanism

The Clean Development Mechanism (CDM) is one of three market mechanisms established by the Kyoto Protocol. The CDM allows industrialized nations to earn emissions credits through investment in emissions reductions projects in developing countries. For example, industrialized country X can invest in a hydroelectric project in developing country Y. The hydroelectric project reduces emissions as electricity is now coming from renewable, non-carbon emitting sources, rather than from coal or other fossil fuels. The industrialized country can then use these emissions credits to meet its Kyoto Protocol commitments. In December 2007, the Canadian government pledged $1.5 million for CDM projects.

The CDM has been used outside of compliance with the Kyoto Protocol for compliance with other national or regional emissions reductions plans. For example, member states of the European Union can use the CDM in order to meet the goals set out in their National Allocation Plans. As well, Canadian companies have the option of using the CDM in achieving their emissions reductions goals as part of the Government of Canada's *Turning the Corner Plan.*

2.5 Joint Implementation

Joint Implementation is one of the market mechanisms to reduce carbon emissions permitted in the Kyoto Protocol. Joint implementation is similar to the CDM, however rather than investment by an industrialized country in a developing one, it is between two industrialized nations. The projects earn emissions reduction credits through the investment in emissions reductions or sink enhancement projects. Like the CDM, joint implementation is permitted under some emissions trading regimes, like the European Union Emissions Trading Scheme.

3. Carbon Trading Instruments

3.1 Carbon Market

Carbon markets allow for the buying and selling of GHG emissions allowances. This can include the purchasing of emissions credits and/or offsets. The methods used to establish a carbon market can vary from voluntary to mandatory entry and from targeting specific industries to broad participation. The idea behind carbon markets is to use market forces to find the most efficient means of reducing GHG emissions. A carbon market typically involves the setting of an emissions cap that limits the total amount of GHG emissions, hence the term cap and trade (see below).

3.2 Emissions Trading

Emissions trading is a critical component of cap and trade systems, as well as one of the three market mechanisms incorporated into the Kyoto Protocol. Emissions trading refers to the buying and selling of emissions credits. The hope is that through trading, the cost of compliance with GHG emissions reduction targets is reduced by allowing those who can reduce emissions cheaply to sell those credits to those for whom the cost of reducing emissions is prohibitive.

There have been signals from different levels of government that some form of emissions trading may be an option in Canada. For example, the Western Climate Initiative (comprised of the states of Washington, Arizona, California, New Mexico, and Utah, along with the provinces of British Columbia and Manitoba) is taking steps to create a regional cap and trade system. Additionally, the Government of Canada's *Turning the Corner Plan* notes the potential for a North American emissions trading market.

3.3 Carbon Cap and Trade Systems

Carbon cap and trade systems combine two separate policy instruments—emissions caps and emissions trading—into

one market-based policy solution to the problem of GHG emissions. Emissions caps limit the amount of man-made carbon emissions. To comply with caps, operational efficiency may need to be improved, offsets may need to be purchased or emissions trading undertaken. These caps may be based upon emissions intensity (emissions per unit of economic output) or upon absolute emissions levels.

Emissions trading allows emitters to buy or sell emissions allowances or credits to other emitters. Companies, individual factories, or countries could sell credits that are in excess of what they require for operations. This provides an additional source of income and rewards increased efficiency. Simultaneously, countries or industries that cannot meet their targets through cost-effective measures can purchase credits and meet their emissions allowances.

Carbon cap and trade systems have been implemented, with varying degrees of success, in several jurisdictions. One of the largest systems established to date, and the first to be implemented, is the European Union Emissions Trading Scheme (EU ETS). The successes and challenges of the EU ETS may be

Box 1: The European Union Emissions Trading Scheme

The European Union Emissions Trading Scheme (EU ETS) entered into force in January 2005. The initial aim of the scheme was to establish a cost-effective and environmentally sound means for EU industries to reduce emissions while simultaneously creating new business opportunities for investment in carbon-reducing projects nationally, within the EU, and internationally.

The EU ETS was to be implemented in stages, with the first trading period lasting from 2005-2007. The initial focus was on the largest emitters of GHGs, which included power and heat generation industries, as well as select energy intensive sectors (combustion plants, oil refineries, coking, iron and steel plants, cement, glass, lime, brick, ceramic, and pulp and paper factories). There are plans in place to include aviation emissions.

Emissions caps and national allocations are determined by the member countries periodically and submitted to the Commission of the European Union for approval. These National Allocation Plans (NAPs) are to reflect Kyoto targets as well as the progress made and projected toward those targets. The NAP must also reflect the potential of industry to reduce emissions and verify compliance. If countries are planning to use Kyoto mechanisms to reach their targets, this must also be included in the NAP.

Member states can then distribute allocations to industry. In the initial trading period, at least 95% of allocations were to be distributed freely; in phase two of the plan this number was to be decreased to 90%. The remainder could be sold through auction or other means. At the end of each year, industry must provide enough allocation credits to cover its actual emissions. Fines of €40/tonne (increased to €100/tonne after 2008) can be applied if insufficient credits are provided.

In order to avoid fines, companies can purchase credits from others who possess surplus credits. This can be done directly, through a broker, or through any other market mechanism.

There have been some challenges to the implementation of the EU ETS, many of which may be addressed in future trading periods. Among the challenges, the over-allocation of permits resulted in low prices of carbon (they fell from €33/tonne to €0.22/tonne). Because each country sets its own targets, some industries faced ambitious reductions, while others continued with business-as-usual. Furthermore, there were problems with the ability to use Kyoto mechanisms (the Clean Development Mechanism and Joint Implementation) to compensate for almost all scarcity in the market, leading to criticism that actual change is not happening and that actual EU emissions are not decreasing.

Sources: European Commission. 2005. *EU action against climate change: EU emissions trading—an open scheme promoting global innovation*. http://ec.europa.eu/environment/climat/pdf/emission_trading2_en.pdf

Open Europe. 2007. *Europe's dirty secret: Why the EU Emissions Trading Scheme isn't working*. http://www.openeurope.org.uk/research/etsp2.pdf

informative for Canadian decision-makers considering a similar approach (see Box 1).

Cap and trade regimes can incorporate a high degree of flexibility and can be implemented gradually, targeting the largest industrial emitters first before shifting focus to less energy-intensive industries and/or to the consumer. The design of the cap and trade program can incorporate specified measures to allow for the uniqueness of each jurisdiction to be accommodated.

One of the most important elements of the design of cap and trade regimes is determining how permits are allocated across jurisdictions and industries. In Canada, determining where allocations should go could be a complicated process. For example, should each province be allowed to set its own allocation plans, approved by a regulatory body, as in the EU ETS? Does each province receive equal permits? Should permits be distributed based upon the industries present in each province? Should permits be based upon the relative ability to reduce emissions? Should allocations be set at a level that encourages innovation and appropriate trade while ensuring continued economic growth? Answering these and similar questions is not easy and can involve many interrelated interests and complex relationships. Ultimately, the success of a cap and trade system is dependent upon the design and eventual implementation of the program.

There has been some movement toward cap and trade systems within Canada and North America. For example, the Western Climate Initiative (WCI) is in the process of considering options for design, regulation and reporting. Five subcommittees of the WCI have produced several discussion papers that outline options for allocation, electricity, offsets, reporting and scope for a regional cap and trade system. Stakeholder consultations are ongoing and the WCI aims to have the subcommittees present initial design recommendations in March 2008, final recommendations in May 2008, with final design determined and released in August 2008.

3.4 Permit Auction

There are several ways that allocations within a cap and trade system can be distributed. For instance, in the first trading period of the EU ETS, 95% of all allocations were distributed free of charge. The remaining 5% could be distributed by other means, such as an auction. In a permit auction, companies bid to purchase the necessary credits for compliance with an emissions cap; the highest bidder wins. Revenue from the auction could be used to insulate low-income families from increased energy costs due to climate change policies; invest in new emissions-reducing technology; invest in government infrastructure projects like mass transit systems; or to provide consumer rebates for high energy efficiency products.

Auctioning permits is one way that governments can allow the market to determine the price of carbon. This assists in establishing the market price of carbon and improves the fairness of permit distribution. For example, there have been allegations of unfair lobbying by industry in some member states of the EU ETS, resulting in preferential treatment of select industries and relaxed standards in some member states. It has been suggested that the problem should be corrected by increasing the proportion of permits auctioned, with an aim of reaching 100%.

3.5 Carbon Offsetting

Carbon offsets involve the purchase of credits generated from emissions reducing projects, through either a broker or through other means, to compensate for the emissions produced by the activities of a business, country, or individual.

The practice of offsetting is often voluntary. However, there is the potential for government regulation or promotion through appropriate legislation. They also hold the potential to be incorporated into broader cap and trade systems or into carbon taxation instruments.

Commonly, carbon offsets are carried out through tree-planting by a nonprofit group. Other methods can be used, such as purchase of renewable energy, investment in methane capture and other energy conservation measures. The purchase of carbon offsets has been popularized by celebrity figures such as Al Gore, by sporting events such as the Grey Cup, and by other companies proclaiming to be “carbon neutral.”

There are challenges with the increased use of offsets. Some, like George Monbiot, have likened carbon offsets to the indulgences of the 15th and 16th centuries, allowing corporations and individuals alike to absolve themselves of their environmental sins through the purchasing of offsets, without making actual changes. Many of the brokers of carbon offsets would agree with this analysis in the sense that, if individuals or corporations merely bought offsets without taking steps to reduce their own consumption, the offsets benefits would be minimal. However, they note that offsets are a starting point—a way to raise awareness about the impact of human activity and do some environmental good (through the offsets themselves). If offsets are to be used effectively, they could be used as one way to compensate for the unavoidable emissions that are produced, even after all appropriate consumption and emissions reductions methods are implemented.

3.6 Full Cost Pricing and Accounting

Full cost pricing refers to the concept of incorporating the external and internal environmental and social costs into the prices of goods and services. After calculating these costs, the "full cost" is then transferred to the consumer. For example, under an environmental full cost pricing, the price of apples would reflect not only the costs of growing and transporting the apples, but the costs to the environment from, for instance, the carbon emissions associated with the farming and transportation of apples.

Full cost accounting is an accounting method that includes environmental costs, both direct and indirect, connected to a product, process, service or activity. This can be interpreted in a few different ways. For example, some would include only the environmental costs that directly result from a product's manufacture while others would include the full life-cycle costs of the product, from raw material extraction to product disposal.

3.7 Carbon Price

A carbon price refers to the economic cost per unit of carbon emitted. This price is established either through market forces (as in a cap and trade system), taxation (through a carbon tax or energy tax), or through the costs of complying with new regulations. The price of carbon determines what consumers pay for energy sources as well as what sources of energy are competitive. Establishing a price for carbon emissions forces industry and consumers to acknowledge the environmental costs of consumption. Pricing carbon reduces the temptation to over-pollute or to over-consume; cost becomes a deterrent.

4. Taxation Instruments

4.1 Carbon Tax

A carbon tax is a surcharge on fossil fuels like oil, coal, and gas. It is designed to discourage the use of these carbon-emitting products and to encourage conservation. It has been suggested that in order to have the greatest impact, the tax should be applied relative to the carbon content of the fossil fuel in question, although this is not always the case.

Carbon taxes are unpopular, however, there is some evidence that they can be effective economic tools to reduce GHG emissions. As the *Stern Review on the Economics of Climate Change* suggested, carbon taxes can provide solid, predictable price signals on the value of carbon to industry and consumers alike.

Unlike cap and trade systems, where the market determines the price of carbon emissions, carbon taxes are generally set by the government or by regulating bodies. This establishes a stable price of carbon and allows for long-term planning and strategizing by industry to adapt to changes. If the price signals created by a carbon tax are strong enough to persuade changes in industry and consumption patterns, but not so strong as to damage economic performance, there is the potential for environmental gains at minimal economic cost.

A few of the questions surrounding the development of a carbon tax are who to tax, how much to tax, who collects the tax, and what is done with the tax revenue?

One potential way to use revenues generated by a carbon tax would be to recycle them back into technological investments

that would reduce carbon emissions, like carbon capture and storage or high efficiency processes. A similar system is Alberta's emissions levy. In Alberta, the large industrial emitters are required to reduce their emissions intensity by 12% against the 2003-2005 average by March 31, 2008. Any emissions exceeding this level are subject to a $15/tonne levy. Additionally, the plants have the option to purchase offsets within Alberta to apply against their emissions. The levy is recycled not into general revenue funds, but rather into the Climate Change and Emissions Management Fund, a technology and innovation fund that invests in projects to reduce emissions.

Other options for the revenue from a carbon tax include recycling revenue back to industry or reducing income taxes (this would be done to make the carbon tax revenue neutral) and earmarking funds for green infrastructure projects.

Many European jurisdictions have had experience with implementing a carbon tax. For example, Norway was the first to introduce a carbon tax in the 1990s. This carbon tax was applied to gasoline, diesel, mineral oil and to the offshore petroleum industry. It was designed to reduce energy emissions while simultaneously spurring technology and development to bring Norway to the forefront of clean energy production. There is some evidence that the tax did have the desired effect of spawning new technology in carbon emissions reduction.

Although other Nordic countries have since implemented their own carbon taxes, harmonizing taxes across these states has been a major challenge. The difficulties in harmonizing carbon taxes across a relatively small area highlight one challenge that a Canadian carbon tax could face. As provinces can implement their own taxes, it may be challenging to devise a national strategy and to ensure fair taxation across the nation.

4.2 Tax Rebates and Credits

To encourage businesses and consumers alike, governments have the option of providing tax credits or rebates for the purchase of energy-efficient and/or emissions reducing products. For example, a government can choose to provide a tax rebate on the installation of energy efficient windows for the home or office.

There are many other examples of tax rebates being used to encourage more energy efficient homes, offices, vehicles and products. Tax rebates can also be used to encourage the development of alternative fuel sources such as biodiesel or wind power. Tax rebates can take the form of refunding sales taxes or through providing tax credits toward corporate or personal income taxes.

4.3 Energy Tax

Energy tax refers to a surcharge on the consumption of fossil fuels. These taxes are designed to curb consumption and encourage energy efficiency. Emissions are reduced as consumption is reduced. This is similar to the idea of a carbon tax but is aimed specifically at energy use.

4.4 Tax Shifting

Tax shifting refers to the practice of using the revenue from energy taxes or carbon taxes to reduce taxes elsewhere. Tax shifting has been used in Europe for many years. For example, in Norway, when the first carbon tax was implemented in 1990, the funds raised from the tax were used to reduce labour taxes. Similarly, in 1999 Germany phased in higher taxes for carbon-emitting energy sources (electricity, gasoline, fuel oil, and natural gas) and used the tax reductions to reduce social security payments by both employers and employees. This carbon tax and tax shift also incorporated protections for industries and low-income individuals so they would not be disproportionately affected.

5. Alternative and Renewable Energy Sources

5.1 Energy Substitution

The practice of energy substitution refers to replacing high carbon-emitting energy sources (like coal or gasoline) with lower emitting, or non-emitting sources, such as clean coal, ethanol blended gasoline, wind or hydroelectric power. Through increasing the use of low-emissions fuels and energy sources, overall emissions can be lowered.

5.2 Alternative and Renewable Energy

Renewable energy refers to the energy sources that can produce usable energy without depleting resources. This includes energy from water, biomass, wind, solar and geothermal sources.

Alternative energy refers to energy derived from non-traditional sources and tends to have a low environmental footprint. Sometimes the term is used interchangeably with renewable energy, although this is not always the case.

Water as a source of renewable energy is by far the most common. Hydroelectric projects involve the damming of rivers and using the movement of the water to produce electricity. More recent developments in hydropower include the use of tidal currents (using the movement of tides to produce electricity).

Biomass energy involves the use of biological matter such as that from corn, sugar cane, or woody material that can be processed into usable fuels.

Wind energy utilizes the movement of air masses to turn turbines and produce electricity.

Solar energy captures the energy radiated by the sun to the Earth. One method of converting solar radiation into electricity is through the use of photo-voltaic cells which convert the light energy into electrical currents. Alternatively, solar radiation can be used to heat fluids that produce steam, which turns a turbine and produces electrical energy.

Geothermal energy is generated from heat energy stored below the surface of the Earth.

5.3 Biofuels and Biomass Energy

Biofuels and biomass energy sources are those that are made from plants that are processed to make usable fuels. Biofuels, like ethanol, are made from plants like corn in the US or sugar cane in Brazil. These fuels are less toxic than gasoline and other fossil fuel energy sources and are renewable. As they can be grown basically anywhere, they reduce the need for pipelines and oil tankers. Additionally, they are thought to emit less carbon than non-renewable fossil fuels making them an attractive option to reduce carbon emissions.

However, biofuels are not without challenges. There is a need for land to produce them and there is some doubt that there will be meaningful reductions in carbon emissions through extending their use. Some, like the David Suzuki Foundation, advocate for a more gradual approach to their use, focusing first on developing the technology for biofuels production, reducing fossil fuel consumption, increasing overall energy efficiency, and conservation and remediation of grasslands, savannah, and forests.

The challenge surrounding land availability is especially important to consider when looking at expansion of biofuels programs. Western Canada is home to valuable agricultural land that is essential for both human and animal use. Considering the impact of converting these lands to biofuel production would be important to ensuring potential net environmental gain to biofuels use.

There has been some movement toward alternative sources of biofuels. This has come out of concerns about biofuel sustainability and their potential challenges. These alternatives include fast growing grasses and woody plant material. There is some evidence that these grasses and plant material provide more efficient sources of biofuels and are much closer to being "carbon neutral" than current corn and sugar cane sources. Furthermore, it is suggested that grasses may be a better source given the need to maintain food supply; grasses can be planted on marginal croplands or be used for remediation on previously cultivated or disturbed lands, providing further environmental benefits while preserving land required for food production.

In the US, subsidies to the biofuels industry (primarily of corn producers) have been estimated by the International Institute for Sustainable Development at between $5.5 billion to $7.3 billion US per year and are expected to increase as the US looks at ways to secure new fuel supplies.

Currently, there are many programs within Canada to encourage further development of biofuels. Financial incentives include tax credits and subsidies and most provinces include some

form of subsidies or incentives for fuel distributors to increase the percentage of ethanol in their fuels. One example is Alberta's Nine-Point Bioenergy Plan, which spells out Alberta's financial incentives to bioenergy producers. It includes a Commercialization/Market Development Program, a Bioenergy Infrastructure Development Grant Program, a Renewable Energy Producer Credit Program, taxation and investment instruments as well as investment support from other government programs that align with the goals of the bioenergy plan.

Nationally, ecoEnergy for Biofuels provides incentives to producers of biofuels. The program will invest approximately $1.5 billion over nine years with the hope of stimulating development of ethanol and biodiesel.

5.4 Feed-in Tariffs

Feed-in tariffs are prices paid by electricity companies to renewable energy producers. These prices are determined per unit of electricity and are regulated by the government. They are designed to promote the increased use of renewable energy and to make it profitable for investors through predictable price support and guaranteed rates. The specific program design can be varied with respect to length of time and rates that electricity companies are required to pay. The practice of feed-in tariffs is common throughout the European Union, with Germany being one of three model countries.

Feed-in tariffs were introduced to achieve Germany's goal of 12.5% gross electricity consumption from renewable energy sources by 2010, and 20% by 2020. In Germany's feed-in tariff program, electricity providers pay fixed rates and renewable energy providers receive fund support that varies depending upon the source. For example, solar energy is eligible for €0.457 to 0.624 per kWh while wind is eligible for €0.055 to 0.091 per kWh. Tariff rates are guaranteed for 20 years after the installation of the new technology and are decreased every year to encourage competitiveness and increased efficiency.

The result of this financial incentive to invest in renewable energy was that by 2005, 10.2% of electricity in Germany was sourced from renewables and by 2010, the Federal Environment Ministry (BMU) expects that the program will prevent 52 million tonnes of CO_2 from entering the atmosphere. The cost passed on to consumers (all consumers pay a surcharge to electricity providers who pay the feed-in tariff) was €0.0056 per kWh, which makes the tariff revenue-neutral.

Feed-in tariffs have been used or are proposed in jurisdictions within North America as well. While movement of these programs has been slow, they are beginning to gain popularity. For example, Ontario has a small-scale program, known as the Standard Offer Program that offers small producers of renewable electricity (water, wind, solar, biomass) a standard price for electricity sold onto Ontario's grid. Similarly, California has taken steps to introduce a feed-in tariff program modeled after Germany's feed-in tariff structure.

Feed-in tariffs have the potential to encourage investment in industry. However, there is the risk of over-funding projects, which can result in inefficiencies and in enormous windfall profits for the renewables sector. Careful planning and design of systems is needed to ensure that funding levels are appropriate, considering the investment costs of the technology, and that the producer's learning curve is taken into account. Furthermore, governments should provide long-term contracts with price stability in order to encourage appropriate investment. Other questions arise with feed-in tariffs when electricity is sold between provinces and between countries. As feed-in tariff programs gain momentum in Canada and the US, questions of jurisdiction, competitiveness, and trade will likely come into play. Answering these questions will be key to developing long-term successful programs.

5.5 Clean Coal Technology

An alternative to finding new sources of energy is to "clean" existing fuels so that fewer emissions are generated. Through the implementation of new technology, industry can not only reduce emissions, but can increase efficiency and reduce costs. Investing in the research and development of these technologies can allow for the implementation of efficient, low emissions processes.

Clean Coal Technology is one such effort to reduce emissions through improving existing fuel supplies. Coal plays an important role in electricity generation throughout Canada, but particularly in Alberta and Saskatchewan. In Alberta, the sub-bituminous coals are naturally cleaner burning, due to

lower sulphur and lower mercury than coals found elsewhere. However, these coals produce less heat than others.

One of the technologies that could be used to produce a cleaner coal is gasification. Gasification is a process where steam and oxygen turn coal into a synthetic gas, which is then burned to produce electricity. Through the use of gasification, fewer emissions (carbon dioxide, sulphur oxides, nitrous oxides, particulate matter, mercury) are produced. The carbon emissions associated with burning the synthetic gas are estimated to be similar to the burning of natural gas. Additionally, because of lowered carbon dioxide emissions, the costs of implementing carbon capture and storage systems would be reduced.

5.6 Landfill Gas Capture

An alternative source of energy can be found in the methane released from the decomposition of municipal waste in landfills. Landfill gases are comprised of approximately 50% methane, 50% carbon dioxide and less than 1% non-methane organic compounds. The US Environmental Protection Agency (EPA) estimates that 0.8MW of electricity and 432,000 cubic feet of landfill gases are produced by 1 million tons of municipal solid waste. This amount is significant, and if allowed to enter the atmosphere, can contribute to global warming, smog, health and safety concerns, and can raise aesthetic concerns. Through landfill gas incentive programs, governments at all levels can encourage the capture of methane for electricity or heating purposes and can prevent methane from being released into the environment (methane is a powerful GHG).

In the US, the EPA established its Landfill Methane Outreach Program in 1994 to attempt to "reduce methane emissions by lowering barriers and promoting the development of cost-effective and environmentally beneficial landfill gas energy projects." This voluntary program allows a transfer of knowledge and access to resources for managers of landfill operations or for those in governments who wish to put landfill gas recovery programs into place within their jurisdictions.

Incentives for recovering landfill gas in the US range from tax credits for electricity generation to access to renewable energy payments from the government. Furthermore, the Chicago Climate Exchange offers a credit of 18.25 tonnes of carbon dioxide per tonne of methane combusted, which can allow further income to be generated via landfill methane collection programs. This is an attractive offsetting option for municipalities looking to make progress on climate change and GHG emissions. The result to date of the EPA's Landfill Gas Outreach Program is that there are 424 operation projects in 42 states that produce 10 billion kWh of electricity and 75 billion cubic feet of landfill gas for direct use. This translates into an estimated benefit of planting about 20 million acres of forest, not using 170 million barrels of oil or the removal of emissions of 14 million vehicles.

5.7 Fuel Emissions Standards

One option for reducing emissions is to regulate vehicle emissions. Through regulation, the fuel industry can be required to provide lower-emitting products to consumers. A program that takes this approach is California's Low Carbon Fuel Standard (LCFS).

According to the State of California, transportation accounts for 40% of annual GHG emissions. To reduce these emissions and to diversify fuel sources (and by extension, protect the economy from fluctuations in the price of oil), an Executive Order of the Governor was issued to establish a low carbon fuel standard for transport fuels in the state, with the goal of reducing the carbon intensity of passenger vehicle fuels by 10% by 2020.

The rationale behind the LCFS is that, through regulation, California will be able to increase diversity in fuel use, promote new technology and development through regulatory certainty, and provide greater consumer choice.

The LCFS requires fuel providers to achieve a declining standard for GHG emissions, reported as carbon dioxide equivalents. The measurements and calculations to determine the carbon emissions related to a particular fuel include upstream extraction, refining and delivery to market. Credits will be generated through meeting and exceeding the standards. Companies can retain these credits for future use, or have the option of

selling them to other companies. To become compliant with the LCFS, companies can either take steps to reduce the emissions related to their fuel product, use banked credits, or purchase credits from other companies. Through credit generation and trading, fuel providers can choose different methods for different fuels based upon volume sold. This allows for both market and consumer response to play a significant role in reducing overall emissions.

The LCFS is expected to be implemented by the end of 2008.

6. Technical Terminology

6.1 Hot Air

Hot air is an important component of emissions trading. It is created when individual emissions (an industry, company, or country), are involuntarily lower than mandated emissions targets. This can occur if growth projections are more ambitious than realized or if a country enters a recession. Emissions projections are generally tied to growth, as emissions are predicted to rise proportionally to GDP or proportionally with factory output. However, if a country were to enter a recession and these growth projections were not met, emissions targets would appear to have been met. This is known as "hot air."

In this scenario, the country or company has the ability to continue to pollute and to continue with business as usual and can profit substantially from it. These emissions reductions do not represent actual reductions from what would happen in the normal course of events.

6.2 Intensity Based Targets and Absolute Targets

Intensity based targets are a ratio of the GHG emissions per unit of economic activity. This method of determining targets could be calculated using a variety of economic indicators, from GDP to barrels of oil produced. Absolute targets are based on actual emissions levels, regardless of economic activity.

Both approaches are not without their critics. Intensity-based targets have been criticized for being weak. If economies are growing, the GDP will increase and the emissions intensity will decrease, regardless of progress made toward actual emissions reductions. Furthermore, the emissions reductions through increased efficiency can be overwhelmed by increased economic output, and increased emissions. This may reduce the impact of positive steps.

Absolute targets are generally the preferred method of many environmentalists for setting emissions reductions goals. They are simple to calculate and to integrate into emissions trading systems. However, absolute targets have been criticized for their inability to account for economic performance, an important consideration when determining how to set emissions targets.

6.3 Polluter Pays Principle

The polluter pays principle is the idea that countries or industries should compensate others for the effects of the pollution that they have generated. This principle has been at the heart of many of the climate change negotiations at the international level. There is a sentiment that the industrialized nations need to pay for the costs associated with their development to those countries that will suffer the ramifications of climate change the most. However, this principle does not fully address the problem of who pays for climate change, nor does it fully distribute the costs associated with the production and consumption of goods that emit GHGs.

6.4 Voluntary Measures

Voluntary measures and programs are those that are not mandated by a regulatory body or by a governing body. Rather, they are optional programs and steps companies and individuals can take to make positive changes. In the case of climate change and energy use/production, voluntary actions can include taking steps to reduce energy consumption through turning off lights, encouraging employees to take public transit, early implementation of new technologies, or voluntary reporting of emissions data. These programs and measures can be varied in scope and effectiveness.

6.5 Costs of Compliance

This refers to any additional costs that individuals, companies or governments will incur in order to implement a new policy or to become compliant with a new regulation. This could include the costs of hiring additional consultants, experts, planners, or lawyers, or even changes to business practices, all of which add to the financial costs of implementing a new regulation.

In the EU ETS, member governments incurred large costs as they attempted to set up regulatory bodies that held the capabilities to manage allocations within the state as well as to coordinate with the central regulatory body. Furthermore, some companies included in the EU ETS found that there were enormous costs for compliance with government caps. There is some evidence that governments were subjected to a great deal of lobbying by high-emitting industries, leading to the allocation of more permits to these industries, and left others, like hospital trusts in the United Kingdom, to pay high costs to purchase credits and to reduce emissions.

6.6 Carbon Footprint

A carbon footprint is the measure of human impact upon the earth due to GHG emissions, measured and reported in terms of carbon dioxide equivalents. It is comprised of both direct emissions, like those from automobile emissions or from heating homes, and from indirect emissions, like those involved in the manufacturing, transportation, and breakdown of products used.

Once a carbon footprint is calculated, it can be used to purchase offsets or to act as a baseline to measure improvements. Additionally, calculating the carbon footprint of a product could assist in the determination of full-cost pricing or in the determination of the social cost of carbon.

6.7 Social Cost of Carbon

The social cost of carbon refers to the full cost of present increases in carbon emissions, in addition to the full cost of damage due to those emissions over their lifetime in the atmosphere. This cost of carbon can be estimated using a variety of economic analyses and could be used to inform decision-making. Additionally, the social cost of carbon should provide an indication of what society should be willing to pay to avoid the negative effects of climate change.

A January 2002 UK Government Economic Service paper estimated the social cost of carbon at £70/tonne carbon equivalent rising by £1/tonne carbon per year. This calculation is not without its difficulties and uncertainties. For instance, there is uncertainty in how emissions will rise, their effects on the environment, alternate sources of GHGs, and what major damages will be caused in the future. These uncertainties are important to consider when taking the social cost of carbon figures into account.

6.8 Large Industrial Emitters

Climate change and energy policy programs have tended to be directed toward a select group of industries, known as large industrial emitters. Depending upon the jurisdiction involved, the definition could vary somewhat, but generally contains the most energy intensive industries, like power production, oil and gas, refining and smelting. According to Alberta's *Climate Change and Emissions Act,* industries that emit more than 100, 000 tonnes of carbon dioxide equivalents per year are considered to be large industrial emitters. This includes oilsands producers and coal-fired power plants.

These large industrial emitters have the potential to produce half of the total GHG emissions in Canada by 2010. Emissions reductions programs in Canada and internationally often target this group of industries.

6.9 Green Buildings

In general, the term "green building" refers to structures that have some element of energy conservation, recycled or certified sustainable building materials, low toxicity materials, and possibly low water use appliances, incorporated into their construction. Incorporating environmentally friendly design elements into buildings represents an attempt to mitigate the

potential harm that building developments can have on the environment.

A desire to standardize what it means to have a green building has led to the development of green building certification and standards. A well-known certification is the LEED (Leadership in Energy and Environmental Design) standard, which is administered by the Canadian Green Buildings Council.

The BuiltGreen Society of Canada provides checklists of goals to be achieved to obtain corresponding levels of certification and recognition. These programs are voluntary and have tended to be industry-led. Organizations and builders can choose how ambitious their project will be and what level of recognition or certification they wish to achieve. There may be tax incentives, rebates or other financial incentives involved, from programs that encourage energy and water efficiency (such as the EnerStar program) or through reduced cost of building permits (as in Calgary and Edmonton).

6.10 Adaptation

Adaptation, within the context of climate change and energy policy, refers to changing business practices to cope with lower supplies of carbon-based fuels and products at higher prices. Furthermore, adaptation can include the measures taken by businesses and governments to lessen the impacts and costs of climate change related phenomena such as changes in precipitation, temperature, and water resources. Preparation for and reactions to change that occur in a cost-effective way can ensure the long-term sustainability of investments made in the present.

An example of adaptation requirements would be changing building codes to prepare for more intense storms or for increased occurrence of flooding or forest fires. Other examples include securing water supplies or developing new technology for water re-use to adapt to reduced availability of water. Adapting to reduced availability of carbon-based fuels would require the addition of renewable energy supplies and the construction of high efficiency devices.

7. Conclusion

Getting it Straight presents a basic inventory of the key terms and policy instruments that are frequently referred to in the climate change policy debate. This inventory is intended to serve as a useful background document in advancing a discussion of how best to address the threat of climate change.

As the pros and cons of the available policy options in different jurisdictions demonstrate, there is no "one-size-fits-all" approach. Not all policies are suitable for all jurisdictions and what may work in one case may be not be possible in another. Ultimately, policy-makers must select options that make sense for their jurisdictions.

About the Canada West Foundation

Our Vision
A dynamic and prosperous West in a strong Canada.

Our Mission
A leading source of strategic insight, conducting and communicating non-partisan economic and public policy research of importance to the four western provinces and all Canadians.

Canada West Foundation is a registered Canadian charitable organization incorporated under federal charter (#11882 8698 RR 0001).

In 1970, the One Prairie Province Conference was held in Lethbridge, Alberta. Sponsored by the University of Lethbridge and the Lethbridge Herald, the conference received considerable attention from concerned citizens and community leaders. The consensus at the time was that research on the West (including BC and the Canadian North) should be expanded by a new organization. To fill this need, the Canada West Foundation was created under letters patent on December 31, 1970. Since that time, the Canada West Foundation has established itself as one of Canada's premier research institutes. Non-partisan, accessible research and active citizen engagement are hallmarks of the Foundation's past, present and future endeavours. These efforts are rooted in the belief that a strong West makes for a strong Canada.

More information can be found at www.cwf.ca.

CanadaWest FOUNDATION

Manitoba Office:
#400, 161 Portage Avenue East
Winnipeg, Manitoba, Canada R3B 0Y4
Telephone: 204.947.3958

British Columbia Office:
#810, 1050 W. Pender Street
Vancouver, BC, Canada V6E 3S7
Telephone: 604.646.4625

Head Office:
#900, 1202 Centre Street SE
Calgary, Alberta, Canada T2G 5A5
Telephone: 403.264.9535

www.cwf.ca