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Alberta's CO_2 Reduction Strategy – Assessing the Environmental Integrity of Emissions Trading Schemes

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Abstract

National and regional emission trading schemes (ETSs) for greenhouse gas (GHG) emissions represent an essential policy response to climate change around the world. Witnessing a proliferation of carbon pricing schemes in different jurisdictions, the possibility of further reducing compliance costs by allowing allowances to be traded, not just within, the systems become reality. This is commonly referred as *linking* the systems. This process is not risk-free; as a matter of fact *ill-considered links* may be counter-productive, to the point that they might undercut the efforts to reduce GHG emissions.

This paper signals the need to identify such ill links and points out the danger zones when linking ETSs. In achieving this goal, the concept of *environmental integrity* emerges from the research hypothesis that linking ETSs is directly dependable on the degree of *environmental integrity* of each system. Several criteria are proposed for assessing the degree of environmental integrity: *effectiveness*, *comprehensiveness*, *transparency* and *fairness*. Each criterion can be expressed by one or more design elements of a carbon pricing scheme, with some of them being more "linkage relevant" than others.

After providing overview of the existing ETSs: European Union, Quebec, California, New Zealand and Norway the paper proposes a criteria-based analysis in order to determine the degree of environmental integrity. The results are then presented in a matrix indicating what are the design factors that trigger low-risk, medium-risk and high-risk linkages. Next, Alberta's carbon policy is discussed with the purpose of highlighting what are the regulatory changes that Alberta would have to make in order to integrate itself in broader, regional schemes.

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List of Abbreviations

CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CH_4	Methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CSA	Canadian Standards Association
EPCs	emission performance credits
ERUs	Emission Reduction Units
ETSs	Emission Trading Schemes
EU	European Union
EUAs	European Union Allowances
EU ETS	European Union Emissions Trading Scheme
GHG	greenhouse gas
GWPs	global warming potentials
HFCs	hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LCFS	Low-Carbon Fuel Standard
Mt	megatonnes
N_2O	nitrous oxide
NF_3	nitrogen trifluoride
NZD	New Zealand Dollar
NZ ETS	New Zealand Emissions Trading Scheme
NZU	New Zealand unit
ODS	ozone-depleting substances
PFCs	perfluorocarbons
RMUs	Removal Units
SF_5CF_3	trifluoromethyl sulphur pentafluoride
SF_6	sulphur hexafluoride

SGER	Specified Gas Emitters Regulation
tCO_2e	tonnes of carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WCI	Western Climate Initiative

1.0 Introduction

1.1 Alberta's Carbon Policy

Alberta has adopted an intensity-based scheme, applying to facilities whose emissions exceed a threshold level of 100,000 tonnes of carbon dioxide equivalent (tCO_2e).[1] An intensity-based program strives to improve production efficiency in terms of greenhouse gas (GHG) emissions. In other words, there is no cap on total annual emissions; rather it is the total annual emissions divided by total production for the year that is important. An intensity-based system allows GHG emissions to increase from year to year as production expands, as long as a facility can reduce the amount of GHGs emitted *per* unit of production. In Alberta, new facilities are required to reduce their GHG emissions' intensity by 12% over a six-year period, with a 2% reduction obligation per year. Reductions are measured against facility specific baseline intensities that are determined based on three prior years of historical operations.

Facilities that cannot meet their reduction obligations by improving their own efficiencies have three alternative compliance options that can be combined in any manner:

1. Submit *offset credits* that are registered on the Alberta Emissions Offset Registry;[2]

2. Apply *emission performance credits* (EPCs) (either accumulated or acquired) to that facility. These credits are generated by facilities that have gone beyond the 12% mandatory intensity reduction. EPCs can be banked for future use or sold to other facilities that need to meet the reduction target;

3. Purchase *fund credits* from the Climate Change and Emissions Management Fund[3] (commonly called the Technology Fund) at $15 per tonne of carbon dioxide equivalent (CO_2e).

The benchmark value of $15 per tonne of CO_2e set by the Climate Change and Emissions Management Fund compliance option provides some insight into the financial implications of this program for large emitters. Essentially, this sets a ceiling price for offsets under the *Specified Gas Emitters Regulation* (SGER) and guarantees that an emitter will not be required to pay more than $15 per tonne in order to achieve

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[1] Specified Gas Emitters Regulation, Alta Reg 139/2007.

[2] Canadian Standards Association (CSA) Group, "Alberta Emissions Offset Registry", online: <http://carbonoffsetsolutions.climatechangecentral.com/offset-registry>.

[3] Alberta Environment & Sustainable Resource Development, "Climate Change and Emissions Management Fund", online: Alberta Environment & Sustainable Resource Development <http://esrd.alberta.ca/focus/alberta-and-climate-change/climate-change-and-emissions-management-fund.aspx>.

compliance. Initially due for renewal in September 2014, the SGER will not be revised until December 31, 2014. For the Alberta Progressive Conservative's new leader, this would be a great opportunity to consider what lessons can be learned, and what carbon pricing mechanism should be considered by any successor regulation to the current SGER. Alberta needs to build on the modest results of the SGER and address other problematic issues such as the absence of limits on the use of fund credits and offset credits for compliance reasons. Alberta's Auditor General in the July Report has harshly criticized the responsible office for failing to monitor this program and the economic models upon which it is based.[4]

1.2 World Emission Trading Schemes

National and regional emission trading schemes (ETSs) for GHG emissions represent an essential policy response to climate change around the world. In the absence of a well-established international regulatory regime designed to reduce and stabilize GHG emissions at safe levels, national and regional "carbon control" policies[5] are of utmost importance. There has been a proliferation of carbon pricing schemes in different jurisdictions.[6] The pattern of such schemes indicates a bottom-up approach to the global challenge of climate change. However constructive these regional schemes are, the ultimate goal of reducing and stabilizing GHG emissions requires global action and cooperation.

ETSs are broad policy instruments that can include cap-and-trade systems, baseline and credit systems and offset schemes. Cap-and-trade systems place a cap on emissions by requiring emitters to surrender a government-issued tradable allowance for every tonne emitted, with the cap being reduced over time. The "trade" component of a cap-

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[4] See *Report of the Auditor General of Alberta – July 2013* (Edmonton: 2013) at 37-49, online: <http://www.oag.ab.ca/webfiles/reports/OAGJuly2013report.pdf>. Some of these issues have been explored by Rolandas Vaiciulis, *Linking Emissions Trading Schemes with the European Union* (LLM Thesis, University of Calgary, 2013) [unpublished], online: <http://theses.ucalgary.ca/bitstream/11023/505/2/ucalgary_2013_vaiciulis_rolandas.pdf>.

[5] Carbon control or carbon pricing policies refer to any policy instrument that puts a price on GHG emissions with the purpose of reducing them. This paper talks about market-based instruments as the main exponent of carbon pricing policies. Market-based instruments could be either cap-and-trade schemes, offsets schemes or baseline-and-credit schemes.

[6] Schemes that are already in effect include the European Union Emissions Trading System (EU ETS), the Australian Emissions Trading System (only carbon pricing and offsets market in 2012), the New Zealand Emissions Trading System, the Regional Greenhouse Gas Initiative in the Northeastern United States, the California Emissions Trading System, which conducted its first auction in November 2012 for the 2013 first year of coverage), and the Tokyo Emissions Trading System. Others schemes stand on the verge of commencing operations, including Quebec (2013) and the Republic of Korea (2015). Sub-national jurisdictions that have considered, or are now examining, emissions trading legislation or regulations as part of a national carbon trading pilot program include Chinese provinces (Hubei and Guangdong) and cities (Beijing, Tianjin, Shanghai, Chongqing, and Shenzhen).

and-trade system is motivated by economic efficiency when allowances can be freely traded on an ETS market. The presumption is that competitive market conditions result in least cost emissions reduction. Baseline and credit systems involve a baseline level of emissions for each source within the trading system. Reductions below that baseline level are credited to the source and are available for trading. Offsets are emission reductions achieved by non-capped sources and may also be accepted for compliance in lieu of allowances in a cap-and-trade system or of credits in a baseline and credit system. Offsets are not only a way to add flexibility in achieving compliance but have also proven to be a cost-containment tool.[7]

In North America, both the United States (US) and Canadian governments have begun working on their own climate change policy packages.[8] Whether or not these measures will separate ETSs or a common trading mechanism, remains to be seen. Meanwhile, states and provinces in both countries have taken the lead in implementing climate change measures. California has just implemented its cap-and-trade system,[9] Quebec adopted its scheme in December 2012,[10] and Alberta has had a GHG Emitters Scheme in place for more than six years.[11] Indeed, Alberta plays a significant role both in the Canadian economy and in the reduction of GHG emissions. In 2011, Alberta was responsible for 35% of the total GHG emissions in Canada (245.7 megatonnes (Mt) of CO_2e out of 702 Mt CO_2e).[12] The provincial government has reason to worry about GHGs, since Alberta's GHG emissions have risen by 46% compared to 1990 levels and will likely continue to grow.[13] In this context, it is prudent to examine the possibility of further reducing compliance costs by permitting allowances to be traded between rather than within different systems. This is commonly referred as linking the systems. Due to the lack of an international GHG reduction strategy, I propose that linking ETSs is a

[7] The study suggests that offsets greatly reduce the market price of allowances, thereby decreasing the cost of compliance. Chikara Onda & James Fine, *Cost Containment through Offsets in the Cap-and-Trade Program under California's Global Warming Solutions Act* (Washington, DC: Environmental Defense Fund, 2011), online: <http://www.edf.org/sites/default/files/EDF%20AB%2032offsetsmodelingmemo%20final2_updated_3Jan2012_v2.pdf>.

[8] World Bank, Mapping Carbon Pricing Initiatives: Developments and Prospects 2013 (Washington, DC: 2013).

[9] Center for Climate and Energy Solutions, "California Cap and Trade" (2013), online: <http://www.c2es.org/us-states-regions/key-legislation/california-cap-trade>.

[10] See Regulation respecting a cap-and-trade system for greenhouse gas emission allowances, CQLR, c Q-2, s 31 and Regulation respecting the delegation of management of certain parts of a cap-and-trade system for greenhouse gas emission allowances, CQLR, c Q-2, s 15.1.

[11] Alberta Environment and Sustainable Resources Development website, <http://esrd.alberta.ca/>.

[12] Environment Canada, *Canada's Emission Trends 2012* (Ottawa: 2012) at 32-33.

[13] Environment Canada, National Inventory Report 1990-2011: Greenhouse Gas Sources and Sinks in Canada – Executive Summary (Ottawa: 2013); Canada's Emission Trends 2012, ibid at 32-33.

reasonable and necessary step towards global action for addressing global climate change.[14]

1.3 Linking Emission Trading Schemes

Linking emission trading schemes (ETSs) will also reduce the risk of leakage. Leakage occurs when regulatory dispositions in one area cause source activities to shift or leak to unregulated areas over time.[15] Creating linkages creates consistent regulation that reduces the opportunity for source activities to shift into unregulated areas. Linking ETSs has the following advantages:

- linking equalizes the marginal cost of emissions across different systems;[16]
- linked systems stimulate a more competitive carbon market in which prices more accurately reflect the cost of reducing emissions; and
- the equalization of carbon pricing should reduce concerns about the effect of cap-and-trade on the relative competitiveness of industries in different jurisdictions.[17]

Many jurisdictions are looking to national schemes as an alternative to global action. There is some value to this idea since national (and even subnational (local)) schemes may be able to mitigate global warming to some extent. Local schemes have the potential to bring environmental as well as economic and political benefits that are responsive to the conditions in a specific area. Moreover, a potential linkage between national and subnational schemes would create stronger political environmental and market benefits. However, linked schemes should avoid the following common problems:[18]

- significant differences in carbon prices that may result in shifts in carbon prices and net inter-jurisdictional financial flows;[19]

[14] Erik Haites & Xueman Wang, Ensuring the Environmental Effectiveness of Linked Emission Trading Schemes (Toronto: Margaree Consultants, 2006).

[15] Jonathan B Wiener, "Think Globally, Act Globally: The Limits of Local Climate Policies" (2007) 155 U Pa L Rev 1961 at 1969.

[16] Therefore, emission reductions can be purchased where is least expensive to do so and achieving compliance is more cost-effective.

[17] Michael Hanemann, "The Role of Emission Trading in Domestic Climate Policy" (2009) 30 The Energy Journal 73-108.

[18] Christian Flachsland, Robert Marschinski & Ottmar Edenhofer, "To link or not to link: benefits and disadvantages of linking cap-and-trade systems" (2009) 9:4 Climate Policy 358-372.

[19] A jurisdiction that sees a net export of allowances when linking will experience an inflow of money to pay for them but a higher carbon price than in the unlinked system.

- varying levels of environmental integrity (the degree to which the cap reflects the physical reality of emissions) that make the creation of linkages less feasible and desirable;[20] and

- different treatment for a given sector or sectors, potentially causing significant inter-jurisdictional financial flows (i.e. one jurisdiction ends up providing another with subsidies for actions that it does not subsidize at home).[21]

Therefore, there is real reason to be concerned about ill-considered links. Indeed, they may be counter-productive to the point that they might undercut current efforts to curb GHG emissions.[22]

1.4 Research Purpose and Methodology

The aim of this paper is to propose an assessment tool as a practical instrument for policymakers to use when adopting an ETS or adapting an existing scheme to link with another. This paper explores the concept of environmental integrity and asserts that linking ETSs is directly dependent on the environmental integrity of each system. Environmental integrity refers to the degree to which the cap reflects the physical reality of emissions. In other words, it may be prudent to avoid linkages between ETSs that have a variance in levels of environmental integrity.

A system with low environmental integrity is one where emissions are not accurately quantified, or low-quality offsets are used for compliance. In such systems emissions are presumably reduced less in reality than on paper. Typically, the carbon price will be lower in a low-integrity system. When the two systems are linked, the higher integrity

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[20] Environmental integrity may be reflected in the degree to which the cap reflects the physical reality of emissions. In a system that has low environmental integrity (because emissions are not accurately quantified), emissions may be reduced less in reality than on paper. In some instances, linking two systems will amplify the loss of integrity, causing real aggregate emissions to be higher when two systems are linked than when they are not.

[21] For example, steel producers in one jurisdiction receive allowance free of charge at historical emission levels, and are able to sell some of them after reducing their emissions in response to the carbon price. If the first jurisdiction makes a net purchase of allowances from the second, the producers in the first may be seen as subsidizing their competitors in the second. See also Judson Jaffe & Robert N Stavins, *Linkage of Tradable Permit Systems in International Climate Policy Architecture*, Discussion Paper 2008-07 (Cambridge: Harvard Project on International Climate Agreements, 2008), online: <http://belfercenter.ksg.harvard.edu/publication/18580/linkage_of_tradable_permit_systems_in_international_climate_policy_architecture.html>.

[22] Rob Dellink et al, *Towards Global Carbon Pricing: Direct and Indirect Linking of Carbon Markets*, Environmental Working Paper No 20 (Paris: Organisation for Economic Co-operation and Development, 2010) at 30.

system will import allowances along with a lower environmental integrity standard.[23]

Alberta is not currently part of any regional or international ETS and this may pose problems for Alberta's exported energy in the future. For example, some Western Climate Initiative (WCI)[24] jurisdictions import energy from Alberta, there may be serious economic consequences to Alberta's isolation from the WCI. This is primarily due to the fact that energy producers within WCI jurisdictions will be held to higher environmental standards than producers in Alberta, who export power, oil and gas to WCI members. The energy producers in WCI jurisdictions may exert political influence on their governments in order to prevent "emissions leakage" by imposing a price (tariff or tax) on energy from less-clean sources such as those in Alberta.[25] Therefore, Alberta might have to consider integrating itself in broader ETSs, like the WCI.

As Professor Nigel Bankes notes, this may be possible:

> there is evidence that the system can be made considerably more stringent, without unduly affecting profits and competitiveness. However, this should be done in a way that provides a high degree of regulatory certainty for the future. This would mean a timetable for increases in fees and reduction targets so as to provide clear guidance to investors.[26]

I have adopted a comparative approach in analyzing different ETSs and extracting relevant factors. Based on the existing literature and the information gathered from the Clean Development Mechanism (CDM), I propose four criteria relevant for assessing environmental integrity: *effectiveness*, *comprehensiveness*, *transparency* and *fairness*.

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[23] Matthew Bramley, PJ Partington & Dave Sawyer, *Linking National Cap-and-Trade Systems in North America – Clean Energy and Climate Action: A North American Collaboration*, Paper for Discussion (Drayton Valley: Pembina Institute & International Institute for Sustainable Development, 2009), online: <http://www.pembina.org/reports/linking-cap-and-trade.pdf>.

[24] The Western Climate Initiative (WCI) represents a collaboration among states and provinces to tackle climate change at a regional level. Although only Quebec and California have linked cap-and-trade programs in place through WCI, the initiative facilitates dialogue and collaboration between British Columbia, California, Ontario, Quebec and Manitoba to develop and harmonize their emissions trading program policies.

[25] Many American states are considering legislation and regulations that could severely limit and effectively ban the use of oil sands production. (Governor Arnold Schwarzenegger's Executive Order directing the California Air Resources Board to develop and implement a Low-Carbon Fuel Standard (LCFS) did not affect Alberta's export because Canadian oil is not currently exported to California.) However, 13 American states, of which many currently receive oil sands production, have proposed similar regulations that could copy California's initiative on LCFS. LCFS could essentially outlaw gasoline produced from oil sands' synthetic crude in these states because its life-cycle emissions are higher than the life-cycle emissions of gasoline produced from conventional crude oil.

[26] Nigel Bankes & Elizabeth Wilman, "Summary of Papers and Proceedings from a Workshop on Key Issues in the Design of Carbon Management Policies and Regulations in Alberta, Calgary, January 27 & 28th, 2014", ABlawg.ca (18 February 2014), online: ABlawg <http://ablawg.ca/wp-content/uploads/2014/02/Blog_NB_EW_Specified_Gas_Emitters_Regulation_Workshop_February-2014.pdf>.

Each criterion can be illustrated by one or more design elements in a carbon pricing scheme. Usually carbon pricing schemes have a particular design shaped by different elements. Sometimes, these elements can suffer distortions as a result of the linking process. This may signal the need to harmonize design elements. In other instances, they can act as insurmountable barriers in the course of developing linkages. It all depends on the type of design element at hand. Therefore some design elements are more "linkage relevant" than others. Taken together, these design elements shape the degree of environmental integrity in each ETS. Observing the dynamic between environmental integrity and linkage compatibility has formed the basis for this study. It focuses on assessing the environmental integrity of different ETSs and identifies potential risk zones when linking them.

Section 2 briefly describes the aforementioned criteria and indicates the design elements that best illustrate them. Section 3 provides an overview of existing ETSs in the European Union (EU), Quebec, California, New Zealand and Norway. Following that, an analysis of assessment criteria is conducted based on observations from each ETS. A matrix indicating design factors that trigger low-risk, medium-risk and high-risk linkages is then developed. Section 5 looks at Alberta in the context of emission trading. It briefly analyzes current provincial carbon policy and highlights regulatory changes Alberta would have to make in order to integrate itself in more broader, regional schemes. The paper concludes with a summary of observations and describes additional research issues.

2.0 Criteria

Recent developments demonstrate that, to be successful, carbon trading mechanisms have to be in line with national economic priorities.[27] The implementation of most carbon trading schemes occurs in stages. This allows for the gradual introduction of a scheme with consecutive compliance periods. In addition, many ETSs include the distribution of free permits, which are reduced over time. These approaches make the acceptance of schemes by compliance entities and stakeholders easier.

Without the prospect of a coordinated international approach to carbon pricing (similar to the Kyoto Protocol approach to global carbon reduction),[28] national and regional regimes are of utmost importance in order to address climate change.[29] Both developed and developing countries are advancing carbon strategies and planning future

[27] World Bank, *supra* note 8.

[28] Canada withdrew from the Kyoto Protocol on 15 December 2011. See Environment Canada, "Canada's Withdrawal from the Kyoto Protocol" (15 December 2011), online: <http://www.ec.gc.ca/Publications/default.asp?lang=En&n=EE4F06AE-1&xml=EE4F06AE-13EF-453B-B633-FCB3BAECEB4F&offset=3&toc=show> (Retrieved 10 July 2014).

[29] Ibid.

developments.[30] Different national factors[31] influence the design of each of these policies.

Several regional schemes are already in place and there is currently a dynamism in the carbon market that is without precedent.[32] Although these recent developments represent a step towards establishing a global carbon market, they emphasize the need to analyze and improve linking procedures and find a balance between different carbon schemes. This would allow for progress on carbon initiatives at the national level as well as global initiatives to reduce emissions.

Although it is rarely defined, the concept of environmental integrity in association with ETSs is often mentioned in the literature and informs this paper.[33] The United Nations Framework Convention on Climate Change's (UNFCCC) Clean Development Mechanism (CDM),[34] and the concept of environmental integrity forms the basis for the proposed assessment criteria: *Effectiveness*, *Comprehensiveness*, *Transparency* and *Fairness*, and *Offsets Eligibility*.

2.1 Effectiveness

With respect to an ETS, the criterion of effectiveness encapsulates three main system design elements: the existence and stringency of a cap on emissions, the existence and adequacy of an incentive to reduce GHG and invest in clean energy and the regulation of emission sources.

2.2 Comprehensiveness

Comprehensiveness refers to the degree to which the system comprises all sources of accurately measurable emissions from industrial activity. The following GHGs are covered in the Intergovernmental Panel on Climate Change's (IPCC) *2006 Guidelines for National Greenhouse Gas Inventories* (*2006 Guidelines*):

- carbon dioxide (CO_2);

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[30] Karsten Neuhoff, Michael Grubb & Kim Keats, *Impact of the Allowance Allocation on Prices and Efficiency*, EPRG 0508 (Cambridge, UK: University of Cambridge, Energy Policy Research Group, 2005).

[31] These can include economic factors as well as industrial and energy profiles.

[32] Examples of regional schemes and linkages include the EU ETS-Swiss Linking, the EU ETS-Australia Linking and the Quebec-California Linking. Paul Twomey, Regina Betz & Iain MacGill, "Achieving additional emission reductions under a cap-and-trade scheme" (2012) 12:4 Climate Policy 424 at 426.

[33] PJ Partington & Matt Horne, *Carbon Pricing Approaches in Oil and Gas Producing Jurisdictions* (Drayton Valley: Pembina Institute, 2013).

[34] UNFCCC, Report of the Conference of the Parties on its Seventh Session, held at Marrakesh from 29 October to 10 November 2001, UNFCCC, 7th Sess, UN Doc FCCC/CP/2001/13/Add.2 (2002), Appendix B, para 2(f) [Marrakesh Accords], online: <http://unfccc.int/cop7/documents/accords_draft.pdf>.

- methane (CH_4);
- nitrous oxide (N_2O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs);
- sulphur hexafluoride (SF_6);
- nitrogen trifluoride (NF_3);
- trifluoromethyl sulphur pentafluoride (SF_5CF_3);
- halogenated ethers (e.g. C4F9OC2H5, CHF2OCF2OC2F4OCHF2, CHF2OCF2OCHF2); and
- other halocarbons not covered by the Montreal Protocol including CF3I, CH2Br2 CHCl3, CH3Cl, CH2Cl2.[35]

The extent to which the particular ETS covers sources of emissions and the emission gases is a measure of the comprehensiveness of the ETS.

2.3 Transparency and Fairness

This criterion is reflected by, firstly the permit's price and price containment mechanisms. A price cap places an upper limit on the permit price and, by extension, on total abatement costs. Upon reaching the price cap level, additional allowances are issued leading to more emissions than originally envisaged. The lower the cap, the more likely its activation becomes. A price floor guarantees a minimum price for emission allowances. If the price is below the floor, which is more likely if the price floor is set to a high level, the government contracts the volume of marketable allowances. This leads

[35] These gases listed above have global warming potentials (GWPs) identified by the Intergovernmental Panel on Climate Change (IPCC) prior to finalization of the *2006 Guidelines*. See *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (Hayama, Japan: Institute for Global Environmental Strategies, 2006) [*2006 Guidelines*]. A GWP compares the radiative forcing of a tonne of a GHG over a given time period (e.g. 100 years) to a tonne of CO_2. The *2006 Guidelines* also provide methods for gases for which GWP values were not available prior to finalization, i.e. C3F7C(O)C2F5, C7F16, C4F6, C5F8 and c-C4F8O. These gases are sometimes used as substitutes for gases that are included in the inventory and countries are encouraged to provide estimates for them.

to less emissions than originally envisaged.[36]

Secondly, a design element relevant to this criterion is the use of offsets. A limit on importable credits/offsets implies that more abatement has to be achieved at home. This can raise the allowance price, but may be a good way of ensuring a higher degree of environmental integrity. Moreover, offsets may also be restricted due to concerns over "additionality".[37]

The third important design element is the original system of permit allocation. This can be free or can occur through an auction:

> Gratis allocation of allowances is almost certainly of major help in gaining the acquiescence of the industry subject to the allowance requirement. It can be viewed as paralleling the general regulatory approach, under which firms must meet the costs of reducing emissions down to the required level, but do not face any costs with respect to the remaining, allowable level of emissions. Gratis versus auction allocation of permits is understandably, a very sensitive issue.[38]

2.4 Offsets Eligibility

Offsets are a method of introducing flexibility to an ETS and function as a containment instrument, since they usually offer the least expensive compliance options. Therefore, offsets have the potential to seriously affect the level of environmental integrity.

According to the *Marrakesh Accords*, offsets should represent real, measurable, long-term and additional reductions.[39] Therefore, the following factors are essential in assessing the performance of offsets: accuracy of baselines, third party verification, tracking systems and long-term viability. However, for the purpose of this research paper, this analysis will not be performed. This paper will only focus on comparing the project activities eligible to generate offsets and the use of international credits.

3.0 Current State of Existing Cap-and-Trade Schemes

3.1 European Union Emissions Trading Scheme

The European Union Emissions Trading Scheme (EU ETS) is a mandatory cap-and-trade mechanism that started in 2005 and is the core of the EU's climate change policy. The

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[36] Michael Grubb, *Reinforcing Carbon Markets under Uncertainty: The Role of Reserve Price Auctions and Other Options*, Climate Strategies Issues and Options Brief (London, UK: Climate Strategies, 2009). Flachsland, Marschinski & Edenhofer, *supra* note 18.

[37] The additionality of a project is essentially a certification that the reductions in emissions would not have occurred in the absence of a project.

[38] John H Sargent, "The Economics of Energy and the Environment: The Potential Role of Market-Based Instruments" (2002) 28 Can-US LJ 499 at 506.

[39] *Marrakesh Accords*, *supra* note 34 at Appendix B, para 2(f).

third phase of the scheme began in January 2013 and introduced several major reforms and structural changes agreed to in 2009. As a result, the third phase is significantly different from phases one and two and is based on rules which are far more harmonized. The main changes are:

- A single, EU-wide cap on emissions applies in place of the previous system of 27 national caps;
- Auctioning, not free allocation, is now the default method for allocating allowances. In 2013 more than 40% of allowances were auctioned, and this share will rise progressively each year;
- For those allowances still given away for free, harmonized allocation rules apply. These are based on ambitious EU-wide benchmarks of emissions performance; and
- More sectors and gases are included.

3.1.1 Effectiveness

The EU ETS imposes a 'cap' or limit[40] based on the total amount of certain GHGs that can be emitted by the factories, power plants and other installations in the system. The cap is reduced over time so that total emissions fall. In 2020, emissions from sectors covered by the EU ETS will be 21% lower than in 2005.

Within the cap, companies receive or buy European Union Allowances (EUAs) which they can trade with one another as needed. They can also buy limited amounts of international credits from emission-saving projects around the world. The limit on the total number of allowances available controls the supply of credits thereby ensuring they have value.

After each year a company must surrender enough EUAs to cover all its emissions, otherwise heavy fines are imposed.[41] If a company reduces its emissions, it can keep the spare EUAs to cover its future needs or else sell them to another company that is short of allowances. This flexibility ensures that emissions are cut in an economically efficient way and these private transactions establish a price for a EUA, this is commonly called a "carbon price".

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[40] For a detailed presentation, see: European Commission, "Allowances and caps", online: <http://ec.europa.eu/clima/policies/ets/cap/index_en.htm>.

[41] European Commission, "Monitoring, reporting and certification of EU ETS emissions", online: <http://ec.europa.eu/clima/policies/ets/monitoring/index_en.htm>.

By putting a price on carbon and thereby giving a financial value to each tonne of emissions saved, the EU ETS has placed climate change on the agenda of company boards and their financial departments across Europe.

3.1.2 Comprehensiveness of Emissions Covered

While emissions trading has the potential to cover many economic sectors and GHGs, the focus of the EU ETS is on emissions that can be measured, reported and verified with a high level of accuracy. The system covers emissions of CO_2 from power plants, a wide range of energy-intensive industry sectors and commercial airlines. Nitrous oxide (N_2O) emissions from the production of certain acids and emissions of perfluorocarbons from aluminum production are also included. Participation in the EU ETS is mandatory for companies operating in these sectors, but in some sectors only plants above a certain size are included. Governments can exclude certain small installations from the system if fiscal or other measures are in place that will cut their emissions by an equivalent amount. For commercial airlines, the system covers CO_2 emissions from flights within and between countries participating in the EU ETS (except Croatia, until 2014).[42] International flights to and from non-ETS countries are also covered, but the European Commission deferred the scheme's application until an international agreement for tackling aviation emissions is reached.[43]

The EU ETS covers around 45% of total GHG emissions from the 27 EU countries. The following GHGs and sectors are included:

- carbon dioxide (CO_2) from:
    - power and heat generation;
    - energy-intensive industry sectors including oil refineries, steel works and production of iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals;
    - commercial aviation;
- nitrous oxide (N_2O) from the production of nitric, adipic, glyoxal and glyoxlic acids; and
- perfluorocarbons (PFCs) from aluminium production.

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[42] European Commission, "Reducing emissions from aviation", online: <http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm>.

[43] Council of European Energy Regulators, Market-Based Investment Procedures for Gas Infrastructures: Issues and Approaches – Public Consultation Evaluation: Evaluation of Responses (Brussels: 2012).

3.1.3 Transparency and Fairness

The current low prices for a EUA have led to mixed reactions regarding the ETS's effectiveness as a policy instrument and the consequences for long-term investment.

Under current rules there are no price stabilization mechanisms in the EU ETS, except for some provisions that take effect in the event of excessive price fluctuations. It is unclear whether such mechanisms could strengthen the ETS as part of structural reforms implemented to address the low price of carbon. Indeed, the availability of excess allowances in light of the current economic crisis has caused EUA prices to reach a record low.[44]

The ETS also faces a challenge in the form of a growing surplus of allowances, as the economic crisis has depressed emissions more than anticipated. In the short term, this surplus risks undermining the orderly functioning of the carbon market. In the long term, it could affect the ability of the EU ETS to meet more demanding emission reduction targets in a cost-effective manner.

The European Commission has therefore taken the initiative to immediately postpone (or 'back-load') the auctioning of some allowances. It has also launched a debate on structural measures which could provide a long term, sustainable solution to the problems associated with the surplus.[45]

Linking the EU ETS with other cap-and-trade systems offers several potential benefits, including a reduction in the cost of cutting emissions, an increase in market liquidity and a stabilization in the price of carbon. It would also level the international playing field and encourage global cooperation on climate change.[46]

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[44] This situation is a reflection of the unexpectedly low emissions in Europe as a result of the ongoing economic crisis, cumulated with over-allocation of allowances in the first two phases. On the one hand, prices are kept above zero by the long-term signal provided by the linear cap reduction factor of 1.74% which will continue after 2020 (as of current rules). On the other hand, the absence of long-term binding targets for 2030 and beyond keeps prices low.

[45] European Commission, "The EU Emissions Trading System (EU ETS)", online: <http://ec.europa.eu /clima/policies/ets/index_en.htm>.

[46] In a major step towards the first full inter-continental linking of emission trading systems, the European Commission and Australia announced agreement in August 2012 on a pathway for linking the EU ETS and the Australian ETS. A full two-way link between the two cap-and-trade systems will start no later than 1 July 2018. Under this arrangement, businesses will be able to use carbon units from the Australian emissions trading scheme or the EU ETS for compliance under either system. The European Commission will seek a mandate from the Council to negotiate, on behalf of the EU, a treaty by mid-2015 for the full link. An interim link will be established from 1 July 2015 enabling Australian businesses to use EU allowances to help meet liabilities under the Australian emissions trading scheme until the full link is

3.1.4 Offsets Eligibility

The EU ETS legislation allows participants to use most categories of credits from the Kyoto Protocol's CDM and Joint Implementation (JI) mechanism towards fulfilling part of their EU ETS obligations.[47] Overall, these international credits can be used to cover emissions of 1.7 billion tonnes of CO_2 (or the equivalent amount of nitrous oxide or perfluorocarbons) between 2008 and 2020. This represents half the reduction in emissions that will be made under the EU ETS in that period. Just under one-third of the limit had been used up by the end of 2011.

Credits are accepted from all types of projects except nuclear energy projects, afforestation or reforestation activities, and, starting in 2013, projects involving the destruction of industrial gases. Unused entitlements from the second trading period (2008-2012) are transferred to the third trading period (2013-2020). The exact amount per operator is determined by the methodology set out in the revised EU ETS Directive.[48]

The EU wants to see JI and CDM further reformed in order to improve their environmental integrity and efficiency through increased use of standardized baselines and alternative methods of assessing additionally.[49] For advanced developing countries, CDM offsets should be replaced over time by a new market mechanism covering broad segments of the economy that incentivizes net emission reductions. CDM would then be focused on the least developed countries.

3.2 Quebec's Cap-and-Trade Scheme

On December 14, 2011 the Government of Quebec adopted the *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances*.[50] Quebec thus became the first Canadian province to adopt its own cap-and-trade scheme. This placed Quebec on equal footing with California, which adopted its regulation on October 20, 2011.[51] The Quebec cap-and-trade scheme covers the electricity sector and named industrial sectors,

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established, i.e. no later than 1 July 2018. Based on a mandate from the Council, the European Commission is also negotiating with Switzerland on linking the EU ETS with the Swiss ETS.

[47] World Bank, *supra* note 8.

[48] See EU ETS Directive, Art 11a(8).

[49] Sebastian Goers & Barbara Pflüglmayer, "Post-Kyoto Global Emissions Trading: Perspectives for Linking National Emissions Trading Schemes with the EU ETS in a Bottom-Up Approach" (2012) 3:3A Low Carbon Economy 69-79.

[50] *Environment Quality Act*, RSQ, c Q-2, s 31, para 1.

[51] On 12 December 2012, the Government of Quebec adopted the *Regulation to amend the Regulation respecting a cap-and-trade system for greenhouse gas emission allowances*. The purpose of the amendment is to harmonize Quebec's system with California's, and those of future partners like Ontario and British Columbia. It also sets out the rules under which Quebec will issue offset credits, whose purpose is to recognize GHG emission reductions by companies operating in sectors that are not covered by the cap-and-trade system.

such as manufacturing, whose total GHG emissions are equal to or exceed 25,000 Mt CO_2e/year; coverage expands to include fuel distributors in the second compliance period.

In December 2012, the Government of Quebec also adopted the *Regulation respecting the delegation of management of certain parts of a cap-and-trade system for greenhouse gas emission allowances*.[52] Its purpose is to delegate the management of certain parts of the cap-and-trade system for GHG emissions to the Western Climate Initiative Inc. and determine, by Order in Council, the annual caps on GHG emission units for GHG emission allowances for the 2013-2020 period.

Quebec's cap-and-trade system for GHG emission allowances initially foresaw three compliance periods. The first compliance period began on January 1, 2013, following a transition phase of several months in 2012 during which emitters and participants were able to register for the system and familiarize themselves with the way it functioned without being required to meet a GHG emissions target cap.

3.2.1 Effectiveness

The government initially set a global GHG emission cap for all targeted emitters. The cap will gradually drop over time and achieve absolute reductions in GHG. Regulated businesses were required to cover their GHG emissions as of January 1, 2013.

3.2.2 Comprehensiveness of Emissions Covered

During the first compliance period, approximately 80 sites were subject to the system. These are mainly in the industrial and electricity sectors, with annual GHG emission equal to or greater than the annual threshold of 25,000 metric ton of CO_2e. This initial period will end on December 31, 2014. This first period will last two years, whereas the other two periods will each extend over three years.

Starting on January 1, 2015 (when the second compliance period begins), businesses that distribute fuel in Quebec or import fuel for their own consumption (e.g. all types of gasoline, diesel, propane, natural gas, and fuel oil), whose annual GHG emissions due to combustion reach or exceed the annual threshold of 25 kilotonnes of CO_2e, will also be subject to the system. This second period will end on December 31, 2017. The third compliance period, whose procedures will be identical to the second, will begin on January 1, 2018 and end on December 31, 2020.

[52] *Environment Quality Act*, *supra* note 50, s 46.13, para 2.

3.2.3 Transparency and Fairness

The government may award these companies a number of free emission units or "allocations" that take into account the historical level of their emissions and production. The number of free allocated units will gradually drop by between 1% and 2% each year, beginning in 2015. Companies whose GHG emissions are higher than the number of units allocated will have to modernize by adopting clean technologies or buy emission allowances at government auctions or on the carbon market. Companies whose GHG emissions are below their allocation will be able to sell their excess carbon credits to other companies on the carbon market. The most efficient businesses, those that have significantly reduced their GHG emissions, will be able to sell their surplus emission rights on the carbon market, thus enabling them to partially recover their invested funds or assist with new equipment optimization projects.

3.2.4 Offsets Eligibility

The offset credit component is intended to reduce emitter compliance costs without adversely affecting the environmental integrity of the system. Purchasing offset credits may enable an emitter subject to the *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances* to meet its regulatory compliance obligations. An 8% ceiling on the use of offset credits for regulatory compliance purposes has been set in order to maximize emission reduction by emitters covered by the system.

Only offset credit projects that are voluntarily completed by an individual, organization or company that wants to reduce or sequester GHG emissions in industries or sources of emissions other than those subject to the Regulation's compliance obligations are eligible to receive offset credits. These offset credit projects must have begun on or after January 1, 2007, met the conditions described in Chapter IV of the Regulation and been covered by a protocol listed in Schedule D of the Regulation. The Regulation lists three offset credit protocols:

- Protocol 1 — Covered manure storage facilities – CH_4 destruction;
- Protocol 2 — Waste disposal sites – CH_4 destruction; and
- Protocol 3 — Destruction of ozone-depleting substances (ODS) contained in refrigerator and freezer unit insulating foam.

3.3 California's Cap-and-Trade Scheme

California has been part of the Western Climate Initiative (WCI) since 2007 and its cap-and-trade system began in 2012. The first compliance period is from 2013 to 2014, the second from 2015 to 2017 and the third from 2018 to 2020. California's program is second in size only to the EU ETS based on the amount of emissions covered. In addition

to driving emission cuts in the ninth largest economy in the world, California's program will provide critical experience in how an economy-wide cap-and-trade system can function in the US.

In 2013, the cap was 162.8 Mt CO_2e, which represents about 35% of California's total GHG emissions. The cap decreases by 2% to 159.7 Mt CO_2e in 2014. The cap increases in scope to 394.5 Mt CO_2e in 2015 and then decreases by 3% annually to reach a cap of 334.2 Mt CO_2e in 2020.[53]

Covered sectors include electric utilities, cement, lime, nitric acid, refineries and electricity generation that exceeds 25,000 tCO_2e per year. From 2015 onwards, transportation, fuel distributors and upstream natural gas suppliers will be added to the scheme, a unique feature compared to other existing or emerging ETSs. By that point, the scheme is expected to cover about 85% of California's GHG emissions.

In November 2012 the first carbon allowances were allocated to cover entities using a benchmark[54] approach similar to that used in the EU ETS. At the same time, the first auction of allowances was held. Due to regulatory uncertainties, allowances were sold at just above the US $10 auction reserve price. All 23,126,110 were sold and the auction was considered a success. A second auction in February 2013 cleared at a much higher price (US $13.62), demonstrating the confidence that is building amongst market players.

The use of offsets is limited to 8% of the compliance obligation. Possible generating methods include stationary, mobile and agricultural offsets. The price paid for credits may be affected by the type of source from which reductions are obtained. This is particularly true with mobile sources that have a finite life span. Indeed, the lifespan of the credit may significantly affect the price paid for offsets.

3.4 New Zealand's Emissions Trading Scheme

The New Zealand Emissions Trading Scheme (NZ ETS) was created in 2008 to fulfill the requirements of the *Climate Change Response Act* (2002). Even though it does not contain a hard cap, it states that the main purpose of the NZ ETS is to assist the country in achieving its internationally assumed targets under the Kyoto Protocol. New Zealand

[53] Office of the Governor, State of California, "Proposed Linkage of California's Cap-and-Trade Program With the Canadian Province of Quebec's Cap-and-Trade Program – General Summary of Comments and Preliminary Agency Responses" (21 February 2013).

[54] The revised EU ETS grants partial, temporary free allocation of emission allowances to industry, based on benchmarks to address competitiveness concerns. The EU, led by the European Commission, has developed some 50 to 60 benchmarks covering around 85% of total EU ETS industrial emissions. Benchmarking in the context of climate change policies could translate into setting performance targets for industry sectors, defining (sectoral or national) GHG emission caps in a bottom-up fashion; establishing the level of carbon credits that are granted under the flexible mechanisms of the Kyoto Protocol or of the new post-2012 period or calculating the carbon content of products (e.g. for carbon footprinting).

committed to reducing its annual average GHG emissions to 1990 levels by 2012 and according to Point Carbon (2013), exceeded this goal.[55] Additionally, New Zealand signed the *Copenhagen Accord*, in which it pledged a conditional emissions target range of 10 to 20% below 1990 levels by 2020. The country's long-term target is a 50% emissions reduction by 2050.

This carbon trading scheme features a few unique characteristics. It does not contain any national or subnational caps. In other words, the absolute amount of net emissions attributed to New Zealand is ensured by the government. Furthermore, instead of a hard cap, the purpose of the ETS is to help the country meet its international obligations under the Convention and the Kyoto Protocol, as well as achieving an overall reduction in emissions below their current level. In addition, covered sectors are gradually phased in from 2008 to 2015 and it is the only ETS in the world that included emissions from land-use sectors.[56]

New Zealand's carbon trading scheme covers the following six GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).[57] In 2012, the Government exempted synthetic GHGs (HFCs and PFCs) contained in imported motor vehicles and other goods, opting instead to address them through the imposition of a levy. Emissions are categorized into seven sectors whose units surrender obligations. Participation in the ETS is compulsory for individual installations that exceed sector-specific emissions thresholds.[58]

The primary unit of trade in the NZ ETS is a New Zealand unit (NZU) issued by the Crown. Participants are required to surrender NZUs to the Crown to meet their obligations under the scheme. Participants from the forestry sector are required to surrender one NZU for each tonne of GHG emissions they produce, while participants from non-forestry sectors are required to surrender only one NZU for every two tonnes of GHG emissions. Participants can also surrender a range of 'Kyoto units' that can be purchased overseas. At present, however, only the forestry sector may convert the NZUs to Kyoto units to be traded overseas.

All participants may buy emission units from the Government for a fixed price of $25

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[55] Thomson Reuters Point Carbon, "NZ govt announces further curbs on UN CO_2 offset use" (December 2012).

[56] The covered activities are deforestation of pre-1990 forest land and biological emissions from agriculture (from 2015; but in 2012 the government passed an amendment to defer this pending a review).

[57] New Zealand Ministry for the Environment, "Emissions Trading Scheme basics", online: <http://www.climatechange.govt.nz/emissions-trading-scheme/about/basics.html>.

[58] In the forestry sectors, for example, forest managers must participate if they deforest more than two hectares of non-exempt, pre-1990 forest land between 2008 and 2012. Liquid fossil fuel refineries must participate if the total amount of fuel refined exceeds 50,000 litres.

or from domestic and international carbon markets at market prices.[59] The Government also provides some sectors with free emission units to help businesses stay competitive internationally. The following sectors of the economy are covered by the NZ ETS: forestry, transport fuels, electricity production, industrial processes, synthetic gases, agriculture and waste.[60]

Allocation is made according to eligibility criteria for each sector. Businesses that can pass on the costs of the NZ ETS to their customers (e.g. fuel and electricity companies) will not be allocated any NZUs. With the exception of some transitional provisions for early entrants, allowance compliance periods last one year, and allocations are made for the next year based on emissions and output data from the previous year. A reconciliation mechanism, or 'true up', corrects for errors in allocation later in the year once valid data from the previous year is available. Through 2012, allowances have been distributed through free allocations.[61] No auctioning has happened to date, but the government has proposed to introduce auctioning starting in 2013. The following sectors are eligible to receive freely allocated allowances: forestry,[62] agriculture,[63] industrial activity,[64] and fishing.[65]

There are two underlying policy rationales for free allocation: (1) compensation for the effect of the ETS on asset values in the fishing and forestry sectors, and (2) prevention of ETS-driven loss of competitiveness and carbon leakage in the industrial

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[59] This means that participants in non-forestry sectors will face a price of carbon that is no higher than NZD $12.50 per tonne.

[60] The forestry, transport fuels, electricity production and industrial processes sectors have already started facing obligations to report their GHG emissions and surrender emission units. The waste and synthetic gases sectors started facing full obligations under the ETS in January 2013. The agricultural sector has already started facing the obligation to report its emissions. However, the Government has yet to make decisions on when the agricultural sector will start facing obligations to surrender emission units.

[61] One purpose of free intensity-based allocations of NZUs is to protect firms of losing competitive leverage creating incentives for shifting production and associated emissions to other countries (carbon leakage).

[62] Allocation is being provided as compensation to owners of pre-1990 forests for the impacts on land values of the ETS. This is because they face obligations under the ETS if the land use is changed from forestry. Forest owners are able to voluntarily enter the scheme and receive credits of NZUs for forests planted after 1989 because trees absorb carbon and reduce New Zealand's international obligations.

[63] All agricultural activities facing ETS obligations are eligible for free allocation. When (and if) the agricultural sector enters the ETS, land owners are set to receive allowances covering 90% of an emissions baseline which will be established by regulation. Free allocations are set to decline by 1.3% per year starting in the year after entry.

[64] Ninety percent free allocation for highly emissions intensive activities (>1,600 tCO_2e per NZD $1 million) and 60% free allocation for moderately emissions intensive activities (>800 tCO_2e per NZD $1 million). Free allocations are set to decline by 1.3% per year starting in 2013.

[65] The total amount of emissions units to be allocated to fishing quota owners is 700,000 NZUs. Each eligible person receives allowances based on a formula.

and agricultural sectors. Allocation in the industrial and agricultural sectors is intensity-based; it can increase as production increases. Accordingly, there are no absolute emissions limits that apply to emission units to those sectors.

The sectors that do not receive freely allocated allowances are stationary energy supply, waste, liquid fossil fuels supply, and synthetic GHGs. Free allocation was not provided to the upstream stationary energy and liquid fossil fuels sector because these producers were expected to pass on the costs. Likewise, electricity generators were not allocated free units.[66] Allocation is provided to certain industrial activities to ensure they remain competitive against producers that do not face equivalent costs for emissions. For example, a company's position could be weakened if they pass costs onto consumers to cover the impacts of the NZ ETS, because a competitor could import a similar product at lower cost. Allocation will gradually be phased out over time as businesses adjust to the NZ ETS. Emission units will be granted to those businesses carrying out eligible activities rather than to specific firms or sectors.

An 'activity' is the chemical or physical transformation of a set of inputs into a given set of outputs. There are two tests that activities must pass before they are considered eligible for allocation: a trade exposure test and an emissions intensity test based on the tonnes of emissions produced for every $1 million of revenue. The minimum threshold for eligibility is 800 tonnes of CO_2 equivalent per $1 million of revenue. Participants can meet their NZ ETS obligations with NZUs or with eligible UNFCCC compliant emission reduction units purchased abroad. These may include Removal Units (RMUs), Emission Reduction Units (ERUs) or Certified Emission Reductions (CERs). ERUs and CERs from nuclear projects are not eligible. Additionally, in 2011, CERs from HFC-23 and N_2O industrial gas destruction were excluded and in 2012, ERUs generated in Eastern Europe from projects destroying HFC-23 and N_2O from adipic acid plants became ineligible.

There is no limitation on trading domestic or approved international units, nor are there quantitative limits for banking or offsets. The domestic market is open to linkages with international markets. Indeed, some design elements (such as the allocation system) were created so that a linkage with Australia is possible. However, another element that could impede the linkage is the inclusion of sectors, such as agriculture and forestry that other schemes might choose to exclude. Point Carbon also noted that "New Zealand must make a number of significant amendments to its CO_2 scheme before it can link to the common Australia-EU market, such as setting a total cap on emissions for companies and introducing a ceiling on the use of U.N. offsets".[67] Indirect linking already exists between

[66] Many are government-owned and because the electricity sector is deregulated they were all expected to pass costs on directly. New Zealand Government, "Energy in the Emissions Trading Scheme" (December 2011).

[67] Thomson Reuters Point Carbon, *supra* note 55.

the NZ ETS and the EU ETS considering the fact that both schemes allow overlapping international offsets, such as credits from the CDM of the Kyoto Protocol.[68]

3.5 Norway's Emissions Trading Scheme

Norway has a long history of activism in the fight against climate change. Its GHG mitigation policy includes a CO_2 tax, the *Pollution Control Act*, the *Petroleum Act* and the *Greenhouse Gas Emissions Trading Act*. The *Greenhouse Gas Emissions Trading Act* outlines the country's emissions trading system which became active on January 1, 2005. These combined measures cover more than 70% of domestic GHGs. The Norwegian ETS is designed in three phases: Phase I (2005-2007), Phase II (2008-2012)[69] and Phase III (2013-2020), and has been officially linked to the EU ETS since 2008.

In June 2007 and February 2009, Norway amended its system in order to ensure compatibility with the EU's ETS. In Phase I (2005-2007), the cap for covered entities was 6.57 Mt CO_2e/year, representing approximately 10% of the GHG emissions in Norway. In Phase II, more sectors were included and the cap for covered entities shifted to 15 Mt CO_2e/year, representing a 17% decline relative to 2005 levels and a 30% decrease relative to projected 2010 emissions.[70] In 2012, Norway emitted 52.9 Mt CO_2e, up 5.1% from 1990 levels; so, the Norwegian government purchased 21.5 million UN offsets to outperform its Kyoto Protocol target. To date, the country's voluntary pledge has not yet been met. By 2020, Norway aims to reduce its GHG emissions by 30% relative to 1990 levels, and by 40% if there is an international agreement.

When the EU ETS expanded to include Norway, Iceland and Liechtenstein on October 26, 2007, it "highlighted that for nations or regions to join the EU's program, their emissions trading systems must be mandatory, set absolute limits on emissions, have robust registry systems, and have strict monitoring and compliance measures in place."[71]

At first, the Norwegian ETS included a one-way linkage with the EU ETS. Norwegian entities could purchase EU allowances for compliance, but EU entities could

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[68] International Emissions Trading Association, "New Zealand – The World's Carbon Markets: A Case Study Guide to Emissions Trading" (May 2013), online: <http://www.ieta.org/assets/Reports/Emissions TradingAroundTheWorld/edf_ieta_new_zealand_case_study_may_2013.pdf>.

[69] Starting with Phase II (January 2008) the Norwegian ETS became officially linked with the EU ETS. To ensure its compatibility, the Norwegian scheme suffered a few modifications in June 2007 and February 2009.

[70] Norway's commitment under the Kyoto Protocol was to reduce emissions to 1% above 1990 levels for 2008-2012; an ambition that was later bolstered by a voluntary pledge to reduce emissions to 9% below 1990 levels for 2008-2012.

[71] MJ Mace et al, Analysis of the Legal and Organizational Issues Arising in Linking the EU Emissions Trading Scheme to Other Existing and Emerging Emissions Trading Schemes (Report commissioned by the European Commission and prepared for the Foundation for International Environmental Law and Development (FIELD), May 2008).

not purchase Norwegian allowances. A bilateral linkage with the EU ETS became effective in early 2009 once Norway's allocation plan was accepted by the European Commission, along with a few mutually accepted adaptations.[72]

Norway's cap-and-trade scheme includes an allowance set-aside that is reserved for new gas fired power plants that use carbon capture and storage, as well as for licensed, high-efficiency combined heat power plants. In Phase II, the total size of the allowance set-aside was 9 Mt CO_2e, or 1.8 Mt CO_2e.

The scope of the revised Norwegian ETS is identical to the EU ETS, including 110-120 installations and covering about 40% of Norway's total emissions. The total volume of covered emissions is about 14 million tons. This amounted to 80% of emissions in 2005 (18 million tons) and is expected to lead to significant reductions when compared to 21 million tons of projected emissions in 2010.

In line with Article 11(a) of Directive 2004/101/EC, a cap is set on the number of credits from the Kyoto Protocol project-based mechanisms that installations may use. The cap for Norway is 20% of the total quantity of allowances. Relative to most European companies, Norwegian companies will have a high degree of access to such credits. The decision was part of the Government's efforts to establish a Norwegian ETS in line with the EU Emissions Trading Directive. The Government considered the ETS to be a cost-effective system for reducing emissions of GHGs. It also provided a predictable framework for the installations involved.

Moreover, Norway unilaterally included nitrous oxide (N_2O) in its ETS framework. N_2O is a GHG listed in Annex I of the Kyoto Protocol but is not included in the EU ETS. The ETS Directive provides member states with the option to apply for the unilateral inclusion of additional activities and gases in the EU ETS,[73] subject to certain conditions and approvals."[74]

As noted above, the EU ETS introduced stronger safeguards to enhance the scheme's environmental effectiveness. The establishment of an EU-wide emissions cap, a linear

[72] For Phase II of the EU ETS, auctions were capped at 10% of overall allowances; however in the Norwegian ETS during the same phase almost 50% of allowance distribution is auctioned. In addition, Norway has kept the right to withdraw from the Kyoto Protocol and/or buy allowances to comply with its Kyoto Protocol commitment. If Norway is at risk of falling short of its strengthened Kyoto commitment of 9% below 1990 levels for 2008-2012 through domestic reductions, the government also has the option to purchase Kyoto-eligible units.

[73] This unilateral inclusion will encourage further N_2O emission reductions to be achieved in Norway and is likely to result in a faster application of N_2O-abatement technologies, by providing the industry with strong economic incentives to develop new cleaner technologies and to implement measures that would result in significant environmental benefits.

[74] Christina Voigt, "Environmental Integrity and Non-Discrimination in the Norwegian Emissions Trading Scheme" (2009) 18:3 RECIEL 304 at 306.

reduction of the total amount of allowances at a factor of 1.74% per year, the use of auctioning as the main allocation method and increased harmonization of allocation rules for exempted, exposed industries are steps that will likely improve the performance of the scheme. However, Norway did not act on these changes. The following was stated in the National Allocation Plan 2008-2012:

> In principle, all installations are supposed to face [the] full incremental environmental costs of their activities in accordance with the polluter pays principle. The petroleum sector, representing 64% of covered emissions, will not receive allowances free of charge. For this sector, all installations must purchase their allowances on the market.[75]

The plan also contains special allocation rules for the remaining land-based industries. These industries will be allocated allowances free of charge based strictly on each installation's actual historic emissions during the base period 1998-2001. They will receive allowances amounting to 87% of their average annual emissions from energy production and 100% of their average annual emissions from industrial processes during the base period. This averages to approximately 92% of the historical emissions of these industries during the base period, or 80% of their verified emissions in 2005. The total volume of allowances allocated according to this is estimated to be 5.5 million tonnes of CO_2 per year. Due to reasons associated with environmental integrity, neither a general reserve was included for new entrants nor an increase of activity at existing installations. However, the scheme does provide for a special reserve for highly efficient combined heat and power plants and gas fired power plants based on carbon capture and storage.[76]

Another important aspect of Norway's climate change efforts is that, in addition to a trading scheme, the government implemented a carbon tax. Indeed, this tax dates back to 1991, when it was enforced on the following sectors: gasoline, light and heavy fuel oil, oil and gas extraction in the North Sea, pulp and paper, fishmeal production, domestic aviation, and domestic shipping.[77] In 2005, the tax covered 68% of CO_2 emissions and 50% of GHG emissions. The Government intends to reduce the CO_2 tax in the future if allowance prices in the EU ETS rise from the levels that existed when the tax increase was implemented — in 2013 the CO_2 tax on offshore petroleum production by Norwegian Krone was $200 per tonne. The tax rate also varies across sectors. Higher rates apply to petroleum-related activities, whereas sectors involving mineral oils receive lower rates. Some energy intensive industries that are exposed to international trade and competition are exempt from the tax.

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[75] International Emissions Trading Association, "Norway – The World's Carbon Markets: A Case Study Guide to Emissions Trading" (May 2013), online: <http://www.edf.org/sites/default/files/EDF_IETA_Norway_Case_Study_May_2013.pdf>.

[76] Voigt, *supra* note 74 at 311.

[77] Jenny Sumner, Lori Bird & Hillary Dobos, *Carbon Taxes: A Review of Experience and Policy Design Considerations* (Golden, CO: National Renewable Energy Laboratory, 2009).

4.0 Criteria Analysis

The aforementioned overviews of several ETSs provide useful insight into how the design of an ETS can vary depending on different national and regional policy priorities and circumstances.[78] According to Andreas Tuerk:

> In schemes which cover almost all economic sectors, the CO_2 price is reflected in the costs faced by consumers, and the country may want to keep CO_2 prices low, at least initially, in order to achieve political acceptance for the scheme. Some emissions trading schemes, such as the WCI, are not only designed to meet an emissions target at least cost, but are also intended to stimulate innovation in low-carbon technologies (Western Climate Initiative, 2008); accordingly, they rely on a higher range of CO_2 prices as a condition for their goal attainment. Each ETS, in its design, reflects the evolution of climate policy and other specific circumstances in the country concerned. Some of the resulting differences in ETS design will make short-term harmonization difficult to achieve".[79]

This paper will now discuss how these systems compare on the criteria level. By reviewing the different existing standards for *effectiveness*, *comprehensiveness*, *transparency and fairness* and *offsets eligibility*, this paper will identify potential conflicts that can occur when trying to link systems. A matrix is therefore developed to show low conflict, medium conflict and high conflict areas with respect to certain design elements.

4.1 Effectiveness

As described in the first section, the *effectiveness* criteria relates to the design of a cap and can be expressed by the stringency of the target, the cap's rate of decrease and the percentage of regulated sources. From the previous discussion in Section 2 of this paper, there appears to be variation in cap design, particularly in the emission reduction target, the reliance on historical baselines and the cap's rate of decrease. The data is summarized in Table 1 below.

Table 1**:** Comparison of three components of effectiveness criteria in different jurisdictions

Factor	EU		California		Quebec	Norway		New Zealand
Target	20% (1990) by 2020	80 % (1990) by 2050	1990 level by 2020	80 % (1990) by 2050	20% (1990) by 2020	30% (1990) by 2020	100% (1990) by 2050	No target
Cap decrease	1.74% every year		2015 onwards 3% every year		4% every year	N/A		N/A
Regulated sources	45% of emitters		35% of emitters	2015 onwards 85% emitters	2015 onwards 85% emitters	40% of emitters		100% once all sectors are phased in

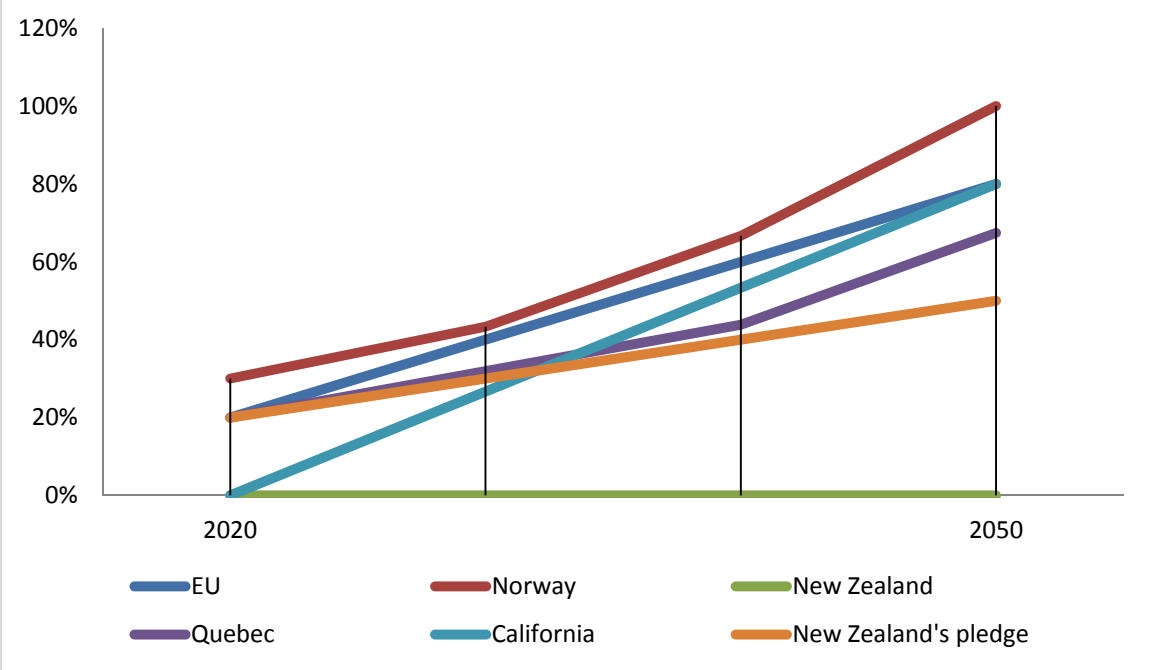
[78] Andreas Tuerk, ed, "Linking Emission Trading Schemes" (2009) 9:4 Climate Policy 339-432.
[79] *Ibid* at 349.

Although New Zealand is the least stringent regime since it does not have a target, this assists the country in meeting its international commitments. Norway, on the other hand, imposed a 30% emission reduction compared to 1990 levels by 2020.

The cap's design in an ETS is particularly important as it demonstrates the level of commitment a government has to achieving GHG reductions. Caps can be absolute or relative. In a potential linkage, the existence of a relative cap may negatively affect market liquidity, since its total emissions within the relative cap are not known in advance.[80]

Therefore, in the context of linking ETSs, this design element could represent a high risk factor in destabilizing the economic efficiency and environmental integrity of the linkage. The stringency of caps is also important as it can potentially cause significant wealth transfers between linking partners in cases involving non-comparable stringency levels. Ideally, the percentage of regulated sources is as close to uniform as possible. This, however, is not necessary.

Chart 1: Emission Reduction Targets



4.2 Comprehensiveness

As noted above, comprehensiveness of ETSs can be assessed by reviewing the GHGs that are included in the trading scheme as well as the covered sectors. Different regimes may

[80] Goers & Pflüglmayer, *supra* note 49 at 74.

choose to cover different GHGs. For example, the Kyoto Protocol covers six GHGs (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) and represents the baseline for our analysis. In comparison, the IPCC's *2006 Guidelines for National Greenhouse Gas Inventories* identifies more than 10 different GHGs that have global warming potential. Moreover, the covered economic sectors are also a good example of a comprehensive carbon trading scheme.

Chart 2: ETS Coverage (GHGs & Industrial Sectors)

GHGs	EU	California	Quebec	Norway	New Zealand
Carbon Dioxide (CO_2)	Y	Y	Y	Y	Y
Methane (CH_4)	Y (since 2012)	Y	Y	Y	Y
Nitrous Oxide (N_2O)	Y	Y	Y	Y	Y
Hydrofluorocarbons (HFCs)	Y (since 2012)	Y	Y	Y	Y
Perfluorocarbons (PFCs)	Y	Y	Y	Y	Y[81]
Sulphur Hexafluoride (SF_6)	Y (since 2012)	Y	Y	Y	Y
Nitrogen Trifluoride (NF_3)		Y	Y		N
Sector	**EU**	**California**	**Quebec**	**Norway**	**New Zealand**
Mining, Quarrying and Oil and Natural Gas Extraction	Y	Y	Y	Y	Y
Electric Power Generation, Transmission and Distribution	Y	Y	Y	Y	Y
Natural Gas Distribution	Y	Y (2015 onward)	Y (2015 onward)	Y	Y
Steam and Air-Conditioning Supply	Y	Y	Y	Y	Y
Manufacturing	Y	Y	Y	Y	Y
Pipeline Transportation of Natural Gas	Y	Y (2015 onward)	Y (2015 onward)	Y	Y
Aviation	Y	N	N	N	N
Agriculture	N	N	N	N	Y (from 2015 but under review)
Forestry	N	N	N	N	Y

[81] With the 2012 amendment the government of New Zealand exempted synthetic GHGs (HFCs and PFCs) contained in imported motor vehicles and other goods which will be covered by a levy instead.

For the purpose of linking ETSs, uniformity of gas coverage is desirable but not essential.[82] For example, linking to a scheme that is more comprehensive may have consequences for abatement, but these pose relatively little risk to environmental integrity. Furthermore, attention must be paid to sector coverage as double counting is a possibility and competition issues may arise. Taking these concerns into consideration, lack of uniformity in sector coverage may pose a medium level of risk to the performance of linked ETSs.

4.3 Transparency and Fairness

Transparency and fairness relate to price protection mechanisms, such as price floors and price containment, allowance allocation/auctioning, and monitoring and verification. The following table summarizes the collected data on transparency and fairness components.

An analysis of carbon markets suggests that price certainty is an important design element in any carbon pricing mechanism, either independent or linked.[83] Price certainty is necessary for the industry, at least in the introductory phase, as it allows an emitter to anticipate the costs of compliance. Price certainty might also help diminish leakage. If emitters know from the onset the cost of compliance they might be less incentivized to move their business to non-regulated jurisdictions. They may instead choose to implement measures improving their efficiency and GHG emissions performance, especially since most improvements have proven to turn expenses into sheer profit over a five-year period.[84] Once the market is established and the emitters start to improve their operations, it may be feasible to eliminate price ceilings. Price floors, on the other hand, would likely influence price volatility, innovation, and the management of cost uncertainty for GHG abatement policy.[85]

When an ETS with no price containment mechanisms is joined with an ETS that does contain price caps, the safety valve will be applied in the linked system. This will prejudice the notion of environmental integrity and the economic efficiency of the first ETS.

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[82] Goers & Pflüglmayer, *supra* note 49 at 72.

[83] Michele Betsill & Matthew Hoffmann, "The Contours of Cap and Trade: The Evolution of Emissions Trading Systems for Greenhouse Gases" (2011) 27:1 Review of Policy Research 83.

[84] *Ibid*.

[85] PJ Wood "Price floors for Emission Trading" (2011) 39:3 Energy Policy 1746 at 1747. As Wood notes, "investment certainty would be improved by price floors … policy design that reduces cost uncertainty can therefore limit the overall effective cost of achieving a mitigation outcome, and is more likely to attract political support."

Chart 3: ETS – Transparency and Fairness Comparison

Factors		EU	Quebec	California	Norway	New Zealand
Price protection	**Price Floor**	N	$10, 5% annual increase	$10, 5% annual increase	No	$25 forestry $12.5 non-forestry (until 2015)
	Price Containment	N	$40-50/tonne and increases 5% per year	$40-50/tonne and increases 5% per year	No	No
Allocation	**Free**	Y Based on EU-wide benchmarks, historical activity data, a carbon leakage factor, and a reduction factor. 80% in 2013 and decreases over time to 0 in 2027.	Mining and quarrying sectors (excluding oil and gas sector); manufacturing activities (including oil and gas sector); Steam and air conditioning suppliers; Electricity imports from jurisdictions that are covered under a separate cap and trade program but not linked to Quebec's; Electric power generation sold under contract, with a fixed sale price, and signed before 1 January 2008.	Only for electric utilities, industrial facilities and natural gas distributors Starts at 90% and declines over time	39% of the total number of allowances were freely distributed. Offshore oil and gas production received no free allocation. No land-based industries established after 2008 could receive free allocation.	Through 2012 allowances have been distributed via free allocation. The following sectors receive freely allocated allowances: forestry, agriculture, industrial activity and fishing. Allocation in the industrial and agricultural sectors is intensity-based
	Auctioning	Y 40% of allowances will be auctioned. Aviation: 15% of allowances to be auctioned.		Y Investor-owned utilities must consign their free allowances to be sold at auction; must use proceeds for ratepayer benefit	Y In Phase II (ended in 2012) 50% of all allowances were auctioned. In Phase III (started in 2013) entities will be required to obtain 100% of emission allowances via auctions or secondary markets.	It was supposed to start in 2013
Verification		Mandatory monitoring plan Emissions are third party verified and accredited	Verification by an accredited third party is required.	Verification by an accredited third party is required.		
Trackable allowances		Y	Y	Y	Y	Y

With respect to allocation methodology, differences may occur because of subsequent allocation rules that induce distributional impacts. Allowance allocation involves a tough political decision concerning who is to be the recipient of the value created by the constraint.[86] Caution must be exercised, especially with free allocation of allowances, in order to avoid perverse incentives.[87] If the overall cap is stringent enough, this design element might have little to medium risk when linking ETS.

4.4 Offsets Eligibility

Offsets represent emissions reductions achieved by non-capped sources and may also be accepted for compliance in lieu of allowances. Offsets offer a flexible way to achieve compliance and have also proven to be a cost containment tool. They are sometimes used by governments to ease the cost of compliance in a less obvious way. Nevertheless, the eligibility of offsets within an ETS system is a key design element that can make or break its integrity. According to the *Marrakesh Accords*, offsets should represent real, measurable, long-term and additional reductions. The additionality requirement is essentially a certification that the reductions in emissions would not have occurred in the absence of a project. The additionality of a project is assessed against a baseline scenario representing all the potential alternatives to the proposed project activity. Since offsets would result in reductions of CO_2 emissions, the concept of "measurable" reduction has to be based on a comparison with a defined level of CO_2 emissions. This comparative level, against which the reductions of GHG emissions are measured, is the baseline.[88] This is why mandatory GHG reporting is a prerequisite for any cap-and-trade scheme. Additionality is a key requirement also for CDM projects within the Kyoto Protocol.[89]

Therefore, the accuracy of baselines, third party verification, tracking systems for offsets, and the long-term liability for offsets are all essential factors for assessing the performance of offsets. However, this study does not address all of these factors and takes only an external look at both the project activities that are eligible to generate offsets and the use of international credits.

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[86] A Denny Ellerman, Frank J Convery & Christian de Perthuis, *Pricing Carbon: The European Union Emissions Trading Scheme* (New York: Cambridge University Press, 2010) at 32.

[87] Examples of such incentives are: discouraging plant closure, reducing incentives for producers and consumers, and encouraging "dirty" plant operation. See also Robert Hahn & Robert Stavins, *The Effect of Allowance Allocations on Cap-and-Trade System Performance* (Cambridge, MA: Mossavar-Rahmani Center for Business and Government, 2010).

[88] Matthew Mendis & Keith Openshaw, "The Clean Development Mechanism: Making it Operational" (2004) 6 Environment, Development and Sustainability 183 at 193. See also Mindy G Nigoff, "The Clean Development Mechanism: Does the Current Structure Facilitate Kyoto Protocol Compliance?" (2006) 18 Geo Intl Envtl L Rev 249; Ernestine Meijer & Jacob Werksman, "Keeping It Clean: Safeguarding the Environmental Integrity of the Clean Development Mechanism" in David Freestone & Charlotte Streck, eds, *Legal Aspects of Implementing the Kyoto Protocol Mechanisms : Making Kyoto Work* (New York: Oxford University Press, 2005) at 84.

[89] Kyoto Protocol to the UNFCCC (1998), Art 12, para 5(c), online: UNCCC <http://unfccc.int/resource/docs/convkp/kpeng.pdf>.

Chart 4: Use of Offsets Comparison

		EU		**California**	**Quebec**	**Norway**		**New Zealand**	
Use of international credits	Allowed	Y	Grade	N	N	Y	Grade	Y	Grade
	Limit	Country-based 0-20%	9-10	N/A	N/A	Max. 13% previous year	10	Max. 100%	1
	Excluded activities	Industrial gas projects		N/A	N/A	Nuclear		Nuclear HFC-23 and N2O industrial gas destruction	
		Limited hydropower				Carbon sinks			
		CERs only from least developed countries				Large hydropower			
Offset protocols	CDM project activities			ozone depleting substance (ODS)	Agricultural Methane Destruction	CDM project activities		CDM project activities	
	JI project activities			livestock	Small Landfill Site Methane Destruction	JI project activities		JI project activities	
				urban forests	(ODS) Destruction				
				US forest projects					

In the absence of uniform crediting rules, the design choices surrounding the use of offsets could create market and competition distortions. The main design elements that could have this type of influence are eligibility criteria and quantitative limits. A relatively small variation in these two elements is acceptable but a greater difference could pose high risks to both the environmental integrity and economic efficiency of ETSs.

Based on the evaluation of the four criteria, the following chart was developed, indicating zones of risk/conflict when considering a linkage between two or more ETSs.

Chart 5: Zones of Risk/Conflict

Criteria	Low conflict	Medium conflict	High conflict
Effectiveness		Stringency of targets	Cap setting absolute v. relative
Comprehensiveness	GHG coverage	Sector coverage	
Transparency and fairness	Monitoring, reporting and verification	Allowance allocation	Price containment
Offsets eligibility		Eligibility criteria	
		Quantitative limits	

5.0 Considerations for Alberta's Future Emissions

Based on the analysis developed in the previous chapter, the most significant considerations when designing a linkage are those related to effectiveness (especially the nature of the cap) and transparency and fairness (price containment). Should Alberta consider the scenario of linking its scheme to a different ETS, some design changes have to be made to the type of cap. One option would be to create a hybrid ETS that has both absolute and relative caps differentiated by the industry sector. With respect to price containment provisions, Alberta has either the option to match price containment mechanisms in other systems or eliminate them, depending on the linkage partner. However, caution should be exercised when linking with a jurisdiction that has either a higher or a lower carbon price, since the jurisdiction with a higher carbon price has the potential to deplete the offsets market in the jurisdiction with a lower carbon price.[90]

[90] Let's build a hypothetical case: Alberta were to link its offsets market with another province, e.g. Saskatchewan and both would have a Climate Change and Emissions Management Corporation (CCEMC) (Technology) Fund, where a tonne of carbon was priced at $15 and $30, respectively. This linkage would determine Saskatchewan entities to purchase offsets from Alberta; this increase in demand would determine a price increase. Once the price reaches $15/tonne, Alberta entities would no longer be competitive on the

The next set of design factors are also relevant for creating a linkage to the Alberta ETS, but pose less risk than those discussed above. When addressing the comprehensiveness aspects of the covered industry sectors, the option of having a hybrid ETS may represent a viable solution. In this context, the stringency of targets for both the absolute and relative caps are of utmost importance so that balance can be achieved between the linked ETSs. Of equal significance is having stringent rules on offsets eligibility as well as imposing quantitative limits on the use of offsets as well as qualitative limits. Another potential problem is the absence of project registration requirements, or another form of pre-approval, for offsets. In fact, government approval only occurs at the end of the project cycle once the project has been implemented and is purportedly producing emissions reductions. Nevertheless, the lack of pre-approval steps in Alberta's offset rules may create uncertainty in the market, since some project developers may be reluctant to commit funds upfront without some level of assurance they are on the right track. However, use of the Protocols will likely lower the project rejection risk.

6.0 Conclusions

De-carbonization strategies are being developed in Alberta and all over the world both at the governmental and non-governmental levels. "*The global momentum for implementation of large-scale de-carbonization strategies is rapidly accelerating.*"[91] The challenges that these policies might confront globally and the novelty of these carbon pricing mechanisms encourage the creation of an assessment tool indicating the degree of environmental integrity and compatibilities for creating linkages.

This research revealed a tendency of convergence among different carbon pricing mechanisms. However, there are several design details for each scheme that must be assessed in order to determine the level of compatibility for creating linkages: emission reduction targets, stringency of caps, price stabilization mechanisms, eligibility of offsets, coordination and linking. The level of stringency lies at the core of each system and is determined by the existence of baselines and caps, a carbon tax (if any) and limits imposed on offsets (quantitative and qualitative). Effective carbon pricing is dependent on: the right balance in supply and demand, price stabilization mechanisms and finding the balance between economic growth and ensuring liquidity availability. A few design elements demonstrated signs of convergence in different jurisdictions. This serves as proof that open dialogue and mutual interest in linking could work towards creating a global carbon market.

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offsets market (since Tech Fund price is $15). In this case, the compliance options for Alberta entities would be reduced and this does not seem to be the intent of the regulation.

[91] John Wiseman, Taegen Edwards & Kate Luckins, Post Carbon Pathways Towards a Just and Resilient Post Carbon Future: Learning from Leading International Post-Carbon Economy Researchers and Policy Makers (Sydney: Centre for Policy Development, 2013) at 22.

This paper aimed to create an assessment tool that could indicate risk zones for linking ETSs and point out the level of environmental integrity of each scheme. By interpreting the results, I could conclude that the most suitable candidates for linking are the EU ETS, the Norwegian ETS and New Zealand´s system. The Norwegian ETS and EU ETS have been linked directly and bilaterally since 2008, whereas New Zealand is considering the possibility of modifying its trading scheme to be more compatible with the Australian scheme-to-come and EU ETS. It is not surprising to note that New Zealand and the EU are already indirectly linked through UN carbon credits (CERs, ERUs and RMUs).

On the other hand, California and Quebec present a higher level of environmental integrity which made them good candidates for linking. In March 2013, the California Air Resources Board released proposed amendments to the cap-and-trade regulation, authorizing linking with Quebec in 2014.

Based on my assessment, I conclude that the environmental integrity of a domestic cap-and-trade system can be maximized by:

- targeting all fossil-fuel-related CO_2 emissions through an upstream, economy-wide cap;
- setting a trajectory of caps over time that begins modestly and gradually becomes more stringent, establishing a long-run price signal to encourage investment;
- adopting mechanisms to protect against cost uncertainty and establishing a minimum carbon price, thus ensuring that the mitigation efforts are not undermined; and
- including linkages with the climate-policy actions of other countries.

By providing the option to mitigate economic impacts through the distribution of emission allowances, this approach can establish consensus for a policy that achieves meaningful emission reductions.

Additional areas of research that can be explored may be:

1. The design of a hybrid system for Alberta;
2. The design and assessment of offset mechanism;
3. The particular adjustment factors for linkages; and
4. The difficulties in multi-linking ETS.

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