PACIFIC INSTITUTE FOR CLIMATE SOLUTIONS

CAP AND TRADE

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A Cap and Trade System for Reducing Greenhouse Gas Emissions in BC

A PRELIMINARY EVALUATION OF THE WESTERN CLIMATE INITIATIVE DESIGN PROPOSAL

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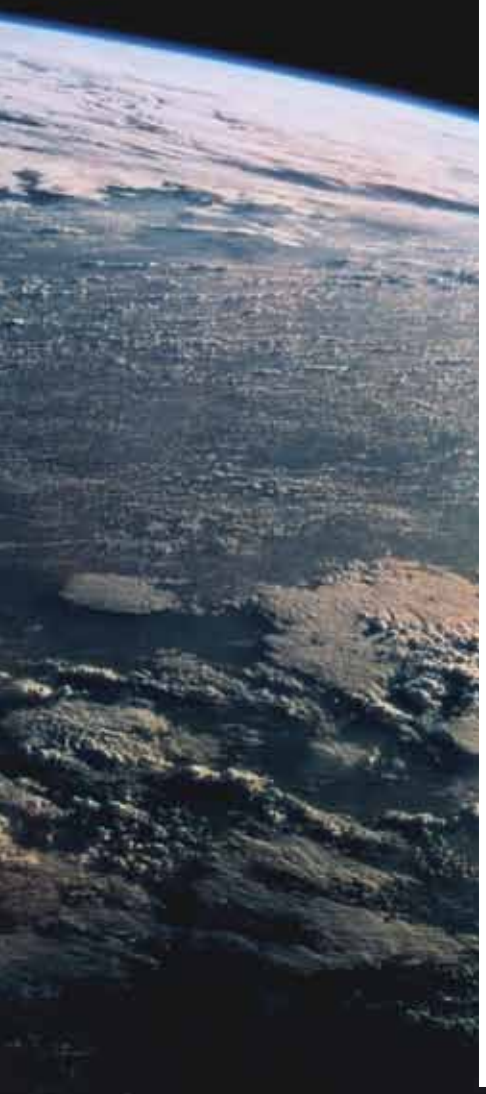

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EXECUTIVE SUMMARY

British Columbia plans to initiate a cap and trade system in 2012 as part of the provincial government's commitment to reduce greenhouse gas emissions 33% below BC's 2007 levels by 2020. BC is a participant in the Western Climate Initiative (WCI)—a group of US states and Canadian provinces that intends to establish a cap and trade market to open in 2012. A "design draft" for the WCI was released in September 2008 that requires BC to respond to the key features of the proposed program. This report focuses on critical components of a cap and trade system—coverage and scope, allocation of allowances, volatility and uncertainty in allowance prices, use of offsets and earned reduction allowances, competitiveness concerns, and integration with other GHG policies, and establishes a number of principles for assessment of the design features of the cap and trade proposal. The principles are:

- ***Include as broad a coverage of sources of GHGs as is pragmatically possible***
- ***Auction allowances for efficiency and use revenue to address equity issues***
- ***Minimize allowance price volatility & uncertainty to reduce costs of meeting GHG targets***
- ***Offsets can reduce the cost of meeting targets, but require careful implementation***
- ***Assess the impact of the WCI on BC's business sectors prior to provision of any assistance to these sectors***

The analysis of the critical components of the WCI draft design highlights where more in depth analysis is needed of the design features that remain open for discussion across the WCI and for the aspects that are under BC's direct control. It is vital that BC examines fully a number of design options in the next 8 to 12 months during this period of on-going consultation in the WCI. These areas include:

BC input needed for WCI-wide decisions:

- ***The auction process***
- ***Coverage and levels of safety valves of all types***
- ***The offset policy***
- ***Leakages***

BC analysis needed to implement WCI program designs in BC:

- ***Determine baseline GHG emissions from covered sources (for 2012 and 2015 coverage).***
- ***Use economic models and consultation to determine the potential impact of the WCI design on:***
    - *BC's industries covered beginning 2012*
    - *Small businesses, households, non-profits, crown corporations, and municipalities*
- ***How many allowances to auction versus distribute freely: use modeling to simulate the impacts of an auction from 10 to 100% of allowances on wealth transfer between business***

and households. My recommendation is to auction as large a percentage as is economically and politically viable.

- ***If less than 100% of the allowances allocated to BC are auctioned, determine effective, efficient and equitable rules for allocating permits.***
- ***Examine how to integrate the suite of GHG policies in place or proposed for BC with the WCI cap and trade system.***
- ***Model the impacts of the impact on the BC demand for allowances with different percentages of offsets (at and below 49%) as a percent of total BC allowances.***
- ***Develop an efficient, effective and equitable Earned Reduction Allowance policy.***

Issue: British Columbia plans to initiate a cap and trade system in 2012 as part of the provincial government's commitment to reduce greenhouse gas emissions 33% below BC's 2007 levels by 2020 in compliance with the Greenhouse Gas Reduction Targets Act of 2007 and the Greenhouse Gas Reduction (Cap and Trade) Act of 2008. Simply put, a cap and trade system establishes a market where an entity covered by the plan must possess a carbon allowance (permit to emit carbon) for each tonne of carbon dioxide equivalent (CO_2e)1 it releases into the atmosphere over a given period of time. BC is a participant in the Western Climate Initiative (WCI)—a group of US states and Canadian provinces that intends to establish a cap and trade market.[2] The WCI released a finalized "design draft" on September 23, 2008 that lays out the foundation of the regional cap and trade system. I evaluate key features of the WCI design. There is scope for discussion with WCI partners prior to the implementation of the policy as well as aspects of the system where there are 'made in BC' components of the policy. It is vital that BC examines fully a number of design options in the next 8 to 12 months during this period of on-going consultation in the WCI.

THE WCI DESIGN IN BRIEF

The WCI sets an overall target reduction in greenhouse gas (GHG) emissions of 15 percent below 2005 levels by 2020. This level was set by aggregating the 2005 emissions and emission targets of the members of the WCI. When all the sectors to be covered are in the system, approximately 90 percent of the WCI's GHG emissions will be included in the cap and trade market. Starting in 2012, large stationary sources emitting 25,000 tonnes of carbon dioxide equivalent per year will come under the cap and trade system. Sectors include combustion at industrial and commercial facilities, industrial process emission sources including oil and gas process emissions, and electricity generation (including carbon emissions from electricity generated outside the WCI, but delivered into a WCI jurisdiction for consumption in that jurisdiction). Each compliance period will be three years long. In 2015, the beginning of the second compliance period, GHGs from residential, commercial and industrial fuel combustion at facilities with emissions below the threshold as well as transportation fuel combustion from gasoline and diesel will come into the system with allowance coverage upstream of these points of discharge.[3] Baseline emissions data back to 2006 will be required from all sources covered in the first compliance period (2012 to 2015). BC is in the process of designing reporting regulations for its sources as a necessary step in precise measurement of GHG emissions and determination of the overall cap for BC.[4]

DESIGN OF THE WCI: KEY ASPECTS AND IMPLICATIONS FOR BRITISH COLUMBIA

Cap and trade markets are complex. There are many facets to their design and care must be taken to ensure the market will operate effectively, efficiently, and equitably. An effective cap and trade market meets its target, in this case the 33% reduction in emission from 2007 levels by 2020. The market is efficient if it succeeds in minimizing costs of meeting targeted emission reduction (compliance costs) for both the regulator and the regulated parties. There are different types of equity. The concept I use is horizontal equity—treating regulated entities in similar circumstances equivalently. It is impossible in this overview paper to delve deeply into all aspects of the WCI draft design. Rather, I focus on critical components of a cap and trade system that in principle promote effective, efficient and equitable outcomes, as identified by the expert literature and experience in other jurisdictions that have implemented a cap and trade system. I highlight key aspects of the WCI proposals to help identify any areas needing further research and analysis. The attributes of a cap and trade system I examine are: program coverage and scope, price volatility and cost containment, allowance allocation and potential revenues, use of offsets, competitiveness concerns, and integration with other GHG policies.[5]

PROGRAM COVERAGE AND SCOPE

Principle: Include as broad a coverage of sources of GHGs as is pragmatically possible

Effectiveness: A policy that covers a large percentage of the GHG emissions from a jurisdiction will be more effective in meeting its aggregate GHG targets. However, the impracticality of running a market with millions of individual and dispersed emitters means that most cap and trade designs focus on large point sources that are typically upstream of the final users. One concern with upstream coverage is that sources that operate in world markets will not be able to pass along the cost of the permits to their consumers and hence the incentive effects will be weaker than if the ultimate consumer of the carbon-intensive product also faced higher prices. Sectors affected include oil and gas, regulated utilities, even coal due to market power of the railroads shipping their product. There are two other downsides to limiting the number of covered sources. Narrow coverage may eliminate sources that could reduce their emissions at lower cost than those covered and hence, lead to higher prices for allowances than in a more broadly based system. Higher allowance prices mean higher compliance costs. There have been few studies that estimate the relative impact of a broad versus narrow coverage within a country. One study using a model simulation (Pizer et al., 2006) found a negligible impact on costs when direct emissions from residential and commercial buildings are excluded. Another concern is the so-called 'leakage' problem. Carbon emissions from entities that are not covered but provide products that are substitutes in the marketplace for their goods may expand production and hence, increase carbon emissions. These could be from uncovered sources within or those outside the jurisdiction. The WCI addresses some potential leakage in electricity markets by requiring the importers of any electricity generated

from thermal sources generated outside the WCI region to purchase allowances for their carbon content.

The WCI, in the first compliance period from 2012 to 2015, excludes a number of sectors and sources of GHGs in British Columbia. Figure 1 shows the major sources of GHGs in the province. Excluded sectors make up about 60% of BC's emissions in this initial period. A large number of emissions will not be covered in BC until 2015 when fuels for transportation, residential and commercial sectors are added. But even the expanded inclusion will not cover all emissions because it has minimum size provisions and will provide only indirect incentive for final consumers to reduce their carbon emissions.

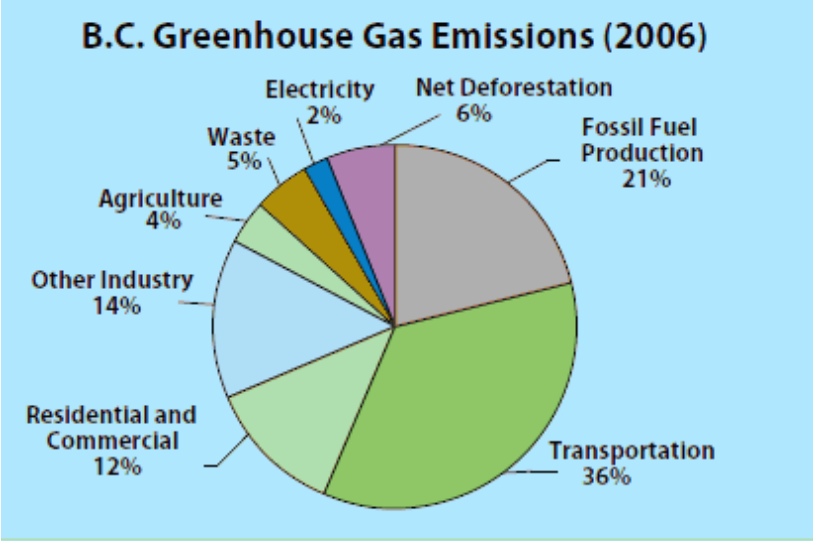


Figure 1 BC greenhouse gas emissions by sector, 2006 *Source: British Columbia (2008). Climate Action Plan, p. 25.*

Another way to deal with the potential adverse impacts of a narrow coverage under the cap and trade proposal is to have a broadly based GHG strategy that includes policies that target the non-covered sectors. BC already has its carbon tax that focuses on the downstream sources of carbon emissions. The carbon tax mitigates much of the potential leakage from within BC, but not from without. An issue for BC is what to do with its carbon tax post-2015. It is not obvious that the extension of a cap and trade to the upstream fuels used for transportation and by residential and commercial sectors will be equivalent to the carbon tax in terms of impact on prices to consumers. This is an area that requires further study. We will have a number of years of data to examine the incidence and behaviour modification effects of the BC carbon tax prior to 2012.

Efficiency: GHG emissions are a global 'public bad'—emissions released anywhere in the world contribute to increasing CO_2 concentrations in the atmosphere. GHGs are thus unlike many air contaminants whose impact on environmental quality differs depending on the amount and where these compounds are released and their resulting concentration in local airsheds. GHGs are what can be called 'uniformly mixed' emissions and the economics literature argues that an efficient policy would have a single price for carbon regardless of where the emissions occur. The broader the coverage of a cap and trade system therefore, the more likely the system is efficient. Efficiency is enhanced for two reasons. First, by creating a uniform market price for allowances, the cap and trade system produces the same tradeoff for all covered sources—

they can release the tonne of carbon and purchase an allowance at the uniform market price (or not sell one they already own) or they can reduce their emissions by one tonne and sell the permit. In either case, the opportunity cost of the permit is identical. When all sources face this uniform price on the margin, their aggregate costs of meeting the target are less than if they face different prices as would be the case under a scheme that dictated specific levels of emission control for each source (or type of source)—a common element of air quality standards.[6] Second, the larger the number of traders in the market, the more likely they will behave competitively and not strategically, thus leading to a market price for allowances that genuinely reflects their relative scarcity. The WCI should have enough covered entities to ensure the price is determined competitively and hence, should contribute to efficient pricing of carbon and allow covered sources to minimize their costs of compliance.

Equity: A cap and trade system with broad coverage is likely highly equitable horizontally as long as entities in the same circumstances (e.g. carbon producing firms in the same industry) are covered. The proposed coverage in the WCI is horizontally equitable within the WCI partners, but of course, not so across Canada as only four provinces are currently in the WCI, or internationally. WCI-covered industries may be less competitive in international or interprovincial trade if the market price of the allowances is a significant component of their costs. Competitiveness problems are unlikely to be severe in the early phases of the WCI due to a number of factors. First, as discussed below, it is highly likely that significantly less than 100 percent of the allowances BC firms need to hold will be auctioned. Firms who are given allowances still face the marginal price of an allowance (an allowance not sold foregoes the market price), but there will be less impact on costs if the majority of their permits were allocated initially without charge. The overall cap is also met by gradually reducing total allowances, giving firms time to adapt. Finally, it is highly likely that there will be a national and perhaps international cap and trade system operating well before 2020.

ALLOCATION OF ALLOWANCES

Principle: Auction allowances for efficiency and use revenue to address equity issues

A cap and trade system that allocates all its allowances through an auction (i.e., no initial free distribution) provides a number of advantages for the jurisdiction: (1) the market is more likely to be efficient because the number of trades will be maximized and there is little scope for market manipulation; (2) each jurisdiction collects the revenue from the auction and can use that revenue to recycle back to the economy or to specific groups adversely affected by the policy; (3) cap and trade then acts more like a carbon tax with all its attendant advantages; (4) there is no need for complex rules and decision making about how to distribute the allowances.

A cap and trade system with stringent caps will generate significant wealth in the form of the value of the allowances established by their market price.[7] A fundamental decision all participating governments must make is who will get this wealth. A system that allocates all its allowances rather than auctions them will distribute the wealth to the initial allowance holders, leaving no funds for the government to redistribute. I do not have an estimate for the

revenue potential for BC; it would be smaller in the 2012 to 2015 period than the carbon tax revenue because the total amount of emissions covered by allowances is likely less than the emissions taxed. If however the allowance prices on the market rose significantly above the carbon tax rate, revenues could be substantially higher and most definitely would be after 2015. The question is: does the government want to give away millions of dollars of revenue.

One way to think about whether to allocate freely or auction allowances is to speculate on the impacts of the cap and trade policy on downstream consumers. These impacts are dependent on the ability of the allowance holder to pass along to the consumer the explicit or implicit price of the allowance (an allowance not sold is valued at the market price or future price of the allowance). While this degree of forward shifting of the cost of allowances to consumers is dependent upon features unique to each sector (nature of the supply chain, product markets, other regulations, etc.), US studies that use energy-economic models predict that most of the carbon price would be passed on to consumers.[8] If this prediction is borne out, a cap and trade system with free initial allocation could make businesses and their shareholders in the energy supply chain better off as a result of the policy with households worse off. As much of a household's energy budget is fixed, the cap and trade system could be highly regressive; low income households would be proportionately more adversely affected than higher income households. Geographical inequities could also be created if allowances are not auctioned because residents in rural communities and those without access to public transit may have fewer options to reduce their use of carbon-intensive fuels. Government revenues from allowance auctions could also be used to support clean technology development. The BC government should thus think about the potentially adverse effects on R&D if a significant number of allowances are distributed freely in that less revenue would be collected to support R&D. Governments would then have to use other funding sources (or cut expenditures) to redress the inequities of the cap and trade system and/or support R&D.

The other side of the argument is that granting allowances to businesses can help them compete with companies in their market who are not covered under the cap and trade system. An obvious question is then is there some combination of auctions and free allocations that meets two objectives: address inequities created by the free allocation and provide relief to companies competing with non-covered entities? A few papers have addressed this question. Goulder (2001) estimates that a reservation of 15 percent of the allowances for free distribution will help protect vulnerable industries from equity losses. Allocations above this level can create windfall profits as occurred in the initial compliance period of the European Trading System. Morgenstern et al. (2007) had the critical number at 20 percent perpetual free allocations. Stavins (2007) and NCEP (2007) both found that 50 percent free allocation declining to zero over time (25 years for Stavins) is the same as giving the firms a 15 percent free allocation in perpetuity in present value terms. The auctioned allowances could then be used to offset adverse outcomes on households, small businesses, and others. These papers thus suggest the jurisdiction should auction at least 50 percent of its total allowances.

The WCI design proposal calls for a minimum auction of 10 percent of each jurisdiction's total allowances in the initial period, rising to 25 percent by 2020. Each jurisdiction has the right to determine the percent auctioned. I recommend the government use its energy-economy models to simulate the impacts of auctioning an increasing proportion of allowances and using the revenues to offset adverse outcomes. It should also simulate the possible incidence of the percentage auctioned on consumers versus shareholders prior to making a decision on the share to auction. Each jurisdiction in the WCI will have a different incidence

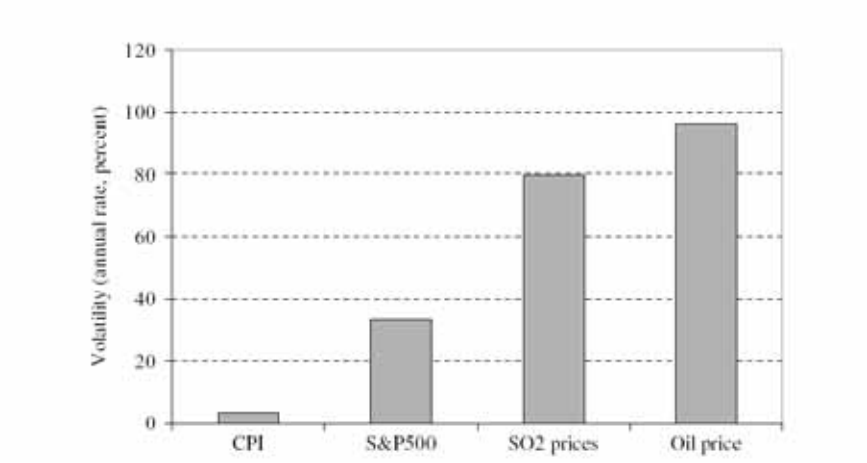
of the policy, so it would be unwise to simply adopt the WCI minimum without study. One example of how BC differs from other WCI members is that over 90% of our domestic electricity generation comes from non-carbon emitting sources (hydroelectricity), thus impacts on electricity pricing of the cap and trade system will be smaller than in, for example, Arizona where domestic generation and imports are mostly thermal. As well, a number of our entities covered by the WCI (e.g. natural gas) face regulations and world market conditions that may limit their ability to pass the cost of the permits on to consumers. The key point is that we need to determine the appropriate mix of auctions versus free allocations based on careful analysis as well as consultation with affected parties.

VOLATILITY AND UNCERTAINTY IN ALLOWANCE PRICES: COST CONTAINMENT

Principle: Minimize allowance price volatility and uncertainty to reduce costs of meeting GHG targets

When the market is used to determine the price of a tonne of carbon, rather than an administered price set by the government through a carbon tax, covered sources may face difficulty determining their optimal response to the policy when the price of carbon allowance is uncertain and volatile. Entities need to determine their rate of return on investment in infrastructure or processes that reduce carbon emissions (or sequester carbon). While research has shown that a market-based policy significantly reduces the cost of meeting environmental targets compared to command and control regulation (e.g., emission standards), the more uncertain the pricing component of the market-based policy, the smaller the gap in compliance costs between the policy regimes. Experience with cap and trade systems has shown that allowance prices can fluctuate considerably despite the emergence of the usual mechanisms such as hedging in futures markets. Figure 2 illustrates the relative volatility of the sulphur dioxide allowance market in the US compared to other financial markets up to 2006.[9] Simulations of the Warner-Lieberman bill that sets a target of 33 percent reduction in US GHG emissions from their 2007 level by 2030, estimate that allowance prices might vary from a low of $24 per ton of carbon dioxide-equivalent emissions (tCO_2e) to a high of $160/$tCO_2e$ (Tatsutani and Pizer, 2008).

Figure 2 Price volatility in selected markets, 1995-2006



Source: Congressional Budget Office (2008)

There are a number of mechanisms that can be built into cap and trade systems to reduce the volatility in market prices and hence reduce uncertainty and compliance costs. The introduction of some of these mechanisms moves the cap and trade policy much closer in impact to a tax with a firm cap. The 'hybrid' policies have advantages and disadvantages discussed below. They can improve the efficiency of the market, but may reduce effectiveness depending on one's time horizon.

Banking and borrowing: If sources are allowed to bank their permits from a current compliance period to use in a future one, or borrow from future allotments (if permits are not auctioned), they will have more price certainty at least in the short term. Reduced volatility from banking can cut costs for emitters. Economic modeling undertaken for the WCI found that banking moderated allowance prices more than any other design feature (WCI, 2008, p. 36). Whether the market price will be more volatile or not is an open question as there may be more or fewer allowances on the market in any time period than if these features were not part of the policy.[10] The WCI allows banking for an indefinite period, but not borrowing. Indeed, no operating cap and trade system allows borrowing. The reason is perhaps concern that it may be difficult to enforce the larger reductions in emissions needed in future periods if there has been a lot of borrowing; regulators will be pressured to issue more allowances rather than carry through with the planned reductions in total allowances. The WCI proposes limits on the number of allowances that any one entity can bank to reduce the opportunity for market manipulation.

Indexing future caps to economic conditions: Both the Alberta and the proposed Canadian federal cap and trade systems operate with a flexible cap in that the cap is tied to emissions intensity—carbon emissions per unit output. The emissions intensity allows emissions to grow in absolute terms, but the economy becomes relatively less carbon intensive over time. Other cap and trade proposals are to link the cap to GDP as a whole, again to allow for economic growth. The tradeoffs are obvious: an indexed cap will give sources more degrees of freedom in planning their response to the policy and helps them better absorb economic shocks to output (in principle, both positive and negative shocks), and hence, improves the efficiency of the system. However, the greater the indexing, the less likely the policy will be effective in reaching targets. Equity is likely unaffected. The WCI does not appear to have any provision for automatic indexing; total allowances are based on the compilation of each

jurisdiction's baseline emissions set for the first compliance period of 2012 to 2015, with a decline factor that allows the system to reach the emissions target by 2020. The total will be adjusted upward when the additional sectors are added in 2015, but the proposal says that the "trajectory for each WCI Partner jurisdiction's annual allowance budget for covered sectors will be a straight line [downward] from the year of initial coverage...to 2020" (WCI, 2008, p. 6). Total allowances for 2020 and beyond will be set three years in advance, again, with no mention of indexing. I concur with the WCI proposal; the increased flexibility provided by indexing can be addressed with other mechanisms.

Safety values—price ceilings and floors: If the regulator specifies the minimum and maximum price of an allowance, there is of course more certainty for the emitters, but less scope for the market to 'work' in the sense that there is no guarantee that the supply of permits will equal the demand for permits within the range set by the floor and ceiling. Efficiency losses are thus the tradeoff for more price certainty. This means that total costs of the system may be higher than with a market-determined price. And if the floor and ceiling are very close together, the cap and trade begins to strongly resemble a tax (which may be a good or bad thing depending on one's perspective). Alberta has a price ceiling where the sources have the option of paying into a technology fund at a fixed price if the market price of the allowances exceeds this ceiling. Canadian and US federal proposals also contain ceilings. A more complex safety valve is the 'circuit breaker' that stops or delays the reduction in the total number of allowances in the market if the allowance price exceeds a pre-set trigger price.[11] The WCI design recommendations discuss only a floor price, not other safety values, and state that there will be a floor price (level not yet determined) for the first 5 percent of allowances in the 10 percent of allowances auctioned to guard against over allocation. The design draft also notes that by the end of 2009, the jurisdictions in the WCI will develop a coordinated design for the auction process. Safety values thus appear to be an open issue and one I recommend the BC government study in depth to develop a position for the upcoming discussions and ensure that if any safety values are included, their consequences on the integrity of the system, the efficiency of the price signal, and other potential impacts are fully understood and factored into the design.

One final feature of the proposed WCI system that could be interpreted as a measure to reduce compliance costs, and perhaps price volatility is the three-year compliance period. The longer the period, the more flexibility covered sources have in determining the best strategy. However, whether longer compliance periods decrease price volatility will depend in part on whether the total number of allowances on the market varies more than if the compliance period was shorter. Examination of how the three-year period is working after the first compliance period is advisable.

USE OF OFFSETS AND EARNED REDUCTION ALLOWANCES

Principle: Offsets can reduce the cost of meeting targets, but require careful implementation

The WCI proposed to omit a number of emission sources due to the complexity and cost of monitoring emissions. Fugitive emissions from agriculture and forestry are the main cat-

egories. One way to expand the range of options for covered sources is to allow them to purchase verifiable emission reductions known as offsets from these uncovered sectors. Any reduction in emissions from the uncovered sectors below their baseline level can be sold into the market. Offsets either allow the same level of emission reduction at lower cost than in a system without them (due to the expansion of ways to reduce emissions; an offset would not be purchased if its price exceeded that of the allowance), or allow the system to achieve greater emissions reduction at a the same cost because the offset works like a withdrawal of allowances from the market. Assuming the price of offsets is $20/metric tonne, their inclusion in the WCI market leads to a predicted allowance price of $6/mt in 2015, rising to $24/mt in 2020 (WCI, 2008, p. 60). While the principle of an offset market is simple, the practice is anything but. The main challenge is to be convinced there is an actual reduction in emissions and one that would otherwise not occur. The literature has come up with five criteria that should be satisfied in order to establish an effective offset system that leads to real emission reductions.[12]

- *Certainty* in the measurement and monitoring of emission reductions or sequestration;
- Verify *additionality*: the emission reductions backing the offset would not have occurred in the absence of the cap and trade system;
- The *baseline* level of emissions from the offsetting source is appropriately measured;
- *Leakage* in the form of shifts in emissions outside the market boundaries is minimized; and
- Any *reversals* in the form of subsequent releases of carbon from the offsetting source are themselves offset or covered by allowances.

Fulfilling these criteria is expensive in terms of transactions costs—the time costs, complexity introduced into the market, the possibility of fraud, and the need for a bureaucracy (private or public sector) to certify the offsets. One way to address the tradeoff—more offsets allow flexibility and dampen allowance prices, but may be overall more costly for the entire system13—is to limit the types of offsets and how many each entity (or the market as a whole) can have at any point in time.

Additionality is a significant issue as the regulators or market operators need to ensure that uncovered entities are not setting up an operation just to sell offsets and shut it down again. This has been a major problem for the Clean Development Mechanism (CDM) allowing developing countries to sell offsets to the countries that ratified the Kyoto Protocol.

The WCI design document says "the WCI Partner jurisdictions will include a rigorous offset system" (WCI, 2008, p. 10). Offsets will be limited to no more than 49 percent of the total emission reductions for the period 2012 to 2020 and individual jurisdictions can set a lower limit. Criteria for offsets will be set by the WCI partners. A list of potential priority areas for offsets includes agriculture (soil sequestration and manure management), forestry (afforestation/reforestation, forest management, forest preservation/ conservation, forest products) and waste management (landfill gas and wastewater management). The WCI expects that offsets issued under the CDM will be accepted as might emission allowances from other GHG trading systems recognized by the WCI. BC issued a policy intentions paper in the

summer 2008 to gather comments prior to determining its emissions offsets regulation for domestic policy under the *Greenhouse Gas Reduction Targets Act* and for input into the WCI process. The policy intentions paper proposes all offsets should be within scope, real, measurable, additional, verifiable, counted once and have clear ownership. These criteria are in accordance with best practices seen in other offset programs. BC will need to determine, through modeling, the appropriate maximum percentage of offsets in the WCI compliance periods. I offer that it is better to err on the side of too few because expanding eligibility creates fewer problems and is cheaper (no compensation to parties whose offsets are removed) than restricting offsets when it is discovered that there is insufficient allowance trading (prices significantly below expectations), or faulty eligibility conditions for offsets.

The earned reduction allowance (ERA) can also be thought of as a type of offset. ERAs give sources that will be covered by the cap and trade system credit for actions to reduce emissions below their baseline level taken between January 1, 2008 and the WCI start date, January 1, 2012. Any action deemed to qualify as an ERA will be incorporated into the source's allowance budget at the start of trading. While this policy provides a stimulus for actions prior to the start of trading, it also introduces complexity and requires the same sort of very careful definition of what 'counts' as an ERA as do the offsets that can continue once the market opens. The presence of ERAs puts pressure on BC to quickly measure the baseline level of emission through the processes now being established, so there is no gaming of the system or double counting of emission reductions.

COMPETITIVENESS CONCERNS

Principle: Assess the impact of the WCI on BC's business sectors prior to provision of any assistance to these sectors

Industries within British Columbia that are carbon-intensive and with product prices set in international markets will be less able to pass the cost of securing allowances to consumers. If so, there is incentive for the companies to relocate and shift production to a region not under the WCI (e.g. Alberta). The impact on BC would be lower employment and output levels other things equal (e.g. no offsetting increase in other sectors). It is important to establish what might be the possible impacts of the WCI system on BC's industries. While that task is outside the scope of this paper, a few observations are as follows:

- BC's carbon intensive industries are relatively less mobile than its non-carbon intensive sectors. These include the oil and gas sector. The deposits cannot be moved, only the willingness to invest in their operation. Unless the cost of compliance with the cap and trade system exceeds the net rents to the industry, they will not move. Until the global financial crisis and significant reduction in energy prices, the rents in the industry were high. Whether allowance trading results in significant costs to this sector depends on the allowance price and percentage of allowances auctioned (as noted above).
- Some large sectors are not covered under the WCI (e.g., forestry) and may be net beneficiaries of the system.

- Our electricity generation is predominately hydroelectric. In addition, BC's Energy Policy has set electricity self sufficiency as a goal with incremental generation coming from clean (non-carbon or fully carbon sequestering) sources. Costs of any imported thermal electricity can be passed on to consumers. Thus industries using electricity (e.g. pulp and paper, aluminum, computer-intensive sectors) will be much less affected in BC than in jurisdictions dependent on thermally generated electricity.

My sense is that there will be relatively few industries in BC that will be adversely impacted to any considerable degree by the WCI proposed system. Research done for the US supports this argument. Ederington et al. (2005) found that only a few of the very energy intensive industries would face considerable competitiveness challenges. Morgenstern et al. (2007), using simulation and econometric models, found that only for iron and steel, non-ferrous metals, and chemicals was there any economic threat that was also statistically significant.[14] These are not industries with a major presence in BC and thus it is unlikely that BC will need to take substantial action to insulate its industries from the WCI. The literature suggests (see Aldy and Pizer, 2008) that the allowance system could be used to deal with vulnerable sectors, for example to grant them free allowances based on historical production levels or other criteria. As noted, free allowances represent a wealth transfer to those receiving them but do not distort the price signal from the allowance market. One potential troubling outcome of free allowances is that jurisdictions outside the cap and trade region could view the allowances as a subsidy and this could lead to trade disputes. If allowance trading was national not provincial and regional, border adjustments could be contemplated to deal with non-covered international competitors. The WCI has one form of border adjustment in the requirement for covered jurisdictions to hold allowances for any imported thermal electricity that is consumed in the region. The issue here, as noted above, is the leakage problem. In the case of electricity, BC will need to work with other WCI members to assess the potential for Alberta or other thermal-intensive jurisdictions to undermine the integrity of not only the cap and trade system, but also our BC energy policy as any significant amounts of leakage could drive down the value of clean electricity generation.

INTEGRATION OF THE CAP AND TRADE POLICY WITH OTHER GHG POLICIES

Whatever form the cap and trade system takes, it cannot be the only policy tool used to help BC reach its GHG targets. Cap and trade cannot cover all GHG emissions and hence reductions in allowances over time cannot be large enough to meet our targets, nor would we want them to. Even when transportation, residential, and commercial sectors are covered in 2015, the impact on these sectors will be indirect and the number of allowances would have to be very restricted to get the 33 percent reduction from 2007 levels. It would simply be too draconian. The WCI estimates that much of the reduction from residential and commercial sectors will come from other policies such as energy efficiency standards for buildings and vehicle emission standards. In BC, the carbon tax should play a major role in reaching targets with its focus on downstream carbon users. The challenge in policy design is to ensure an appropriate mix of policies that are mutually complementary with a cap and trade system and reinforce reductions in carbon emissions with no unintended adverse consequences.

An issue that deserves attention in the discussion of policy integration is to try to reduce the potential for policy conflict and ensure that policies are not offsetting each other. An example illustrates this point. Suppose we have a renewable portfolio standard, biofuel mandate or efficiency standard for some carbon-intensive sector. These policies should work to accelerate the development of less carbon-intensive technologies—a good thing. However, to the extent they succeed, the need for allowances will fall and contribute to lower allowance prices. If allowance prices fall, there will be less incentive to develop emissions-reducing technology in sectors covered by the cap and trade. BC will need to carefully consider what mix of policy instruments it needs to sustain when the WCI is in full operation. Economic modeling can help this analysis.

LESSONS LEARNED AND FUTURE RESEARCH AGENDA

The WCI's design proposals are a good start to the development of a cap and trade program that will help BC meet its GHG targets. Considerable research undertaken by the WCI including in depth analyses of existing cap and trade systems and economic modeling of the potential impacts of the system have greatly aided the development of the proposal. What is now needed is more in depth analysis for BC of the features of the design that remain open for discussion within the WCI and for the aspects that are under BC's direct control. I conclude with a list of these two areas for more research and consultation.

BC input needed for WCI-wide decisions:

- ***The auction process***
- ***Coverage and levels of safety valves of all types***
- ***The offset policy***
- ***Leakages***

BC analysis needed to implement WCI program designs in BC:

- ***Determine baseline GHG emissions from covered sources (2012 and 2015 coverages).***
- ***Use economic models and consultation to determine the potential impact of the WCI design on:***
    - *BC's industries covered beginning 2012 (the 'competitiveness' issue and within sector equity)*
    - *Small businesses, households, non-profits, crown corporations, and municipalities.*
- ***How many allowances to auction versus distribute freely: use of modeling to simulate the impacts of percentage auctioned from 10 to 100% on wealth transfer between business and households. My recommendation is to auction as large a percentage as is economically and politically viable.***
- ***If less than 100% of the allowances allocated to BC are auctioned, determine effective, efficient and equitable rules for allocating permits.***

- *Examine how to integrate the suite of GHG policies in place or proposed for BC with the WCI cap and trade system. This is a complex task.*
- *Model the impacts of the impact on the BC demand for allowances with different percentages of offsets (at and below 49%) as a percent of total BC allowances.*
- *Develop an efficient, effective and equitable ERA policy.*

ENDNOTES

1 The greenhouse gases (GHG) regulated include: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons. The CO_2 equivalent measure allows for comparison between carbon dioxide and other GHGs and is based on the quantity of the gas multiplied by a factor representing its global warming potential. I'll simply refer to CO_2e emissions as 'carbon' emissions in this paper for simplicity.

2 Other members of the WCI are Manitoba, Ontario, Quebec, Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington.

3 It is impractical to measure and monitor these individual sources at the point of emission. The intended point of regulation is where the fuels enter commerce in the WCI. It is likely for most in this category the regulated source will be distributors of the fuels who will need to secure/hold allowances for the carbon content of the fuels sold. This design feature is not yet specified precisely and it may differ by jurisdiction. See WCI (September 23, 2008).

4 The Ministry of Environment recently released a Policy Intentions Paper for Consultation on *GHG Reporting Regulation*.

5 Aldy and Pizer (2008) provide a similar framework for examining cap and trade policies generally and those in the United States in particular.

6 Proof of this assertion can be found in any standard environmental economics textbook. See for example, Field and Olewiler (2005).

7 Estimates for the US are that 100% auctioning under a federal policy such as the Warner-Lieberman bill (S. 2191) would yield annual revenues of $130 to $370 billion under full implementation of the program in 2015. By comparison, the US raises $350 billion per year from corporate income taxes. See Paltsev et al. (2007) and EIA (2008). The BC carbon tax will raise $1.[85] billion over the three years from 2008.

8 See Lasky (2003) for a survey of the energy-economic models and their predictions.

9 The chart would look a lot different for the financial markets if updated to this fall. However, the point remains that the SO_2 market, while having prices lower than the 'experts' predicted prior to the opening of the market, is more volatile than many other markets and typically less predictable than an environmental tax rate.

10 Wigley, Richels and Edmonds (1996) find that banking and borrowing lead to smoother prices over both short and longer time horizons. However, simulations by Fell, MacKenzie and Pizer (2008) for carbon markets and evidence from the SO_2 system found that banking is not sufficient to prevent large price swings, particularly during changes in the number of sources covered (e.g. when the SO_2 market size was increased in 2004-2005). Large swings in prices tend to happen at the beginning of trading periods when banking will be less effective.

11 See Bluestein (2003).

12 See for example Olander (2008)

13 Aldy and Pizer (2008, p. 12) note that the transactions costs from using offsets under the 1977 Clean Air Act in the US eliminated most of the cost advantages of trading. Transaction costs of up to 30 percent and EPA rejection of 40 percent of the proposed offset trades led to a cost savings of only about 1 percent.

14 There is also an extensive literature that finds very little evidence for the flight of capital from regions with more to less stringent environmental regulation. Pollution abatement costs have to become a relatively high percentage of total costs before migration occurs.

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