Background Paper: Market-Based Mechanisms for Carbon Sequestration, Energy Efficiency and Renewable Energy in North America—What Are the Options?

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1 Market Failures and Market-Based Mechanisms

This paper examines the different market-based mechanisms that could be used to encourage the sequestration of carbon;[1] increase energy efficiency; and support the development and use of renewable energy sources. Market-based mechanisms in this paper refer to all mechanisms, voluntary or mandatory, that affect demand for or supply of energy and/or carbon sequestration, either through prices, regulation or information.

Price mechanisms, through taxes, subsidies or "green" pricing, are often used to create financial incentives for companies and individuals to internalize the environmental costs associated with their production processes and consumption. The fact that these costs remain external represents a market failure that prevents markets from signaling to companies and individual companies these added environmental costs to society, and provides justification for the use of such mechanisms to help internalize them.

Interest in market-based mechanisms stems from the growing acceptance that such mechanisms are sensible complement to conventional forms of environmental regulation. Conventional forms of environmental regulation have tended to use one-size-fits-all regulatory approaches that mandate the use of specific technologies to control pollution, thereby leaving no flexibility in how to achieve desired environmental goals, and no room for markets to provide incentives for environmental costs to be incorporated in the most cost effective way.

Despite their promise as an effective mean of environmental regulation, market-based mechanisms must be carefully designed to ensure that desired environmental goals will be achieved despite the asymmetry of information between environmental regulators and the regulated industries or firms. Indeed, environmental taxes provide certainty on pollutants prices but not on quantities. Conversely, cap-and-trade provides certainty on emissions limits but not on prices. In addition, policies need to be designed so that they are enforceable (at a reasonable cost) and politically acceptable.

Mechanisms classified as mandatory market-based mechanisms are instituted by governments and include mechanisms such as: performance standards, renewable portfolio standards, taxes, subsidies and subsidy reform, production regulations, labeling requirements, buy-back and scrappage programs and emission permit trading.

Voluntary mechanisms considered here include: third-party incentive programs such as labeling schemes or tradeable renewable energy certificates; 'green' pricing, time of use pricing; and 'green' capital market investment. A section on public-private partnerships, unilateral company or industry initiatives, or initiatives negotiated, or agreed to bilaterally, between companies or industries and governments is also included.

[1] The term carbon sequestration in this paper refers to carbon sequestration generally and at different times refers to more specific types of carbon sequestration (be it biological or geological/technical) depending on the context in different parts of the paper.

In all cases, and as will be described throughout this document, there is room for government involvement to either develop explicit market-based policies or to put in place the structures, rules, or accounting practices that improve the functioning of market-based mechanisms and their ability to encourage consumers and producers to consider the environmental costs of their consumption and production.

Mandatory market-based mechanisms as they could be used to encourage carbon sequestration, energy efficiency and renewable energy are presented first. The second section presents voluntary market mechanisms.

2 Mandatory Mechanisms

All eight mandatory mechanisms presented in this section could apply to any sector with the exception of the first, Renewable Portfolio Standards, that are specific to renewable energy development. Table 1 outlines the major advantages and disadvantages of the mandatory mechanisms described in this section.

Table 1 – Summary of Advantages and Disadvantages of Mandatory Mechanisms Described in this Paper

Mechanism	Advantages	Disadvantages
Renewable Portfolio Standards (RPSs)	• Create markets for renewables and incentives to scale-up, and reduce cost of, 'renewable' electricity production.	• Issues surrounding the multitude of definitions of what is 'renewable.'
Environmental Taxes and Tax Exemption	• Straightforward to apply. • Provide additional revenue for the government implementing the tax.	• Political opposition to taxes in general. • Opposition to taxes by non-exempted competitors. • Uncertain environmental result
Subsidies and Subsidy Reform	• Straightforward to implement. • Little political opposition from those receiving subsidies.	• They can be expensive. • Vocal opposition from those having subsidies removed.
Investments in Science and Technology	• Similar to subsidies.	• Similar to subsidies, and results riskier.
Labeling Schemes	• Provide consumers with information on environmental performance of the goods that they purchase.	• Proliferation of labels can lead to 'label fatigue.' And prevent the capture of economies of scale.
Performance Standards	• Straightforward to apply	• Not least cost solution, because lowest cost abaters do not abate more unless they are targeted
Buy-back and Scrappage Programs	• Can be effective at replacing older capital stock reducing emissions or improving energy efficiency.	• Can be expensive and require institutions and institutional capacity to ensure the programs function.
Emissions Trading	• Environmental outcome is certain. • Effective and cost-effective way to reduce emissions.	• Require institutional capacity to ensure markets function

2.1 Renewable Portfolio Standards (RPSs)

Renewable Portfolio Standards set a minimum proportion of electricity that is required to be generated from 'renewable,' or cleaner sources in a given jurisdiction. Generally they determine both a proportion of electricity generation or consumption that is required to be renewable as well as what sources of electricity qualify as 'renewable.' So far fourteen US states have adopted RPSs, another eleven US states have proposed RPS legislation, and the US Congress is considering RPS legislation. In addition, the province of Quebec has a RPS and several other Canadian provinces are considering them.[2] While there is no RPS legislation per se in Mexico, the Secretary of Energy has announced plans to install 1,000 MW of renewable energy over the period 2001-2006 and announced in Johannesburg that 5% of its energy use will be from renewable sources by 2015.[3]

RPSs could potentially have a large impact on environmental quality given the important impact that the electricity sector has on North America's environment. Table 2 shows the sector's important contribution to NO_x, CO_2, and SO_2.

Table 2 – Percent Contribution of the Electricity Sector to Total Emissions of NO_x, CO_2, and SO_2 in each country and in North America *

Country	**SO_2**	**NO_x**	**CO_2**
Canada	18%	12%	31%
Mexico	51%	23%	39%
United States	64%	26%	39%[4]
North America	57%	25%	39%

*These statistics are from the late 1990s and come from two sources OECD 1999a and the Government of Mexico 2001.

The majority of air pollution emissions from the electricity sector come from coal and oil powered plants that make up 52 percent of all electricity generation in North America. Since RPSs call for up to 30% of electricity to come from renewable sources and these sources generally have lower emissions (and many have none), their adoption has the potential to have important positive effects on environmental quality.

At the moment, most renewable sources of electricity have trouble competing with more conventional sources of electricity generation such as coal, natural gas and nuclear, despite the fact that generation costs for certain forms of renewable electricity have been dropping quite rapidly over the past thirty years (see section 2.4 below).While RPSs have great potential, the issue of what exactly is renewable might inhibit their widespread use.

Each RPS contains a different definition of what is renewable.[5] This presents problems for scaling up renewable energy production (because what qualifies as renewable is different from jurisdiction to jurisdiction), and capturing economies of scale. These different definitions of renewables have also been identified as a possible trade irritant if electricity exports from one jurisdiction were to be prevented access to an export market

[2] The CEC Electricity and Environment Database contains information on RPS standards introduced or adopted in jurisdictions in North America. See <www.cec.org/electricity>.
[3] Secretaría de Energía (2001)
[4] U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000, April 2002 (online at http://www.epa.gov/globalwarming/publications/emissions).
[5] See CEC (2003)

because they did not qualify as renewable in the export market,[6] however others have argued otherwise.[7]

2.2 Environmental Taxes and Tax Exemption

Environmental taxes are applied either to production inputs or to final goods or services deemed to be environmentally more damaging. The advantages of an environmental tax are that it is relatively straightforward to implement, in addition to which, taxes levied contribute to government revenues. The overall ability of taxes to provide environmental improvement depends on whether the taxes themselves affect marginal costs faced by users of the goods being taxed, as well as on the price elasticities of the goods in question. If users are very price sensitive, then small taxes may have a large impact on how much consumption is affected.[8] If the tax is large enough it creates a price signal such that firms and households take into account environmental costs when they make production and consumption decisions. If the tax is too low to affect the relative prices of goods, and thus their demand, moneys that are levied from taxes can be used to help support government initiatives and ideally to mediate the environmental impacts of using the damaging good. Almost all countries apply one or more 'environmentally related' tax, even if they were not intended for environmental purposes in the first place, such as fuel taxes, motor vehicle taxes and packaging or waste taxes. A list of these taxes can be found on the OECD/EU database on environmentally related taxes, fees and charges.[9]

Environmental effects also depend on what is actually taxed. A carbon tax would likely have the most significant and direct impact on carbon sequestration, energy efficiency and renewable energy. With respect to carbon sequestration, a tax on carbon would translate into higher prices for goods for which the production process or end-use emit carbon. This would create incentives to reduce the production or use of these goods in favor of the production of less polluting goods and of certified carbon sequestration projects to offset emissions. With respect to energy efficiency and renewable energy, it would increase the cost of carbon intensive fuels, and as a result allow renewable sources of energy be more competitive relative to more conventional forms of energy. The increase in the costs of fuel more generally would provide incentives for firms and households to reduce their energy consumption overall such as through improvements in energy efficiency.

The greatest disadvantage facing the use of environmental taxes in general is the uncertain environmental result, as well as political difficulty of imposing or increasing taxes of any sort. Taxes provide certainty as to the price on emissions faced by regulated firms. However, the environmental outcome is uncertain. It is difficult, given uncertainty in economic models of mitigation, to set the tax level in advance to achieve the desired level of emissions reduction. For example, if mitigation costs are higher than forecast, the environmental result will be less than anticipated. In addition, the public,

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[6] See Horlick and Schuchardt (2002)

[7] Hempling and Rader (2002)

[8] Presentation by Nils Braathen of the OECD's Environment Directorate, given at the OECD Conference on Environmental and Fiscal Reform in Berlin, in June of 2002.

[9] <www.oecd.org/env/tax-database>

especially in North America, is quite sensitive to either the adoption of, or increases in, taxes. With respect to carbon taxes more particularly there are concerns about the macro level effects of carbon taxation and whether taxing such a pervasive input could present problems in the overlapping of taxes and possibly for the level of inflation in an economy.[10] Moreover, others have voiced concerns about decreased competitiveness that could follow from the levying of such taxes because of the energy dependence of the North American economy.

Taxes need not always be used by applying them to environmentally more harmful goods, some environmentally-preferable products can be exempted from taxes or they can be subsidized.

2.3 Subsidies and Subsidy Reform

2.3.1 Subsidies

This category of market-based instruments includes a wide variety of policies and can take the form of: direct payments to producers and/or consumers; tax cuts (i.e. reducing the amount of tax that one needs to pay for producing or consuming a particular good); research and development support; and regulatory waivers, which allow some forms of production or extraction to continue for producers, that are exempt from regulations for various reasons.[11] Subsidies are straightforward to implement and are generally well received.

Subsidies could be given as production incentives or incentives to expand capacity. They could be direct, such as a payment of a given amount of money for each unit of carbon sequestered, for each reduction in electricity need per unit of production, or for each unit of electricity produced from a renewable source. They could also include other incentives, such as tax credits for the installation and use of particular technologies or energy sources.

Examples of production incentives are most common for the production of renewable energy. Examples include: Canadian federal incentives for wind production that the government has committed to, of between C$0.008and C$0.012 kWh over the period 2002 and 2007. The government expects to spend C$260 million on this incentive. Another example is the production tax credit from the US federal government of 1.5 US¢ per kWh for the first ten years of wind generated electricity. The program was estimated to have been worth US$20 million in 1998.[12] One example of an incentive to increase the supply of renewable energy generating capacity is the Canadian Renewable Energy

[10] E.g. in the debate about the Italian carbon tax, see e.g. Environment News Daily issues 767, 1121, 1204 available at http://www.environmentdaily.com.
[11] An example of a regulatory waiver is the "grandfathering" provision of the Clean Air Act (CAA), or the recent EPA rule today exempting the oil and gas industry from compliance with new stormwater runoff regulations.
[12] Moomaw (2002)

Deployment Initiative (REDI) offering a 25% rebate for businesses and institutions installing solar and biomass systems.[13]

Such initiatives have the potential to increase renewable energy production and deployment, and evidence suggests that generally, production incentives are more successful at encouraging renewable electricity generation than are supply incentives which aim to expand renewable energy generating capacity.[14] Similar initiatives for energy efficiency or carbon sequestration could also be devised, and would likely be effective at improving energy efficiency and encouraging carbon sequestration. The potential for such programs is limited by the ability of governments to fund them. They have the potential to be very expensive unless innovative public-private partnerships are designed.

Depending on how environmentally-preferable goods are defined, following WTO negotiations, some environmental goods and services may face lower tariffs, thus reducing their relative prices compared to the goods or services they substitute for. This would have the same effect as subsidizing these goods without government disbursements. Thus, including renewable energy, energy efficient goods and low carbon content products in the list of goods for which countries are seeking reduction or, as appropriate, the elimination of tariff and non-tariff barriers is another mechanism that could be explored.[15]

2.3.2 Subsidy Reform

The notion of subsidy reform suggests the existence of subsidies that produce a negative outcome. Subsidy reform (at least from an environmental perspective) involves the removal of subsidies that distort the market in favor of less environmentally preferable solutions, sometimes referred to as 'perverse' subsidies.

Subsidy reform can promote energy efficiency and renewable energy by removing subsidies to carbon intensive fuels that would result in an overall increase in fuel costs. This would lead to incentives to cut down on the use of these fuels and substitution into other fuels, including renewable energy sources. This would also lead to incentives to cut down on the use of energy consumption more generally, partly through an increased demand for more energy efficient products and fuels.

Subsidies are especially pervasive in energy and carbon intensive products and industries. In the United States, for instance, direct federal subsidy support for primary energy use in 1999 totaled approximately US$4 billion, more than half (US$2.2 billion) of which went to natural gas, coal and oil.[16] It is hard to quantify the total level of fossil fuel subsidies in the US and Canada since they take various forms including: tax write offs, fuel tax

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[13] Presentation by Environment Canada at CEC meeting "Assessing Barriers and Opportunities for Emerging Renewable Energy in North America." February 18, 2002.
[14] Moomaw (2002)
[15] Doha Ministerial Declaration. Paragraph 31.
[16] Energy Information Agency (1999)

allowance, loans and grants, refundable tax credits, and forgiveness on royalty (in Canada) by many agencies.

Removing environmentally harmful subsidies should lead to reduction in market distortions caused by the subsidy and at the same time, remove a *de facto* incentive to use more energy. While this line of reasoning is intuitively appealing, the amount of real world evidence about the environmental effects of the systematic removal of 'perverse' subsidies is limited,[17] with the cases of New Zealand and Indonesia's farming sectors being notable exceptions.[18] New Zealand's example is often cited as an empirical example of decreasing input use and intensity of agricultural inputs when price supports are removed. Similarly, the Indonesian removal of pesticide subsidies led to government savings and a shift to integrated pest management.[19] Another example is Jorgenson (1998)[20] that combined a general equilibrium model with other models to find that removing US$15.4 billion in subsidies world-wide would result in the reduction of 64 million tons of CO_2 by 2010—that is, roughly a reduction of four million tons for each one billion dollars of subsidies removed.

Of course removal of subsidies or subsidy reform is unpopular with former recipients. However, evidence suggests that the overall trend in OECD countries is decreasing energy subsidies.[21]

2.4 Investments in Science and Technology

Resources can be used for the encouragement of carbon sequestration, energy efficiency and renewable energy at different stages in the technological development process. Public investment in research and development is often seen as a remedy for the perceived failure of markets to reward private sector investment in research (because of the shared nature of scientific discoveries). Most of the mechanisms discussed in this paper consider methods of encouraging the use of technologies either already in use or those in late stages of development. Also important is the creation of incentives for the development of technologies through investment in research and development and science and technologies (such as fuel cell, tar sand etc.). This type of encouragement can take the form of direct funding of independent research in particular areas promising for the development of science and technologies that could help in the more widespread adoption of technologies that can be used to sequester carbon, improve efficiency or generate renewable energies. Governments can (and have) undertaken such research directly, as well as having partnered with industry and academia to make important technological advances and developments.

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[17] Presentation by Nils Braathen of the OECD's Environment Directorate, given at the OECD Conference on Environmental and Fiscal Reform in Berlin, in June of 2002.

[18] See for example Lingard (2001)

[19] Lankoski (1997)

[20] Jorgenson (1998)

[21] Presentation by Trevor Morgan, of the International Energy Agency's Economic Analysis Division, given at the IEA/UNEP Workshop on Energy Subsidy Reform and Sustainable Development in Paris in November of 2000.

One such program has been the US Department of Energy (DOE) Wind Energy Program. This program, in conjunction with the wind industry, led to important advancements such as:

- The establishment of the scientific body of knowledge relating to aerodynamics for wind energy and developed and tested airfoils designed for wind turbine blades;
- The development of computer design codes that have substantially improved the structural engineering and design of wind turbines and turbine components;
- The completion of a nationwide assessment of the size and location of the U.S. wind energy resource.
- As well, the National Renewable Energy Laboratory (NREL), a DOE national laboratory located in Golden, Colorado, developed a set of airfoils designed specifically for wind turbine blades. These new blades capture 10%–35% more energy from wind compared to blades from earlier turbines, and at little additional cost.

The importance of such research can be seen in the history of the cost of wind generation. The cost of energy from wind has decreased from more than $0.35/kilowatt-hour (kWh) in the nineteen seventies to less than $0.05/kWh today at the same time that efficiency has increased (see Table 3).

Table 3 – Wind Power Generating Costs over the Past 30 Years

Year	**Cost/kWh***	**Capacity Factor**
Before 1975	$0.5-$1	10%
1998	$0.05-$0.035	25%
2000	$0.04-$0.025	35%

* For a wind site with an annual average wind speed of 7.0 m/s (15.5 miles per hour) as measured at a height of 30 meters (100 ft.) The low-end cost assumes municipal utility financing.
http://www.eren.doe.gov/power/success_stories/wind_cost.html

Similar programs exist in Canada such as the CANMET Energy Technology Branch which works on the development and deployment of energy technologies. Technology development activities are performed on a cost-shared basis through either in-house research and development work at CANMET laboratories or by providing funding support to its technology partners.[22]

Support for such work is similar to a subsidy for research and as such shares similar advantages and disadvantages, they are often welcomed, but can also be quite expensive. One other important difference is that the results of investing research are not quite as predictable as the effects of subsidizing the use of a particular good and in this sense this type of subsidy is somewhat riskier and has more long term impacts.

[22] Please see <http://www2.nrcan.gc.ca/es/es/technologies_e.cfm>

2.5 Labeling Schemes

Two labeling systems are mandatory in Canada (EnerGuide) and the United States (Energy Guide).[23] In Mexico, there are currently 20 mandatory official standards related specifically to energy efficiency for different products, all of which have corresponding energy efficiency labels.[24] These mandatory labels require manufacturers of certain products (different in the three countries) to include, on a label, the amount of energy that their products use, as well as how their product compares with others in the same category. For example Natural Resources Canada's EnerGuide programme mandates that the producers of appliances and motor vehicles provide information on the energy use of their products so that products can be compared on this basis (e.g. annual electricity usage in KWh and costs associated with electricity, or litres of gasoline consumed per 100 km driven).

Energy efficiency labels and certificates (see section 3.4 below as well for more details on voluntary labels) allow consumers to differentiate between products based (at least partly) on their energy efficiency. This can help to increase energy efficiency in two ways. First, information on the energy consumption of products allows consumers to compare the operating costs of the products they buy. As such, and all else equal, it would be expected that consumers buy more efficient products because they cost less to run. Second, if consumers want environmentally-preferable goods, they may favor more efficient products, simply because they are better for the environment and not necessarily for the cost savings that efficiency implies. In other words, labels tend to "pull" the markets by supplying consumers with information that will allow them to make informed choices on products with the best energy efficiency.[25] For both of these reasons labeling and certification can increase demand for more energy efficient products, providing incentives for companies to produce more energy efficient products, and thereby to increase energy efficiency more generally.

The effect of such labels can be substantial. For example in Mexico, the Mexican National Comission for Energy Conservation (Conae) estimates that standardization and labeling efforts resulted in annual power savings in 2002 of 1358 GWh and avoided the installation of capacity on the order 286 MW. Regarding thermal energy, for that same year, labeled products represented savings equivalent to 114,842 cubic meters of propane.[26]

Although the effect of energy efficiency labels and certificates on actual consumer choice when purchasing products is not well established, the existence of so many schemes (particularly of voluntary labels and certification schemes) suggests that they are playing an important role in the marketplace.

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[23] Grupo de Trabajo de Energía de América del Norte (NAEWG in English) (2002)
[24] Please see <http://www.conae.gob.mx/wb/distribuidor.jsp?seccion=1002>
[25] Grupo de Trabajo de Energía de América del Norte (NAEWG in English) (2002)
[26] Please see <http://www.conae.gob.mx/wb/distribuidor.jsp?seccion=287>

2.6 Performance Standards

Performance standards are a broad category of mandatory market-based instruments that set caps on emissions rates of pollutants emitted by firms or industries. Performance standards can be applied to many different pollutants or media, such as SO_2 or NO_x. Because actual standards are applied, the environmental effect of the standards is generally known with certainty. They are market-based, because while they do set particular environmental quality goals, they do not determine how these goals should be met (Batie and Ervin, 1999). They differ from technology design standards that dictate the type of technology that must be used to meet environmental quality restrictions and leave no flexibility to producers.

Different performance standards could be used to encourage any or all of carbon sequestration, energy efficiency and renewable energy. An example is a performance standard for carbon intensity (or greenhouse gas emissions intensity more generally) for any number of products or services. One example of a performance standard that encourages energy efficiency is Corporate Average Fuel Economy (CAFE) standards.[27] These standards apply to automobile manufacturers and they set the average fuel economy of the whole fleet of automobiles produced in a model year.[28] The efficiency of the automobile fleet is mandated, but not of individual models thereby allowing companies flexibility in how to achieve their fuel efficiency obligations.

Another example of performance standards that can be used to promote renewable energy are the Emissions Performance Standards (EPS) developed and considered by several states in the US. These standards set output based limit on emissions per unit of electricity (e.g. lb/MWh) of the entire portfolio of an electricity supplier. They can help in the promotion of renewable energy by providing incentives for electricity suppliers to either take on renewable capacity or to buy electricity from renewable sources to sell to its customers in order to satisfy the emission performance standards.[29]

If such standards were combined with carbon trading schemes, the pressure to reduce carbon dioxide emissions per unit of output for the regulated companies could increase the demand for carbon offset credits, raise their price and increase the economic value and thereby the incentive for carbon sequestration.

One disadvantage of the use of emission standards in trying to attain environmental policy is that they are not a least cost method by which to reduce emissions, because all producers are bound by the same standard. Since it will cost some firms more to reduce their emissions than others, and since the standards, by themselves, do not allow for the trading of emission permits, costs of compliance are not as low as they would be if other mechanisms, such as emissions trading or targeted standards to lowest cost abaters or

[27] CAFE standards apply in the United States. The same standards are used in Canada, although in Canada the standards are not mandatory. In Canada, they are called Corporate Average Fuel Consumption (CAFC) standards.
[28] Patterson (2000)
[29] M.J. Bradley and Associates (2001)

producers were used. As well, they do not provide any incentives for firms to reduce emissions below the standard.

2.7 Buy-back and Scrappage Programs

Buy-back programs are market-based mechanisms that provide incentives to retire old capital stock and replace them with newer, less polluting stock by providing incentives to purchase new machines or appliances. Scrappage programs are programs which endeavour to create incentives to get rid of old capital stock (mostly automobiles) The logic behind these programs is that older capital stock is generally less efficient and more polluting leading to a newer capital stock that is less energy intensive and polluting.

Buy-back programs are loan programs that provide capital with which to purchase new products. Such programs generally target energy efficiency improvements and tend to be based on the idea that improvements in energy efficiency lead to operational cost reductions (e.g. in electricity or fuel bills) which can fund the debt repayment. In other words the energy efficiency funds the capital stock investment. One example of such a buy back program is the pilot refrigerator loan program being developed by the federal energy commission of Mexico in several municipalities across Mexico.[30]

Scrappage programs generally take two forms and have been used most commonly for the retirement of automobiles. First are programs where people are actually paid for retiring their old vehicles. These are generally government funded, though occasionally (as is in the case of Unocal's Scrap I program) are funded by private companies to demonstrate the effectiveness of such programs. Second are programs that generate emission reduction credits. These credits are earned by organizations (often companies) which purchase old vehicles that otherwise would not have been retired, thereby earning credits for the reduced emissions from these more polluting vehicles. These credits themselves can be traded and can either be used by the companies who retire the vehicles to comply with air emission regulations, or they can be sold to other companies that can use them to comply with their air emission regulations. VAVRs or voluntary accelerated vehicle retirement programs, have been tried in many localities in North America. In fact, 18 projects have been implemented in North America in many different jurisdictions including in California and Delaware in the US, as well as in British Columbia, Canada.[31]

These programs could be used either to achieve goals of carbon sequestration or energy efficiency. As mentioned above, some of these programs target energy efficiency directly and thus their use for the improvement of energy efficiency is clear. Indirectly, programs such as VAVRs can also improve energy efficiency, assuming that new vehicles (all else equal) are more efficient than the vehicles that are retired. Traditionally, VAVRs have been adopted in order to reduce ground level ozone by targeting emissions of NO_x and reactive organic gases (ROGs).[32] VAVRs could encourage carbon sequestration if such programs targeted carbon, or carbon dioxide and sinks were allowed as offsets.

[30] CFE (2003)
[31] Dill (2001)
[32] Dixon and Garber (2001)

Experience with such programs suggests that they can be quite effective. For example, between 1993 and the second quarter of 2002 vehicle scrapping program administered by the South Coast Air Quality Management District (encompassing part of southern California including Los Angeles) retired 30,000 old cars, resulting in reduction respectively of 5.8 million, 2.5 million, 36.1 million and 14 thousand pounds of volatile organic compounds (VOCs), NO_x, carbon monoxide and particulate matter respectively.[33] What's more is that they can be cost effective when compared with other measures to achieve the same policy goals.[34] They are by no means cost free. They do require administrative infrastructure to ensure that, in the example of VAVRs, vehicles being scrapped are vehicles that otherwise would not have been retired. Indeed, some cars would have been scrapped anyway and one would want to avoid business-as-usual purchasers from earning credits. Coming up with the capital for loan programs to purchase new appliances, even if the money is paid back eventually, means that this capital must be made available for this purpose and not for others. In the case of direct buy-back programs, the cost of actually buying older vehicles can be quite expensive, however in the case of emission credit reduction schemes, the costs of purchasing vehicles can be offset by the value of the credits themselves, enough so that it can be profitable for companies to scrap cars for these credits. That these programs have been tried in so many jurisdictions suggests that they should be kept in mind when considering differing market-based mechanisms for carbon sequestration and energy efficiency.

2.8 Emissions Trading

There are three commonly discussed forms of emissions trading: cap-and-trade, project-based trading, and rate-based trading. Emissions trading is a market-based mechanism whereby firms or countries can only emit regulated substances up to the level allowed by an aggregate emissions cap. Each emitter must surrender allowances equal to its actual emissions. [35] The right to emit usually takes the form of permits that can be traded between different emitters (or parties interested in obtaining these permits) at a price determined in the market for these permits, based on supply and demand.

Under a project-based trading scheme, emitters are allowed to buy credits for emission abatement in unregulated sectors in order to reduce the cost of emission reduction. This process is often referred to as offset trading and reduces the overall economic cost of achieving a given cap.

A rate-based trading system is very similar to a performance standard, as discussed in section 1.6, but it allows firms with emission rates above the standard to buy credits from those with emission rates below their standard.

For some trading programs thus far implemented, governments have initially allocated permits to companies, prorated to the existing contribution of the given pollutant of the

[33] SCAQMD (2002)
[34] Dixon and Garber (2001)
[35] It is possible to have emissions trading in the absence of limits on emissions, however, in the absence of such limits, incentives to actually participate in emissions trading are greatly reduced.

company at the time that the program was launched. The value of the permits is based on the total number of permits (equal to the cap on pollution emission) allocated by the government compared to actual emissions. Allocation of permits - auctioning, grandfathering or output-based – does not affect the permit prices but may affect firms' behavior differently.

Under this mechanism, firms (or countries) with low abatement (reduction of emissions) costs will lower their emissions below their allowances and sell excess permits as long as the value of the permit is higher than the firm's (or country's) marginal costs of emission reduction. The converse is true for buyers of permits. The use of traded permits should, in theory, result in a given level of emissions at least cost and create an incentive to achieve more abatement than under a uniform performance standard.

There is a growing amount of experience with emissions trading systems in North America, including trading systems aimed at reducing SO_2 and NO_x and lead in gasoline. These programs have generally been considered successful at attaining their environmental goals cost-effectively.[36] At the moment, the Bush Administration and the US Congress are considering the Clear Skies Initiative, a legislative proposal which would build upon the successful cap and trade system for SO_2 developed under the 1990 Clean Air Act Acid Rain Program and will extend that model to NOx and mercury. As well, the Canadian federal government has announced plans to develop a domestic emissions trading system for its large industrial emitters as part of its plan to reach its commitments for GHG reductions under the Kyoto protocol.[37]Emissions trading can take many forms, for examples of several possibilities for North America, please see Swisher et al. 1997.

An emission trading scheme that involved CO_2 (or greenhouse gases more generally) could encourage the development of carbon sequestration (if there exists an offset system), increases in energy efficiency, as well as the development of renewable energy. The Climate Change Plan for Canada[38] proposes to address part of its emission abatement through the creation of an emission trading scheme between large industrial emitters. Although the final details of this mechanism have yet to be completed, it is already envisaged that units of carbon abated through sequestration can be sold as credits to the large final emitters.

In the same vein, as an international market for carbon is rising, emission trading further encourages carbon sequestration, energy efficiency as well as renewable energies as it gives a financial value to carbon reduction, if offsets are allowed. The Prototype Carbon Fund[39] as well as the BioCarbon Fund[40] were created to facilitate emission trading, as they act as intermediary between buyers of carbon credits and institutions that actually abate their emissions.

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[36] Russell (2002)
[37] Government of Canada (2002)
[38] Ibid.
[39] World Bank (2003b)
[40] World Bank (2003a)

Including Canada and Mexico as part of US trading mechanisms for NO_x and SO_x would also potentially serve to encourage improvements in energy efficiency and the expansion of the use of renewable energy, depending on the design of the system. It could make renewable energy and other non-emitting sources more competitive and cost-effective compared to emitting sources that would have to pay for their emissions.

GHG trading systems could create incentives for companies (or countries) with higher abatement costs to invest in land-based industries (such as the farm and forestry sector) to reduce their emissions. For example, the possibility of earning carbon credits in the long-term could help to make farming techniques, such as no-till farming that reduce erosion and the emission of carbon dioxide, more profitable and thereby more likely to be implemented. Another practice that could be adopted to offset carbon is the precise application of fertilizers to reduce N_2O emissions and nitrogen runoff to water courses and groundwater. Similarly, depending on the design of the trading system, carbon offsets could be obtained for forest plantations and for the conversion of marginal agricultural land to forest. It could also encourage livestock practices that reduce emissions of methane such as feed alteration and the covering of manure lagoons for intensive livestock operations and incite them to capture the methane for on-farm use, or to sell as fuel for the generation of electricity, or any other agreed form of GHG sequestration in these sectors.

Such systems could also create incentives for the development of energy efficiency by providing incentives for industries to reduce their total carbon emissions or impact by using less energy intensive processes and less energy in general. In addition, companies that develop energy efficient technologies resulting in carbon dioxide reductions would likely see an increase in demand for their products, and depending upon the nature of the trading scheme (e.g., if a set-aside incentive was used), earn offsets from producing technologies that help others to reduce their energy and thereby carbon dioxide use (e.g. Smithfield Foods, Inc. in Utah).

Renewable energy would get a similar boost as demand for less GHG-intensive forms of energy and electricity increased. This increase in demand would likely increase investments in these alternative sources of energy.

Administrative and transaction costs of cap-and-trade are low, compared to the high cost of project-based trading.[41] While emissions trading seems like a potentially effective and important tool in environmental management, actually implementing it may be complex, specially rate-based trading, and requires careful planning. Six requirements are needed in particular. First, before any such systems can work, baseline emissions of all emitters must be known, be they firms, regions or countries. This requires comparable (if not harmonized) methodologies for the quantification of current levels of emissions (a baseline), as well as the resources and will to develop these baselines in the first place.

[41] For more complete discussion on these distinctions, see EPA's "Tools of the Trade: A guide to designing and operating a cap and trade program for pollution control." The document is online at http://www.epa.gov/airmarkets/international/tools.pdf.

Second, the trading program must also minimize leakage, that is minimize the risk of GHG reductions in one place leading to compensating increases elsewhere. Third, if offsets are allowed, common methodologies are necessary to calculate additionality to ensure that any reduction claimed under the offset system would not have been made otherwise. A fourth important issue is the need for common methods to ensure that any emission reductions or removals are verified, that is that they are certifiable. A fifth important issue is known as 'fungibility,' that is credits earned in such a system need to be recognized by others in the system if they are to have value to any and all of the participants.[42] Finally, the type of "pollutant" being traded plays an important role in the development of such a system and indeed the success of the system is highly dependent upon the nature of the pollutant to determine the breadth of the scheme. If the pollutant contributes to a global problem (e.g. CO_2), the greater the reach of the trading system the better. On the other hand, for more localized pollutants, such as SO_2, additional local air pollution controls may be necessary to protect against any localized effects.

Emissions trading is considered in the section on mandatory mechanisms because trading systems thus far implemented, and most generally considered are mandatory in the sense that they are implemented in conjunction with caps on the regulated pollutant. That being said, emissions trading systems need not necessarily be mandatory.

[42] World Bank (2003a)

3 Voluntary Mechanisms

Of the seven voluntary mechanisms presented, the first three are specific to the energy sector and the rest are applicable to any sector. Table 4 outlines the major advantages and disadvantages of the mandatory mechanisms described in this section.

Table 4 – Summary of Advantages and Disadvantages of Voluntary Mechanisms Described in this Paper

Mechanism	**Advantages**	**Disadvantages**
Green Energy **Certificates**	Expand the geographical extent of potential markets by decoupling environmental attributes from electricity generated	Lack of North American standards for certificates
Green Pricing and Green Power Marketing	Direct incentive for producers and providers of electricity to offer renewable electricity. Already well developed in many locations in the US resulting in added capacity	Limited consumer willingness to pay, combined with the higher cost of renewable electricity production
Time of Use and Real Time Pricing	Innovative and sensible mechanism encourages consumers to reduce dirtier, peak-time electricity use	Higher cost of metering electricity; requires local public utility commission buy-in, which will take time to develop
Labeling and Certification Systems	Same as in mandatory section	Perceived credibility of third party certifiers Limited public awareness.
'Green' Capital Market Investment	Potential for investment in green goods and services to do well by doing good.	Little known by public.
Green Procurement	Potential to help scale up production and provision of green goods and services.	Procurers and procurement policies very price sensitive, so that higher prices of green alternatives may be prohibitive. Lack of awareness from, and information for, procurement officials.
Voluntary Environmental Agreements	Engages industry in environmental policy.	Limited evidence demonstrating environmental effectiveness.

3.1 Green Energy Certificates[43]

Currently, renewable generation facilities produce electricity that is sold to wholesalers, retailers, and end- use consumers on the local grid as a single product—energy coupled with renewable energy attributes. Some consumers, when given the opportunity, specifically purchase renewable electricity, often paying a small premium for it, because

[43] See Center for Resource Solutions (2001).

the single product includes both the electric energy that is consumed and an intangible “green” quality that the consumer considers an added value.

Green certificates (also known as green tags, renewable energy certificates, or tradeable renewable certificates) represent the environmental attributes of a specific quantity (commonly one megawatt-hour, MWh) of renewable energy. They can help develop renewables because they broaden the potential market for the environmental services of a particular renewable generation source beyond its grid. Green certificates decompose the energy commodity and the renewable attributes that can be sold on different markets allowing renewable electricity to be generated in one location, and the environmental benefits of this generation to be sold to a customer in another, potentially far off, location. As such, a renewable electricity generator could conceivably have clients all around the continent, even if their local utility company or utility regulatory commission is not offering electricity generated from renewable sources.

The use of renewable certificates is in its infancy in the United States and Canada, though the market for renewable certificates is growing rapidly. There are currently about seventeen providers in the US offering a total of twenty-two renewable certificate-based products, and approximately two providers and products in Canada. These renewable certificate products are "certificate-only" products, meaning that the associated energy is sold into other markets. In addition, there are numerous other retail and wholesale electricity providers who are using renewable certificates bundled with energy as part of a green electricity product. There are currently two organizations that offer certification and verification of renewable certificate products, the Center for Resource Solutions in the US and TerraChoice in Canada. The Center for Resource Solutions certifies and verifies retail electricity and certificate-only products under the "Green-e" logo; Terrachoice certifies and verifies renewable generators and retail electricity and certificate-only products under the Canadian "EcoLogo."

Some power generators like the Los Angeles Department of Water and Power are beginning to sell Green certificates. Other companies are beginning to offer Green certificates to retail consumers in states that do not otherwise have renewable energy facilities. The Center for Resource Solutions, a non-profit organization that manages the Green-E program, continues to work at bringing the trading of Green certificates into the mainstream. The situation in Europe is quite different. Four European countries have green certificate systems in place and trading has actually begun in Austria. There has also been considerable buy-in to two different extra-governmental international renewable certificate trading regimes (RECS and RECerT).

Trade in green certificates is complicated and is so far limited by a number of hurdles. One hurdle, similar to the problem facing RPSs (see section on mandatory mechanisms), is that definitions and information associated with Green certificates are not standardized, and neither are processes and rules compatible between various green certificate programs. Other hurdles include uncertainties in property rights and other legal issues associated with different renewable attributes; the difficulty of how to communicate to the public just what Green certificates are; the potential for double counting (and double selling) of renewable attributes; and the lack of development of market structures (structures that would give value to Green certificates) that would help to encourage capital investment in renewables. The Center for Resource Solutions continues to work on these issues and has been trying to overcome these issues through the development of an emissions tracking and verification system for North America called the North American Association of Issuing Bodies, modeled after a similar organization in the EU.

3.2 Green Pricing and Green Power Marketing

Green Pricing and Green Power Marketing are optional services that are offered to electricity customers allowing them to choose to buy electricity generated from renewable sources. This is generally provided for a premium of around 3-5 cents per kWh of electricity, although in some cases, namely Texas, green power is being sold at a flat price that can be lower than natural gas-fired power. Clearly, if customers are willing to pay more for green electricity and a significant demand exists, this has the potential to prove to be significant for the development of renewable energy.

This is one of the best developed market-based mechanisms for renewable energy. There exist many utilities and electricity providers that now offer green electricity options. In fact, in the United States there are over 90 utilities that offer green pricing options and over 50 marketers.[44] NREL estimates that 650 MW of capacity has been installed because of this demand and that another 440 MW is in different stages of development to meet future demand. In Canada, there are 10 companies offering green power, to around 8,000 customers.[45] In perspective, however, this still represents a fraction of a percent of current installed capacity in the United States and Canada.

Despite its success, green pricing potential is limited by two factors. First is consumer willingness to pay extra for green electricity. Clearly the more that people are willing to pay for green electricity, the larger will be the potential for green pricing as a method of encouraging renewable energy. This willingness to pay is very dependent upon people's awareness about the effects of electricity production on the environment and their resulting concern. Second, the premium on green electricity is necessary due to higher renewable energy production costs. As these generating costs decline (or as generating costs of conventional forms rise due, for example, to the internalization of environmental costs caused by their use) , renewable energy becomes more competitive with other sources increasing their demand. Again procurement by large institutional and government agencies could help decrease these costs.

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[44] The distinction between utilities and marketers is that marketers exist in competitive electricity markets, and utilities in non-liberalized electricity markets. Here the use of the terms green pricing and green power marketing are the same as used by the US Department of Energy's Office of Energy Efficiency and Renewable Energy.

[45] Presentation by Theresa Howland of Enmax Energy Corp. "The Fundamentals of Alternative Energy: Retail Fundamentals," at the Canadian Electricity Association conference on Alternative Energy, November 25, 2002 in Ottawa.

3.3 Time of Use and Real Time Pricing

Time of Use Pricing (TOU) and Real-Time Pricing (RTP) is where electricity prices vary based on the time of day when electricity is consumed. For TOU pricing, prices are higher during high demand times of day and lower at lower demand times of day. Under RTP, electricity prices vary continuously (or hour by hour) based on the electricity provider's load and the different types of power plants that have to be operated to satisfy demand. These mechanisms were originally conceived as part of demand-side management initiatives to both reduce overall load, as well as to shift load from peak to non-peak times of day. They are market mechanisms because they create incentives for electricity consumers not only to shift electricity consumption to different times of day, but also to reduce energy consumption through energy efficiency (particularly those for whom not consuming electricity during peak times is difficult or undesirable) and to increase awareness among consumers.

Time of use pricing has been in use for many years for larger scale electricity consumers, but is now beginning to be available to retail customers as well. Companies such as Massachusetts Electric, San Diego Gas and Electric, Portland General Electric, New York State Electric and Gas Company, to name a few now have TOU options for their customers. Large industrial power consumers in Mexico are also offered TOU rates. While there has been less experience with real-time-pricing (e.g. mainly Georgia Power, Niagara Mohawk and Kansas City Power and Light), there does seem to be customer interest in the purchase of electricity on a real-time or TOU basis, and these mechanisms appear to have a sizable impact on electricity consumption.[46]

At the moment, most TOU and all real time pricing initiatives involve commercial customers. This is due to the high cost of operating and metering electricity for TOU and RTP. However, costs associated with enabling TOU and RTP pricing are dropping and the liberalization of the distribution of retail electricity markets is giving impetus for electricity providers to offer a wider range of pricing structures and products. Recently, FERC has shown its interest in, and support of, transmission service and market design. This would allow greater transparency and pricing which could open the door to more widespread use of both TOU and RTP, at least in the United States.[47]

3.4 Labeling and Certification Systems

In addition to the mandatory energy efficiency labeling schemes discussed above in section 2.5, the CEC has collected information on eight different voluntary labeling and certification schemes that include energy efficiency in their criteria.[48] Examples include EnvironmentalChoice in Canada, or Sello Fide in Mexico. Certification schemes are systems that certify particular products as conforming to specific energy efficiency (as well as other) criteria. An example of the type of criteria that a product would have to satisfy is GreenSeal's (criteria in the US) for compact fluorescent light bulbs. It requires that a compact fluorescent light bulb that uses less than 7 W, must give off at least 40

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[46] See Borenstein, Severin (2001) or Hirst, Eric and Brendan Kirby (2000).
[47] FERC (2002).
[48] See the CEC Electricity and Environment Database <www.cec.org/databases>.

lumens/W. Some labels, such as EnvironmentalChoice, considers the environmental impact of the entire chain of production in addition to considering end energy use, and thereby certify products based on their entire lifecycle.

As mentioned above in section 2.5, the effects of these systems can be substantial. For example, Energy Star estimates that in 2000, over 864,000 pounds of CO_2 emissions were avoided because of Energy Star products, and that cumulative cost savings from the program will exceed US$60 billion in saved energy bills, to 2010.

The problem with third party certification systems is partly their success. Since there are so many of them, it is potentially difficult for consumers to distinguish and understand them all, creating the possibility of 'label fatigue.' Another issue, as with mandatory labeling schemes is that consumers may simply not be aware of the labels, or if they do, of how to interpret or understand them. Demand for, and supply of certified products is dependent on the price premium, if any, received for the certified product. The premium is in part a function of the added cost of producing these alternative appliances and of certification, the cost of which often keeps smaller producers out. Institutional and government procurement could generate the economies of scale that allow for comparable costs with conventional products, thus increasing the market share of these more energy efficient alternatives.

3.5 'Green' Capital Market Investment

'Green' Capital Market Investment is investment in environmentally-preferable goods and services by private investors, investment funds, pension funds, etc. Potential capital from these sources is real considering that investment funds in Canada and the US value around US$20 trillion and that pension funds in Canada alone total CDN$600 billion. Screened investment is an interesting approach to secure financing for carbon sequestration, energy efficiency and renewable energy research and development and make these technologies more competitive with other traditional technologies, as well as providing the capital needed for the installation and production of these technologies to allow them to compete. Also, interest in green investments, and particularly in green energy implies that investors believe this sector is profitable.

While some estimates put green energy investment at a relatively small US$7 billion worldwide (the annual market in the US for all energy is US$350 billion annually), clean-energy technologies represent one of the fastest growing sectors of the energy market.[49] The market for wind power alone has been growing at around (and is expected to continue at this rate) 25 percent per year since 1995.[50] Investment in green technologies in general is becoming quite mainstream. For example, Merrill Lynch has just launched its New Energy Technology Fund focusing on alternative energy-providers. The fund includes a range of stocks that span renewable energies like wind, wave, solar and biomass, onsite energy generation, energy storage and the engineering that 'glues' all the technology together. As well, Jupiter International Group PLC has recently launched

[49] Makower, Joel and Ron Pernick (2002)
[50] Moomaw (2002)

Global Green Investment Trust worth 70 billion pounds. Alternative energy makes up 30 percent of its portfolio.[51] In addition to strictly private funds, there are also many funds that have been, or are being, developed with the aim of providing credit to, and investing in, investments with environmental or development benefits. These funds have been developed with the help of non-governmental organizations, development organizations and inter-governmental organizations. Some examples of these include the Conservation Enterprise Fund, the International Finance Corporation's Renewable Energy and Energy Efficiency Fund, and the NADBank loan program.

There are policies governments can adopt to help the development of green investment. One example is the recently enacted (July 2000) British legislation that requires all pension funds in the UK to report publicly on their socially responsible investment (SRI) policies and initiatives. Specifically, the legislation requires trustees to declare in their Statement of Investment Principles: the extent (if at all) to which social, environmental or ethical considerations are taken into account in the selection, retention and realization of investments; and the policy (if any) directing the exercise of the rights (including voting rights) attached to investments. Another example, is a recent requirement that all Canadian banks, insurance companies, and trust and loan companies with equity of $1 billion or more provide public accountability statements disclosing, for instance, their charitable donations. This type of initiative can give customers for whom the environment is important, information necessary to make their investment decisions based on environmental considerations. Perhaps this legislation helps to explain the 59% British pension funds and local municipal funds incorporating Socially Responsible Investment principles into their investment process.[52]

Another example of a government policy that can encourage green investment is the Dutch Green Investment Directive developed (albeit not implemented yet due to the recent change in government) to encourage green investments. The Green Investment Directive was established in 1995 to promote access to finance for environmentally sound or worthwhile projects. Under this directive, the returns (interest payments, dividend yields) from so-called Green Intermediaries are exempt from income taxes, where a 'Green Intermediary' is a financial intermediary from which loans and investments for green projects originate, and that comply with a host of criteria as determined by the Green Investment Directive. This provides an incentive for lenders to direct more resources to green projects at more favorable interest rates because of the reduced taxes on proceeds from loans.[53] As well, the Mexican government has introduced some significant and innovative changes in the regulatory framework of the electricity industry that can certainly foster private investment in renewable-based generation projects.[54]

The major downside of green capital market investment is the lack of consumer awareness of the possibility for green investing. With the possible exception of a few

[51] Sustainable Development International (2002)
[52] Michael Jantzi Research Associates Inc. (2002)
[53] Eurosif (2002)
[54] Breceda (2002)

mutual fund companies like Ethical Funds, few people know of the other green investing options available to them.

3.6 Green Procurement

Green procurement is the purchase of environmentally-preferable goods and services by large institutional buyers, e.g. governments, large companies, hospitals, etc. Were such large buyers to purchase green goods, there would be large incentives for producers of these goods to scale up production. The resulting economies of scale can reduce per unit costs making environmentally-preferable goods more cost competitive potentially further increasing their demand. Ensured markets also spur R&D that in the long run reduce production costs.

The potential for green procurement is large, government consumption makes up around 20% of GDP in the three NAFTA countries, or close to US$2 trillion. Not only is the potential large, but also governments and large companies have already started to source environmentally-preferable goods and services. For example, the 200,000 vehicles run by the United States Postal Service (USPS) make up the largest federal fleet in the country. For several years, the USPS has been buying cleaner vehicles, ranging from pure electric to those using ethanol and natural gas. Another example is the Canadian government's commitment to purchase 13 million kWh of wind electricity over ten years. Through the Federal House in Order program, the Canadian government also committed to reduce GHG emissions of its largest emitting department to 31 percent below 1990 levels. Under that program, the federal departments have already reduced their emissions by 21 percent. [55] Similarly, municipalities such as Toronto, Chicago and Santa Monica are either already purchasing, or intending to purchase renewable electricity for their own operations. And it is not only governments that are making strides in green procurement, companies like Interface Inc., the carpet manufacturer are getting on board with their purchase of wind and solar power from Ontario Power Generation. (For other examples of how companies are participating in green procurement, see Five Winds International, 2003.)

Clearly, green procurement could help in the development of carbon sequestration, energy efficiency and renewable energy. If these large institutional buyers were to buy products, which as part of their production carbon was sequestered, or products that were more energy efficient, or renewable energy products directly, the potential demand for these goods could be enormous.

The main constraint to green procurement is that often procurement officers are mandated to buy at least cost or when they are mandated to buy environmentally-preferable goods and services do not have readily information to make their purchasing decisions. Producers of environmentally-preferable goods are often emerging and small making it difficult for them to obtain the economies of scale that would be required to compete with established and larger firms. In addition, the small size of these enterprises makes it difficult to obtain financing because of their (perceived) higher risk. In addition, Since

[55] Government of Canada (2002)

small firms are less able to lobby for a policy that affects their products, often procurement policies target only one product as opposed to a general category limiting thus the competition and development of all applicable technologies. For instance, many policies specify a type of renewable energy such as wind instead of renewable energy in general. What is more, many procurement officials are simply not aware that environmentally less harmful alternatives exist.

Others might argue that the latitude that governments have in developing green procurement strategies may conflict with rules and regulations of international agreements. A soon to be released study by the Commission for Environmental Cooperation, however shows that these concerns are not founded.[56]

3.7 Voluntary Environmental Agreements[57]

Voluntary environmental agreements, can either be unilaterally agreed to by private sector members, or they can be agreed on and negotiated between members of the private sector and government. Unilateral initiatives are lead by individual firms to control pollution or by industry groups to establish industry standards or to self-regulate. The Chemical Manufacturers Association's "Responsible Care" program to reduce hazards from the manufacture and use of chemicals is an example of group action. This private collective action followed closely on the heels of the Bhopal chemical spill disaster in India.

Bilateral or negotiated agreements result from negotiations between the government and private firms and usually contain a voluntary environmental target and a timetable for reaching the target.[58] One bilateral approach is the US Environmental Protection Agency's (EPA) Project XL, initiated in 1995, that allows a firm to violate some statutory requirement if it can demonstrate that it will achieve higher environmental performance. To date, 50 final project agreements have been approved with companies, cities, utilities, and government services such as Postal Service. Another example is the US Pork Producers Council negotiations with the EPA on "voluntary" strategies for reducing air and water pollution emissions from large confined animal facilities in the mid-1990s, ostensibly to avoid more direct controls that would restrict growers' options. Public voluntary agreements are the most common form of agreement in the United States, where over 40 were identified.[59]

While such voluntary mechanisms (unilateral and bilateral initiatives) have generated significant positive effects in certain cases and has help disseminate information and has increased awareness, it is clear that the environmental effectiveness of voluntary agreements has its limits as was found by the OECD.[60] Evidence suggests that voluntary agreements and negotiated agreements should be used as a part of a policy mix with other economic as well as regulatory instruments. They could also be effective in new policy

[56] Earley (2003)
[57] This section draws from Carpentier and Ervin (2002).
[58] OECD (2001)
[59] OECD (2001)
[60] OECD (1999b)

areas which are not yet fully understood and which are not covered by existing regulations.[61]

[61] OECD (2001)

4 Conclusion

As has been shown in this paper, there exit many market-based mechanisms that can be used to encourage carbon sequestration; increase energy efficiency; and support the development and use of renewable energies. The choice of a specific mechanism should be guided by the policy goal being pursued and the market it addresses.

It is also important to keep in mind that despite the fact that these mechanisms are market-based and thereby create incentives for producers or consumers to make environmentally sound choices, government involvement is in many cases essential to put them in place. This involvement includes the development of explicit market-based policies or the formalization of structures, rules, and accounting practices that allow and improve the functioning of market-based mechanisms The purpose of this paper has been to provide the public in general, and policymakers in particular, with an idea of the breadth and richness of many market-based mechanisms and the types of structures that need to be present in order for them to be efficient.

Bibliography

Batie S. and D. Ervin. 1999. "*Flexible Incentives for Environmental Management in Agriculture : A Typology in Flexible Incentives for the Adoption of Environmental Technologies in Agriculture"*, F. Casey, A. Schmitz, S. Swinton and D. Zilberman eds. Massachusetts: Kluwer Academic Publishers.

Borenstein, Severin. 2001. *"FAQs about Implementing Real-Time Electricity Pricing in California for Summer."*

Breceda, Miguel. 2002. *"Promotion of Renewable Energies in Mexico."* CEC, Montreal.

Carpentier, Chantal Line and David Ervin. 2002. *"Businesss Approaches to Agri-Environmental Management: Incentives, Constraints And Policy Issues."* OECD, <http://www.oecd.org/pdf/M00032000/M00032566.pdf>.

CEC (Commission for Environmental Cooperation). 2003. *"What is Renewable?"* Background paper produced for the CEC, Montreal

CEC (Commission for Environmental Cooperation). 2001. *"Mexico and Emerging Carbon Markets: Investment Opportunities for Small and Medium-size Companies and the Global Climate Agenda."* Commission for Environmental Cooperation, Montreal.

CEC (Commission for Environmental Cooperation). 1998. *"Phase II Emissions Trading: Capacities for Trading,"* Montreal

CEC (Commission for Environmental Cooperation). 1997. *"Analysis of the Potential for a Greenhouse Gas Trading System for North America,"* Montreal.

CFE (Comisión Federal de Electricidad). 2003*. "Mecanismo de Operación del Programa de Refrigeradores Domesticos."* Obtained through communication with the CFE.

Center for Resource Solutions. 2001. *"Summary Report on Tradable Renewable Certificates (TRC): The Potential and the Pitfalls."* San Francisco.

Dill, Jennifer. 2001. *"Design and Administration of Accelerated Vehicle Retirement Programs in North America and Abroad." Transportation Research Record (1750),* Paper No. 01-2640, pp. 32-39.

Dixon, Lloyd and Steven Garber. 2001. "*Fighting Air Pollution in Southern California by Scrapping Old Vehicles*." RAND Institute for Civil Justice, Santa Monica, California.

Earley, Jane. 2003. "*Green Procurement in Trade Policy*." Paper produced for the CEC, Montreal.

Energy Information Agency. 1999. *"Federal financial interventions and subsidies in energy markets, 1999: Primary energy,"* United States Department of Energy, <www.eia.doe.gov/oiaf/servicerpt/subsidy>.

Eurosif. 2002*. "SRI Legislations Netherlands."* Accessed on August 12, 2002 at <http://www.eurosif.info/sriln.shtml>.

FERC. 2002. *"Federal Energy Regulatory Commission Working Paper on Standardized Transmission Service and Wholesale Electric Market Design."* Washington.

Five Winds International. 2003. *"Green Procurement: Good Environmental Stories for North Americans."* Paper produced for the CEC, Montreal.

Government of Canada. 2002. *"Climate Change Plan for Canada."* Ottawa. <http://www.climatechange.gc.ca/>

Government of Mexico. 2001. "*Segunda Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático"*, Mexico City.

Grupo de Trabajo de Energía de América del Norte (NAEWG in English). 2002. *"Normalización y Etiquetado de Eficiencia Energética en América del Norte."*

Heggelund, M. 1991. *"Emissions Permit Trading: A Policy Tool to Reduce the Atmospheric Concentration of Greenhouse Gases"*, Study 36, Canadian Energy Research Institute, Calgary.

Hempling, Scott and Nancy Rader. 2002. Comments of the Union of Concerned Scientists to the Commission for Environmental Cooperation In response to its "NAFTA Provisions and the Electricity Sector" Background Paper to its October 22, 2001, Working Paper Entitled "Environmental Challenges and Opportunities of the Evolving North American Electricity Market." Washington, DC.

Hirst, Eric and Brendan Kirby. 2000. *"Bulk-Power Basics: Reliability and Commerce"*. Consulting in Electric-Industry Restructuring for Oak Ridge National Laboratory, Oak Ridge, TN.

Horlick, Gary and Christiane Schuchardt. 2002. *"NAFTA Provisions and the Electricity Sector"*. Background paper produced for the CEC Article 13 Initiative on Electricity, Montreal.

Jorgenson, Dale W. 1998. *"Growth: Energy, the Environment and Economic Growth"*, Volume 2, MIT Press, London.

Lankoski, Jussi. 1997. *"Environmental Effects of Agricultural Trade Liberalization and Domestic Agricultural Policy Reforms"*. UNCTAD Discussion Paper No. 126. UNCTAD, Geneva.

Lingard, John. 2001. *"Agricultural Subsidies and Environmental Change"*. Chapter in the Encyclopedia of Global Environmental Change, John Wiley and Sons, London.

M.J. Bradley and Associates. 2001. *"Electric Utility Restructuring and the Ability of Environmental Regulations to Mitigate Environmental Impacts"*. Concord, MA.

Makower, Joel and Ron Pernick. 2002. *"Clean Energy Markets: Five Trends to Watch in 2002."* Clean Edge, Oakland, California.

Michael Jantzi Research Associates Inc. 2002. *"Socially Responsible Investing in Canada: A Market Backgrounder"*. January 2002, Toronto.

Moomaw, William R. 2002. *"Assessing Barriers and Opportunities for Renewable Energy in North America"*. Background paper produced for the CEC Article 13 Initiative on Electricity, Montreal.

OECD (Organisation for Economic Co-operation and Development). 2003. *"Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes"*, OECD, Paris.

OECD Organisation for Economic Co-operation and Development. 2001. *"Encouraging Environmental Management in Industry"*, OECD, Paris.

OECD (Organisation for Economic Co-operation and Development). 1999a. *"OECD Environmental Data: Compendium 1999"*, OECD, Paris.

OECD (Organisation for Economic Co-operation and Development). 1999b. *"Voluntary Approaches for Environmental Policy: An Assessment"*, OECD, Paris.

Palmisano, J. 1996. *"Air Permit Trading Paradigms for Greenhouse Gases: Why Allowances Won't Work and Credits Will,"* mimeo, London, July.

Patterson, Zachary. 2000. *"Do Fuel Efficiency Standards Really Matter?"* Masters project. Simon Fraser University, Burnaby, BC.

Russell, Douglas. 2002. *"Policy Considerations for North American Emissions Trading"*. Paper produced for the CEC, Montreal.

Secretaría de Energía. 2001. *"2001-2006 Energy Sector Program"*. México, DF.

SCAQMD (South Coast Air Quality Management District). 2002. *"Rule 1610 – Old Vehicle Scrapping Quarterly Update"*. Diamond Bar, California.

Smith, A.E, A.R. Gjerde, L.I. DeLain and R.R. Zhang. 1992a. *"CO_2 Trading Issues, Volume 1: Emissions from Industry"*, U.S. Environmental Protection Agency, Washington, D.C., Table 2-2, page 2-5, May.

Smith, A.E., A.R. Gjerde, L.I. DeLain and R.R. Zhang, *CO_2*. 1992b. *"Trading Issues, Volume 2: Choosing the Market Level for Trading"*, U.S. Environmental Protection Agency, Washington, D.C., Table 1-1, page 1-4, May.

Sustainable Development International. 2002. *"Funds Develop A Taste For Clean Green Energy. Sustainable Development International"*, London. Accessed on 2 May 2002 at <http://www.sustdev.org/energy/Industry%20News/06.01/26.02.shtml>

Swisher, J.N. 1996a. *"Regulatory and Mixed Policy Options for Reducing Energy Use and Carbon Emissions,"* Mitigation and Adaptation Strategies for Global Change, vol. 1.

Swisher, J.N. 1996b. *"Facts and Myths on Joint Implementation in the Framework Convention on Climate Change"*. Air and Waste Management Association Conference, Nashville, Tennessee, June 1996.

Swisher, J.N., Hoyt, Edward, Haites, Eric, Zamudio, Carlos and Sid Embree. 1997. *"Analysis of the Potential for a Greenhouse Gas Trading System for North America: Phase 1: Institutional Analysis and Design Considerations"*. Report produced for the Commission for Environmental Cooperation, Montreal.

Swisher, J.N. and G.M. Masters. 1992. *"A Mechanism to Reconcile Equity and Efficiency in Global Climate Protection: International Carbon Emission Offsets,"* Ambio, vol. 21, pp. 154-159, April.

Tomich, Thomas P., Hubert de Foresta, Rona Dennis,Daniel Murdiyarso, Quirine M. Ketterings, Fred Stolle, Suyanto, and Meine van Noordwijk. 2002. *"Carbon Offsets for Conservation and Development in Indonesia?"*, American Journal of Alternative Agriculture, X.

Vaughan, Scott, Zachary Patterson, Paul Miller and Greg Block. 2002. *"Environmental Challenges and Opportunities of the Evolving North American Electricity Market"*, Background Paper to CEC Article 13 Initiative on Electricity.

World Bank. 2003a *"BioCarbon Fund"* <http://biocarbonfund.org/>.

World Bank. 2003b. *"Prototype Carbon Fund"* <http://prototypecarbonfund.org/>.