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REPORT

# Closing the Gap: A Comparison of Approaches to Encourage Early Greenhouse Gas Emission Reductions

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# Closing the Gap?
# A Comparison of Approaches to Encourage Early Greenhouse Gas Emission Reductions

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## Contents

## List of Tables



## List of Figures

**Glossary**

"1605(b) Program" is the US voluntary emission reduction reporting program created by s. 1605(b) of the Energy Policy Act of 1992 (42 USC 13385).

" Allocation base period" is the historic period used in grandfathering, e.g. if emitters are granted emission allowances in proportion to their total emissions from 1990 to 1995, 1990 to 1995 would be the allocation base period.

" Annex 1 Parties" are the nations listed in Annex 1 to the UNFCCC. This includes all the nations that were members of the OECD in 1992 plus the nations of Eastern Europe that are undergoing transition to a market economy.

" Annex B Nations" are the nations listed in Annex B of the Kyoto Protocol. These nations are subject to emission limits under Protocol. Currently Annex B only lists those Annex 1 Nations that have ratified the UNFCCC (i.e. all besides Belarus and Turkey).

" Assigned Amount Units" are units of the allowable emissions assigned to Annex B Nations under the Kyoto Protocol. The unit of trade in international emissions trading.

"Baseline protection" is a policy intended to ensure that, in the event of grandfathering, parties reducing emissions prior to the allocation base period are not disadvantaged. Baseline protection is a contingent policy, only coming into effect in the event of grandfathering.

"BAU or business as usual emissions" is the level of emissions that would exist in the absence of a Credit for Early Action program or market instruments.

"Carbon allowances" permits to import or produce a unit of carbon in fossil fuels. The unit of trade in upstream cap and carbon allowance trading programs.

"Carbon tax" is a tax placed on fossil fuel proportionate to its carbon content. Although not strictly speaking simple carbon taxes, this report also refers to taxes placed on non-energy sources of carbon dioxide and other greenhouse gases, as carbon taxes.

"Certified Emission Reductions" are emission reduction credits generated under the Clean Development Mechanism and useable to supplement assigned amount units.

"Clean Development Mechanism" is the mechanism created by the *Kyoto Protocol* for generation of emission reduction credits in Non-Annex B nations (i.e. developing nations).

"Credit budget" is a limited portion of a nation's Kyoto Budget allocated to Credit for Early Action.

"Credit generation baseline" in a Credit for Early Action system is the level of emissions below which actual emissions must drop in order for an entity to generate early action credits.

"Credit generation base period" refers to any period which is used to establish the credit generation baseline. For instance, if reductions are generated by improvements in performance of greater than one percent per annum, and the credit generation baseline is initially based on performance in 1999, 1999 is the credit generation base period.

"Downstream cap and emission allowance trading": see Section II.A.2.

"Emission allowances" permits or allowances to emit a unit of greenhouse gases. The unit of trade in a domestic downstream cap and emission allowance trading program.

"First Compliance Period" is, under the Kyoto Protocol, the 2008 to 2012 period during which Annex B Nations' emissions must be reduced relative to 1990 levels.

"Grandfathering" is an allocation of emission allowances based wholly or partly on a emitters' emissions in a historic period.

"Kyoto Budget" is the total assigned amount units assigned to an Annex B nation during the First Compliance Period.

"Mandatory performance standards combined with credit trading": see section II.A.2.

"Pre-compliance period" is the period before the first compliance period.

"Upstream cap and carbon allowance trading": see section II.A.2.

**Zusammenfassung**

Das Kyoto-Protokoll zur UN-Klimarahmenkonvention setzt verbindliche Treibhausgasemissionsziele für Industrieländer, die allerdings erst im Zeitraum 2008-2012 gelten. Da für die Zeit bis 2008 mit einem erheblichen Emissionsanstieg zu rechnen ist, wird über Ansätze nachgedacht, schon vorher Anreize für Emissionsverringerungen zu setzen. Frühzeitige Emissionsverringerung reduziert das Risiko, klimatische Schwellenwerte zu überschreiten, die nichtlineare Veränderungen im Klimasystem auslösen. Außerdem wird der normale Investitionszyklus ausgenutzt, indem Neuinvestitionen emissionsärmer ausfallen. Dies verursacht keine oder nur geringe Kosten. Dazu bedarf es konkreter Anreize, die unterschiedlich ausfallen können. Während in Nordamerika eine freiwillige vorzeitige Anrechnung von Emissionsverringerungsmaßnahmen auf die Verpflichtungen des Kyoto-Protokolls diskutiert wird, werden in Europa konkrete marktwirtschaftliche Instrumente wie Emissions- oder Energiesteuer sowie Emissionsrechtshandel geplant und teilweise bereits umgesetzt.

Die vorzeitige Anrechnung erzeugt einen Anreiz zur Emissionsverringerung in den erfaßten Sektoren. Allerdings wirkt dieser Anreiz nur indirekt, da der Preis für Emissionsrechte von der Wahrscheinlichkeit der Umsetzung des Kyoto-Protokolls und davon abhängt, ob und in welchem Maße das Unternehmen zukünftigen Regulierungen unterworfen sein wird. Entscheidend ist nun die Wahl des Referenzszenarios, das zur Berechnung der Anzahl der Emissionsrechte herangezogen wird. In den nordamerikanischen Vorschlägen werden dazu höchst unterschiedliche Verfahren angewandt. Die Berücksichtigung bereits erfolgter Verringerungen sowie von Verringerungen im Ausland und Kohlenstoffspeicherung in Biomasse ist umstritten. Die Bestimmung des Referenzszenarios führt unweigerlich dazu, daß manche Verringerungen nicht angerechnet werden; beispielsweise solche aus verändertem Konsumverhalten.

Vorzeitige Anrechnung führt zu Umverteilungseffekten, die enorme Größenordnungen erreichen können. Jede Zuteilung von Emissionsrechten zwingt die Nichtteilnehmer zu höheren Anstrengungen während der Zielperiode. Dabei handelt es sich voraussichtlich um die Unternehmen mit den höchsten Verringerungskosten. Diese Effekte wirken desto stärker, je höher der Anteil von Emissionsrechten ist, der für vergangene oder fiktive Emissionsverringerungen ausgegeben wurde.

Vorzeitige Anrechnung ist also ein Instrument mit deutlichen Schwächen. Marktorientierte Instrumente sind eindeutig vorzuziehen. Auch kommt die vorzeitige Anrechnung

nicht mit einfachen Regeln aus; der für ihre Einführung notwendige Regelungsaufwand sollte lieber in die Schaffung von Anreizsystemen investiert werden, die bruchlos in die Zielperiode des Kyoto-Protokolls einmünden. Falls diese jedoch politisch nicht durchsetzbar erscheinen, ist die vorzeitige Anrechnung dem Verzicht auf jegliche Klimapolitik vorzuziehen.

**Summary**

This discussion paper explores policy approaches for the period prior to 2008 that close the gap between nations' projected greenhouse gas emissions, and the level of emissions that will be allowed in the period 2008 to 2012 if the Kyoto Protocol comes into force. Current 'business as usual' projections suggest greenhouse gas emission from industrialised nations emissions will grow substantially over the next decade. For instance, some forecasts suggest US emissions might increase to 30 percent above 1990 levels by 2010. However, if it comes into force, the Kyoto Protocol will require industrialised nations to reduce emissions to an average of five percent below 1990 levels in the 2008 to 2012 period. Eventually, far greater reductions will be needed to provide significant protection to the global climate system.

Taking early action to close this gap has a number of advantages. It reduces the risks of passing thresholds that trigger climate change "surprises" – rapid, non-linear, potentially catastrophic, shifts in the global climate system. Early action also increases future generations' ability to choose greater levels of climate protection as they gain a better understanding of climate systems, and it leads to faster reductions of other pollutants. From an economic sense, early action is important because it allows shifts to less carbon intensive technologies during the course of normal capital stock turnover. Moreover, many options for emission reduction have negative costs and thus are economically worthwhile because of paybacks in energy costs, healthcare costs and other benefits. Finally, early emission reductions are consistent with existing international law obligations, enhance the probability of successful ratification of the Kyoto Protocol, and lower the risk of non-compliance with the Protocol.

Achieving either the environmentally or economically optimal emission reduction path will require governments to implement measures prior to 2008. The possibility that businesses may, in the future, receive emission rights in proportion to past emissions (i.e. the possibility of emissions being "grandfathered"), creates a disincentive to early action. Businesses may fear that they will receive a lower allocation of emission limits if they take early action, and thus may not implement such action.

Even where this disincentive is eliminated, individuals and businesses are likely to invest in low carbon technologies at a rate that is below what is socially or economically optimal. They may be unaware of or underestimate the chances of future emission limits. Moreover, consumers, commercial enterprises and industry already tend to under-

invest in energy efficiency from an individual profit-maximising perspective. To ensure a continued thriving economy in the long run it is even more important to invest in measures that have longer term paybacks. In order to reduce the cost of compliance with the Kyoto Protocol, it is particularly important to adopt policies that shift investment in long lived capital stock towards less carbon intensive technologies and to encourage innovation and technology development that will reduce future compliance costs.

Although a number of specific reforms to regulation and tax policy may help reduce emissions at low cost, most economists agree that the creation of incentives to reduce emissions throughout the economy is an essential component of any greenhouse gas reduction strategy. This paper focuses on two such measures, comparing the concept of "Credit for Early Action" with various "market instruments". It also discusses uses of the Kyoto Protocol's only explicit early action provision – the "Clean Development Mechanism".

Market instruments create a market price for emissions and use the market to encourage reductions at the lowest price. They do this by either placing a price – a carbon tax – on emissions or limiting emissions and allowing businesses to trade a limited number of emission allowances or credits. Although market instruments can be applied within a sector, in the context of greenhouse gas emissions, they are generally used to encourage reductions throughout the economy or across large sectors. Many European countries have introduced carbon and energy taxes, some at very high levels, and several countries are planning to use domestic emissions trading systems. Market instruments have also been discussed as essential components of eventual North American climate strategies, but there appears to be less interest in immediate implementation.

Like market instruments, Credit for Early Action creates an incentive for emission reduction throughout the economy or across many sectors. However, rather than imposing a carbon tax or limiting emissions, Credit for Early Action programs promise that entities which take action to reduce greenhouse gases prior to the imposition of a domestic emissions charges or emission limits will receive a credit against future carbon taxes or emission limits. Up to the present, domestic Credit for Early Action is a policy mainly discussed in North America, presumably due to reluctance among politicians to impose binding emission limits or carbon taxes. Credits are generated when an entity reduces its greenhouse gas emissions below a credit generation baseline. Under the leading proposals for Credit for Early Action, baselines are established by reference to either absolute emissions or emissions per unit of production in a credit generation base period. In

some cases, entities can generate credits from reducing emissions at facilities that lie outside their operations. The credits are tradable and usable in any future where there is either a tax or regulatory limits on greenhouse gas emissions.

Baseline protection is another feature of these proposals although it can also be adopted as a stand alone policy. Baseline protection ensures that if future emission rights or emission limits are grandfathered, entities will not receive lower limits or lower allocations because they took early action. Baseline protection is a contingent policy and involves transaction costs due to the need of independent verification. It only comes into effect if future allocations are grandfathered.

Despite of an intense debate, basic aspects of Credit for Early Action system design remain unresolved. It is uncertain whether credits will be generated relative to an absolute emissions baseline or an emissions performance per unit of output baseline. The aggressiveness of the baseline for credit creation and degree of baseline protection are uncertain. The treatment of past action, treatment of foreign emission reductions, treatment of carbon sequestration by sinks and the existence of a cap on credits created are unresolved.

The environmental effectiveness and economic efficiency of market instruments and Credit for Early Action will depend on the details of how a program is designed, and how the market reacts to price signals. The decrease in greenhouse gas emissions achieved by emissions trading will obviously depend primarily on emission limits set by government. The cost of achieving these emission limits will depend on how many low cost emission reductions exist in the economy. For a carbon tax, government will establish the price of emissions and the market will determine the emission reduction that results. Under Credit for Early Action, supply and demand for credits will determine the level of emission reductions. If there is insufficient demand there is a risk that few additional emission reductions will occur (although considerable trading or credit generation could occur).

Investment and costs under all instruments will be affected by the ability to purchase internationally recognised “certified emission reductions” (CERs) created under the Protocol’s Clean Development Mechanism through reduction projects in developing nations. The cost of CERs will likely place an upper bound on the price emitters are willing to pay for early action credit or emission allowances.

Both Credit for Early Action and market instruments will encourage investments in innovative low carbon technologies and shift investments in long lived capital stock toward lower carbon alternatives. However, the incentives created by Credit for Early Action may initially be less effective at encouraging innovation and investments in long lived low carbon technologies. The weaknesses of Credit for Early Action are twofold: the value of a credit is entirely speculative and it is impossible to credit certain emission reduction activities.

Among other things, the demand for credits, and thus the incentive to innovate, will depend on:

- *Perceptions as to the likelihood of future emission limits.* If emitters expect the Kyoto Protocol to fail there will be less demand for credit and less incentive to invest.
- *Perceptions as to future emission reduction costs.* Because Credit for Early Action does not create either emission limits or impose a carbon charge, it is less effective in helping determine the cost of emission reductions. If emitters expect that future international or domestic emission reduction costs will be low, they will tend to under invest in emission limits.
- *Perceived risk of credits being discounted.* There are a number of reasons for capping the amount of the Kyoto Budget allocated to Credit for Early Action. If there is a risk that credits will be discounted to comply with such a budget, the value of emission reductions becomes more speculative.

The lack of certainty of credit value may make early crediting less relevant in planning for projects involving significant capital investments and longer term emission impacts. If investors expect the Kyoto Protocol to fail, they may simply attempt to generate credit from reductions that would have occurred in any event and some very low cost reductions with immediate paybacks. At least initially, both early introduction of a market instrument and announcement of a future minimum price for carbon are likely to give greater certainty as to the value of investing in technologies that will lead to long term reductions in cost. If the credit market is flooded with credits from non-additional reductions and very low cost reductions, credit prices will be depressed and the incentive for further reductions weakened. On the other hand, Credit for Early Action could be reshaped to only give credits for use of pioneer technology. Such “technology push” crediting would also reduce the negative impacts of Credit for Early Action on other participants.

The degree of additional investment in innovation and long lived capital will also be limited by the failure of Credit for Early Action to value all emission reductions equally. If there is a cap on the amount of the Kyoto Budget that is allotted to Credit for Early Action, and this cap is implemented through a reservation system, only the first companies to participate will be encouraged to take early action. The most likely companies to register under a reservation system are those that would have reduced emissions in any event. Companies that need the incentive of early credits to invest in cutting edge innovation are likely to face higher risks in a reservation system.

Even in the absence of a cap on credit, some emission reductions will not be valued under Credit for Early Action. First, some reductions will not be valued because they do not fall below a credit generation baseline. All responses to this problem – allowing credits to be generated on a project by project basis through offsets, use of less aggressive baselines or establishing individual baselines for individual companies reflecting business as usual emissions – create new problems. Second, reductions that result from structural changes in the economy and changes in consumption patterns will often be impossible to credit.

In comparison, well designed market instruments create a clear price signal – the value of reductions is far less speculative. In addition, well-designed market instruments value all emission reductions equally. In theory, they should yield the lowest cost emission reductions. Of course, real world emissions trading systems will also suffer from problems such as less than full coverage of all emitters.

The failure to value all emission reductions equally creates a number of perverse incentives to engage in activities that generate credit but do not reduce emissions. For instance, Credit for Early Action proposals may reward reduced production of carbon intensive goods or shifts in product mix toward less carbon intensive products. While this reduces emissions at one location, the reductions may be completely offset by shifts in the opposite direction at facilities that are not participating in Credit for Early Action. There is even a risk that Credit for Early Action could encourage changes that increase emissions.

Initially, the speculative nature of credit value provides a weak signal for emission reduction. However, the final weakness of Credit for Early Action from an economic perspective is that depending on the design of the early crediting program, the signal could become too strong once ratification and coming into force of the Kyoto Protocol ap-

pears certain. In this case, Credit for Early Action could lead to the acceleration of some emission reduction options to a degree that may be more expensive than slightly delayed implementation. While this is good for the environment, it may be more costly for the economy. The same problem is true of market instruments; however, the ability of government to phase in a carbon tax or emission limits can control the problem.

Because they generally create a clear market signal, environmental effectiveness of different market instruments is relatively easy to predict. The difference between projected emission trends and the cap gives a good indication of environmental effectiveness of trading programs. The long and short term effectiveness of a carbon tax is harder to predict in practice, but is theoretically simple.

In contrast, the environmental effectiveness of Credit for Early Action is extremely difficult to predict. The speculative nature of credits' value makes their market price highly uncertain. However, auctioning of some credits could reduce this uncertainty. In addition, the relation of baselines to corporate emission patterns is central to determining the effectiveness of Credit for Early Action, but there is a dearth of data. Both too lax and too stringent a baseline will reduce effectiveness, but there is insufficient data to determine the appropriate stringency. The effectiveness of existing Credit for Early Action proposals will also depend on the variability among companies' emission patterns relative to the chosen baseline, but there is a lack of data on the degree of variability.

The distributional impacts of both Credit for Early Action programs and market instruments can be significant and depend on program design. For an economy the size of the US, the value of credit generated will likely be in the range of tens to hundreds of billions of dollars. Credits are not a free good, and the reward of credit will increase the future compliance costs of non-participants. These non-participants are likely to be the firms with the highest transition costs.

While the distributive impacts of market instruments are potentially of an equal or greater scale than Credit for Early Action, there are several disadvantages to early crediting in terms of it equitable impacts. First, there is a high potential for Credit for Early Action having significant distributive effects while having very limited environmental impact. This is particularly true if credit is rewarded for past action (existing American proposals could potentially reward between three and twelve percent of the US Kyoto Budget on the basis of past action) and if there is large variability among companies' emission patterns relative to credit generation baselines. Second, the beneficiaries of

credit, especially credit for past action, may tend to be very concentrated. Third, the distributive impacts of Credit for Early Action are largely accidental: sometimes compensating companies for premature retirement of carbon intensive capital; sometimes penalising companies that have greater compliance costs; sometimes creating windfalls for companies that are at a fortuitous point in their capital cycle or are the lucky beneficiaries of technological developments. In contrast, market instruments can be designed to generate revenue. This revenue can be used to compensate or aid people, firms and communities facing the greatest difficulties in shifting to a low carbon economy. The revenue can also be used to reduce taxes that inhibit economic growth or job creation.

Both market instruments and early crediting may conflict with rules of the world trade regime laid down in the General Agreement on Tariffs and Trade (GATT) and the treaties setting up the World Trade Organisation (WTO). Tax adjustments and exemptions of specific domestic sectors as well as initial free allocation of emission permits could be seen as a subsidy. They will be infringing the rules of the WTO subsidy agreement if they discriminate against foreign producers, are specific to a particular sector and cause "adverse impacts" to foreign competitors, i.e. reduce their market share. While both early crediting and market instruments could potentially involve violations of world trade agreements, it is also clear that both instruments can be designed to avoid any such problems. Consistency with trade agreements does not favour either market instruments or Credit for Early Action, although it may suggest that certain possible aspects of programs are trade illegal. For instance, credit for past action could be ruled as discriminatory and trade illegal if program rules tend to concentrate credit in certain sectors.

Thus, Credit for Early Action involves some significant weakness: it does not necessarily encourage the lowest cost reductions; initially it may be less effective in encouraging the types of reductions that are most important from the perspective of reducing the cost of compliance with the Kyoto Protocol. Its environmental impact is uncertain, but it could have huge impacts on the costs of non-participants. However, Credit for Early Action is often promoted as an interim measure that could be put in place prior to the imposition of market instruments. It is also often promoted as essential to removing the disincentive created by the possibility that future market instruments will use grandfathering. However, analysis suggests that while Credit for Early Action may have some political attractiveness, inherent complexities make it harder to implement than market instruments. Moreover, the disincentive created by Credit for Early Action could be removed by a relatively simple commitment to baseline protection.

Politically, Credit for Early Action has the advantage that it does not impose any immediate costs on any parties beyond the cost of administering the system. The costs of crediting early action are significant, but they are imposed at a later date. However, the suggestion that Credit for Early Action is an easy first step is questionable. While both Credit for Early Action and market instruments can be complex in design, a degree of complexity is inherent in Credit for Early Action because of its reliance on rules rather than actual market signals (such as scarcity of emission rights or costs for emissions). A workable Credit for Early Action program will be more complex and require more administrative infrastructure than a simple (but potentially very effective) market instrument.

Nor does Credit for Early Action necessarily completely counteract the disincentive created by the possibility of grandfathering. It will do so partially, but likely not fully in all cases. Baseline protection – in particular, baseline protection that bases allocations on the "reconstruction" of business as usual emissions during the allocation base period – can eliminate the disincentive created by the possibility of grandfathering and can be adopted in the absence of a Credit for Early Action program. Completely removing the disincentive for early action will also require a clear rejection of the Credit for Early Action concept. As long as governments are discussing whether and how to pursue early crediting, firms may hold emission reduction projects in abeyance, waiting until rules are known so that they can maximise credit. Finally, it should be noted that baseline protection alone guarantees a reward for early action in a carbon constrained future. All else being equal, emitters will be better off taking early action. A commitment to the basic tenets of baseline protection could be made without establishing a major administrative infrastructure (administration would become important if grandfathering is eventually implemented).

While the added certainty of guaranteed baseline protection helps ensure consistent signals in favour of emission reductions, it will still not necessarily ensure the optimal emissions path. Announcements of future policy frameworks and minimum carbon price can further increase the signals favouring early action, but firms may gamble that government will change its mind. The early introduction of market instruments and/or other policies are still likely needed to achieve the lowest cost future emission reduction path.

While the above analysis has identified a number of weaknesses associated with Credit for Early Action, adopting Credit for Early Action may still be better than governments

taking no action. While the authors believe a combination of baseline protection and market instruments are preferable to Credit for Early Action, it is recognised that market instruments face considerable opposition from many large, politically powerful emitters. If a Credit for Early Action program proceeds a number of difficult choices need to be made in how the program functions.

Credit for early action programs could limit credit creation to projects that involve technological innovation. Although this involves some administrative difficulties in setting technology benchmarks, it is likely to be most effective in reducing future compliance costs and avoids shifting an undue burden onto non-participants. This approach would clearly need to be combined with baseline protection as it will not remove the existing disincentive to early action.

If Credit for Early Action uses a "one size fits all" approach to baselines, stringent performance baselines are likely most effective, but they may not be practical in all cases. To ensure that Credit for Early Action does not place undue costs on non-participants it is likely advisable to adopt stringent baselines and cap the number of credits created. Although this reduces environmental and economic effectiveness, the consequences of not doing this are potentially severe and could reduce prospects for ratification of the Kyoto Protocol.

The inclusion of sinks creates some unique problems that require considerably more sophistication than simple counting of increments in sequestered carbon. Setting rules for crediting sequestered carbon prior to the elaboration of Kyoto Protocol sink provisions is particularly risky.

On the other hand, there are some advantages to governments providing credit for actions that might qualify for credit under the Kyoto Protocol. Under the Protocol industrialised nations can get credit against their 2008 to 2012 emission limits by implementing projects that reduce emissions in developing countries. Credit – or certified emission reductions – from CDM projects can begin to accrue as early as 2000. However, CDM rules are not yet clear, creating considerable uncertainty as to what kinds of projects will yield credits. Governments of industrialised countries could choose to support international early action over domestic early action, because the former enlarges the country's emissions budget. However, consideration would need to given of the political, economic and local and global environmental costs of redirecting investment in emission reduction abroad.

## I. INTRODUCTION AND BACKGROUND

This discussion paper explores policy approaches for closing the gap between nations' projected greenhouse gas emissions and the level of emissions that will be allowed if the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (the "Kyoto Protocol") comes into force. Once it comes into force the Kyoto Protocol will require industrialised nations to reduce emissions in the period 2008 to 2012 significantly below current and projected levels. Specifically, the paper compares the concept of Credit for Early Action with various market instruments as means of narrowing the gap between projected emissions and Kyoto limits.

Market instruments create a market price for emissions and use the market to encourage reductions at the lowest price. This is done by placing limits on greenhouse gas emissions and allowing the market to decide where reduction occur, or by imposing a carbon tax or emissions charge. Although market instruments can be applied within a sector, in the context of greenhouse gas emissions, they are generally used to encourage reductions throughout the economy or across large sectors.

Similarly, Credit for Early Action involves creating an incentive for emission reduction throughout the economy or at least across many sectors. However, rather than imposing a carbon tax or emission charge or placing limits on emissions, Credit for Early Action programs promise that entities which take action to reduce greenhouse gases prior to the imposition of a carbon tax or emission limits will receive a credit against future taxes or limits. Up to the present, Credit for Early Action is a policy concept unique to North America, while market instruments for greenhouse gases appear to be the primary economy wide early action measures in Europe.

After providing an overview of the Kyoto Protocol and the rationale for taking early action the paper reviews the theory and specific proposals for market instruments and Credit for Early Action. The next part provides a comparative analysis of these approaches, examining their relative efficiency, environmental effectiveness, and impacts on redistribution of wealth. Credit for Early Action is found problematic on a number of counts, and is next evaluated as interim strategy for imposition while political support for market instruments develops. Finally, because of the possibility that governments may choose to proceed with Credit for Early Action, different aspects of Credit for Early Action programs are analysed. Finally, the last section provides case studies of the impacts different programs would have on different entities.

## A. Background

In June 1992, the nations of the world negotiated the United Nations Framework Convention on Climate Change (the UNFCCC). The ultimate objective of the UNFCCC is to avoid dangerous anthropogenic interference with the climate system. The first step in achieving that goal was a commitment by the most industrialised nations to develop policies and measures with the aim of returning their greenhouse gas emissions to 1990 levels by 2000.

The UNFCCC came into force in 1994, and the first Conference of the Parties in 1995 recognised that the non-binding stabilisation commitments of the UNFCCC were insufficient to avoid dangerous interference with the climate system. The conference directed the negotiation of a legally binding emission reduction commitment. This lead to the negotiation of the Kyoto Protocol in December, 1997.

In December 1997, the Kyoto Conference of the Parties to the UNFCCC agreed to a protocol that, for the first time, set quantitative limits on the emissions of greenhouse gases (GHG) from a number of industrialised countries (the "Annex B Nations"). Each Annex B Nation is assigned an amount of emissions (the nation's "Kyoto Budget") based on varying proportions of 1990 emissions. During the "First Compliance Period" from 2008 to 2012, Annex B Nations are required to reduce average annual emissions to a specified percentage of 1990 levels. Overall, Annex B Nations are required to reduce emissions to approximately 95% of 1990 levels. Actual national limits range from 92% for the EU to an allowable increase of ten percent for Iceland.

The emission reductions called for in the Kyoto Protocol are clearly insufficient to avert the continuing atmospheric build up of greenhouse gases, and are disappointing compared to earlier EU proposals for 15% cuts. Nonetheless, given rapidly increasing emissions in many countries, the Kyoto reductions potentially necessitate major changes. United States emissions are projected to exceed 1990 levels by 23% or more in 2010, but under the Kyoto Protocol the US is required to achieve a 7% emission reduction.[1] In

1 The U.N. Climate change secretariat projects aggregate greenhouse gas emissions 23% higher than 1990 levels by 2010 (see Table C.6 of UNFCCC (1998a): *Second Compilation and Synthesis of Second National Communications, Tables of Inventories of Anthropogenic Emissions and Removals of Greenhouse Gases for 1990-1995 and Projections up to 2020,* (UNFCCC Secretariat, doc. FCCC/CP/1998/11/Add. 2). More recent projections of US emissions are higher. The US Energy Information Administration currently projects carbon dioxide emissions to grow to 33% above 1990 levels by 2010: (see United States, Department of Energy, Energy Information Administration (1999a): *Annual Energy Outlook 1999,* Report # DOE/EIA-0383 (99), Washington).

Canada, emissions are projected to increase by 18%, but the Protocol calls for a 6% reduction.[2] European Union emissions are projected to increase by 6% but the EU is subject to an emission reduction target of 8%.

The Kyoto Protocol allows Annex B Parties to meet these limits through domestic emission reductions and various international flexibility mechanisms. The international flexibility mechanisms include:

- *International Emissions Trading.* (IET) International emissions trading allows Annex B Parties to buy and sell assigned amount units for First Compliance Period.
- *Joint Implementation. (JI)* Joint implementation allows Annex B Parties to transfer assigned amount units, but transfers are associated with emission reductions from specific projects. Rules regarding liability for non-compliance may be different under JI and IET.
- *The Clean Development Mechanism.* (CDM) Starting in 2000, certified emission reductions can be generated by emission reduction activities in developing countries. These can be transferred to Annex B Parties and used to increase Annex B Nations' Kyoto Budgets.
- *Joint Fulfilment.* Parties can choose to be jointly responsible for meeting an aggregate emission limit.

The Kyoto Protocol has been signed by almost all the Parties to the UNFCCC, but is unlikely to be widely ratified prior to 2000 or 2001, when negotiations over the details of these flexibility mechanisms are expected to conclude. It has not yet been ratified by any Annex B Nation.

## B. The Rationale for Early Greenhouse Gas Emission Reductions

### *1. The Environmental Rationale*

The human enhanced greenhouse effect is caused by the build up in the atmosphere of gases which remain in the atmosphere for periods that range from decades to millennia. Avoiding dangerous anthropogenic interference with the climate system entails limiting cumulative emissions over many decades. Earlier reductions also reduce environmental impacts prior to stabilisation of greenhouse gas concentrations, and they increase future

2 *Ibid.* UNFCCC (1998b).

generations' ability to choose greater levels of environmental protection. Earlier action reduces the need for deeper, more rapid reductions in the future, and reduces the risks of passing thresholds where impacts of climate change increase non-linearly.[3]

There are also other environmental benefits to individual nation's choosing early action. Aside from climate impacts, measures to reduce greenhouse gas emissions will reduce air pollution in urban areas. Tentative calculations show that the benefits of emission reduction through reduction of local pollutants, especially $SO_2$, are comparable to the value of carbon credits under a high carbon tax of 20-2000 $ per ton carbon.[4]

### *2. The Economic Rationale*

Economically, it makes sense neither to reduce emissions to Kyoto Protocol levels overnight nor to delay reductions until 2008. Ideally, the emissions path that makes the most sense is a compromise between these two extremes. It will depend on an assessment of the likelihood of the Kyoto Protocol coming into force and an assessment of how the costs of reductions will change over time.

It is clear that in many cases the long term costs of reductions will increase if action is not taken in the short term. As individuals, businesses and governments invest in infrastructure, equipment, buildings and production facilities, their decisions will have a long term impact on emissions. In the case of equipment such as cars this impact might last ten years. In other cases, e.g. roads and transportation infrastructure, the impact can last centuries.[5] If investments are made in carbon intensive capital stock, there will be a future cost of prematurely replacing such stock in order to meet future emission limitations. Ensuring appropriate investment in the course of capital stock turnover is particularly important in the context of greenhouse gases because there are few "end of pipe solutions" to greenhouse gas emissions. Solutions generally lie in increased efficiency throughout the economy.

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3 For example, the Gulf stream could stop flowing meaning that temperatures in Europe would drop by several degrees Celsius even if global temperatures rose strongly. See Rahmstorf, Stephan (1999): *Shifting seas in the greenhouse?*, in: Nature, 399, p.523-524.

4 Ekins, Paul (1996): *How large a carbon tax is justified by the secondary benefits of $CO_2$ abatement*, in: Resource and Energy Economics, 18, p. 161-187

5 Jaccard, Marc (1997): *Heterogeneous Capital Stocks and Decarbonating the Atmosphere: Does Delay Make Cents?* (Simon Fraser University, School of Resource and Environmental Management, Burnaby, BC) [unpublished].

Moreover, when governments or the private sector choose between alternative technologies – e.g. between investing in the rail system or the road system, or between expanding fossil fuel production and introduction of renewables – they reinforce a pattern of development which is increasingly difficult to turn away from. Once certain choices are made, the market tends to reinforce them. Investing in low carbon intensity technologies today may sometimes impose an immediate cost, but it will help ensure that businesses and individuals do not face higher costs in the longer term. These "bifurcation points" – points where choices are made between models of development – are most obvious in the context of developing countries and economies in transition, but also exist in developing countries.

Government could choose to delay introduction of emission reduction policies until the First Compliance Period allowing firms to assess the likelihood of future emission limits, the likely shape of future regulations and the lowest cost emissions path given these uncertainties. However, this laissez faire approach is unlikely to yield emission reduction patterns which are ideal from a broad societal perspective:

- Even in the absence of future emission limits that are likely to increase the cost of emissions or energy usage, there is some evidence that consumers and firms already under-invest in energy efficiency due to various market failures. There is also agreement among many economists that energy efficiency gains of 10 to 30% above current trends are possible at negative or zero net cost.[6] Measures which can cost-effectively overcome these barriers are justified regardless of future emission limits.
- Firms and individuals may be largely unaware of the Kyoto Protocol and its implications, and may be less able than governments to assess the likelihood of future emission restrictions and the likely cost of future emission reductions. This is especially true where climate change economics and science have become highly politicised.
- Firms and individuals are likely to apply a higher discount rate to future emission reduction costs, focussing too much on short term costs at the expense of long term economic well being;
- Given uncertainty as to the shape of future regulations, businesses may fear that they will be penalised for early emission reductions.[7] Even where firms are not directly

6 Intergovernmental Panel on Climate Change, Working Group III, "Economic and Social Dimensions of Climate Change: Summary for Policy Makers" in James Bruce et al. *Economic and Social Dimensions of Climate Change, Contribution of Working Group III to the Second Assessment Report of the IPCC* (Cambridge: Cambridge University Press, 1996)

7 See section II.B.1 and III.E.2.

penalised for reductions, they may choose not to invest in lowest cost measures if doing so negatively impacts their ability to negotiate for beneficial climate policies.

- Firm's individual investment decisions will not take into account a number of economic and environmental benefits associated with taking early action. As noted above, measures to reduce greenhouse gas emissions will also reduce air pollution in urban areas. Studies for European countries and the US indicate that secondary benefits of air quality improvements related to lower greenhouse gas emissions could offset between 30 and 100% of the greenhouse gas emission reduction costs.[8]
- Early reduction policies are likely to lead to increased research and development on energy efficiency, renewable energy and other greenhouse gas mitigation techniques. If policies lead to innovations and development of new low cost, low carbon technologies they will reduce the costs of achieving future emission reductions for other firms. Policies that encourage innovation are particularly important in achieving long term low cost reductions.

All these factors suggest some early reduction measures are appropriate. It should be noted that early actions have another benefit: they help reduce the uncertainty that makes climate change policy difficult. Policies which yield a better understanding of the marginal costs of abatement throughout the economy will help shed light on the uncertain costs of emission reductions.

Encouraging early domestic greenhouse gas emission reductions also make sense in the context of any single nation's domestic economic strategy. Lack of early domestic action is likely to result in greater reliance on international flexibility mechanisms. Having failed to realise low cost reductions during capital stock turnover, costs of compliance through domestic measures will be higher and the international flexibility mechanisms will appear more cost effective. This will result in lower overall investment in improving domestic efficiency and a redirection of capital away from the domestic economy.

A July 1999 study by the US Energy Information Administration examined the impacts of meeting the Kyoto Protocol under an emissions trading system starting in 2000 versus one that started in 2005.[9] The methodology of the report included an implicit assumption that, contrary to the previous paragraph, reliance on international flexibility

8 D.W. Pearce et al. "The Social Costs of Climate Change: Greenhouse Damage and the Benefits of Control," in James Bruce et al., above at footnote 6, at 218.

9 United States Department of Energy, Energy Information Administration (1999b): *Analysis of the Impacts of an Early Start for Compliance with the Kyoto Protocol*, Washington.

mechanisms would not be affected by the start date. Moreover, the macroeconomic study did not include economic, environmental or social benefits from reduced emissions. Despite these limitations which tend to understate the benefits of an early start, modelling indicated that earlier implementation lead to a smoother transition to a low carbon economy with lower cumulative costs. Delaying action only became relatively economic when future costs were significantly discounted.

### *3. The Political Rationale*

Early greenhouse gas emission reductions are also consistent with existing obligations. As noted above, the UNFCCC commits most industrialised nations to develop policies and measures with the aim of returning their greenhouse gas emissions to 1990 levels by 2000.

Although stabilisation at 1990 levels is a goal and not a binding commitment, in many cases Annex 1 nations cannot be said to have delivered on their commitment in a meaningful way. For instance, a 1998 report on domestic climate change policy by the Canadian Parliament's independent Auditor General concluded that many of the key elements necessary to manage the implementation of Canada's response to climate change are missing or incomplete.[10]

The failure of most Annex 1 Parties to meet the stabilisation target and the failure of several nations to implement policies that could realistically hope to stabilise emissions carries a political cost in current international climate change negotiations. Developing countries, for instance, have been highly critical of Annex 1 failures. Calls for quantitative emission caps on developing countries emissions have been criticised as premature given Annex 1 Parties' failure to implement their initial commitments.

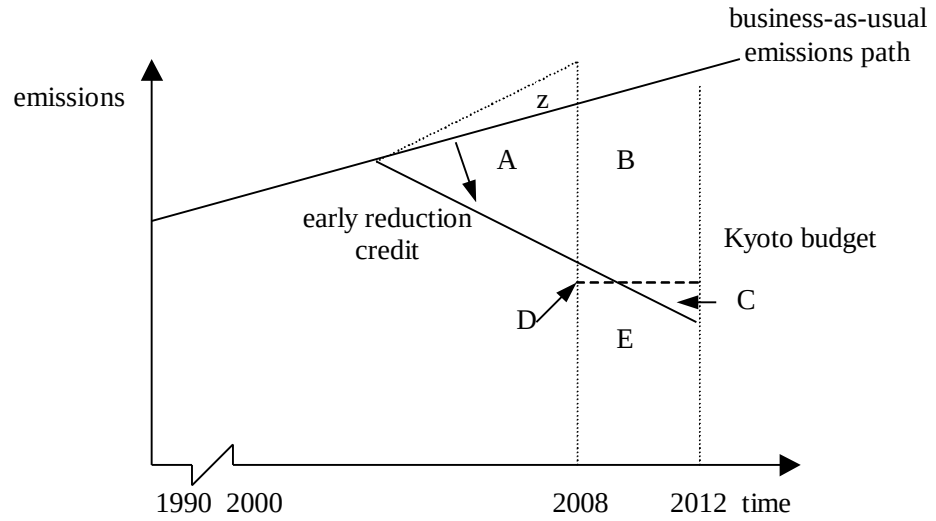
Failure to take early action is also increases the risk of non- compliance with the Kyoto Protocol. First, the Protocol calls for demonstrable progress in achieving commitments by 2005. Second, as noted above, the failure to take early action is likely to lead to increased reliance on the international flexibility mechanisms. At the same time, the EU is calling for stringent limits on use of the mechanisms. If such limits are adopted, there is an increased likelihood of a breach if early actions are not taken.

10 Auditor General of Canada (1998): *Report of the Commissioner of the Environment and Sustainable Development*, Ottawa

## II. POLICY APPROACHES TO EARLY ACTION

Given the above, governments will likely need to adopt policies prior to 2008 in order to meet the Kyoto target. Figure 1 indicates the purpose of early policies to reduce emissions. Early programs shift the emission path from business as usual-growth to a downward-sloping path. Ideally, they will reduce emissions during the first compliance period to below a nation's Kyoto Budget. While a portfolio of measures will likely be needed to achieve this end, the creation of incentives to reduce emissions throughout the economy are likely an essential part of this portfolio. Such incentives can be created by market instruments or through Credit for Early Action.

**Figure 1: Impacts of Early Policies on Overall Emissions Between Now and 2008**




A: emissions reduced through the early action policy
B: emission reduction need from business as usual to meet the Kyoto commitment
C: gross surplus
D: gross shortfall
z: non-additional reductions
E: emissions during budget period
A+z-C+D: reduction of domestic emissions budget due to early policies. The higher the reduction, the higher the internal price for emission rights if all else is kept equal

### A. Market Instruments

Outside of North America, policy makers responsible for developing economy wide incentives to reduce greenhouse gas emissions have focussed on either emissions trading and/or carbon taxes.

## *1. The Rationale for Market Instruments*

Both economic theory and experience suggest that these market instruments have a number of advantages. In particular:

- *Achieving emission reductions at lowest possible cost.* In a competitive market without any market failures, well-designed market instruments should reduce emissions at the lowest possible costs. In practice, market failures (e.g. information barriers or externalities) exist, but the market will still often be more effective than government regulators in locating low cost emission reductions.
- *One instrument yields a myriad of adjustments.* One instrument can encourage production efficiency, shifts in purchasing behaviour, shifts to renewable energy, changes in consumption patterns, and recycling, but these behaviours are only encouraged to the extent that they are the most cost effective emission reduction solutions.
- *Incentive to innovation.* Market instruments create an economy wide economic incentive to innovate in ways that reduce greenhouse gas emissions. In a traditional regulatory "command and control" environment, emitters have no incentive to reduce emissions beyond required levels and may even be fearful that innovation will lead to government imposing stricter regulation.
- *Shifting the onus for finding low cost emission reductions.* Market instruments also have an advantage in terms of the political achievability of reductions. Regulations that prescribe a particular technology or emission rate encourage businesses to exaggerate the cost of emission reductions so that they can avoid stringent regulations. Government is usually at a disadvantage in determining whether a business can cost effectively reduce its emissions. It does not have the same understanding of an emitters' needs and opportunities as does the actual emitter, and it cannot easily separate gross exaggerations from valid concerns. Market mechanisms shift the onus of finding most cost-effective emission reduction measures from government to the private sector.
- *Separation of where emission reductions occur and who bears the cost.* Market instruments generally allow government to achieve equitable sharing of costs while also ensuring cost effective solutions. Market instruments separate the issue of who pays for emission reductions and where they occur. In the case of a carbon tax or emissions trading with auctioned allowances, government can determine the distribution of benefits and costs through the recycling of revenue. Where allowances are allocated gratis, the allocation formula will determine winners and losers.

## *2. How Market Instruments Work*

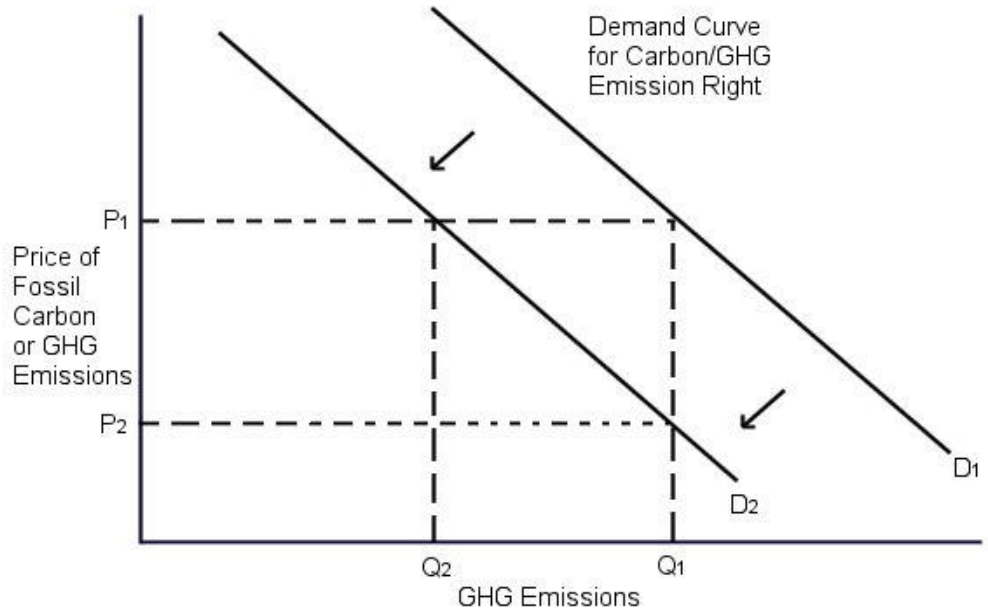
There are innumerable permutations in how an emissions trading system or carbon tax could work, but there are a number of basic elements that can be used by themselves or combined. Under a carbon tax or emissions charge, a charge is placed on emissions. In the context of greenhouse gases this can be most easily accomplished by placing a charge or tax on the carbon content of fossil fuels. The revenue can be used to reduce other taxes, to reduce the debt or fund increased program spending. The tax would be highest per unit of energy on carbon intensive fuels such as coal and non-existent on renewable energy sources. Changes to the prices of energy will be reflected in prices for products. Energy providers have an incentive to switch to renewables, manufacturers to switch to more efficient production processes, and consumers to switch to products which consume less energy, especially fossil fuel energy, in their manufacture and use. Although taxes on carbon content of fossil fuels cover the great majority of most Annex 1 emissions (e.g. 84 percent of US emissions) a tax could be extended to many other emissions (e.g. greenhouse gases from industrial processes).

Figure 2 shows how a carbon tax works. If government sets a carbon tax equal to P1, and the demand for the ability to emit carbon is as indicated by the line D1, emissions will be reduced to Q1. Overtime the carbon tax should spur innovation and technological development. This will reduce the demand for the right to emit greenhouse gases or consume fossil carbon (the demand curve moves from D1 to D2), and the same carbon tax (p1) should result in a larger reduction to Q2. On the other hand, growth in the economy will tend to move the demand curve to the right, but at the very least a carbon tax will ensure less growth in emissions.

Under emission trading programs, like carbon taxes, individual polluters are given flexibility in how to reduce their emissions. Where an emitter can, at a low or negative cost, reduce emissions or energy use beyond what is required by regulation they can sell an emission reduction credit or an emission allowance to a polluter who cannot reduce their emissions as easily. The purchaser of the credit or allowance is then allowed to emit more. Trading itself is not intended to reduce emissions; it is intended to reduce the cost of meeting a government imposed limit on emissions. (However, without trading the government imposed limits may be impractical.) The essential difference between trading and a carbon tax is that under a trading regime government controls the quantity of emissions through regulatory limits, but not the price of emission rights. Under a tax, the price is set by government, but not the quantity. Under the example in figure 2, if

government sets the quantitative limit on emissions at Q1, the price for emission limits will initially be P1, but will reduce to P2 as innovation occurs.

**Figure 2: How a Carbon Tax Works**




There are essentially three basic forms of trading that could be used to reduce greenhouse gas emissions. Any actual program is likely to combine these forms. The three forms are:

- *Downstream cap and emission allowance trading.* The quantitative limit on emissions is set by an explicit cap on actual emissions from defined sources during a defined time period. Government then makes a political choice as to how it allocates allowances to emit greenhouse gases. The total emissions permitted by all allocated allowances is equal to the cap. Allowances can be allocated through a number of different mechanisms; these including grandfathering based on emissions in a historic base period, auctioning, or allocation on the basis of production levels (e.g. one allowance per tonne of steel produced in a historic allocation base period). Several other allocation methods are discussed below in the descriptions of specific proposals. Those sources that expect to emit less than permitted by their allowances may sell surplus allowances to other sources whose emissions would otherwise exceed the allowances allocated to them. Over time, the number of allowances in circulation

can be reduced and thus total emissions are reduced. Because of the administrative difficulty of making individuals, households and small businesses responsible for their emissions, the cap is likely only to apply to major industrial sources and other large emitters.

- *Upstream cap and carbon allowance trading.* This program is similar to cap and emission allowance trading but the quantitative cap is set by regulating the source of emissions rather than emissions per se. Rather than trading an allowance to emit a given unit of greenhouse gases, allowances represent licences to sell or import carbon bearing fuels for the purposes of combustion. Exemptions or credits would be available for fossil carbon exports or carbon sequestered in long lived products. Since carbon in fossil fuels is a very close proxy for the carbon dioxide emitted by burning those fossil fuels, and since carbon dioxide from fossil fuel combustion accounts for the overwhelming majority of greenhouse gas emissions, the limitations on carbon in fossil fuels reduces greenhouse gas emissions. The cap can also be extended to other gases and other sources that can be easily and accurately monitored. In order to match demand for fossil fuels with a limited supply, allowance holders will charge a premium on carbon based fuels. Carbon allowances are valuable and the holders of the allowances are not necessarily bearing the costs of emissions reductions. Because of this, in order for a upstream program to be socially acceptable, it is likely government would need to either auction allowances or tax back windfall profits, and use the revenue to reduce other taxes or invest in government programs and transition strategies.
- *Mandatory performance standards and credit trading.* The quantitative cap on emission is less explicit than other programs. Government, rather than prescribing a cap, prescribes numerous performance standards (e.g. *x* kg $CO_2$ per kWh/ *y* kg $CO_2$ per tonne of steel produced). Emitters who cannot cost effectively meet the applicable standard can buy credits from emission reductions at other locations. Credits can be generated by improving performance beyond required standards or by reducing emissions at sources not covered by a standard.

The above classification of programs should not be taken as meaning there are only three ways of implementing emissions trading. As will be seen below, actual proposals often combine elements of programs. For instance, credit trading can supplement an upstream or downstream cap and allowance trading program. Credits can be generated by reducing emissions at facilities outside the cap, and used in lieu of allowances. Alternatively, downstream trading might be applied to the industrial sector while upstream trading or a carbon tax is applied to small sources.

### *3. Specific Market Instrument Proposals*

*a) RFF proposal for Credible Early Action: Upstream Cap and Carbon Allowance Trading*

Resources for the Future, a Washington, D.C., based environmental think tank, has proposed adoption of an upstream cap and carbon allowance trading scheme in the US by 2002. Mindful of opposition in the US Congress to the Kyoto Protocol, and aware that the Protocol may not be ratified, the RFF proposal's central features include a cap which is initially not too aggressive, and a "safety valve" which ensures the effect on energy prices is limited. The details of the program are as follows:

- *Cap initially equal to 1996 emissions.* RFF proposes initially maintaining the cap at 1996 emission levels. This represents a ten percent reduction from BAU levels in 2002 and a ten percent increase over 1990 levels.
- *Price ceiling on allowances.* If the cap leads to allowance prices that exceed a maximum level, the cap would be lifted and an unlimited number of allowances would be sold at this price. The price ceiling would initially be $25 per short ton carbon ($22.67/metric tonne or six cents per gallon of gas), but would increase by seven percent above inflation per year.
- *Revenue recycling to households and states.* RFF proposes that 75% of carbon allowance auction revenues be recycled as direct payments to US households. The remaining 25% would be distributed to states based on vulnerability of their industries and energy use by low income households.
- *Expansion to cover additional GHGs.* RFF proposes rapidly expanding the system to cover greenhouse gases not covered by the upstream cap and carbon allowance program. Depending on difficulties in monitoring and enforcing emissions and emission reductions, these gases could be included either through credit trading or by requiring allowances for their emissions.

*b) New Zealand Hybrid*

In January 1999, New Zealand published a consultation document laying out three potential options for reducing greenhouse gas emissions prior to 2008. One involved simply signalling to large scale emitters the details of a downstream cap and emission allowance trading program and allowing them to act accordingly (this would allow emitters to begin planning for emission limits and engage in forward trading). Another in-

volved imposing a low level carbon charge in 2000 and keeping it in place until a domestic emissions trading system is established.

The third involved implementing downstream emissions allowance trading in 2000 and imposing an emissions charge on sources not included in the trading system. The emissions charge would apply to all energy emissions of $CO_2$ plus major industrial emissions of other gases. Participation in the trading program would initially be voluntary, but sources not participating would be subject to a low level carbon charge ($NZ 5 to 10 per tonne $CO_2$ or $US 10 to 20 per ton of carbon). This would be replaced by a comprehensive mandatory trading program as early as 2005.

Initially, allowances would be allocated through grandfathering. Emission limits would be lower than business as usual, but the options paper does not describe how emission limits will be set for those participating in the trading system.

To ensure that least cost emission reduction opportunities are adopted, companies subject to an emission limit would be able to generate credits from emission reduction activities either in sectors subject to the carbon charge or in other emitting sectors.

*c) European Proposed Carbon Taxes*

In Europe, a number of countries have introduced carbon or general energy taxes. While smaller countries have been the pioneers in this regard, after Kyoto some of the big countries have joined the bandwagon as attempts for a co-ordinated EU wide approach failed due to protracted resistance from the UK and some Southern member countries. This development has to be seen against the background of already very high gasoline taxes in most of these countries. For example, the UK has introduced a "road fuel duty escalator" in 1993 in order to combat climate change and to raise revenues. This escalator entails an annual increase of the fuel tax by five percent in real terms that was later raised to 6%. The tax systems differ substantially:

Pure carbon tax with no exemptions:

- In 1990, Finland was the first country to introduce a carbon tax with almost no exemptions. Since 1997, a revised system of energy and carbon taxes has been in effect. The carbon tax was modified to a pure output-based tax from 1997 on. The splitting of the tax on fossil fuels into an energy component and a $CO_2$ component

has been abandoned as part of the reform in 1997. The tax rate is now determined by the carbon content alone.

Pure carbon tax with exemptions for energy-intensive industry:

- Denmark introduced carbon taxation in 1993. Danish tax rates are differentiated according to the energy intensity of a process and depending on whether companies agree to do an energy audit.
- Sweden introduced a carbon tax in 1991 to spur innovation of industry before the EU would introduce such a tax. However, after the EU did not act, the tax rate for industry was reduced to 25% of that of households. In mid-1997, the rate of the carbon tax on industry was increased to 50% of the normal rate after industrial energy consumption had grown due to this reduced rate. Reduced rates are possible for energy-intensive industries that apply for special tax relief.
- Norway has a carbon tax for households and offshore oil industry in place since 1991.

Energy tax with no exemptions:

- Italy, which has had high energy taxes for some fuels for quite some time, introduced an adder in 1999 to take account for carbon emissions. It will yield a revenue of 1.4 billion $ per year and will have raised heating oil prices by 51%, coal prices by 42%, diesel by 12%, gasoline by 7% and natural gas by 2% after five years.

Energy tax with exemptions for industry:

- Austria (introduced in 1996) and Denmark use a general energy tax.
- Germany followed with an energy tax in 1999. The originally planned exemption for energy-intensive industry was not retained due to fears of other countries' complaints for distortion of competition. Now all industry and agriculture only pays a fifth of the normal tax rates. Coal is exempt.
- The Netherlands exempted all industry from their energy tax introduced in 1996.
- The UK has announced that it wants to introduce a "climate change levy" on industrial and commercial energy use from 2001 onwards. Despite its title, it is a pure energy tax levied on energy input. Domestic and transport energy use shall be exempt. Moreover, energy-intensive industry shall be exempt if it can show that it is active

in reducing emissions. Thus these industries have argued for a grandfathered emissions trading scheme (see above).

**Table 1: Revenue from Carbon/Energy Taxes in 1997**[11]

| Country | Austria | Denmark | | Finland | Nether-lands | Norway | Sweden |
|---|---|---|---|---|---|---|---|
| | Energy Tax | Carbon tax | Carbon, energy & sulpher | Carbon tax | Energy Tax | Carbon tax | Carbon tax |
| Revenue (million $) | 474 | 457 | 3645 | 436 | 1655** | 323 | 1344 |
| Revenue per capita ($) | 59 | 87 | 693 | 85 | 107 | 74 | 151 |
| Revenue ($) per ton C emitted | 28.4 | 26.7 | 213 | 29.0 | 33.9 | 37.5 | 89.4 |

The table shows that even before Kyoto, the European countries with a carbon/energy taxation had introduced tax rates that would have yielded 15 to 40 billion $ of revenue if applied in the U.S.. From 1997, carbon and energy tax revenues have risen substantially in some countries:

**Table 2: Countries with Post Kyoto Increases in Carbon/Energy Taxes in 1999 (Estimates)**[12]

| Country | Austria | Denmark[+] | | Germany | Italy | Nether-lands | UK* |
|---|---|---|---|---|---|---|---|
| | Energy Tax | Carbon tax | Carbon, energy & sulpher | Energy tax | Carbon Tax | Energy tax | Carbon tax |
| Revenue million $ | 550 | 660 | 4105 | 4615 | 1400 | 2310 | 2810 |
| Per capita ($) | 69 | 125 | 780 | 56 | 24 | 149 | 48 |
| Per ton C emitted** | 33 | 39 | 240 | 19 | 12 | 47 | 18 |

[+] 1998 data, further tax rises announced for 1999 and 2000.
* Planned for 2001.
** 1997 emissions data.

11 Sources: Baranzini, Andrea; Goldemberg, José; Speck, Stefan (1998): Are carbon taxes an alternative to prevent climate change?, in: International Academy of the Environment (ed.): Climate change in the global economy, Geneva, p. 97-113, p. 10; personal communication from Stefan Speck, Aug. 27, 1999; World Energy Council (1998): The Kyoto Conference and Protocol, WEC Report No. 8 Update, London; own calculations.

12 Sources: Ibid.

Overall European carbon and energy tax revenues now approach 15 billion $ and will grow further.

*d) European Proposals for Emissions Trading*

While for a long time, emission trading had been seen with great scepticism among European countries, it has become more attractive after Kyoto. This is due to the pressure from energy intensive industries that want to avoid being subject to carbon or energy taxes, the impending liberalisation of electricity markets within the EU and the discussion of the positive U.S. experience with $SO_2$ trading. Currently, no system is in place but several systems are being discussed intensely. The Danish one will be the first comprehensive greenhouse gas trading system to be really operational.

(1) Danish Electricity Sector Trading Hybrid

In May 1999, Danish parliament passed a bill that specified a trading system for the electricity sector.[13] Trading starts from Jan. 1, 2000 and annual allowances decline from 23 Mt of $CO_2$ to 20 Mt in 2003 (1990 emissions were 27 Mt).[14] Combined heat and power (CHP) plants emitting less than 0.1 Mt p.a. are exempt, which means that about 90% of utilities' emissions are covered, but only the 10-15 biggest utilities. However, the exempt CHP plants' emissions are deducted from the total quotas which means that the allowances available to the utilities subject to the quota are reduced accordingly. The allowances are grandfathered based on emissions in the 1994-1998 allocation base period. The original provision that part of the allowances may be withheld by the government to take into account market entry of new electricity producers was deleted due to pressure of utilities. Unused allowances can be banked. Certified emission reductions from CDM projects lead to allocation of additional allowances. Prices and quantities of trades must be notified to the Ministry of Environment and Energy. Excess emissions are subject to a tax of 21 $/t C, which thus constitutes an upper cap for the allowance price. Revenues from that tax are earmarked for energy efficiency projects. Due to the limited number of participants, it is unlikely that the trading volume will be high. It

13 Folketinget (1999): Act 376 of 2 June 1999 on $CO_2$ quotas for electricity producers, Copenhague

14 However, the number of allowances may be raised if "1) energy demand changes considerably or unexpectedly, 2) certain types of fuel or certain power plants are no longer available to the same extent as earlier, and this causes serious technical difficulties in complying with the quota and the $CO_2$ emission permits" The notes to the act, however state that this "provision will only be applied in connection with an energy crisis which makes it impossible or extremely expensive to buy natural gas or oil, thus making it necessary for the electricity producer to use coal which emits far more $CO_2$". In 2003, the experiences from use of the system will be used to update the quota.

might be that the scheme ends up as a de-facto carbon tax if emission reduction costs are high.

(2) UK Trading Scheme for Industry

In early 1999 the Confederation of British Industry (CBI) and the Advisory Committee on Business and the Environment (ACBE) agreed to design an industry-wide scheme for emissions trading instead of being subjected to a carbon tax[15]. It shall link into a future international trading system. In late June, the UK government backed plans being drawn up by 24 large emitters and six business organizations for an emissions trading system. However, there was no agreement on whether companies that take part in the scheme will be exempted from the planned energy levy.[16] Completion of the first phase of design is targeted for the autumn.

As part of this process the International Petroleum Exchange has proposed a down-stream cap and emission allowance trading program that would cover 3,500 point sources accounting for 44% of UK emissions. The system would commence in 2001. A steadily declining cap is placed on emissions from covered sources. The system grand-fathers emitters based on 1996 to 1999 emissions. Emitters whose 1996-1999 emissions are greater than a defined ratio of actual emissions to optimal emissions are not fully grandfathered. The ratio becomes more stringent over time, thus ensuring that early actors are rewarded. Starting in 2008 permits are be auctioned.[17]

(3) Norwegian Trading Scheme

In 1998, the Norwegian government tried to extend carbon taxation to industry. Industry rallied against the proposal but suggested a domestic trading system in its place. A government commission has been tasked with developing a proposal for the end of this year with implementation by the end of 2000.

15 Confederation of British Industry (1999), Emissions trading offers a way forward to reduce greenhouse gases and global warming, Press release June 30

16 "Government backs plans" Financial Times, London, July 1, 1999, p. 10

17 International Petroleum Exchange, "Design of a UK Greenhouse Gas Emissions Trading System" (August 1999).

## B. Credit for Early Action

### *1. Introduction to Credit for Early Action*

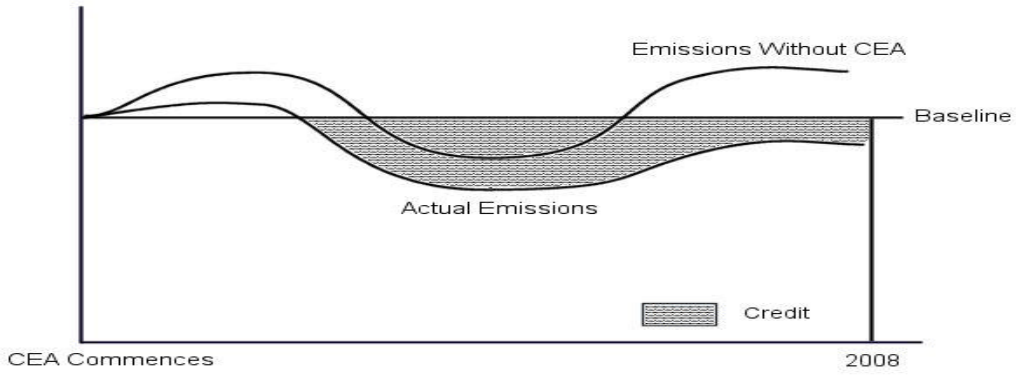
Many North American proposals for encouraging early greenhouse gas emission reduction have focused on creating incentives for voluntary emission reductions without imposing new regulations or fiscal incentives. This appears to be due to a widely perceived lack of political appetite for mandatory greenhouse gas emission limits or carbon taxes. Indeed, within the US Senate there has been opposition to any regulatory initiatives to implement the Kyoto Protocol prior to ratification.

There are two aspects of the proposals for encouraging early voluntary action: Credit for Early Action and baseline protection. Credit for early action is the core of several US proposals.

Credits are generated when an entity reduces its greenhouse gas emissions below a credit generation baseline. The baseline is set by reference to absolute emissions in a credit generation base period or emissions per unit of production in a credit generation base period. In some cases, entities can generate credits from reducing emissions at facilities that lie outside their operations. In these cases a separate baseline has to be created for the specific project.

Figure 3 provides an example of Credit for Early Action. A company gets credit for all the cumulative reductions below baseline, but not reductions below business as usual which fall above baseline. Some reductions (the area between credit generation baseline and BAU emissions) would have occurred anyway (i.e. non-additional reductions).

**Figure 3: Example for Credit for Early Action**



The credits are usable in any future where there is either a tax on greenhouse gas emissions or there are regulatory limits on greenhouse gas emissions. For instance, if an upstream carbon allowance trading program is implemented, emitters might receive allowances to import or produce fossil fuels. They could sell these to fossil fuel producers or importers. Credits are tradable, so that a company can profit from emission reductions even if it does not expect to need credits.

While Credit for Early Action involves the generation of credits that could be used under any carbon constrained future, baseline protection only comes into play if a future regulatory system uses "grandfathering." Grandfathering occurs where allowable emission levels or emission permits are given to emitters based on their emissions in an allocation base period. In the event of grandfathering, and in the absence of baseline protection, emitters who took voluntary action prior to the allocation base period would receive a smaller allocation. Baseline protection is intended to wholly or partly protect emitters from this possibility, thus wholly or partly removing a disincentive to early action.

Figure 4 indicates the relation between baseline protection and Credit for Early Action. In the figure it is assumed that credit is only given for absolute emission reductions. The area ACD represents the total credit generated. These cumulative reductions are rewarded with credits. Under baseline protection, in the event of grandfathering, the amount of reductions achieved in the allocation base period (BCDE) are added onto actual base period emissions (DEFG) for the purposes of calculating the allocation. Government might, for instance, give emitters allowances equal to 85% of their protected base period emissions (BCFG).

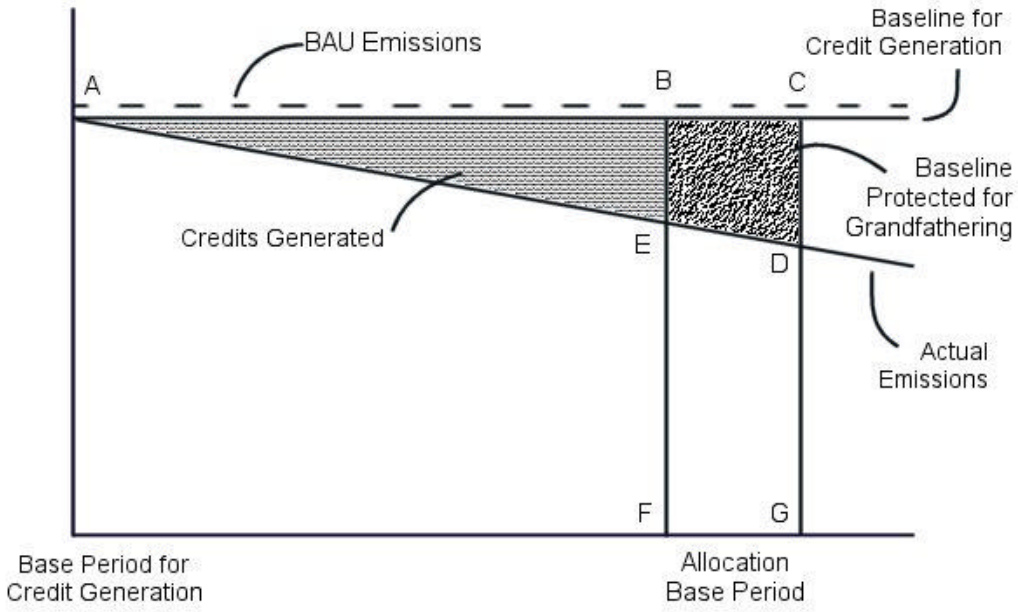
Credit for early action has several advantages similar to market instruments. In particular,

- *One Instrument encourages multiple adjustments.* Depending on its design one Credit for Early Action instrument can encourage many changes. These include production efficiency and shifts to renewable or less carbon intensive energy.
- *Incentive to Innovation.* Credit for early action can create an incentive to innovate if properly designed.

However, as will be seen in the analysis below, Credit for Early Action does not create a clear price signal that values all emission reductions equally. While it is an incentive to

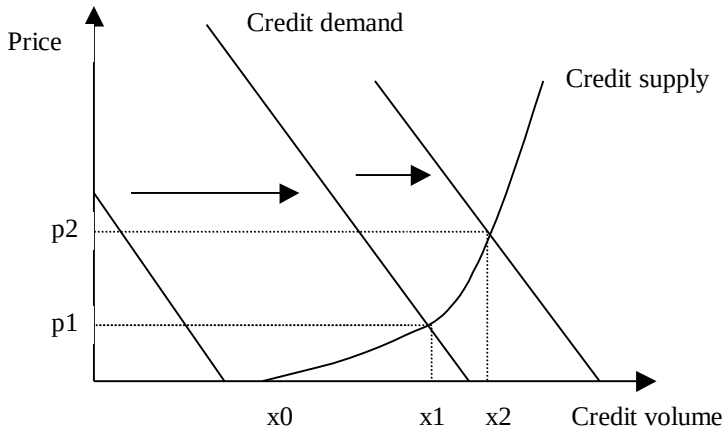
low cost emission reductions, it may not achieve lowest cost emission reductions. Credit for early action is better described as a "quasi-market instrument."

**Figure 4: Baseline Protection and Credit for Early Action**




As indicated in figure 5, there are two main forces influencing the degree of emission reduction achieved through Credit for Early Action – supply and demand for credits. Below[18] we discuss the various factors that influence the supply and demand curves and the thus the effectiveness of a Credit for Early Action program.

**Figure 5: Domestic Static Credit Market**




18 See section III.B.2.

Figure 5 assumes no international trade in emission permits.

Assuming that credits can be generated by activities that would have occurred in the absence of Credit for Early Action, and assuming that these credits will have the lowest cost, weak demand could lead to no additional emission reductions. For instance, if x1 credits can be generated by activities that would have occurred anyway, a low level of demand (represented by D1) will not result in any additional emission reductions. Trading will occur for easily verified, non additional emission reductions, but the costs of verification (even if they are purely transaction costs) will outweigh any added incentive for additional emission reductions created by credits. If the CEA system were designed to only give credit for additional emission reductions, no trading would occur. This situation might be the case if market participants expected the Kyoto Protocol to fail. On the other hand, if there is an expectation of entry into force of the Protocol and an expectation that emission levels will exceed the Kyoto budget, greater demand will result and additional emission reductions will occur. If major shortfalls between actual and allowed emissions are expected, or if high emission reduction costs are expected, the curve would move even further to the right.

For companies, participating or not participating in Credit for Early Action bears both advantages and disadvantages. For the participating company, the advantages are a prolonged emissions planning period (up to 13 instead of 5 years), partial or complete relief from future reduction obligations, a “green” public image, and in some cases the ability to sell credits that are excess to the needs of the company. Where credit is received for non-additional reductions, it will be a fortuitous windfall. On the other hand, under some proposals participants are liable if their emissions exceed the credit generation baseline or receive less credits if they do not reduce emissions to the extent they initially projected. In either case, companies may find themselves compelled to accelerate reductions that have higher costs than expected at the time they enrolled in the CEA program. Non-participating companies may be able to delay their investment and thus profit from lower opportunity costs (although there is no loss of opportunity cost if the reductions are non-additional or profitable). Similarly, they may benefit from lower implementation costs if the program as a whole leads to lower cost emission reduction technologies.

### *2. Credit for Early Action Proposals*

In the United States, by the summer of 1998 the Environmental Defence Fund ("EDF"), the Center for Clean Air Policy ("CCAP") and the Coalition to Advance Sustainable Technology ("CAST") had all proposed Credit for Early Action programs. In October 1998, a bill based on the EDF proposal, the *Credit for Voluntary Early Action Act*[19], was introduced into the Senate. In March 1999 it was reintroduced with some minor amendments by Senator John Chafee as the Credit for Voluntary Reductions Act[20] (the "Chafee Bill"), and in July 1999 the *Credit for Voluntary Actions Act*[21] (the "Lazio Bill") was introduced into the US House of Representatives by Congressman Rick Lazio. In Canada, a group with representatives from several large emitters and several environmental organisations introduced the Canadian Early Emissions Reduction Program proposal ("CEERP") to a meeting of ENGOs, industry and government in March 1999.

Although the Chafee Bill, the Lazio Bill and the CEERP proposal have become the focus of discussion in Canada and the US, the debate over design elements of a voluntary incentive program has not narrowed appreciably. Basic aspects of system design remain unresolved. It is uncertain whether credits will be generated relative to an absolute emissions baseline or an emissions performance per unit of output baseline. The aggressiveness of the baseline for credit creation or baseline protection are uncertain. The treatment of past action, treatment of foreign emission reductions, treatment of carbon sequestration by sinks and the existence of a cap on credits created are unresolved.

#### *a) The Chafee Bill*

The Chafee Bill establishes a basic legal framework for generating greenhouse gas reduction credits. It anticipates detailed rules being set out by regulation and in early action agreements between participants and the administration. The following basic rules are set out in the Bill:

- *Tonne for tonne credit.* Credit under the Chafee Bill is an allowance to emit one metric tonne of carbon dioxide or its equivalent. One tonne of credit is given for every tonne of reductions below a baseline.
- *Flat baseline.* The credit generation baseline will generally be equal to average emissions in the base period.

19 U.S. Senate (1998): S.2617, 105th Congress, 2d Session.
20 U.S. Senate (1999): S.547, 106th Congress
21 U.S. House of Representatives (1999): H.R. 2520, 106th Congress

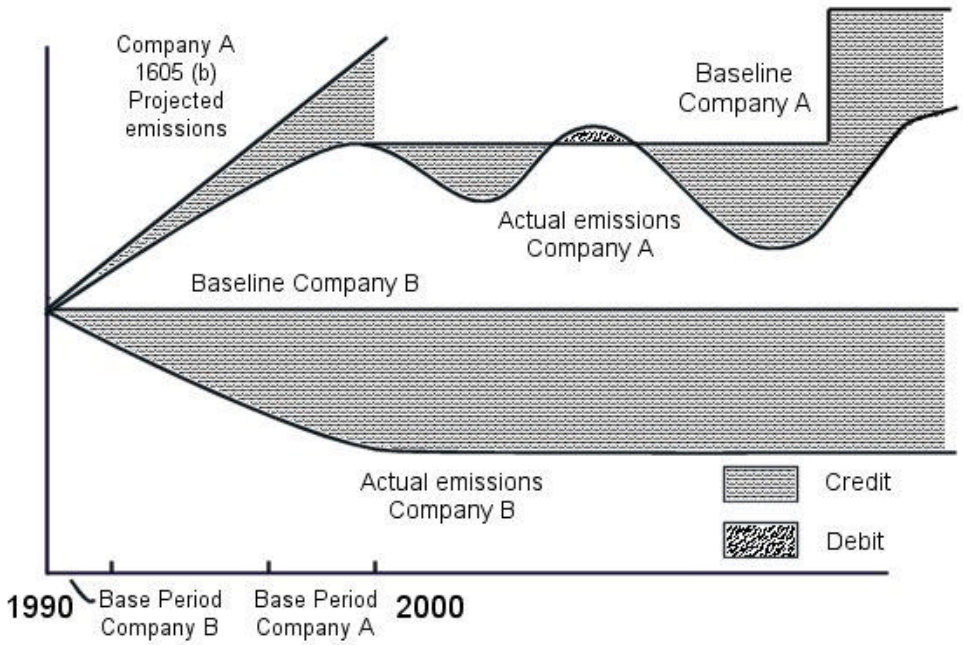
- *Cumulative net reductions.* Credit generation is cumulative. A one tonne per year reduction in 1991 could yield a 13 tonnes of credit if domestic limits are imposed in 2003. If a company exceeds its baseline in any year this exceedance will be deducted from credits generated.
- *Credit generation until imposition of domestic limits.* Credit generation will run until carbon taxes or domestic emission limits are imposed.
- *Baseline adjustments for acquisitions and new production investments.* If after the base period, the participant acquires or sells an existing source of emissions, the credit generation baseline is adjusted accordingly. Participants' baselines will also be adjusted upward if they build a new facility. For "new sources" (including new facilities that rely solely on renewable energy) baselines will be adjusted upward by an amount based on the emissions performance of the most efficient commercially available technology for comparable facilities. It is not clear what will constitute a new source.
- *Full credit for past action.* The Bill provides participants with the option of choosing a base period between 1990 and 1995, or using the default base period of 1995 to 1998. Emitters choosing an earlier base period begin credit generation earlier and credits will continue to be generated until domestic emission limits are imposed.
- *Credit for pre-base period actions.* In addition, participants can claim tonne for tonne credit for any reductions from 1991 until the end of their base period, so long as the reductions are reported under the US voluntary reporting program (the "1605 Program") or other voluntary US Climate Change Action Plan programs before 1999. Although these reductions do not continue to generate credits after the base period, the criteria for what reductions can be counted may be less stringent than for reductions after the base period. In particular, the Chafee Bill appears to recognise reductions from growth baselines that may not qualify for credit after the base period. Reductions must simply be real, meet minimal accuracy standards and not subject to competing ownership claims.
- *No cap on credits.* There is no limit on the number of credits which can be generated under the Chafee Bill.
- *Upstream emissions and leakage from production shifts.* Early action agreements are required to include provisions to guard against shifting of emissions from a source covered by an agreement to a source not covered by an agreement.
- *Offsets.* Credit can be claimed for offset projects – i.e. projects not owned by the credit generator. Rules for offset credit generation are to be set out in regulation.
- *Pooling.* Different companies and government agencies are allowed to pool their emissions and act as a single participant. The Bill contemplates agreements covering

sources not owned by participants, but the rules and baselines applicable to such sources are undefined.

- *Baseline protection.* If allowance allocations are based on emissions in a historic period later than a participant's base period, an amount equal to the credits generated during the historic period will, for the purposes of the allocation, be added onto the participant's greenhouse gas emissions during the historic period.
- *Recognition of international actions.* Participants are entitled to receive credit for any actions in other nations which result in transfers of assigned amount units or certified emission reductions to the US. Agreements can also provide credit for reductions that occurred under US AIJ projects that do not result in an increase in the Kyoto Protocol emission limit.
- *Recognition of carbon sequestration.* Under the Chafee Bill, any increases in carbon sequestration in biological or other reservoirs are treated as reductions.

Figure 6 indicates the basic elements of Chafee. Company A is a company with increasing emissions relative to its baseline and thus chooses a late credit generation base period. Company B has decreasing emissions, and thus chooses an early base period. While figure 6 shows baselines as flat, it should be noted that most companies will have increasing baselines due to the addition of new sources.

**Figure 6: How the Chafee Bill Works**



*b) Lazio Bill*

The Lazio Bill is closely modelled on the Chafee Bill but includes some very significant changes. These changes include greater detail around the generation of credit by manufacturers of products with lower greenhouse gas emissions, detailed rules for generation of credits from different forest and land use change activities, and, most significantly, stringency of baselines and the use of credit generation baselines which are tied to production levels.

The Chafee Bill adjusts a firm's credit generation baselines upwards if the firm establishes a new source (thus accommodating growth), and requires regulations ensuring that credit will not be given for shifting of production and emissions to sources excluded from the CEA system. Lazio, on the other hand, adjusts baselines according to a "economic change factor" that reflects changes in production output from the base period. If a firm's production drops or increases after the base period, the credit generation baseline will see a corresponding drop or increase. This may eliminate some of the need for specific rules regarding production curtailments, shutdowns, or new sources. The bill does not specify how product output should be measured. Potentially, it could be measured as corporate value added, corporate revenue or units of specific products (e.g. tonnes of kraft pulp, number of cars manufactured).

Credit generation baselines are also more stringent under the Lazio Bill. Baselines are adjusted by a GDP adjustment factor. Essentially, to generate credit, a firm's emissions performance (emissions per unit of output) must improve at a rate faster than growth in US GDP. If all firms participated in the program the average of all baselines would be flat. In comparison, if all firms participated in the Chafee Bill, the average of all baselines would be rising due to adjustments for increased production.

The Lazio Bill sets out specific rules for generating credits from the manufacturer or construction of products that consume electricity or emit greenhouse gas emissions. Essentially, manufacturers or builders can take responsibility for emissions resulting from the lifetime emissions associated with the use of the products they build or manufacture. Actual emissions and credit generation baselines are the product of the number of products sold by the participant in the US, each product's expected useful life, and an annual emission factor for the product. It is not clear whether the builder of an energy efficient house would receive immediate credit for the full life of a house.

The Lazio Bill represents major improvements on the Chafee Bill regarding the counting of sequestration activities. Credit is only generated for sequestration on privately owned land. Reforestation or afforestation on unforested areas will generate one tonne of credit for every tonne of sequestration during the credit generation period. Credit will be generated by changes to forest management if there is an annual increase in carbon stocks that exceeds the average increase in carbon stock on comparable land in the same region. These credits will be discounted for leakage if the changes to forest management reduce timber supply from the participant's land and shift production to other lands. Permanent protection of mature primary forests is valued at fifty percent of the biomass of the carbon stock on the land protected. Participants are responsible for maintaining increased sequestration levels for at least fifty years.

*c) Canadian Early Emission Reduction Program ("CEERP")*

CEERP is also based closely on the Chafee Bill, but includes several significant differences. The following description is based on the draft of the CEERP proposal released in July 1999. This version differs from Chafee on the following points:

- *Declining baseline.* Like Chafee, CEERP gives credit for absolute reductions. However, CEERP includes an improvement coefficient in its baseline. At time of print the improvement coefficient had not yet been settled, but CEERP was proposing that rate of improvement necessary to generate credit would depend on emissions in the chosen base period compared to 1990 emissions. Thus, for example, a participant with emissions 11% above 1990 levels in the base period might have a baseline which declined by 0.5 per annum, while a participant with emissions only 4% above 1990 levels might only be required to reduce emissions at 0.25% p.a.
- *Responsibility of participants for net debits.* In addition to having emissions which exceed the baseline being deducted from credits owed, a participant that, on a cumulative basis, exceeds the baseline is responsible for purchasing credits from other participants or purchasing international emission units equal to the excess.
- *Indefinite credit generation.* So long as the CEERP program continues, participants are exempted from regulatory emission limits or carbon taxes.
- *No credit for pre-base period actions.* Participants can choose any credit generation base period between 1990 and 1999, but credit cannot be claimed for reductions prior to the base period.
- *Upstream emissions.* Baselines and measured emissions levels include both the actual emissions from a facility and upstream emissions associated with its energy use.

If a firm reduces its energy consumption, the firm will get credit for resulting reductions in upstream emissions. A firm can also generate credits by switching to energy suppliers with lower upstream emissions. (The emissions baseline will be based on emissions from the energy supplier used during the credit generation base period; measured emissions will reflect the change in supply.) On the other hand, suppliers' of energy – not consumers – will receive credit for any improvements in their performance.

- *Leakage from production shifts.* Baselines are adjusted for production shutdowns. In addition, if audits indicate that reductions were the result of significant production curtailments, the resulting reductions may be discounted or invalidated.
- *Cap on credit created by limited access to program.* Under CEERP, government establishes a budget for total credit creation under the program. The program can limit the creation of credits by either terminating the program or not allowing new participants if project credit generation exceeds the budget.
- *Offsets.* Like the Chafee Bill CEERP recognises offset projects. The participant adopts the project as if it were part of the participants' operations. The emissions reductions from the offset project must be additional to what would have occurred in the absence of adoption.[22]
- *Recognition of international actions.* CERs can be counted in meeting a participants' CEERP reduction obligations. For purposes of promoting Canadian experience in areas not yet addressed internationally, government is given the flexibility to provide credits for pre-2008 projects in other Annex B Nations, and pre-2000 AIJ projects, even if the Kyoto Protocol does not recognise such reductions.
- *Recognition of carbon sequestration.* Special rules will be developed for sequestration. Recognition may be given for some "leading edge" projects not recognised under Kyoto, but government could limit its recognition of such projects.
- *Baseline protection.* Under the Chafee and Lazio provisions for baseline protection, if there is grandfathering, the credits generated during the allocation base period are added onto the participant's calculated emissions for the base period.[23] CEERP, on the other hand, counts absolute reductions during the allocation base period. For the purposes of allocation these are added back onto actual emissions during the allocation base period. The reductions do not need to be below the credit generation base-

22 CEERP does not actually use the term "additional". Instead it refers to whether the project has produced "real and incremental emission reductions." One of the criteria for determining incrementality is "whether or not it can be reasonably demonstrated that Canada's national GHG emission liability is reduced from what it would have been had the project not been adopted (e.g. the project exceeds prevailing technology or management practices in that sector)."

23 See Section 11(a)(2) of the Chafee Bill.

line, and may be the result of any actions occurring after the credit generation base period.

*d) Center for Clean Air Policy*

Like other proposals, the Center for Clean Air Policy proposal calls for comprehensive, entity-wide approach to emissions reporting and credit generation. Credits are given for cumulative net reductions prior to the implementation of regulated limits on emissions. There are, however, significant differences from the Chafee proposal:

- *Declining baseline.* Most companies are subject to a declining baseline. The baseline is a straight line between the participant's 1998 actual emissions and seven percent below its 1990 emissions by 2008. [24]
- *Performance baseline for the electricity generation sector.* For utilities, a performance baseline (carbon per kWh) will be used. The baseline is a straight line between a utility's actual 1998 performance and a national average performance target for 2007. The national performance target is equal to what would be required for the utility sector to achieve an absolute seven percent reduction below 1990 levels.
- *Cap on credit.* The CCAP proposal limits the amount of the national emissions budget for 2008 to 2012 that can be allocated as credit. Four percent of the budget can be allocated for post 1998 action and one percent for pre-1999 actions. If the tonnage of creditable reductions is greater than the tonnage cap on credits, participants would receive a fraction of tonnes reduced.
- *Limited credit for past action.* One fifth of the cap on credit would be allocated to rewarding reductions registered under the 1605(b) Program. Alternatively, the 1998 starting point of a company's credit generation baseline would be adjusted upward to reflect average annual reductions from qualifying 1605(b) reductions. Under that option, participants would only receive credit for actions from 1998 forward.
- *Leakage.* Credits are not given for shut downs. The CCAP proposal does not deal with leakage from shifts in production.
- *Limited role for offsets.* Project specific credits could be generated from projects that would be difficult to capture in the standard entity wide approach to credit generation. A bounty schedule would define emission reduction measurement protocols.
- *Recognition of international actions.* Companies would be able to purchase CERs.

24 Details of the CCAP proposal are found in Center for Clean Air Policy (1999): *Key Elements of a Domestic Program to Reward Early GHG Emissions Reductions*, Washington, and Center for Clean Air Policy (1998): *An International Market in Credits for Early Greenhouse Gas Emissions Reductions*, Washington. Both documents are available on the CCAP website http://www.ccap.org.

- *Recognition of carbon sequestration.* At least initially, early reduction programs would be limited to energy related carbon dioxide.

*e) Coalition for the Advancement of Sustainable Technology*

The Coalition for the Advancement of Sustainable Technology is a public policy organisation of corporate chief executive officers. This description of the CAST proposal is based on the May 1, 1999 version of the proposal.

- *Performance baseline.* The CAST proposal awards credit for improvements in emissions per unit of output. For most companies this is measured as $CO_2$ eq. per unit of revenue. For the electricity sector it is measured as emissions per unit kWh, and for the public sector it is measured as emissions per dollar of operating expenses and amortised capital expenses. Annual reductions are calculated by measuring the difference between the performance baseline and actual performance and multiplying this by the participants' annual output.
- *Declining baseline.* The credit generation base year is 1995 and the baseline decreases at 1.5 percent per year.
- *Full credit for greater reductions.* Full tonne for tonne credit would only be given for reductions that reflect an improvement rate that exceeds three percent per annum.
- *Full credit for post 1995 action/limited credit for 1995 and earlier.* 1995 is the base period. Credit would be given for pre-1995 actions on a case by case basis.
- *Upstream emissions.* Like CEERP, companies count emission reductions achieved by reducing their demand for electricity and electricity producers are credited with reductions in emissions per kWh. Electricity consumer's upstream emissions and baseline are adjusted on an ongoing basis to reflect most recent emissions per kWh from the producer.[25]
- *Credit for purchasing renewable electricity.* Like CEERP, a participant can get credit by switching from a high emissions electricity supplier to a low emissions or renewable supplier. To encourage renewables, a special ten percent bonus is given to emission reductions resulting from production of more renewable based energy.
- *No cap on credit created.* No cap is created on the total tonnage of credits created.

25 The CAST proposal is somewhat ambiguous in this regard, referring both to emissions per KWh being frozen at base year values and being based on most recent emission factors. This interpretation is based on personal communications with one of the CAST authors, Mike Burnett, Vice President, Trexler and Associates.

## C. Early International Action

The Kyoto Protocol only directly credits early action in the context of the Clean Development Mechanism (CDM). Certified Emission Reductions in non-Annex B nations can be generated beginning in 2000 (although rules may be uncertain until some later date), and used as credit towards meeting Annex B obligations for the 2008 to 2012 period. In this chapter, we will provide a short description of the CDM and make proposals on how national and international action can be combined.

The Clean Development Mechanism (CDM) has a number of special properties because it was designed both to reduce the cost of achieving the Kyoto Protocol and because of the desires of developing countries to ensure development that benefited them. The explicit purpose of the CDM is to achieve sustainable development. Ideally, the CDM will shift investment patterns at key junctures in developing countries development paths, reenforcing a pattern of less carbon intensive development. Participation by the host countries is voluntary and projects must lead to "real, measurable, and long-term benefits related to the mitigation of climate change" and emission reduction must be "additional to any that would occur in the absence of the certified project activity". Emission reductions achieved abroad need to be independently certified as being additional before they can be transferred to the investing country.[26] This certification process brings about problems of defining the business-as-usual case (in contrast most domestic Credit for Early Action proposals simply define a "one size fits all" baseline that is unlikely to work in the context of developing countries).

Currently, the rules for determining additionality, certifying projects, measuring emission reductions and whether projects meet the sustainable development purposes of the CDM are completely undefined. The international community has identified the CDM as a high priority for further definition of rules, but little progress has been made to date. The 6th Conference of the Parties to the UNFCCC, scheduled for the fall of 2000 or early 2001 has been set as a deadline for further elaboration of the CDM. Because of the importance of the CDM to the US and several other members of Annex B, it is unlikely that there will be widespread ratification of the Kyoto Protocol until after the further resolution of CDM rules.

The impact of Credit for Early Action or market instruments on domestic emission reductions will clearly be affected by their relation to the Clean Development Mechanism.

26 Kyoto Protocol, Art. 12 (5).

Both emitters and governments will need to consider this interaction in designing programs.

In the absence of a cap on use of the Kyoto Mechanisms (the CDM, international trading, joint implementation and bubbles), the price for CERs and forward contracts for assigned amount units set an upper bound on the price for early action credits or domestic emission allowances. Similarly, if assigned amount units or CERs can be used as a credit against carbon taxes, they will set an upper bound on the tax level.

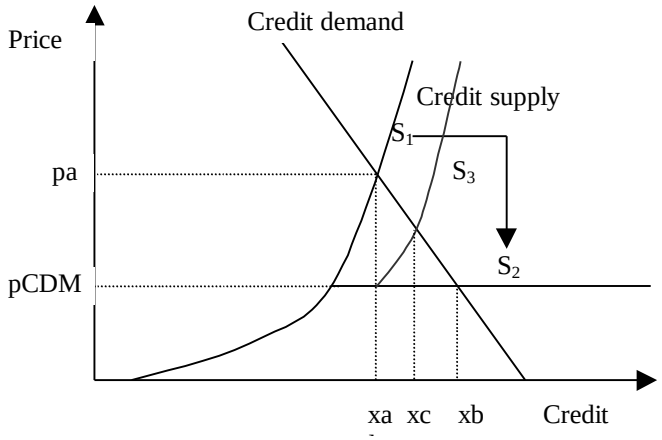
Depending on which project categories are eligible for the CDM, costs per unit of $CO_2$ equivalent for reductions achieved under the CDM are supposed to be considerably lower than those in Annex B countries. On the other hand, adders for CDM administration and for adaptation measures against climate change in especially vulnerable countries will increase the costs of "Certified Emission Reductions" (CERs).

If a cap on use of the Kyoto Mechanisms is imposed, as declared by the EU ministers of the environment,[27] governments will need to define upper limits for credits to be acquired through these mechanisms. Paradoxically, this could cause a run-up for these limited GHG reduction options, thereby delaying domestic investment. As shown in Figure 7, costs for CERs will bend the domestic supply curve from $S_1$ to $S_2$. As soon as their price level is reached domestic credits will no longer be attractive. If a quantitative restriction (Xa) for CERs is chosen, $S_3$ will result. In practice, the CDM supply price will not be stable but will rise as higher quantities are reached. Countries that chose not to support CDM in phase I may have to acquire CERs later when their costs will be higher.

Early CDM credits could thus delay domestic action, thereby contradicting the objective of a domestic early action program. Although there might be some technology spin-off of CDM projects, most of the solutions required for developing countries (e.g. building up a decentralised power grid) are not applicable to emission reduction needs of the industrialised world.

27 "Common EU Position on 'Ceilings'", Joint Implementation Quarterly, 2/1999, p. 5

**Figure 7: Influence of CDM Credits and Forward Prices for Domestic Credits**




## III. ANALYSIS

This part is a comparative analysis of the strengths and weaknesses of the Credit for Early Action approach versus market instruments approach. It begins by discussing the properties of a market for credits and compares the extent to which different instruments create an effective price signal that encourages least cost emission reductions. It then compares the probable environmental effectiveness of market instruments versus Credit for Early Action, the impacts of both on equitable sharing of emission reduction costs, compatibility with WTO rules and effects on competitiveness. Much of the analysis suggests significant advantages to the use of market instruments as opposed to Credit for Early Action. The question then becomes, does Credit for Early Action make sense as an interim strategy? If so, how should what are the pros and cons of various design elements? These questions are discussed in the final section. Finally, the interrelation between credit for early domestic action and credit for early international action is discussed.

### A. Efficiency and the Creation of a Price Signal

Above, in the "Introduction to Credit for Early Action" and "How Market Instruments Work" sections, this paper examined how both Credit for Early Action and market instruments create incentives to encourage emission reductions throughout the economy. While incentives are created in both cases, Credit for Early Action programs do not cre-

ate the same clear price signal for reductions. There are several aspects to this distinction between Credit for Early Action and market instruments:

- Credit for early action is less likely than a market instrument to shift the investments which are most important from the perspective of reducing long term compliance costs (i.e. early credit is less likely to increase investment in research and development of low carbon technologies, and less likely to increase investment in major capital projects that have a long term impact on emissions);
- Credit for early action is less likely to result in least cost reductions because, some reductions within a company are not creditable and it may be impossible to effectively reward cost effective structural shifts;
- Credit for early action inherently creates perverse incentives to engage in behaviour that is not economic in its own right.

### *1. Achieving Compliance with Kyoto at Lowest Cost*

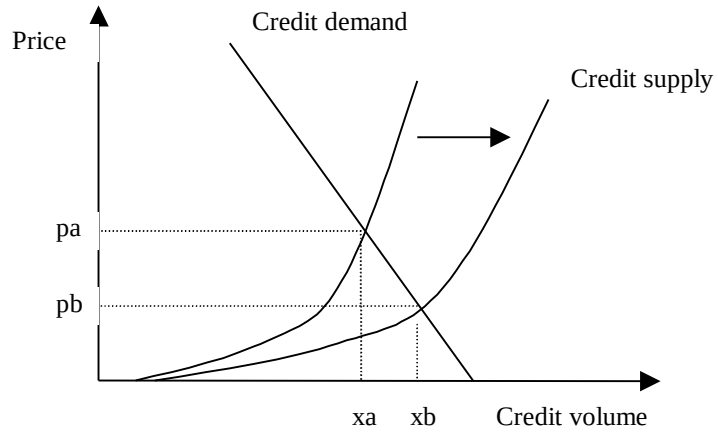
In order to minimise the costs of complying with the Kyoto Protocol, policies should ideally target abatement that involves significant capital investments that will effect emissions into the First Commitment period. Policies should also specifically encourage technological innovations that reduce the cost of achieving reductions in the long term. Credit for early action is problematic on both counts. Ideally, Credit for Early Action will affect the supply curve of low cost emission reductions. At the same time credit will tend to make emission standards more stringent for non-participants. As shown in figure 8, it could theoretically lower the cost of emission reductions for the whole economy, possibly offsetting the negative impact on non-participants.

However, as discussed below,[28] during the period prior to widespread Annex 1 ratification and likely coming into force of the Kyoto Protocol, Credit for Early Action provides little added certainty as to the value of an emission reduction. The value of credits is dependent on perceptions regarding the likelihood of future emission limits and a number of other intangibles. For projects involving significant investments in capital or research and development, capital projects with long lead times before reductions occur, and projects with long term emission impacts, investments are already likely to be influenced by the possibility of future emission limits (although lack of baseline protection provides a countervailing influence). Provision of baseline protection along with measures that reduce uncertainty by signalling the future value of low carbon technology

28 See chapter III. B.

may have a greater impact than Credit for Early Action on innovation. Both early introduction of a market instrument (by signalling that government is serious) and announcement of a future minimum price for carbon will give greater certainty, especially in the short term before the coming into force of the Protocol.[29]

**Figure 8: Credit Market with Innovation**




In period a, xa credits are sold at price pa. If the incentive to innovate leads to successful development and penetration of new technologies, the credit supply curve will be shifted to the right over time and in period b a higher credit quantity xb is sold at a lower price (pb).

While these weaknesses are inherent in Credit for Early Action, it should be noted that Credit for Early Action could be re-designed, to the greatest extent possible, to encourage innovations in technology. Section II.F.3 discusses ways of revamping Credit for Early Action to maximise innovation.

Specific elements of Credit for Early Action may also make programs less effective in encouraging low carbon technology innovations. For instance, CEERP imposes a liability for participants that fail to reduce emissions below a baseline. Participants that have net cumulative emissions that exceed their baseline (i.e. net "debits") are required to purchase credits from other participants, or purchase CERs or AAUs. A participant that believes it might be able to reduce emissions using a new technology is discouraged from participating, because the participating in anticipation of reductions from an unproven technology carries a risk. CEERP thus encourages easy reductions using known technologies while discouraging risky investment in the cutting edge technologies that

29 Centre for International Economics (1999): *Early greenhouse action*, Canberra, p. 62.

are most important for reduction of long term compliance costs. Similarly, proposals to implement a cap on credit generation through a reservation system or through first come/first serve issuance of credits favour reductions that are already planned. Moreover, reservation systems may need to include a penalty for generating less credits than anticipated (this would be needed to avoid reserving more credits than can be reasonably expected). Like the CEERP debiting proposal, this encourages investment in known technologies over cutting edge technologies.

While ratification and coming into force of the Kyoto Protocol remain uncertain, Credit for Early Action provides a less certain signal than market instruments as to the value of investments in low carbon technology. However, as the entry into force of the Kyoto Protocol becomes certain, there is a risk that Credit for Early Action will over-value immediate reductions in emissions.[30] This is good from an environmental perspective, but in some cases, it may be economically preferable to delay reductions. Early introduction of a market instrument can also lead to emitters bringing forward abatement opportunities from later in the pre-commitment period. However, the risk of over-investing in immediate early action can be reduced under market instruments by choosing either a less aggressive reduction target or emissions tax and slowly increasing the stringency of the target or tax as the First Compliance Period approaches.

Similarly, it should be noted that both Credit for Early Action and market instruments may encourage reductions that do not continue through the First Compliance Period. While there is an environmental and learning value to such reductions, they may not reduce compliance costs. This problem is likely to be more significant under Credit for Early Action because the value of reductions are not phased in over time.

### *2. Least Cost Reductions*

Compared to market instruments, Credit for Early Action is not only problematic in terms of its ability to encourage least cost compliance with the Kyoto Protocol. It is also problematic in terms of encouraging least cost emission reductions.

#### *a) Market Instruments*

Under well-designed market instruments all emissions have a similar opportunity cost. Under the RFF proposal for instance, if a one ton carbon allowance is auctioned for

30 Ibid.

$20.00, it theoretically encourages all parties that can reduce fossil carbon consumption at a cost of $20.00 or less per tonne to do so. In a competitive market, any action that reduces emissions by one tonne should yield a $20 saving. As the system proposed by RFF is expanded beyond the 82% of greenhouse gas emissions caught by upstream carbon allowance trading, there is a $20 benefit from making equivalent reductions at other emissions sources.

Economic theory suggests that if the market price for carbon allowances is twenty dollars, recipients of free allowances will increase their prices in the same manner as if they were paying a twenty dollar per tonne carbon tax, or paying twenty dollars per tonne of allowances. Thus, price signals created by emissions trading or emission charges flow through the economy, are incorporated into the costs of carbon intensive products, and encourage substitution to less carbon intensive inputs.

Even where market instruments are a mix of trading and carbon taxes, they can generally be designed so that all emission reductions are valued equally – i.e. they have the same opportunity cost. For instance, under the New Zealand proposal, the ability to generate emission reduction credits within sectors outside the trading regime, means that if lower cost emission reductions lie in those other sectors they can be sought out first. (Likewise, a party subject to the emissions charge should qualify for a one tonne tax credit if they purchase and retire emission allowances.)

Some market instruments can, of course, place different opportunity costs on different emissions. For instance, mandatory performance standards combined with credit trading[31] creates a situation where, despite a uniform price for credits, not all emission reductions have a similar opportunity cost. There will be less of an incentive to substitute highly carbon intensive products with less carbon intensive products, if manufacturers of the carbon intensive products are subject to a less stringent performance standard than manufacturers of the less carbon intensive substitutes. Similarly, while carbon taxes and upstream cap and carbon allowance trading systems give governments opportunities to remove existing distortionary taxes, there is a risk that governments may

31 For instance, one of the greenhouse gas emission regimes evaluated by the Canadian National Roundtable on the Environment and Economy (NRTEE) involved mandatory performance standards combined with voluntary credit trading: see NRTEE (1999): *Canada's Options for a Domestic Greenhouse Gas Emissions Trading Program*, Ottawa. Proposals have also been made for a downstream emission allowance trading system in which allowances are allocated on the basis of annual production levels and emission factors: see Rolfe, Christopher (1998): *Turning Down the Heat: Emissions Trading and Canadian Implementation of the Kyoto Protocol,* Vancouver, p. 261.

also choose to create distortions by subsidising sunset industries that are no longer viable in a low carbon economy. Market instruments can also create perverse incentives to engage in behaviour that is otherwise uneconomic. For instance, if new large industrial sources are required to purchase allowances from existing sources, while small sources are subject to performance standards, there will be an incentive to establish new production capacity at small sources – even if they are less economic and have higher emissions. However, despite these potential shortcomings in market instruments, the problems are not inherent in the design.

*b) Credit for Early Action*

While market instruments can be designed to impose equal opportunity costs for all emissions within the sectors subject to them, under Credit for Early Action the value of a reduction will be variable, and there will be less of an incentive to make least cost emission reductions.

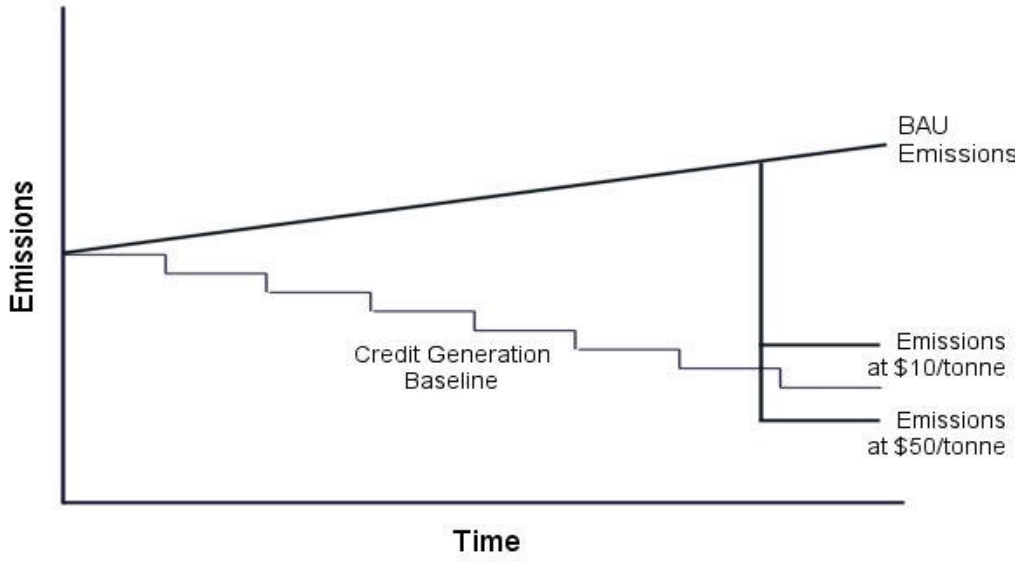
Unlike market instruments, the market can not be relied on to yield the lowest cost emission reductions even if there is a liquid credit market. Governments can try to overcome these limitations, but efforts to do so will either be open to abuse or will rely heavily on bureaucratic oversight and tend to increase transaction costs. They may also decrease the environmental effectiveness of the program or have larger, possibly undesirable, impacts for the equitable sharing of emission reduction costs.

(1) Some Reductions not Creditable

In the absence of offsets, the value of an emission reduction will depend on the relation between a firm's business as usual emissions and the baseline set by the state. For a firm with BAU emissions that are equal to or below its credit generation baseline, every tonne of reductions will have a value equal to the market value of a credit. However, to varying degrees all existing Credit for Early Action proposals will create situations where business as usual emission rise relative to the credit generation baseline. In figure 9, a firm can reduce emissions significantly at very low cost ($1 per tonne) but, even with those reductions, its emissions will remain above the credit generation baseline. The firm can only reduce its emissions further at very high cost ($50 per tonne). In this situation, even if the value of a credit is $15 per tonne, Credit for Early Action does not increase the attractiveness of making low cost emission reductions. (The company may still choose to make the low cost reductions in order to reduce its potential exposure

once Kyoto is ratified, but in the example given, this choice is unrelated to the incentives created by Credit for Early Action.)

**Figure 9: Credit Generation Baseline too Low for Participation**




There are three potential responses to this problem: allow credits to be generated on a project by project basis through offsets; use less aggressive baselines; or establish individual baselines for individual companies reflecting business as usual emissions. Each possible solution creates problems.

(a) Offsets

The Chafee Bill and CEERP proposal allow the use of offsets. Allowing the use of offsets in a Credit for Early Action program creates new problems. First, allowing offsets undermines the utility of standardised credit generation baselines. Participants' with business as usual emission trends that are below the standardised baseline would use the standardised credit generation baseline and generate credit for non-additional emission reductions. Parties with business as usual emission trends that exceed the standardised credit generation baseline would be better off not participating directly in Credit for Early Action. Instead, they could allow adoption of various projects under their control and buy back the resulting credits. This way credit could be generated even though an entity's emissions are above the credit generation baseline.

CEERP tries to address this problem by imposing an additionality requirement and allowing participants to adopt projects owned by other parties. Under CEERP it must be reasonably demonstrated that the adoption of the project will lower Canada's GHG emissions. Emissions associated with the adopted project are added to the participant's baseline, and the participant can claim emission reductions from the adjusted baseline. Although this still allows companies to secure credits without achieving firm wide reductions, it aims at eliminating credit from single projects that would have occurred anyway.

Determining additionality is likely to prove difficult especially if many entities try to avoid entity wide baselines by allowing adoption of emissions from their facilities and subsequently purchasing credits. CEERP proposes determination of additionality based on factors such as comparison with prevailing practices and viability of a project under prevailing investment practices. These determinations will likely prove difficult for agencies that are not familiar with a particular industry and have limited access to confidential information.

(b) Less Aggressive Baselines

Another means of ensuring that all emission reductions are valued equally is to either establish a lax approach to baselines which ensures that virtually all emission reductions are creditable. If credit were given for all improvements in emissions whether they reflect absolute reductions or improvements in performance – there would always be some incentive to make low cost improvements.

However, it would also mean that credit is given for a large number of non-additional emission reductions. Credit for non-additional emission reductions will increase the supply of credits, depressing the price for credits and reducing the number of additional emission reductions. It will also increase future compliance costs for non-participants. Efforts to limit the transfer of costs onto non-participants by imposing a cap on credit creation will further reduce environmental effectiveness.

(c) Case By Case Baselines

Individualising baselines so that they reflect BAU emissions of a specific company can theoretically avoid excessive credit creation from non-additional emission reductions, but would be bureaucratically cumbersome and entail high transaction costs. For instance, entities participating in credit creation could be required to carry out a green-

house gas emission reduction audit. The audit could identify all emission reduction opportunities, with an analysis of their cost and financial payback. The baseline from which creditable emission reductions are measured would be equal to the performance achievable by a firm if it implements all measures that have a pay back of a specified amount.[32] To the extent that the baseline is accurate it will ensure that all additional emission reductions have an equal value. However, like the assessment of additionality in the context of offsets, it creates an incentive for industry to exaggerate the costs of emission reductions, and as is dependent on the ability of government or auditors to accurately assess emission reduction opportunities. The potential for gaming has lead all of the leading Credit for Early Action proposals to focus on use of standardised baselines.

(2) Structural Changes are not Rewarded

Many low cost emission reductions are likely to be the result of structural changes in the economy caused by shifts to production of more energy efficient products and shifts to inputs that have less embodied greenhouse gas emissions. As noted above, market instruments will lead to changes in prices that reflect the differences in emissions associated with different products, and changes in cost will lead to substitution to less carbon intensive inputs where they are most cost effective.

The following example indicates how, under a market instrument, the market can lead to investment in cost effective structural changes. A carbon charge or greenhouse gas emission charge is placed on carbon content of fuel and industrial emissions of other greenhouse gases. This will increase the price of emissions intensive aluminium relative to steel. Even if an allowance trading system with gratis allocation of allowances is imposed, economic theory suggests that the same increases in product prices will occur.[33] On the other hand consumers, faced with higher fossil fuel prices will be demanding lighter, more energy efficient cars, leading to an increase in demand for aluminium. If aluminium car construction is a solution to climate change, despite its high emissions intensity, aluminium will prevail in the market. If not a solution, other solutions will prevail. This example has been chosen because of recently published competing claims that steel (or aluminium) is better for reduced greenhouse gas emissions. With a market

32 See Rolfe, Christopher (1999): *Early Crediting and Baseline Protection: Issues of Immediate Concern*, Vancouver (available at West Coast Environmental Law Association website: http://www.wcel.org).

33 Steel and aluminium manufacturers will demand a higher price for their product that compensates for the fact that at lower prices they would be better off reducing production and selling allowances

instrument, economic theory suggests that the market will sort out the competing claims.

Unfortunately, this sort of adjustment is more difficult in a Credit for Early Action system. Unlike market instruments, under many Credit for Early Action proposals, aluminium manufacturers will have no incentive to reduce production and increase the price of their product.

First, some proposals contain provisions that work against credit from reduced production of energy intensive goods. Performance baselines in the Lazio Bill and CAST proposals will not reward decreased production of energy intensive goods unless firms are able to increase production of other goods or services. Under CEERP, credit from reduced production risks being invalidated.

Second, even if credit is available for shifts away from greenhouse gas intensive products, some manufacturers of energy intensive products may face no downside to increasing output of these products. They may not be participants in Credit for Early Action system. Alternatively, investment in new production facilities for energy intensive goods may be rewarded by an upward adjustment of baselines (as in Chafee and CEERP) or lead to credit generation if the new facilities are more efficient (CAST and Lazio). So long as some firms do not charge more for their products because there is no opportunity cost to producing energy intensive products, other manufacturers may be unable to increase prices and decrease production in a way that effectively reduces overall emissions. If they were allowed to generate credit from reducing production of carbon intensive goods, equally carbon intensive competitors who are not participants in the early crediting system could simply increase their production, and there would be no overall reduction in emissions.

There is a risk that Credit for Early Action could even encourage changes that increase emissions. Under CEERP and the Lazio Bill, manufacturers of more energy efficient cars can gain credit. Car manufacturers will have a strong incentive to switch to aluminium. However, because Credit for Early Action is unlikely to yield adjustments to steel and aluminium prices that reflect their greenhouse gas emissions, there is no countervailing incentive to switch away from aluminium. If steel components are better for reducing greenhouse gas emissions, Credit for Early Action could encourage a move in the wrong direction. While this risk could be dealt with through subjecting all credit generation activities to lifecycle analysis, the current dispute between the emissions im-

pact of aluminium vs. steel is testament to the difficulty of doing life cycle analysis of large numbers of emission reduction activities.

Credit for early action systems can, of course, include design elements that encourage shifts to less carbon intensive inputs, but doing so may encourage changes in suppliers without changes in aggregate emissions. For instance, under the CEERP and CAST proposals, a consumer can get credit for switching from an electricity provider with high upstream emissions to one with low upstream emissions. Unfortunately, neither proposal guards against a nominal shift in supply arrangements with no changes in overall production of low and high emissions electricity. Credit generating industries could switch from buying coal fired electricity to hydro power, but consumers and non-credit generating industries could switch to coal, due to the price decrease caused by lower demand.

### *3. Perverse Incentives*

The lack of a clear economy wide price signal in Credit for Early Action can reward activities which shift the location of emissions without achieving actual emission reductions (i.e. credit for projects which create leakage is probable). This may create perverse incentives for uneconomic activity. There are various ways in which credit could be given for emissions shifting. These and the difficulty in accounting for them are discussed further below.[34]

### *4. Which will be the Target Group for Early Action Crediting?*

Even without Early Action Crediting, entities are currently undertaking early action on GHG emission reduction. There may be various reasons for this kind of non-incentivated early action. Many public sector entities have been influenced by a recognition of the secondary benefits whether economic or environmental of greenhouse gas reductions. Within the private sector, there are a number of motivations. One is certainly marketing, all the more for first movers. Limiting greenhouse gas emissions is a positive asset to a company's public image, and it is not surprising that fossil fuel providers and chemical companies are among the first to take action. For transnational companies, the expectation of future climate policy in one or more countries of operation is very real. Investment in outdated equipment might turn out more expensive over its lifetime than applying state-of-the-art technology. A voluntary company target might even help pre-

34 See Section III.B.3

venting stricter legal restrictions. While searching for the most cost-efficient solutions, many "no-regret" options may appear, thus paying off at least partly the investment. In Part IV the illustrative example of BP Amoco's internal trade model is presented as an example of early private sector action.

What is the profile of companies that under the current situation are not yet taking voluntary action? These companies may be sceptical of the actual predictions on climate change and subsequently hope for a change in climate policy in the long run, which would devaluate any truly additional investment in emissions reductions. Belonging to a pressure group that opposes the Kyoto Protocol may also prevent a company from taking visible action. If the company operates outside the public notion (which cannot be taken for granted over long periods) there is no marketing benefit in taking early action. The company could already be highly efficient and expect high marginal costs for further reduction or does not expect to be submit to future regulations as its emissions are very low. Other reasons could be that companies mainly operate outside Annex 1 countries or that their financial situations do not allow for discretionary investments. Among these there will be many medium sized enterprises.

Early Action Crediting can only partially react to these hindrances. Small and medium sized enterprises might be interested most in creating tradable credits, but will only incur extra investment if there is a rough price estimation or, better, a ready market or guaranteed price for credits.

### *5. Conclusions*

Encouraging investments in innovative low carbon technologies, and shifting investments in long lived capital stock toward lower carbon alternatives are most important from the perspective of lowering Kyoto compliance costs. In the short term, the clarity of the price signal created by market instruments is likely to be more effective than current Credit for Early Action proposals in encouraging this type of investment. Indeed, specific aspects of some Credit for Early Action proposals may disadvantage these investments relative to investments in known technologies that have less permanent impacts on emissions or compliance costs. Simply guaranteeing a future minimum price for emissions may be more effective than Credit for Early Action in achieving compliance at lowest cost. In the longer term, both Credit for Early Action and market instruments could lead to the acceleration of emission reductions beyond what is optimal

from the perspective of reducing Kyoto compliance costs, but the ability to phase in market instruments over time reduces this problem in the context of market instruments.

Policies will be most efficient and most effective in causing cost effective emission reductions if all emissions have equal opportunity costs. Although some proposals for market instruments create differences in the opportunity costs of emissions, well-designed market instruments will create an equal opportunity cost for all emissions. Ensuring an incentive to pursue least cost reductions is more difficult in the context of Credit for Early Action systems. Reductions that are not below credit generation baselines have no incremental value. Moreover, incentives to reduce emissions through structural shifts to lower carbon intensity inputs may either be non-existent or ineffective.

## B. Environmental Effectiveness of Market Instruments and Credit for Early Action

The last section compared Credit for Early Action and market instruments in terms of their ability to reduce the cost of compliance with the Kyoto Protocol, and in terms of their ability to achieve the lowest cost emission reductions in the pre-commitment period. However, it ignored the climate, local air pollution, human health and other environmental benefits of achieving more reductions in the short term. This section discusses the relative environmental effectiveness of market instruments and Credit for Early Action.

### *1. Market Instruments*

Because they generally create a clear market signal, environmental effectiveness of different market instruments is relatively easy to predict (at least in theory). As shown in figure 2, above, the effectiveness and cost of market instruments are relatively simple to predict from a theoretical perspective. Cap and trade programs will reduce emissions to the defined cap. The difference between projected emission trends and the cap gives a good indication of environmental effectiveness of the program. The long and short term effectiveness of a carbon tax is harder to predict in practice, but is theoretically simple: if twenty percent emission reductions are possible over ten years at prices below $25.00 per tonne, a $25 per tonne charge should yield a 20% emission reduction in ten years. Economists will inevitably argue over business as usual emission trends and the effectiveness of different levels of carbon tax, but there is a theoretical basis for predicting

effectiveness, and economists are familiar with the macro economic models that allow them to predict effectiveness.

However, emissions trading that does not cover all emissions will be subject to leakage. Moreover, the issue of baseline protection comes in when initial allocation is to be decided. Baseline protection can only be achieved without perverse incentives if there is independent verification which leads to transaction costs. Thus it is likely that real world emissions trading programs will suffer relevant efficiency losses compared to theory.

### *2. Credit for Early Action*

Predicting the effectiveness of a Credit for Early Action system is comparatively difficult. As shown in figure 5 above, the effectiveness of early crediting will depend on supply and demand for credits. The effectiveness of an early crediting system is thus dependent on a number of variables (in addition to the cost of emission reductions which determines effectiveness of a carbon tax):

- *The number of creditable, low cost additional emission reductions.* Some low cost reductions may not be pursued because they are not creditable.
- *The number of creditable, non-additional emission reductions.* Large amounts of credit from non-additional emission reductions will increase the supply of credit, and increase the volume of credits generated. However, it will depress prices and thus decrease the incentive for emission reductions that are additional to what would occur in the absence of Credit for Early Action.
- *Perceptions as to the likelihood of future emission limits.* Early action credits only have value if there is future regulation of emission limits. If emitters expect the Kyoto Protocol to fail, there will be less demand for credit.
- *Perceptions as to the future value of one tonne credits.* A Credit for Early Action system will be less effective if most emitters expect a low price for domestic allowances, AAUs, or CERs.
- *Discounting of future cost savings.* A Credit for Early Action system encourages immediate investments in emission reductions in return for potential future cost savings. These future cost savings will be discounted.
- *Extent of non-creditable emission reductions necessary to generate credit.* More stringent baselines will – up to a point – increase the number of additional, non-creditable emission reductions that are pursued in order to begin generating credit.

- *Perceived risk of credits being discounted.* As discussed below, several proposals include a credit budget – a limit on the total amount of the Kyoto Budget allocated to Credit for Early Action. In some cases the cap is enforced by limiting the number of participants in the Credit for Early Action program; in other cases credits are discounted so that the portion of the Kyoto Budget apportioned to Credit for Early Action is not exceeded. Either way, credit for non-additional emission reductions will reduce the effectiveness of a program. If most credit goes to a few participants with non-additional emission reductions little is left to encourage shifts in the emissions trajectory. Similarly, if credits from additional emission reductions are at risk of being severely discounted due to credit for non-additional emission reductions, there will be less incentive to reduce emissions.

Several observations should be drawn from the above.

First, overly stringent baselines as well as overly aggressive baselines can reduce the effectiveness of Credit for Early Action. A stringent baseline will decrease the amount of credit generated by non-additional emission reductions; this will increase the price for credits and encourage more reductions. It will also reduce the amount of a limited credit budget used to compensate for non-additional reductions. Finally, more stringent credit generation baselines will lead to emitters pursuing additional emission reductions which are not creditable because they are above the baseline. On the other hand, as baselines become more stringent there will become an increasing number of additional, cost effective emission reductions that are not be pursued because the total cost of reductions to generate credits outweigh the value of the credit.

Second, Credit for Early Action will work best if there is minimal variation among emitters' emission patterns and emission reduction costs relative to the chosen metric for setting baselines. If, for instance, all emitters can achieve a 1.5 percent per year reduction in emissions per unit of revenue (the CAST requirement) at no cost, there will always be an incentive to make low cost emission reductions. Similarly, if very few emitters exceed the 1.5 percent performance improvement rate in a business as usual scenario, there is little risk that a limited credit budget will be used to reward non-additional emission reductions. On the other hand, if there is great variability in emission patterns and costs, more participants with low cost emission reductions will have no incentive to pursue those reductions, and a limited credit budget may be spent on pursuing non-additional emission reductions.

Unfortunately, at time of writing, the authors were unable to locate any attempt to quantify variability among corporate emission reduction patterns (either measured as absolute emissions (e.g. CCAP), absolute emissions adjusted for asset transactions and new sources (e.g. CEERP and Chafee) or measured as emissions per unit of production (Lazio, CAST). Several relevant studies are underway, but not complete.[35] However, anecdotal evidence suggests that differences in technological opportunities and different opportunities to reduce emissions as capital stock is replaced make for significant differences in emission patterns among companies and sectors. For instance, business as usual projections for the US aluminium sector suggest that, despite modest growth, reductions of PFC emissions of twenty five percent between 1993 and 2010 will be achieved due to improved technology. In Norway, the aluminium industry has made considerable progress in achieving an agreed 50% cut in PFC emissions between 1990 and 2000.[36] Canadian Industry Program for Energy Conservation (CIPEC) reports 1990 to 1994 improvements in energy efficiency/intensity between sectors that vary between a decrease in efficiency of 4.9% (glass) to an improvements of 19.2% (pulp and paper).[37] In the case of utilities, declining performance baselines will give little incentive for a hydro based utilities to meet new demand through investment in natural gas, while they may provide credit for non-additional emission reductions to a coal fired utility that is doing the same thing.

Third, investment in additional domestic emission reductions for the purpose of generating credit is very speculative. If there is much chance that credits will be discounted, investments in domestic emission reductions will be more risky than investments in international flexibility mechanisms. This may minimise the extent of investment in additional domestic actions.

Finally, the variables involved in determining the effectiveness of Credit for Early Action are considerably more complex than the variables involved in determining the effectiveness of a carbon tax or emissions trading. For this reason, there has been little

35 Both the Canadian Industry Energy End-Use Database and Analysis Centre in Burnaby, Canada, and Lawrence Berkeley National Laboratories in the US are working on studies which look at variability in emissions per unit of production in fairly disaggregated sectors. (Neither study looks at different corporate entities.)

36 Mark Storey (1996): *Policies and Measures of Common Action: Demand Side Efficiency: Voluntary Agreements with Industry* Paris, OECD Environment Directorate, Second Draft. Personal communication with Peir Stiansen, Norwegian Ministry of Environment.

37 Canadian Industry Program for Energy Conservation (1995): *1994-1995 Annual Report,* Toronto.

attempt to quantify the reductions achievable by Credit for Early Action in anything but the most cursory way.[38]

### *3. Leakage*

Programs can create situations where there is an economic benefit to shifting emissions to another location. A program that rewards this shifting – also know as leakage – will be less effective in reducing greenhouse gas emissions.

Generally with market instruments, the potential for leakage will be minimised if the system is comprehensive. On the other hand, Credit for Early Action programs inherently create incentives to shift production or consumption to goods with lower embodied emissions; to outsource production that involves higher emissions, and to simply reduce production[39] but do not create an inherent cost to shifts in the opposite direction.[40] Credits may be generated for reductions at one location, but these may be completely offset by leakage from shifting production to other locations. Of course these problems also occur if an emissions trading system is introduced with only partial coverage.

All Credit for Early Action proposals have some provisions against credit from displaced emissions. However, operationalisation of these provisions is often undefined, and often certain types of leakage are ignored.[41] For instance, the Chafee Bill simply states that early emission agreements will ensure that only net emissions will be credited in circumstances where emissions are displaced to sources not covered by an early action agreement. The CAST proposal includes nothing aimed at capturing leakage from

38 See below at III.C.2

39 See Michaelowa, Axel; Stronzik, Marcus (1999): Early crediting of emission reduction – a panacea or Pandora's box?, FEEM Discussion Paper 48.99, Milan.

40 See chapter III.A.2

41 All proposals include provisions against credit generation due to corporate re-organisations or asset sales. For other types of leakage the Chafee Bill simply states that early emission agreements will ensure that only net emission reductions will be credited in circumstances where emissions are displaced to sources not covered by an early action agreement. The Lazio Bill requires rules to avoid credit for outsourcing production, but does not refer to rules to avoid credit from shifting production to less carbon intensive products (If units of productions were defined very narrowly, differentiating between different carbon intensities, this leakage would be caught by the Lazio Proposal). The CEERP proposal does not have any definitive rules guarding against leakage through reduced production, outsourcing or shifts in product, but suggests that the CEERP agency could review the credit created by entities that have taken no emission reduction actions. Under the CAST proposal, participants are required to report outsourcing that has an impact on emissions which exceeds a certain significant threshold of $CO_2$ emissions, and emission reductions associated with the outsourced activity are ignored for the purposes of crediting. Shifts in production to low emissions activities are not caught if they do not involve mergers, divestitures or outsourcing.

shifts in production to low emissions activities if they do not involve mergers, divestitures or outsourcing.

The challenge of operationalizing provisions against leakage is significant. For instance, quantifying the leakage associated with reductions in production or shifts in production mix is daunting, requiring knowledge of the emissions intensity of different products. Unfortunately, such information is often unavailable, difficult to produce or not sufficiently disaggregated.[42] Government administrators will have extreme difficulty assessing whether or not reductions are real.

Rules to avoid leakage may also create loopholes. For instance, under CEERP, if a firm sells a facility, the vendor's emission baseline will be adjusted downward to reflect the loss of the facility. If the purchaser is a non-CEERP participant the vendor will loose credits generated by the sold facility. Under these rules an entity could sell off facilities which have emission increases while maintaining ownership of facilities that have non-additional emission reductions. Owned by the same company the reductions would be cancelled out by the increases and no credits would result, but by selective asset sales, credits can be generated.

### *4. Conclusions*

The environmental effectiveness of Credit for Early Action is difficult to predict in comparison to market instruments. The speculative nature of credits may make them less effective in motivating additional emission reductions. Both too lax and too stringent a baseline reduces effectiveness. Credit for early action will be more effective if there is less variability among company emission patterns relative to the chosen baseline metric. Credit budgets will reduce effectiveness, but may be necessary for other reasons.

Both market instruments and Credit for Early Action can potentially create perverse incentives under which emitters can gain through activities that simply shift emissions elsewhere. However, the lack of a clear price signal in early crediting programs increases the potential for leakage significantly. Credit for leakage is not only inefficient and inequitable, it reduces effectiveness of a program by depressing the price for real emission reductions.

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42 See section III.F.2. See also US, Department of Energy, Energy Information Administration (1999c): *Changes in Energy Intensity in the Manufacturing Sector, 1985-1994*, Washington, p. 8.

## C. Distributing Costs and Benefits of Emission Reductions

The design of market instruments or Credit for Early Action programs will have significant implications on how the costs and benefits of reducing emissions will be borne by society. All of the proposals described in this report potentially involve transfers of assets that, for an economy the size of the US, range from tens of billions of dollars to hundreds of billions.

The distributional impacts of market instruments will depend on: the size of an emissions charge or stringency of an emissions cap; where low and negative cost emission reductions exist; and how either auction/emission charge revenue is recycled or how allocations of allowances or emission limits are set. In cap and trade programs with free allocation of allowances, the allocation formula will create winners and losers. Grandfathering will reward large emitters with low and negative cost emission reduction opportunities; performance standards will reward efficient producers. With a carbon tax or a program where allowances are auctioned, the sharing of costs will be determined by the reallocation of revenue.

Generally, different market instruments can be designed to have the same distributional impacts. For instance, all revenue from a carbon tax could be recycled to emitters in proportion to their historic emissions. This would mimic the distributional effect of a downstream cap and emissions allowance trading program that grandfathers allowances. (Large emitters tend to oppose a carbon tax on the basis that politically it will be more difficult to achieve a distribution equivalent to grandfathering.)

Credit for early action will similarly create winners and losers. The determinants of who wins and looses are: the eventual value of credits; and how baselines relate to low and negative cost emission reductions. Firms that have business as usual emission trends that are lower than credit generation baselines will have windfall credits. Firms that have opportunities for low cost, creditable and additional emission reductions will also generally benefit.[43] Firms that have no low cost opportunities to generate credits are likely to suffer. Credit for early action programs thus can have an important influence on competitiveness of both participants and non-participants, depending on their de-

43 They may not benefit if there is a cap on the amount of the Kyoto Budget allocated to Credit for Early Action and there are so many creditable non-additional emission reductions that the additional reductions are no longer economic.

sign[44]. If both credit and baseline protection are provided, participants have the incentive to reduce greenhouse gas emissions immediately and thus divert funds from other uses, reducing competitiveness in those fields. However, the mobilisation of "no regret" potential may lead to additional revenue that could be fed into other uses. Which effect will be greater depends on the scale and speed of mobilisation of "no regret" potential. A positive influence on competitiveness will be the marketing value of participating in the early credit program.

Reduction of costs for greenhouse gas mitigation in the commitment period leads to a medium-term growth in competitiveness by enhancing profit. If credit or baseline protection leads to innovation in emission reduction technology in the medium term, it could potentially lower the incentives for more technological development in the longer term. However, innovation in other fields might be higher as more funds have been available. The overall evaluation of this development depends on the degree the future will be greenhouse gas constrained: Competitiveness of participants could fall in the long run if early crediting has reduced### research that would have led to reduced emissions and therefore to sinking compliance costs.

Therefore, while the creation of winners and losers is inevitable, programs need to be carefully examined to determine if their distribution effects are reasonably equitable and politically acceptable. In comparing different programs several equity issues stand out.

### *1. Higher Burden for Firms with Higher Costs of Adjustment*

Allocating portions of the Kyoto Budget on the basis of early action is a zero sum game. Whatever the form of future emission reduction regimes, all else being equal, Credit for Early Action will increase the cost of compliance for non-participants. These firms may be non-participants because they already face the highest costs of emission reductions. In the short term, non-participants will not undergo a change in absolute competitiveness but their relative competitiveness will rise if the "no regret" effect for participants is lower than the capital diversion effect.

The only way early crediting will not increase the costs of compliance for non-participants is if it leads to major technological innovation (i.e. if it shifts the supply curve of emission reductions to the right). As noted above, Credit for Early Action may

44 We understand competitiveness to be defined financially, i.e. depending on the level of profit, i.e. revenues minus costs.

not be as effective as market instruments in leading to innovation unless it is specifically designed to credit innovation.[45]

If larger amounts of credit are generated – either because the program is successful in encouraging wide ranging reductions, because of large amounts of credit from non-additional emission reductions or the implementation of emission reduction activities earlier in the pre-compliance period – the distributional implications will be greater. Appendix 1 describes various scenarios for Credit for Early Action and their impact on the compliance shortfall faced by different companies in two or three company universes. Even if credit is only given for additional emission reductions and credit generating reductions are phased in slowly during the pre-compliance period, the impact on non-participants is significant. In Scenario 1 for instance, Credit for Early Action limits emission growth to 24% from 34% in the absence of Credit for Early Action. It also increases the costs to non-participants by fifteen percent or more. In a scenario that is more plausible given current proposals, some companies will get credit for past reductions (by definition non-additional) and companies are likely to accelerate reductions in the pre-compliance period to maximise credit. In Scenario 2, Credit for Early Action limits the growth in aggregate emissions to 26% from 32%. It also increases the non-participant's compliance shortfall by 23% to 32%.

### *2. Potential for Limited Impact and Significant Redistribution*

The second scenario in Appendix 2 suggests that a relatively ineffective early credit system could still have profound distributional effects[46]. The same could be said of a downstream cap and emission allowance trading program or a system of mandatory performance standards and credit trading. The cap or standards could be lax allowing companies to bank allowances in the absence of additional emission reductions. As the cap becomes more aggressive the banked credits will have more value. However, as noted above, the very existence of a cap or performance standards sends a strong signal that should encourage further emission reductions. Given the variables that affect the effectiveness of Credit for Early Action, it is difficult to determine whether Scenario 2 underestimates or overestimates the potential for redistribution with few additional emission reductions.

45 See sections III.F.1 and III.A.1.

46 See also Michaelowa/Stronzik (1999), above at footnote 39, for a microeconomic analysis of redistribution.

The following is a list of different categories of credit generating activities with attempts to quantify the potential credit that might be generated.

- *Future emission reductions.* Estimates for the total amount of credits that might be generated under an American Credit for Early Action program in which tonne for tonne credit is given range from four to 53 percent of the Kyoto budget. At a value per tonne of carbon of $50 ($13.65 per tonne $CO_2$) this amounts to somewhere between 14 and 194 billion dollars.[47] Although these estimates depend partly on program design, the variability seems to be mainly based on the assumptions used, and the assumptions have received little analysis.[48] These estimates do not factor in credit for non-additional emission reductions. Given indications of considerable variation in past corporate emissions paths credit for future non-additional action is likely to be significant.
- *Credit for past action.* Past emission reductions (by definition non-additional) could also claim a significant portion of the budget. For instance, under the Chafee Bill rough estimates suggest that three to twelve percent of the US Kyoto Budget might

47 This is based on the following: US gross emissions in 1990 measured as $CO_2$ equivalent (5.8 billion tonnes) times Kyoto reduction target (0.93) times years in Kyoto budget (5) (yielding budget of 27 billion tonnes $CO_2$ eq.) times conversion factor tonnes of carbon per tonne of $CO_2$ (.273) times fraction of budget used for credit (0,04 to 0.53) times $50 dollars per tonne carbon

48 None of the estimates reviewed included credit for non-additional emission reductions. In all cases the estimates simply assumed a rate of participation and measured the difference between an assumed emission path followed by all participants and a baseline. In all cases the baseline was either the business as usual emission emissions projected for the US economy or a flat line from 1999 or 1996 to 1998 emission levels. The 4% figure is contained in Nordhaus, Robert et al. (1998): *Early Action & Global Climate Change – An Analysis of Early Action Crediting Proposals*, Pew Center on Global Climate Change, Arlington, p. 22. It assumes that 50% of emitters participate (no basis given for this estimate), that emitters choose 1996 to 1998 as their credit generation base period, and that baselines are not adjusted upward to reflect new sources or increments in productive capacity, and that all participants make absolute reductions of one percent per year. The 53% figure (also contained in Nordhaus et al.) assumes every emitter in the economy participates and is immediately successful in reducing emissions to seven percent below 1990 levels, and assumes that the baseline represents business as usual emission trends. The Natural Resources Defence Council estimates that 21 percent of the US Kyoto budget that could be spent on emission reductions from 2000 forward. This assumes 100% participation, credit for all reductions from business as usual and all emitters following a straight line emissions path from current levels to seven percent below. It should be noted that the 21% and 53% figures contain obvious overestimates of participation. These figures also assume business as usual is the baseline – something, none of the proposals explicitly call for. Nonetheless, use of business as usual emission trends may be as accurate a representation of baselines used under proposals such as the Chafee bill as use of a flat line. Since the Chafee Bill calls for baselines being adjusted upwards for new sources, business as usual emission trends would be an accurate representation of actual credit generation baselines if one assumes that all emissions growth is due to the addition of new sources and if one assumes that all new sources use most efficient commercially available technology. The monetary figures are based on Kyoto Budget (27 billion tonnes $CO_2$ eq.) times conversion factor tonnes of carbon per tonne of $CO_2$ (.273) times percentage of budget used for credit (4 to 53) times $50 dollars per tonne carbon.

be allocated to credit for past action.[49] Assuming one tonne allowances are worth $50 per tonne of carbon in the 2008 to 2012 period, this yields a total transfer equal to between 10 and 40 billion dollars. This is in addition to transfers of emission allowances under the baseline protection provisions, which could amount to an additional transfer of two or more percent of the US budget for 2008 to 2012.[50]

- *Credit for Sequestration.* Credit for non-additional sequestration could also be extremely high. Again, using the methodology included in the Chafee Bill, it is possible that 27 percent of the US Kyoto Budget could be allocated on the basis of non-additional sequestration.[51]

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49 The 12% figure is based on the assumption that all entities reporting project based reductions under the 1605(b) program choose base periods that predate their reported reductions under the 1605(b) program. It also assumes that all reported project based emission reductions reported under the 1605(b) program from 1994 to 1998 are creditable, but that no other reductions are creditable. It is clear that some reductions reported under 1605(b) are unlikely to be creditable because they result from double counting. Others may not be creditable because they are not reductions below the Chafee baseline. On the other hand, the estimate of creditable reductions does not include entity level reductions not reported in project level reports. Nor does it include emission reductions not registered under the 1605(b) program. These emission reductions may be significant as companies may, for strategic purposes, choose to not report emission reductions. For instance, of the 13 primary aluminium firms in the US (a sector committed to 45% voluntary reduction under the Voluntary Aluminium Industry Partnership) only two had registered reductions under 1605(b) by 1997. The 12% figures is derived as follows: the sum of 1605(b) project-level emission reductions for 1994 to 1997 (74+146+154+166 million tons $CO_2$ eq.) plus estimated 1605(b) project level reductions for 1998 (263) times nine years (3,170 million tons $CO_2$ eq.) divided by US Kyoto budget of 27 billion tonnes $CO_2$ eq. (resulting in estimated 11.7% of Kyoto budget). The three percent figure is based on the assumption that all participants choose a base period of 1995-1998 and claim credit for reductions registered under the 1605(b) program. The 3% figures is derived as follows: 1605(b) project-level emission reductions for 1994 to 1998 (74+146+154+166+263 million tons $CO_2$ eq.) divided by US Kyoto budget of 27 billion tonnes $CO_2$ eq. (resulting in estimate 2.97% of Kyoto budget). Project level emission reductions have been used rather than entity because the US Energy Information Administration has estimated the former but not the latter for 1998. Figures for project level reductions come from Testimony of Jay Hakes, Administrator of the US Department of Energy before House of Representatives Government Reform Committee on The Voluntary Reporting of Greenhouse Gases Program, July 15, 1999. Available at www.eia.doe.gov/neic/speeches/htest715/ testmony.htm

50 Again this assumes that all project level reported reductions but no others are creditable. It assumes 85% of the US budget is allocated based on historic emissions in 2000 with adjustments to actual entity emissions as called for in the baseline protection provisions of the Chafee Bill. The figure is derived as follows: estimated 1605 project level reductions in 1998 (263 million tonnes $CO_2$ eq) divided by estimated 2000 emissions (6,444 million tonnes) multiplied by 0.85.

51 This is based on US projections of net sequestration from land use change and forestry contained in Table C.2 of UNFCCC (1998). In 1990, the United States estimates that net sequestration from land use change and forestry amounted to 458,000 Gg of carbon dioxide removals. This goes to 411,040 in 2000, 403,700 in 2005, and 400,030 in 2010. Projections for annual sequestration from 1990 to 2007 were based on these figures and interpolation for intervening years, yielding a total of 7,330,950 Gg for the entire period (27% of the US Kyoto Budget). All of this would be creditable under the Chafee Bill. This figure may understate total creditable sequestration as the IPCC figure represents net changes to sequestration counting both land where there are increases in sequestration and land where there are decreases. However, in Credit for Early Action owners of land where there is a reduction in sequestration levels will not participate and these decreases in sequestration will

In summary, reallocation under Credit for Early Action could be significant.

### *3. Rewarding Past Action*

Reward for past action or special recognition of past action is generally only an issue in the context of Credit for Early Action or in the context of market instruments that use grandfathering. In other contexts (e.g. upstream cap and trade, carbon taxes), early actors are rewarded by having to purchase fewer allowances, pay less in carbon taxes, or having a lower or negative shortfall between emissions levels and regulatory requirements.

If the base period for credit generation or the starting date for reductions that qualify for baseline protection is 2000, actions taken in 1998 will have foreclosed potential credit or lowered potential allocations. Although the same could be said for actions that took place at any time prior to the present, most proposals for rewarding past action suggest recognising actions from 1990 forward. This is based on the fact that the Kyoto Protocol and UNFCCC generally require reductions in emissions relative to 1990 levels.

Several proposals have been made for rewarding or recognising past action:

- *Baseline Protection.* Rather than simply removing the disincentive for future action, baseline protection can extend to actions taken from 1990 to present. Although baseline protection only comes into play if there is grandfathering, emitters will benefit from past action in any event.
- *Ongoing Credit for Past Action.* The Chafee, CEERP and Lazio proposals all allow participants the option of choosing a credit generation base period as early as 1990. Under this approach, so long as a past action continues to yield emission reductions, it will generate credit up to the termination of the program. Past actions will receive more credit than future actions as they generate credit for a far longer period.
- *Credit for Future Reductions from Past Actions.* The Center for Clean Air Policy proposal adjusts credit generation baselines upwards to reflect what a baseline would have been had an earlier credit generation base period been chosen. While the credit generation baseline is adjusted upward based on past actions, credits are only generated for reductions from the baseline occurring after 1998. This ensures that

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not offset the total value of credit generated by sequestration. On the other hand, this estimate assumes that all forests are enrolled in the program. In fact nationally owned forests may be excluded from participation or only receive a limited credit.

past emission reductions receive the same credit generating potential as current actions.

- *Limited Credit for Past Action*. Alternatively, Chafee and Lazio Bills provide participants with the option of getting credit for voluntary reductions registered under the 1605(b) program or other Climate Change Action Plan programs. As noted above, this could lead to an allocation of three percent of the US budget.
- *Discounted Credit for Past Action*. The Centre for Clean Air Policy also suggests the possibility of credit for 1605(b) programs as an alternative to crediting future reductions from past action. However, CCAP proposes discounting such credits significantly ensuring that no more than one percent of the Kyoto Budget is used to reward past action.
- *Start dates other than 1990 or 2000*. CAST proposes full credit from January 1, 1996 forward.

The rationale for recognising past action is largely one of ensuring equitable treatment. Also there may be an intangible cost to penalising firms for having been good actors: they may be less likely to act responsibly in the future. On the other hand, equity is highly subjective. It is possible that companies that reduced emissions in the 1980s would feel aggrieved by only recognising action from 1990 forward. The following considerations should be taken into account in deciding how to reward past action.

- *Credit or baseline protection for past action implies a cost on the rest of the economy.*
- *Crediting past action may lead to credit disproportionate to impacts on achieving the Kyoto Protocol.* Allowing credit generation base periods to be set prior to the present means that past actions receive more credit than future actions. (E.G. under the Chafee Bill, a one tonne per year reduction in 1990 could yield 18 tonnes of credit by 2007.) Extending baseline protection back to 1990 does not reward past action more than future pre-commitment period action. The CCAP proposal limits the extent to which past action is highly rewarded.
- *Past actions may have earned their own rewards.* Voluntary past actions are often undertaken because they were profitable.
- *Reductions registered under voluntary reporting programs are sometimes questionable.* Many of the claims for reduction submitted under the 1605(b) program or Canada's Voluntary Challenge and Registry are of questionable quality. These programs have flexible reporting criteria designed to elicit wide participation, and were not designed to be used for crediting. Reductions are in some cases claimed from

project baselines or corporate baselines that are more generous than any early crediting proposal. According to one review only three percent of the 100 megatons of reductions reported by the largest US utilities represented net reductions.[52] The Chafee proposal appears to give full recognition to these reductions so long as they are verified and not double-counted.[53]

- *1990 reductions do not necessarily contribute to compliance.* Because they reduce both emissions in the First Compliance Period and the Kyoto budget, emission reduction actions carried out early in 1990 will have little impact on achieving compliance with the Kyoto Protocol.
- *Pre-1995 reductions of $SF_6$, PFCs, and HFCs may not contribute to compliance.* Under the Kyoto Protocol, parties have the option of using 1995 as their base period year for emissions of $SF_6$, PFCs and HFCs. In the US, 1995 emissions of these gases were higher than 1990 emissions. Thus, the US is likely to use the 1995 as a baseline, and reductions prior to 1995 will thus not help the US achieve compliance.
- *Some early actions pre-date national commitments or corporate challenges to reduce emissions.* While actions in the early 1990's help national compliance with the Kyoto Protocol, it is difficult to argue that they were the result of climate change commitments. The Framework Convention on Climate Change, was not negotiated until mid 1992; it was only in 1993 that President Clinton called on the US to reduce its emissions to 1990 levels. In Canada, the challenge to industry to voluntarily reduce emissions was not announced until late 1994.
- *The ability to choose credit generation base periods increases credit generated by market fluctuations.* Under Chafee and CEERP proposals, past action can be credited by choosing any period after 1990 as a credit generation base period. This, combined with the absolute approach to baselines contained in CEERP and Chafee, may increase the extent to which credit is given for emission reductions that are the result of market fluctuations. Companies will be able to choose peak production years and claim credit for subsequent reductions. Even though the economy as a whole may have increased at a relatively steady rate, individual companies' produc-

52 National Environmental Trust (1999): *Major Special Interest Provision Taints Legislation*, Washington. See also U.S. Government Accounting Office (1998): *Climate Change: basic issues in considering a credit for early action program*, GAO/RCED-99-23, Washington. The GAO calculated only 9 percent of companies reporting in the first two years reported reductions from a historic baseline.

53 The Chafee Bill refers to "actual reductions" but does not refer to actual reductions from any specified baseline.

tion levels tend to fluctuate significantly, allowing for significant generation of credit.[54]

### *4. Differing Ability to Compensate Losses, Assist in Adjustment and Yield a Double Dividend*

A weakness of Credit for Early Action, performance standards and credit trading, and cap and trade programs that use grandfathering is that these programs do not yield revenue which can be used either to aid companies or communities with the highest adjustment costs or to reduce distortionary taxes. This is particularly problematic in the context of Credit for Early Action because it actually increases the compliance costs of non-participants – likely the same parties who face high adjustment costs.

In contrast, the Resources for the Future proposal could generate $36 billion in revenue in 2002.[55] Seventy five percent of the revenue recycled to households ($270 per household in 2002).[56] A number of studies have suggested that using the revenue from auctions or carbon taxes to reduce distortionary taxes could yield a positive benefit to the economy.[57] The RFF proposal also allocates funds for compensating of aiding in the adjustment of adversely affected individuals, communities and corporations. 25% of revenue generated goes to states based on energy use by low income households and vulnerability of industry. States can then assist households, displaced workers and companies with transition costs and potentially compensate corporations for premature retirements of carbon intensive capital stock.

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54 For instance, under the Southern California Regional Clean Air Incentives Market Program, participants were allowed to choose between 1989 and 1992 as their baseline year for an emissions allocation. This resulted in the actual allocation (equal to all companies cumulative baselines) during the first year of the program being 16% higher than actual emissions during the peak year of emissions: see Polesetsky, Matthew (1995): *Will a Market in Air Pollution Clean the Nation's Dirtiest Air?*, in: Ecology Law Quarterly, 22, p. 359. See also California Environmental Protection Agency (1994): *Background Paper for Public Meeting to Consider Approval of SCAQMD's RECLAIM*, Los Angeles.

55 Based on allowances selling for $25 per tonne carbon and the cap not being exceeded,

56 Kopp, Raymond et al. (1999): Domestic Trading: A Credible Early Action" in: National Roundtable on the Environment and the Economy (1999): *Workshop on Progress Toward Development of Domestic Emissions Trading Programs for Greenhouse Gases: A Comparison of Progress Around the World, Proceedings from Workshop March 1 to 3, 1999, Toronto Ontario*, Ottawa.

57 See B.S. Fisher et al., "An Economic Assessment of Policy Instruments for Combating Climate Change." In James Bruce et. al. "Economic and Social Dimensions of Climate Change," above at footnote 6. p. 410f.

Downstream cap and emission allowance trading programs with grandfathering and potentially some forms of Credit for Early Action[58] do compensate large emitters that have to prematurely retire carbon intensive capital, but the value received in exchange for the cost of adjustment or premature retirement is accidental. Some companies receive windfalls (because of negative of low cost options); others pay higher costs. Moreover, only the corporate entity which shuts down or faces adjustment costs receives a benefit; no benefits flow to the employees dislocated by shutdowns or companies which are adversely impacted but are not large emitters (e.g. coal mines).

Credit for early action, downstream allowance trading with grandfathering and mandatory performance standards with credit trading are also likely to concentrate beneficiaries of climate change policy. Costs will be spread broadly throughout the economy in the form of less revenue for recycling (if carbon charges are imposed or allowances auctioned), in the form of lower *gratis* allocations of allowances, or in the form of more stringent standards. Credit for early action proposals vary in terms of the extent to which they involve entities other than large industrial emitters, but most programs are developed primarily for generating credit in those contexts. This is particularly true in the case of credit for past action. The estimated ten to forty billion dollars that could be allocated to past actions under the Chafee Bill would likely be concentrated among the two hundred or so companies which reported under 1605(b) for 1998.[59] Indeed, 18 utilities reported a total 100 megatons of reductions (worth $ US 2.5 billion at $25 per tonne) under 1605(b).[60] For future actions, credits will tend to go to entities with emissions that are sufficiently large to warrant the transaction costs of reporting, and which have the most opportunities for creditable emission reductions. Some of this may percolate down to individuals in forms such as lower taxes from municipalities that have generated credit for reductions or incentives to buy energy efficient equipment.

### *5. Conclusions*

The distributional impacts of both Credit for Early Action programs can be significant and depend on program design. For an economy the size of the US, the value of credit generated will likely be in the tens to hundreds of billions of dollars range. This will increase the future compliance costs of non-participants. Likely this will be firms with the

58 Under Chafee, a firm could potentially generate credit from a shutdown if it can show that emissions did not simply increase elsewhere. Neither CEERP nor performance baseline proposals allow credit from shutdowns.

59 172 companies reported in 1998.

60 National Environmental Trust (1999), above at footnote 52.

highest transition costs. Credit for early action provides no means to aid such firms and the communities dependant on them in the transition to a low carbon economy. Significant increases in compliance costs of others could occur even if a Credit for Early Action Program is largely ineffective environmentally.

While it is possible that market instruments could have equal distributive impacts, there is far greater certainty that market instruments will be environmentally effective. Market instruments that generate revenue have the added advantage that revenue can be used to aid those most adversely impacted by climate policies. These instruments also generate revenue that can be used to displace taxes that impede growth.

In the absence of Credit for Early Action, simply extending baseline protection to past action will ensure that early actors are not disadvantaged. Whether or not baseline protection back to some specified date is appropriate depends on an assessment of whether reductions were made with the expectation of being recognised under future regulatory programs, whether they aid in meeting the Kyoto Budget, and whether they were done in response to climate concerns or simply as part of business as usual. These factors should be weighed against the cost to others of providing baseline protection for past action.

If a Credit for Early Action program does exist and only applies to reductions from future actions, emitters could potentially be prejudiced for having taken past action. Whether this potential prejudice warrants credit for past action depends on the factors noted above. However, some proposals for crediting past action will reward past action more than future action. If credit is given for past action, 1990 is a logical start date (at least in the context of the three primary greenhouse gases), but other dates are equally supportable.

### D. Compatability with WTO Rules

Both market instruments and Credit for Early Action may conflict with rules of the world trade regime laid down in the General Agreement on Tariffs and Trade (GATT) and the treaties setting up the World Trade Organisation (WTO). Their principles include most-favoured nation treatment, non-discrimination and minimising trade barriers. So far, environmental issues have only played a minor role in the world trade regime.

Governments have free reign in setting tax policy so long as taxes are not applied in a discriminatory manner. A comprehensive carbon tax will not run afoul of any GATT rules, although the redistribution of tax revenue could be an illegal subsidy if it favours certain sectors.

However, if a carbon tax provides exemptions of specific domestic sectors it could be seen as a prohibited subsidy. This would be the case be the case if the exemption is specific to a particular sector and causes "adverse impacts" to foreign competitors, .i.e. reduces their market share. "Adverse impacts" would likely not occur if the competitors are not subject to greenhouse gas emission regulations.

Carbon taxes will likely be resisted by domestic emitters unless either foreign competitors' carbon intensive imports are also taxed (this will not affect competitiveness of exports) or tax revenue is not fully recycled to the emitters. Application of a border tax adjustment on the fossil carbon content of fuels equivalent to that imposed on producers would be allowable because it would be a direct product tax. However, if governments impose a border tax adjustment on imports based on emissions associated with their production a conflict will arise, as this would be a tax on processing and production methods. A 1987 panel ruling on a U.S. border tax adjustment to cover costs for rehabilitation of toxic waste decided that this tax was direct and thus legal. [61]

Initial free allocation of emission permits under a trading scheme ("grandfathering") can be seen as subsidy. Grandfathering would thus be likely to be inconsistent with the subsidy rules if grandfathering only occurs for one sector or if only domestic companies are entitled to a free allocation of permits. A system of auctioning permits will certainly be consistent with subsidy rules.

As discussed above, Credit for Early Action can be seen as a subsidy. However, it may be subject to exemptions for environmental subsidies so long as it has a clear environmental purpose. Credit for Early Action may become a subsidy inconsistent with WTO rules if credits are granted for non-additional reductions or reductions that have already

61 See *United States – Taxes on Petroleum and Certain Imported Substances,* Report of the Panel, L/6175, 17 June 1987. See also *United States – Restrictions on Imports of Tuna,* Report of the Panel DS21/R, September 3, General Agreement on Tariffs and Trade (GATT), Geneva and GATT (1994): *United States – Restrictions on Imports of Tuna,* Report of the Panel DS29/R, June 16, General Agreement on Tariffs and Trade (GATT), Geneva (these cases dealt with quantitative restrictions on imports based on production and processing standards.

taken place in the past. In particular credit for past action may be ruled as discriminatory if credit is concentrated in some sectors.

## E. Early Crediting as an Interim Strategy

Credit for Early Action is often promoted as an interim measure that could be put in place prior to the imposition of market instruments,[62] and as necessary in the immediate term to remove the disincentive created by the possibility that future market instruments will use grandfathering.[63] This section discusses whether or not Credit for Early Action is essential to removal of this disincentive, whether it is effective in removing this disincentive, whether it is technically and politically easier to implement than market instruments. Other interim strategies are also discussed.

### *1. An Easy First Step?*

Politically, Credit for Early Action has the advantage that it does not impose any immediate costs on any parties beyond the cost of administering the system. As noted above, the costs of crediting early action are significant, but they are imposed at a later date. While this may be politically attractive, Credit for Early Action could nonetheless be a difficult first step if rewarding early action requires a more complicated administrative infrastructure than market instruments.

The political give and take that has surrounded the development of market instruments has lead to systems which are far more complex than any of the market instrument proposals discussed above.[64] In particular negotiations over *gratis* emission allowance allocations and setting of performance standards in performance standard and credit trading programs are likely to prove complex. However, complexity is not inherent in market instruments. The RFF proposal is a model of simplicity. Monitoring, reporting, auditing and enforcement provisions are important, but will only need to be developed for fossil fuel producers, importers and exporters. Rules are also needed for crediting the use of fossil fuel as feedstock in long lived products. Rules are needed for crediting

62 Coalition to Advance Sustainable Technology (1999): *CEO CAST: First Movers Coalition Early Action Crediting Proposal*, Washington, p. 9.

63 Testimony of Eileen Claussen before the Senate Committee on the Environment and Public Works, March 24, 1999.

64 See for example Polesetsky (1995), above at footnote 54, or Nancy Kete (1992): The US Acid Rain Control Allowance Trading System in: OECD (ed.): *Climate Change: Designing a Tradeable Permit System*, Paris.

reductions among the relatively small number of emission sources not covered by a cap. Other than this, the system uses the market to ensure that reductions are rewarded.

In contrast, complexity and administrative cost appears to be inherent in the Credit for Early Action context, both because of the need to establish baselines and the need to guard against credit being generated by activities that do not reduce emissions. With regard to baselines, absolute emissions baselines like CEERP and Chafee require rules defining what constitutes a new source or a discrete investment in production and setting best commercially available emission standards. Early crediting systems that use an emissions per unit of output baseline (e.g. Lazio) need to develop rules to measure production of numerous products. As discussed elsewhere, this will likely prove difficult to regulate or administer.[65] If additionality requirements are incorporated into offset rules, regulators face a significant challenge.[66] The need to limit credit from activities that merely shift emissions has already been discussed.

Credit for early action may also be more challenging with regard to the monitoring and verification requirements it imposes. While encouraging wide spread participation in a voluntary program is often used as a rationale for minimising monitoring and verification requirements, monitoring and verification are as important under Credit for Early Action as in any tax or regulatory system. As with market instruments or the tax system, there are incentives to cheat, and cheating comes at a cost in terms of environmental effectiveness and compliance costs of others. However, unlike market instruments, market instruments raise a number of additional compliance issues. If past reductions are creditable, they will need to be verified. Moreover, there will be issues such as verification of production levels (if performance baselines are used), verification of outsourcing activities and verification of whether new sources use best available technology.

### *2. Removing a Disincentive*

As discussed above, grandfathering occurs where emission allowances are allocated in proportion to emitters' emissions in a historic baseline year or baseline period or where performance standards are based on historic performance. For instance, emission allowances might be distributed to firms in 2005 in an amount equal to 95% of their emis-

65 See below under Choosing a Baseline Metric and above under Perverse Incentives and Leakage.

66 See Dutschke, Michael; Michaelowa, Axel (1999): Creation and Sharing of Credits through the Clean Development Mechanism under the Kyoto Protocol, in: Jepma, Catrinus; van der Gaast, Wytze (eds.): On the compatibility of flexible instruments, Kluwer, Dordrecht, p. 47-64 regarding difficulty operationalizing additionality in the context of the CDM.

sions in the 2003 "allocation base period." If a firm is able to defer making emission reductions at no or little cost, it will be in a better position in the event of grandfathering if it defers its emission reductions until sometime after the allocation base period. This creates a potential disincentive for early action.[67] A similar disincentive is created by the possibility that firms that are likely to be excluded from the mandatory coverage of a cap and trade program will only be able to generate emission reduction credits from reductions that occur when the program is in force.

Various approaches have been developed to eliminate these disincentives. Early crediting itself can partially or fully remove the disincentive. In addition, various proposals have been made for baseline protection, either as an alternative to or in addition to Credit for Early Action. Baseline protection is a measure that only comes into effect if there is grandfathering. It gives an upward adjustment to an emitter's allocation base period emissions.

Some approaches to baseline protection may not fully remove the disincentive in all cases. Under the Chafee and Lazio Bills, tonnes of credits generated during the allocation base period are added onto the emitters' actual emissions for the purposes of grandfathering. However, if an emitter's actual emissions fall above the credit generation baseline despite emission reduction action, the emitter will receive a higher allocation if they take no action. Thus in figure 10 a company may make substantial reductions and receive no baseline protection. In figure 11, actual emissions fall beneath the credit generation baseline, but the company only receives partial baseline protection. The more stringent the credit generation baseline, the more likely this approach to baseline protection will not fully remove the disincentive to early action.

To avoid this weakness, CEERP uses a less stringent baseline for the purposes of calculating the adjustment to base period emissions (however it is still possible that a company with rising emissions would be better off not taking action).

67 The disincentive does not always mean firms are better off without making emission reductions. If a firm adopts technology that locks it into a pattern of high emissions, it may have greater compliance costs than a firm that adopts low emissions technology and receives a lower allocation.

**Figure 10: Disincentives Through Baseline Setting**

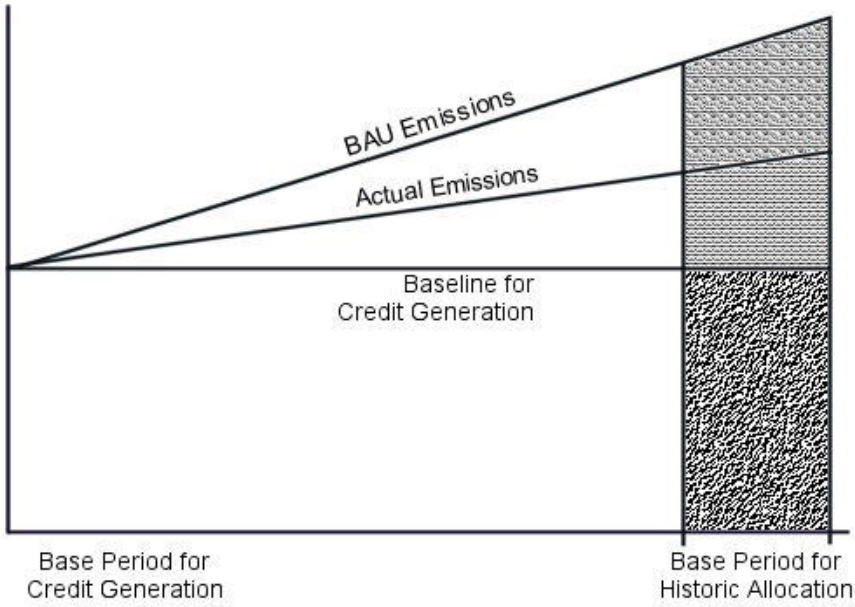
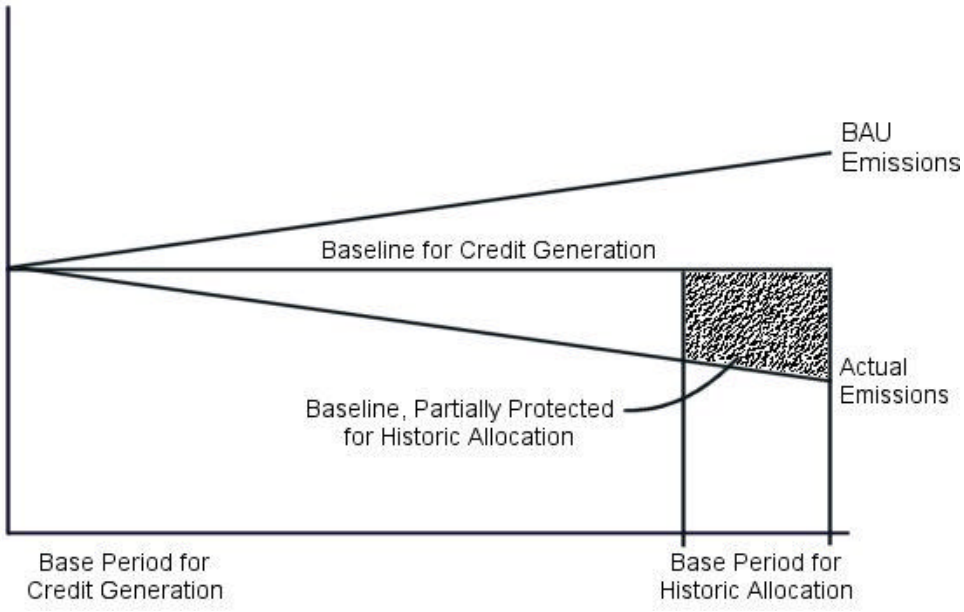



**Figure 11: Disincentives Through Baseline Setting**



The use of "reconstructed baselines" is intended to remove this possibility.[68] The reconstructed baseline essentially tries to reconstruct business as usual emission levels in the base period. Emitters estimate what emission levels would have been if qualifying actions had not been taken prior to the allocation base period. For emission reduction actions to qualify they only need to result in real, measurable and verifiable emission reductions. This ensures that no prejudice will arise from early action even in the absence of Credit for Early Action. The baseline protection concept could extend beyond sources that receive an allocation under grandfathering. This would avoid a disincentive for early action created at sources that are likely excluded from a future downstream cap and emission allowance trading programs but might be potential emission reduction credit generators in a hybrid cap and credit program.

### *3. Alternative Interim Strategies*

Credit for early action is not the only interim strategy to use while market instruments are being implemented. There are a number of steps government could take which will help firms invest appropriately in emission reduction and fall short of immediate implementation of market instruments designed to reach the Kyoto target:

- Announcing a commitment to reconstructed baselines in the event of grandfathering. This creates its own Credit for Early Action, as firms either receive a surplus (or less of a shortfall) of emission allowances (in the event of a gratis allocation) or have to pay less for emission rights (in the event of an emissions charge or auctioned allowances). A commitment to reconstructed baselines does not commit government to the development of elaborate rules (rules for reconstructing baselines will be necessary if government eventually uses grandfathering to allocate allowances).
- Announcing the general nature of future market instruments will help reduce uncertainty and provide a signal to firms to reduce emissions. Some program designs may provide a clearer signal. For instance, the transparency of the cap on emissions in a cap and trade program may send a stronger signal to firms than the announcement of mandatory performance standards and credit trading. In the latter firms may believe there is more scope to negotiate favourable performance standards.[69]
- The detailed definition of a downstream cap and emission allowance trading regime or a regime of performance standards and credit trading will also create signals

68 This approach is discussed in the Options Report of Canada's Credit for Early Action Issue Table. The table is a joint industry, government, environmentalist forum for discussing Credit for Early Action.

69 Centre for International Economics (1999), above at footnote 29, p. 49.

among emitters. In particular it would allow forward markets to develop in emission allowances or credits.

- Committing to a future minimum price for carbon emissions or allowances (regardless of the Kyoto Protocol's coming into force) will provide an even clearer incentive for cost effective early action than Credit for Early Action. Analysis by the Australian Centre for International Economics suggests that defining a minimum marginal price for carbon emissions is likely to be more effective way of ensuring reductions than Credit for Early Action.[70]

### *4. Conclusions*

Whether Credit for Early Action is an appropriate interim step prior to adopting market instruments, depends on: whether it is a politically easy step that will ease the transition to market instruments; whether it can be implemented as an administratively feasible first step while market instruments are being designed; and whether it is a necessary first step to eliminate the disincentive created by the possibility of grandfathering.

Credit for Early Action may be politically easier to implement in the short term than market instruments because any potential costs are deferred until the future. However, it could increase the eventual compliance costs of many sectors of the economy and thus could lead to greater resistance to Kyoto Protocol ratification in the longer term. This is especially true if credits are concentrated among relatively few participants, and if they represent a large portion of the Kyoto Budget.

While both Credit for Early Action and market instruments can be complex in design, a degree of complexity is inherent in Credit for Early Action because of its reliance on rules rather than actual market signals (such as scarcity of emission rights or costs for emissions). A workable Credit for Early Action will be more complex and require more administrative infrastructure than a simple (but potentially very effective) market instrument.

Credit for Early Action helps counteract the disincentive created by the possibility of grandfathering, but it does not necessarily do so. Baseline protection – in particular, baseline protection that bases allocations on the "reconstruction" of business as usual emissions during the allocation base period – can eliminate the disincentive created by the possibility of grandfathering and can be adopted in the absence of a Credit for Early

70 *Ibid.*

Action program. Although designed to remove a disincentive, full baseline protection also guarantees that, all else being equal, emitters will be better off taking early action.

Completely removing the disincentive for early action will also require a clear rejection of the Credit for Early Action concept. So long as governments are discussing whether and how to pursue early crediting, firms may hold emission reduction projects in abeyance, waiting until rules are known so that they can maximise credit.

While the added certainty of guaranteed baseline protection helps ensure consistent signals in favour of emission reductions, it will still not necessarily ensure the optimal emissions path. Announcements of future policy frameworks and minimum carbon price can further increase the signals favouring early action, but firms may gamble that government will change its mind. The early introduction of market instruments and/or other policies are still likely needed to achieve the lowest cost future emission reduction path. Such policies need not represent the final design for meeting the *Kyoto Protocol*. For instance, the RFF proposal is intended as an interim measure that ensures some level of emission reduction, but not sufficient reduction to meet the *Kyoto Protocol*.

## F. If Early Crediting Proceeds

While the above analysis has identified a number of weaknesses associated with Credit for Early Action, Credit for Early Action may still be better than governments taking no action. While the authors believe a combination of baseline protection and market instruments are a preferable approach to Credit for Early Action, it is recognised that market instruments face considerable opposition from many large, politically powerful emitters. This part discusses how Credit for Early Action could be implemented if governments decide it is an appropriate measure.

### *1. Technology Push Crediting*

Ideally, either market instruments or Credit for Early Action, will, by creating incentives for technological development and innovation, affect the supply of low cost emission reductions (see figure 8). This shifting of cost curves is ideal, but, as discussed above, the extent to which Credit for Early Action will lead to greater investments in research, development and application of low carbon technologies, beyond what would occur in the absence of CEA, is highly uncertain. Technological development of long term low cost solutions are more likely to be spurred by market instruments that provide

a clearer signal that reductions will be valued in the long term. For technological developments that are unlikely to become commercially viable in the short term, CEA may to add little certainty to the investment's value.

However, Credit for Early Action could be designed to increase the likelihood that it will lead to investment in technological innovation.[71] The purpose of Credit for Early Action becomes much more specific: it is intended to increase experience with new mitigation technologies and increase research and development of new technologies. The "technology push early crediting" will thus constitute a kind of temporary subsidy to more costly and risky mitigation options using pioneer technology. The risks an investor takes by choosing pioneer technologies are future devaluation of the equipment, "teething troubles" with subsequent production losses and that the future value of the reductions achieved will not cover the investment costs. While the credits for first movers come from their competitors who may as a result face more stringent standards, the competitors will benefit from the technological innovation and increased know-how.

Credit would not be given to activities that reduce emissions but are unlikely to shift the long term cost curve of reductions. Similarly, mitigating carbon dioxide by tree planting likely has little potential for innovation and thus might not be creditable. All these options may need to be seized in order to achieve the Kyoto target, but they will be profitable anyway as soon as emissions trading starts (which will happen as soon as the Kyoto Protocol enters into force). Generally, credit for past action would not be available except in exceptional circumstances where an emitter can prove that it was using ground breaking technology. By limiting the supply of such credits, credits from innovative practices will attract a higher price. At the same time, there is likely to be less of a negative impact on the compliance costs of non-participants, and, if there is a limited credit budget, credits are less likely to be discounted or spent on non-additional reductions.

Initially, while the entry into force of the Kyoto Protocol is uncertain, baselines might be based on today's standard commercial practices. However, once Kyoto's coming into force appears certain, the baseline case would become more stringent, possibly reflecting best available low-emitting equipment for new investment.

71 See Michaelowa/Stronzik, above at footnote 39.

Qualification for credit could be based on exceeding annually updated technology-specific benchmarks. As long as its technology stays below the emission benchmarks, early credit is granted if the company can prove an absolute decrease in emissions due to the new equipment. Non-emitting energy equipment, like photovoltaics or wind power cannot be subject to technology benchmarks, but could be given a benchmark derived from the average emission factor of latest installed technology producing the same good.

***Example***: A company installing a wind power plant applies for early credit. The wind power plant benchmark will be calculated as follows: Composition of national electricity generation * average emission factor of the power stations installed in last 5 years

| | | |
|---|---|---|
| 30% coal | * 900 g $CO_2$/kWh | = 270 g $CO_2$/kWh |
| 30% gas | * 350 g $CO_2$/kWh | = 105 g $CO_2$/kWh |
| 10% fuel oil | * 700 g $CO_2$/kWh | = 70 g $CO_2$/kWh |
| 30% non-emission sources (hydro, nuclear) | * 0 g $CO_2$/kWh | = 0 g $CO_2$/kWh |
| Benchmark: | | = 445g $CO_2$/kWh |

The benchmark would decline over time with technological progress and would even become more stringent with growing attractiveness of early crediting.

The above proposals cover measurable emission features. Organizational emission reduction is more difficult to factor in. However, demand side management or improved transportation schemes can contribute importantly to the development of know-how. The same applies to low-emitting land use techniques whose implementation can imply high costs, but eventually lower emissions output. In the German building sector, approved energy consultants have been used to certify the success of energy savings. In case of disapproval their costs have to be borne by the applicant.

If the purpose of crediting is to subsidize early mover risks, it may not be the appropriate for a project to generate credits for its entire commercial life time. Instead, government may want to limit the number of years during which a project will generate credit. A five year limit would help ensure that projects do not receive more credit than their impact during the budget period. Investors who consider their production to still be ahead of replacement standard after five years might be allowed to appeal for an extended lifetime of credit creation.

Because technology pushing credit lays less explicit ground rules for generation of credit than exist in other proposals it is important to create administrative structures which have an interest in limiting the creation of credits. For instance, credit for past action or extensions of the standard credit generation period might be considered by industry representatives that have an interest in ensuring credit is only given for exceptional investments.

### *2. Setting Baselines*

The discussion above refers to various pros and cons of different approaches to baselines. This section summarises those pros and cons.

#### *a) Technology Forcing Performance Benchmarks*

If Credit for Early Action is redesigned to specifically encourage technological development and innovation, it will have the following advantages and disadvantages:

Pros

- Minimises negative impacts on non-participants by limiting credit generation.
- Maximises the incentives for innovation that benefits all parties.

Cons

- Setting of technology benchmarks likely will require significant administrative expenses.
- Does not encourage reductions that use well established technologies.

#### *b) Case by Case Baselines based on Audits*

As noted above,[72] baselines could be based on audits of companies' operations, providing credits for reductions that exceed a level that could be achieved through measures that have a minimum pay back. Case by case baselines could be established as either performance baselines or absolute baselines depending on what is appropriate for a firm.

72 See section III.A.2.b)(1)(c).

Pros

- Helps eliminate credit for non-additional emission reductions, reducing impacts on non-participants.
- Reduced crediting of non-additional emission reductions limits the credit supply and may thus increase the incentive for additional emission reductions.
- All additional emission reductions are valued equally, encouraging lowest cost reductions.

Cons

- High administrative costs of setting baselines.
- Until baselines are set, companies have an incentive to exaggerate reduction costs rather than find low cost solutions.

*c) Performance Baselines*

Performance baselines are often promoted because they allow growth industries to participate in early crediting. While it is essential to allow participation of growth industries, this advantage of performance baselines may be overstated. CEERP and the Chafee proposals accommodate growth through adjustments to the baseline for "new sources" or "discrete investments in new sources of output". Nonetheless, performance baselines do have distinct advantages and disadvantages:

Pros

- Avoids credit for downturns in the economic performance.
- Allows credit for a company with improved performance that is overwhelmed by increased output even if resulting increases in emissions do not qualify as "new sources".
- Avoids leakage from production curtailment, and if output is defined in narrow categories (i.e. tonnes of fine writing paper as opposed to tonnes of paper products) avoids leakage caused by product shifting.

Cons

- Any monetary measure of output (e.g. GDP or value of shipments) can be affected by changes in market values of commodities or inputs, even though nothing has

changed in the physical plant. Often performance as measured by monetary units shows different trends from performance as measured by physical output.[73]

- Measuring output by physical indicators can also be problematic. Most manufacturing establishments produce more than a single product line; in some cases, such as the chemical industry, thousands of products can be included within the same standard industrial classification code and many can be produced by the same manufacturer. Because these are different products with different production processes, they could only be summed into a single output indicator if energy data for each process step was monitored and reported. Unfortunately, this data is rarely available.[74]
- Given the absolute limitation of the Kyoto Budget, performance baseline could over-mortgage the country's commitment if higher performance led to a decline in prices and an increase in consumption.

*d) Absolute Baselines*

Baselines that are set simply by tonnes of emissions by a company (e.g. CCAP, Chafee and CEERP) are simple yet create particular problems.

Pros

- Relative to other early crediting provisions, absolute baselines are simple (although rules for baseline adjustment will still be challenging).

Cons

- Encourages firms to increase production through investments that qualify as new sources or discrete investments (even if other methods of increased production are more cost effective).
- Less effective in encouraging replacement of old inefficient facilities with efficient facilities. (New facilities would be subject to more stringent best commercial practices baseline).
- Rules needed to avoid leakage associated with production shifts or curtailed production.

73 John Nyboer et al. (1998): *Development of Energy Intensity Indicators for Canadian Industry, 1990 to 1997*, paper prepared for Canadian Industry Program for Energy Conservation by the Canadian Industry Energy End Use Database and Analysis Centre, Simon Fraser University, Burnaby, Canada, p.6.

74 US Department of Energy, above at footnote 42, page 8.

*e) Stringent Baselines*

Proposals vary in the stringency of baselines. The CCAP proposal is probably the most stringent, whereas the Chafee Bill appears the least stringent.

Pros

- Avoids excess credit creation through non-additional emission reductions, reducing negative impacts on non-participants.
- Reduces likelihood of credits being discounted or a limited budget of credits being wasted on non-additional emission reductions (if credit creation capped).
- Reduces overall credit creation, decreasing the supply of credits and increasing credit price. This may increase incentive for technological innovation and major reductions.

Cons

- Some cost effective reductions may not be encouraged.
- If baseline protection is not provided for or is based on auditing credits from the allocation base period onto actual emissions, it may not fully remove disincentive to action.

*f) Lax Baselines*

Pros

- Encourage all cost effective reductions.

Cons

- Increased ease of credit creation may depress credit prices and reduce incentive for technological innovation or major capital investments in low carbon technology.
- Larger negative impact on non-participants.

***3. Not Over-Mortgaging the Kyoto Budget***

As noted above, the amount of credit generated by a Credit for Early Action program can very significant, and, if combined with full baseline protection, will inevitably place higher costs on non-participants. Emission limits on other parties will be more stringent, or there will be less revenue recycled from auctioned allowances or carbon taxes. Stringent baselines, audited baselines, no credit for past action and technology forcing baselines will all reduce the amount of credit generated and thus limit this problem.

In addition, limiting the amount of the Kyoto budget that will be used in providing early action credits is likely necessary to ensure crediting does not have too great an impact on non-participants. This can be accomplished through several means:

- *Cap on Credit Generation and Discounting.* Several proposals have been made for capping the total amount of the Kyoto Budget available for credit. The Center for Clean Air Policy calls for capping the total credit generated at five percent of the Kyoto Budget but provides no mechanism for allocating the cap. One method of enforcing the cap is to discount all credits generated so that the cap is not exceeded. This guarantees that reductions below baseline will have some value, but increases the uncertainty as to the exact value and may thus decrease additional emission reductions.
- *Cap on Credit Generation and First Come-First Serve Allocation.* Another method of enforcing the cap is to award credits annually for as long as they last. This is likely unacceptable unless separate limits are placed on credit for past action (otherwise all crediting could go to credit for past action). As note above, the most important reductions to encourage under early crediting are those involving major capital investments with impacts into the First Compliance Period. However, first come first serve crediting is unlikely to significantly shift these investment patterns as there is no certainty that a reduction will yield credits over its lifetime. This is especially so because there is presumably a time lag between the announcement of a Credit for Early Action program and the development and implementation of such reductions.
- *Cap on Credit Generation and Reservation System.* CEERP proposes a budget for credit generation, with firms participating in the program estimating the credits they will be able to generate. When the total of projected credits from the program appears to exceed the budget, government can close the program to further participants. This provides a strong incentive to immediate participation. However, combined with the obligation to buy credits if a firm's emissions exceed the baseline, it may tend to reward non-additional reductions over additional. Firms with well documented past reductions and firms with plans to reduce emissions for reasons other than credit will be in a position to quickly sign on. Firms that need to evaluate potential reduction possibilities may be slower to act.

### *4. Credit for Sinks*

Several of the proposals provide credit for carbon sequestration. The Chafee Bill creates an entitlement of one tonne of credit for every one tonne increase in sequestered carbon. Although ambiguous, the Lazio Bill has a more detailed and sophisticated approach to sequestration. CEERP accepts credit for sequestration in principle but calls for the development of specific regulations. Recognition of sinks – particularly the recognition of sinks as called for in the Chafee Bill – raises several concerns:

- *The scope of activities recognised under Kyoto may be narrower than what is recognised under Chafee and Lazio.* Article 3.3 of the *Kyoto Protocol* provides for credit from a limited range of land use and forestry activities. The most plausible interpretation of this is that only changes in carbon stock in the First Compliance Period will be counted, and that such changes will only be counted if they result from conversions of land use into or out of forestry after 1990.[75] If this interpretation is correct, the activities recognised by the Kyoto Protocol are very limited. However, the Chafee Bill recognises a much greater range of changes in carbon stock due to activities such as afforestation prior to 1990 and natural regeneration or replanting after harvesting. Lazio recognises at least one category of sequestration not currently recognised by the Kyoto Protocol.[76] CEERP suggests that forms of sequestration not recognised by Kyoto could be recognised in early crediting but suggests limiting the amount of such credit and providing credit only as an incentive for "well developed – leading edge" projects.
- *Reward for non-additional activity.* Credit for sequestration is likely to increase the extent to which credit is given for non-additional activities. The US projects a 23% increase in overall greenhouse gas emissions from 1990 to 2010 – suggesting that most emitters would have to take additional activity to reduce emissions. In contrast, the US land mass is a net sink for carbon, suggesting that most land owners would not need to take additional action to gain credit under Chafee. Indeed, increases in carbon reservoirs due to land use and forestry offset 7 percent of US emissions in 1994 and this is projected to remain relatively stable until 2008. Under Chafee, all of this non-additional activity could be credited. If all of US projected net sequestration were credited from 1990 to 2008 the credits would amount to over 27 percent of the US emissions budget for 2008 to 2012, but the US would be no closer to compliance

75 Rolfe, Chris (1999): *Opportunities and Liabilities from Greenhouse Gas Emissions and Greenhouse Gas Emission Reductions*, West Coast Environmental Law, Vancoucer, available at http://www.wcel.org.

76 Changes in forest management techniques.

with Kyoto.[77] It may be difficult to justify such a transfer of wealth without receiving any additional activity. This problem is restricted in the Lazio Bill as only a limited range of activities are credited and credit for forest management is only provided if the sequestration rate exceeds the average for similar land in the region.

- *Inclusion of sinks may increase potential for gaming.* Although all forms of early crediting create the potential for gaming, the problem becomes particularly acute in the context of the Chafee Bill's inclusion of sinks. This is due to the fact that there are many non-additional increases in carbon sequestration that can be easily treated as separate assets from the land that is a source of emissions. Under the Chafee Bill, sequestration baselines are adjusted when ownership of a carbon reservoir is transferred. This creates an incentive to sell land about to be logged (thus avoiding any carbon debits associated with harvest) while accumulating credit on lands that are regrowing. A forest company owning land on which there is no net sequestration (emissions associated with harvesting being offset by regrowth) could transfer land about to be logged to another company and purchase back cut timber. The forest company could claim credit for all the growth on its lands, while no one is penalised for the emissions associated with harvesting. The Lazio Bill does not completely eliminate this problem.[78]

### *5. Recognition of Reductions in Developing Countries*

As discussed above, several Credit for Early Action program proposals deal specifically with credit for projects in developing countries. In many cases proposals simply guarantee recognition of CERs under domestic regulations. In other cases, credit may be given for reductions which do not result in a transfer of CERs or assigned amount units to the national account.

This transfers a risk onto nations, because in the initial phase of CDM, CDM rules will be uncertain. In the absence of provisions for recognising emission reductions in developing countries, investors are likely to choose investment in early action credit (provided they are not subject to an unknown discount). Guaranteeing the recognition of developing country emission reductions that meet domestically imposed requirements transfers the risk of emission reductions not being recognised from industry to govern-

77 The 27% figure may overstate the transfer of wealth to private sector land owners since a significant portion of the US land base is owned by state or federal governments. See above at footnote 51.

78 Improved carbon stock management is only creditable on land where the management units with merchantable timber represent 20% of total land holdings. This allows a land owner to sell some, but not all, merchantable timber while claiming credit for growth on younger management units.

ment. In the second, "hot" phase of the CDM rules for CDM will be known, there will likely be a liquid market, and there is less risk associated with investment in CDM projects.

There are two reasons government's may want to shoulder some of the initial risk faced by CDM investors. First, as opposed to domestic early action, reductions achieved under the CDM expand the national budget of the acquiring country. For the government, there is a rationale to value projects that yield CERs higher than domestic early action. Second, early external action creates facts that may be used by national governments to influence future climate negotiations. (This influence may benefit the development of the CDM, but could also obstruct progress in resolution of issues).

Against these advantages several downsides need to be considered. First governments will need to consider the implications of directing investment abroad. Second, relying on international emission reductions reduces the domestic benefits of greenhouse gas emissions. Third, investments in domestic emission reductions are more likely to yield innovations that reduce long term domestic emission reduction costs. Although there might be some technology spin off from CDM projects, most of the solutions required for developing countries, e.g. building up a de-centralised power grid, are not applicable to emission reduction needs of the industrialised world.

### *6. Conclusions*

Credit for early action could limit credit creation to projects that involve technological innovation. Although this involves some administrative difficulties in setting technology benchmarks, it is likely to be most effective in reducing future compliance costs and avoids shifting an undue burden onto non-participants. This approach would clearly need to be combined with baseline protection as it will not remove the disincentive to early action.

If Credit for Early Action uses a "one size fits all" approach to baselines, rather than establishing benchmarks or using auditing, stringent performance baselines are likely best where practical (e.g. for companies producing homogenous products), but may not be practical in all cases.

Although there are strong policy reasons for directly or indirectly limiting the generation of credit under an early crediting system, all the means of doing so present prob-

lems from an equity, efficiency or effectiveness basis. A combination of stringent baselines and a cap on total credit creation with discounting is likely the best option if early crediting proceeds.

The inclusion of sinks creates some unique problems that require considerably more sophistication than simple counting of increments in sequestered carbon. Setting rules for the inclusion of sinks prior to elaboration of international sequestration rules is particularly risky. The approach to crediting sinks in the Lazio Bill is a major improvement on the approach in the Chafee Bill but may still generate considerable credit from activities that would have occurred anyway and may thus increase costs for non-participants.

## IV. CASE STUDIES

### A. U.S. Aluminium Industry 1990-2010

#### *1. The aluminium industry in context*

The US aluminium industry is an example of an industry where there is major potential for emission reductions. This sector has committed to achieving 45% reductions in PFC emissions (representing over half total emissions) by 2000. This level of reductions appears to be possible at low, and possibly negative cost. To some extent the reductions appear to be the result of normal capital turnover, although government programs may have accelerated the rate of reduction. Although the magnitude of low cost reductions in the aluminium industry is greater than average, the aluminium industry is not unique. In particular a number emitters with significant non-energy related emissions have been leaders in making early reductions. For instance, Canada's lone adipic acid plant has committed to a 90% reductions in nitrous oxide emissions to be phased in between 1997 and 2000. This amounts to annual reductions of 10 Mt of carbon dioxide.

#### *2. The Reduction Potential*

The U.S. aluminium industry has set targets for voluntary emission reductions and forecast baseline emissions and projected production. The major emissions in aluminium smelting industry are PFCs due to disturbances in the electrolytic process, so-called "anode effects". Anode effects both negatively affect production and energy use. If smelting pots using the oldest technology with the most frequent anode events are re-

placed by technology with the least anode events, PFC emissions from the replaced production units are 94% lower than the old pots.[79] Energy is a major component of aluminium sector costs, and improvements to smelting technology have allowed producers to reduce this cost significantly per unit of output. Because of lack of comparable data on carbon dioxide emissions, this case study only looks at PFC emissions. However, because PFC emissions are associated with energy use the reductions should be in a similar direction. Typically in the primary aluminium industry, $CO_2$ emissions are about 35 to 40% of PFC emissions (on a $CO_2$ eq. basis).[80]

**Table 3: Forecast Baseline PFC Emissions from the U.S. Aluminium Sector**

| | 1993 | 2000 | 2005 | 2010 | Annual Growth Rate (1993 –2010) |
|---|---|---|---|---|---|
| **Constant Technology** | | | | | |
| $CF_4$ | 2,200 | 2037 | 2298 | 2429 | 0.5% |
| $C_2F_6$ | 222 | 204 | 230 | 243 | 0.5% |
| **Replacement of Old Technology with New Technology at 2% per year.** | | | | | |
| $CF_4$ (GWP = 6500) | 2,200 ($CO_2$eq.= 14.3 x$10^6$ ) | 2037 | 1851 | 1658 | -1.7 |
| $C_2F_6$ (GWP=9200) | 222 ($CO_2$ eq.= 2.0 x$10^6$ ) | | | | |

The constant technology scenario is an obvious "upper bound" to business as usual emissions levels if there is only minor growth in production. The 2% p.a. replacement rate also appears to be a fairly conservative estimate of capital replacement.

As little up-to-date information was available on actual emission trends from the aluminium industry (few primary producers have reported under the 1605(b) program) we use the US EPA Voluntary Aluminium Industry Partnership (VAIP) emission reduction goal as a surrogate for actual emissions. The VAIP goal is to make 45% reduction in PFC emission from 1990 by 2000 – equivalent to 1.8 million metric tons of carbon – "using cost-effective approaches that make economic and environmental sense for the Partners." Thus, our baseline until 2000 is a 45% reduction in a straight line from 1990 to 2000. According to their website VAIP has succeeded in getting commitments to this goal. The limited company specific information is consistent with reductions of this magnitude.[81]

79 Mark Storey, "Policies and Measures for Common Action: Demand Side Efficiency; Voluntary Agreements with Industry" Second Draft 3 June 1996, OECD Environment Directorate, p. 71.

80 See table 3-2. *Trends in Canada's Greenhouse Gas Emissions*, 1996.

81 Data from the few aluminium companies that have reported under 1605(b) shows significant reduction. Noranda Aluminium claimed 2,793,600 tonnes ($CO_2$ eq.) of reductions in 1991, increasing to 3,506,900 by 1997. These reductions resulted from reductions in anode events. It is not clear whether the reductions are from a 1990 or some earlier baseline. According the VAIP Company Part-

### *3. Chafee Bill*

The baseline chosen by the aluminium industry under the Chafee bill will likely be 1990 emissions as they were the highest in the period, i.e. 18.2 million t $CO_2$ eq. Credit generated until 2000 would amount to 45 million t if the VAIP goal of a 45% reduction is reached. It rises from 0.8 million t in 1991 to 8.2 million in 2000. If we assume the 2% replacement rate for the baseline afterwards, emissions would decline to 8.5 million t in 2008.

**Table 4: Credits for U.S. Aluminium Industry from the Chafee Bill (million t $CO_2$ eq.)**

| Aluminium industry | 1990 | 2000 | 2005 | 2008 | Sum including 2007 |
|---|---|---|---|---|---|
| Baseline Chafee bill | 18.2 | 18.2 | 18.2 | 18.2 | 309 |
| Actual emissions | 18.2 | 10.0 | 9.1 | 8.5 | 215 |
| Credit Chafee bill | 0 | 8.2 | 9.1 | - | 94 |
| Cumulative credit Chafee bill | 0 | 45 | 88 | 94 | 94 |

Thus the aluminium industry would receive 0.3% of the U.S. budget for no-regrets emission reductions

### *4. Lazio Bill*

Under the Lazio bill, the baseline changes depending on aluminium production and U.S. economic growth. Assuming production of aluminium grows in line with U.S. GDP the baseline is the same as under the Chafee bill. We discuss the implication of two scenarios: one where aluminium production grows at 1% p.a. less than the overall economy, the other where it grows 1% more. The differences in credits accruing are substantial.

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ners website, "as a result of upgrades and continual improvement in potline operations, Noranda has reduced anode effects by over 70 percent since 1990. In addition to reducing PFC emissions, these upgrades have improved energy efficiencies and process stability". Vanalco Inc. also reduced emissions by reductions in anode events, claiming 28,700 tonnes of reductions ($CO_2$ eq.) in 1992, 39,000 in 1993, 67,700 in 1994, 216,100 in 1995, 54,700 in 1996, 67,000 in 1997. It is not clear whether these are from a 1990 baseline. It also appears that Vanalco, unlike most 1605 emission reducers, has tracked annual increments in reductions, not cumulative reductions.

**Table 5: Credits for U.S. Aluminium Industry from the Lazio Bill (million t $CO_2$ eq.)**

| Aluminium industry | 1990 | 2000 | 2005 | 2008 | Sum including 2007 |
|---|---|---|---|---|---|
| Baseline 1% below GDP | 18.2 | 16.5 | 15.7 | 15.2 | 285 |
| Baseline 1% above GDP | 18.2 | 20.1 | 21.1 | 21.6 | 338 |
| Actual emissions | 18.2 | 10.0 | 9.1 | 8.5 | 215 |
| Credit 1% below GDP | 0 | 6.5 | 6.6 | - | 78 |
| Credit 1% above GDP | 0 | 10.1 | 12.0 | - | 129 |
| Cumulative credit 1% below GDP | 0 | 32 | 65 | 78 | 78 |
| Cumulative credit 1% above GDP | 0 | 51 | 104 | 129 | 129 |

### *5. Center for Clean Air Policy*

The Center for Clean Air Policy proposal would lead to a *rising* baseline. We look at two cases: one that assumes that no 1605b reductions have been registered and one that assumes that all reductions until 1998 have been registered, leading to a baseline adjustment of 0.8 million t in 1998.

**Table 6: Credits for U.S. Aluminium Industry from the Center for Clean Air Policy Proposal (million t $CO_2$ eq.)**

| Aluminium industry | 1998 | 2000 | 2005 | 2008 | Sum including 2007 |
|---|---|---|---|---|---|
| Baseline without 1605b | 11.6 | 12.7 | 15.3 | 16.9 | 126 |
| Baseline with 1605b | 12.4 | 13.3 | 15.5 | 16.9 | 130 |
| Actual emissions | 11.6 | 10.0 | 9.1 | 8.5 | 87 |
| Credit without 1605b | 0 | 2.7 | 6.2 | - | 39 |
| Credit with 1605b | 0 | 3.3 | 6.4 | - | 43 |
| Cumulative credit without 1605b | 0 | 4 | 26 | 39 | 39 |
| Cumulative credit with 1605b | 0 | 5 | 29 | 43 | 43 |

### *6. CAST*

The CAST proposal baseline depends on aluminium production. We discuss the implication of two scenarios: one where aluminium production remains constant, the other where it grows at 2% p.a.

**Table 7: Credits for U.S. Aluminium Industry from the CAST Proposal (million t $CO_2$ eq.)**

| Aluminium industry | 1995 | 2000 | 2005 | 2008 | Sum including 2007 |
|---|---|---|---|---|---|
| Baseline constant production | **14.1** | 13.1 | 12.1 | 11.2 | 154 |
| Baseline 2% growth | **14.1** | 14.5 | 14.8 | 15.0 | 174 |
| Actual emissions | 14.1 | 10.0 | **9.1** | **8.5** | 127 |
| Annual Credit constant production | 0 | 3.1 | 3.1 | - | 27 |
| Annual Credit 2% growth | 0 | 4.5 | 5.7 | - | 47 |
| Cumulative credit constant production | 0 | 8 | 23 | 27 | 27 |
| Cumulative credit 2% growth | 0 | 11 | 36 | 47 | 47 |

The amount of credits generated by the proposals differs considerably:

**Table 8: Credits for U.S. Aluminium Industry Under the Different Proposals (million t $CO_2$ eq.)**

| Proposal | Credits generated until 2007 |
|---|---|
| Chafee | 94 |
| Lazio | 78-129 |
| Center for Clean Air Policy | 39-43 |
| CAST | 27-47 |

## B. Shell Canada – Changes in Production and Sources 1990-2000

Shell Canada provides a useful case study due to its annual reporting on greenhouse gas emissions attributing changes to different factors, including energy efficiency, increases in production, divestitures, investments in new productive capacity, etc. for the years 1990 to 1997 with projections for 1998 to 2000. It is a useful example of how a company with moderate growth in emissions could generate significant credit. Because information on actual production was not available, and because the emissions reductions are not projected beyond 2000, only the Chafee Bill was applied to the Shell Canada case study. It should be noted that Shell Canada had not had an opportunity to comment on these figures at time of print. Best efforts have been made to interpret Shell Canada annual reports fairly, but gaps in information, ambiguities and inconsistencies in reporting may lead to inaccuracies.

Both the 1997 and 1998 progress reports discuss specific projects. In most cases they state project costs and resulting savings. The payback period ranges from one to four years which strongly suggests that these projects are no-regrets.

### *1. Chafee Bill*

Table 9 provides a year by year breakdown of changes in Shell Canada's emissions, with an explanation of the changes below the Table. The baseline chosen by Shell Canada under the Chafee bill will likely be 1990 emissions as they were the highest in the period if corrected for sale of sources and production. By 2000 Shell Canada accumulates 4.7 Mt in credit. If no further emission reductions occur this would increase to 8 megatons by 2007. This is despite the fact that Shell's actual emissions declined only marginally, and increased if the baseline is only adjusted for divestitures.

### *2. BP Amoco – Internal Emissions Trading from 2000*

BP has become a leader in corporate climate policy in the last two years. It has set itself a target of reducing its absolute greenhouse gas emissions compared to 1990 by 10% until 2010. It has conducted a very detailed company-wide emissions inventory for 1990 and 1995 onwards which is certified by a consortium of one global, one U.S. and one European consulting firm. Emissions covered are both direct and indirect, such as from im-/exported electricity and steam. Sources covered are energy-related combustion, flaring and chemical processes; the first covers 90%, the second 7% and the third 3% of direct emissions[82]. In production units with several company shares, BP accounts for the share of emissions proportional to its equity share[83]. BP's 1990 $CO_2$ emissions were at 40 Mt and projected to rise to 60 Mt by 2010 under business-as-usual[84]. After the merger with Amoco, 1990 emissions were adjusted to 55.5 Mt $CO_2$; 1995 emissions were 58.1 Mt and 1997 56.4 Mt.

In 1998, BP set up a pilot intra-company emissions trading system with the help of the U.S. Environmental Defense Fund. 12 business units in Annex I countries with 10% of BP Amoco's emissions volunteered for declining emission caps reaching –3% compared to 1995 in 2003[85]. Outsourcing adjusts targets, e.g. in the case of reducing own electricity production and buy in electricity. Trades have to be done via a central broker. After each year, business units can buy allowances needed to comply during a true-up period of two months. Excess emissions will lead to a financial penalty of a multiple of

82 McMahon, Mike, Preparation of a carbon dioxide emissions inventory in a large integrated oil company, London 1998
83 BP, Protocol for the calculation of carbon dioxide emissions, London 1997
84 BP, Where we stand: emissions targets, London 1998
85 BP, Where we stand: BP's pilot emissions trading program, London 1998

**Table 9: Shell Canada's emissions 1990-2000**

| **Year** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2007** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | 8000 | |
| Adjusted for Restructuring | 8000 | 8000 | 8000 | 8675 | 8675 | 8675 | 8675 | 8245 | 8290 | 8335 | 8380 | |
| **Emissions** | | | | | | | | | | | | |
| Adjusted for Restructuring | 8000 | 8000 | 8000 | 8300 | 8300 | 8300 | 8300 | 7870 | 7915 | 7960 | 8005 | |
| Adjusted for refinery throughput | 8000 | 8000 | 8000 | 8300 | 8300 | 8435 | 8300 | 7924 | 8023 | 8121 | 8220 | |
| Adjusted for Energy Efficiency Improvements | 8000 | 7894 | 7788 | 7981 | 7875 | 7770 | 7505 | 7076 | 7228 | 7326 | 7425 | |
| Adjusted for Production Challenges | 8000 | 7967 | 7934 | 8200 | 8167 | 8135 | 7930 | 7516 | 7683 | 7796 | 7910 | |
| **Credit** | | 33 | 67 | 475 | 508 | 540 | 745 | 729 | 608 | 539 | 470 | |
| **Cumulative Credit** | | 33 | 100 | 575 | 1083 | 1623 | 2368 | 3096 | 3704 | 4243 | 4713 | 8002.5 |

Explanation of Table

**Included Emissions:** Although Shell Canada disaggregates direct $CO_2$ emissions, indirect $CO_2$ emissions from purchased electricity and non-$CO_2$ emissions, the reasons for changes in non $CO_2$ emissions are not provided, and reasons behind changes in $CO_2$ emissions are not disaggregated between direct and indirect. For this reason, baselines and emission figures reflect total, direct and indirect $CO_2$ emissions, and non-$CO_2$ emissions are ignored. It should be noted that indirect emissions would be creditable under pooling.

**Energy Efficiency:** From 1990 to 1994 Shell Canada achieved 425 kt p.a. reductions through improvements to their efficiency at upstream operations and downstream. This is reflected in a downward adjustment to actual emissions phased in equal increments in each year. In 1995 reductions of another 240 kt p.a. were achieved. In 1996, an additional 130 kt p.a was achieved, and an additional 210 kt p.a. decrease is projected from 1997 to 2000. These reductions are reflected in downward adjustments to actual emissions.

**Increased Throughput:** No data was available on refinery throughput from 1990 to 1997. A 135 kt p.a. change in emissions due to throughput was reported for 1995 in the 1997 submission, but not in the 1998 submission. It is assumed that this increase was short-lived, and is only reflected in actual emissions for 1995. Increases in emissions of 215 kt p.a. from refinery throughput are projected for the 1997 to 2000 period. It is assumed that these does not involve the creation of new sources and would not yield an increase in the baseline. An adjustment is made to actual emissions.

**Restructuring and Changes to Production** According to Shell Canada's 1995 Action Plan, a number of restructuring changes occurred in 1992 and 1993 yielding a 300 kt p.a. increase in emissions. Subsequent to the 1995 Action Plan, estimates of changes in emissions were revised, but the 1995 information has been used because it is most disaggregated.[86] In the downstream operations two refineries were closed, but production was increased at a more efficient refinery. There was also considerable rationalisation of distribution and retail networks (e.g. relying on several distribution terminals), and the replacement of two lube and grease plants with a modern facility. Although these changes involved closures, they are assumed not to yield a downward adjustment in baseline, given they involved rationalisation with increases in production at other locations. The net effect of these changes was a reduction in emissions of 375 kt p.a. This is reflected in a downward adjustment to actual emissions in 1993. There was also restructuring in the upstream operations from 1990 to 1994, including a new gas complex and the divestiture of some small, non-core oil and gas properties. The net effect was an increase in emissions of 675 kt p.a. It is assumed that the new plant represented best commercially available technology, and would lead to an upward adjustment in baseline, and that the divestitures would lead to a downward adjustment to baseline. The net effect is a 675 kt upward adjustment to the baseline and emissions in 1993. The next major restructuring occurred in late 1996, with the sale of Shell's Alberta Styrene plant. This is reflected by a 430 kt p.a. downward adjustment to both the baseline and actual emissions in 1997.

No data was available on actual production from 1990 to 1997, and no changes in emissions were reported. An increase of 135 kt p.a. from new production is forecast for the 1998 to 2000 period. As this is presumably due to an increase in the number of producing wells (increased refinery throughput is distinguished from increased production), it is assumed that this is treated as a new source, yielding an 45 kt upward adjustment to both baseline and actual emissions in each of the years 1998 to 2000.

**Production Challenges:** Actual emissions were increased by a number of factors. These include increased emissions due to dissolved $CO_2$ in oil and gas formations, changes to the fuel mix, increased energy use due to declines in fields, flaring and miscellaneous increases. The result is 365 kt increase in the 1990 to 1995 period[87], a 60 kt p.a. increase in 1996, and a projected 60 kt increase in the 1997 to 2000 period. All these adjustments are reflected in increases to actual emissions.

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86 The 1996 Action Plan Update states that new investments added 1200 kt p.a. to emissions and divestitures reduced emissions by 1050 mt (suggesting a net increase of 150 kt.). The 1998 Action Plan update states that these changes lead to a net increase in emissions of 405 kt.

87 This is from the 1998 Action Plan update. The 1997 Action Plan update suggests greater increased emissions due to these factors (Total increases from flaring, formation $CO_2$, changes to fuel mix and misc. are reported as 465 kt pa. For the 1990 to 1996 period.)

the highest allowance price in the year[88]. Banking is possible. So far, 120 kt of $CO_2$ have been traded at prices close to 20 \$/t $CO_2$ with market volume being reduced as the merger with Amoco kept managers busy. Next year, trading shall be extended to the full company and credit creation allowed from projects outside the company. Moreover, methane shall be brought in the medium term.

If accounting was broken down on a national basis, the trading system could be easily linked to a credit for early action system. However, different national early credit programmes could lead to a problem similar to transfer pricing to minimise tax payments – the company would try to maximise overall credits by showing reductions in the jurisdiction which has the most unrestrained rules.

88 BP Amoco, An article on the purpose, design and implementation of BP Amoco pilot emissions trading system, London 1999

## V. APPENDIX 1

### A. Scenario 1

| | Company A | | Company B | | Total Emissions | |
|---|---|---|---|---|---|---|
| | No CEA | CEA | No CEA | CEA | No CEA | CEA |
| 1990 emissions | 100.0 | 100.0 | 100.0 | 100.0 | 200.0 | 200.0 |
| 1999 emissions | 114.3 | 114.3 | 114.3 | 114.3 | 228.7 | 228.7 |
| 2000 emissions | 116.1 | 114.3 | 116.1 | 116.1 | 232.1 | 230.4 |
| 2007 emissions | 128.8 | 114.3 | 128.8 | 128.8 | 257.6 | 243.1 |
| 2010 emissions | 134.7 | 114.3 | 134.7 | 134.7 | 269.4 | 249.0 |
| Credit | | 65.0 | | | | |
| Grandfathered 1990 or 1999 | 465.0 | 497.5 | 465.0 | 432.5 | | |
| Shortfall (with credit) | 208.4 | 74.0 | 208.4 | 240.9 | | |
| shortfall grandfathering 1999 (no credit) | | 106.5 | | 208.4 | | |

Assumptions

- Under CEA Company A implements emission reductions slowly at existing facilities. Achieving emission reductions of 1.5% p.a. This offsets increased emissions at new sources.
- Allocation: All budget not used for crediting is allocated through grandfathering using reconstructed baseline approach.
- Crediting: All absolute reductions at existing facilities credited. (same as Chafee Bill). Companies able to choose 1999 base period For company A, post 1999 increases accommodated by upward “new source” adjustments to baseline.

**B. Scenario 2**

| | Company A | | Company B | | Company C | | | Total Emissions | |
|---|---|---|---|---|---|---|---|---|---|
| | No CEA | CEA | No CEA | CEA | No CEA | CEA | Baseline | No CEA | CEA |
| 1990 emissions | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 300 | 300 |
| 1999 emissions | 114 | 114 | 130 | 130 | 91 | 91 | 100 | 336 | 336 |
| 2000 emissions | 116 | 96 | 134 | 134 | 90 | 90 | 100 | 341 | 321 |
| 2007 emissions | 129 | 109 | 165 | 165 | 84 | 84 | 100 | 378 | 358 |
| 2008 emissions | 131 | 111 | 170 | 170 | 83 | 83 | 100 | 384 | 364 |
| 2010 emissions | 135 | 115 | 181 | 181 | 82 | 82 | 100 | 397 | 377 |
| Credit | | 160 | | | | 149 | | | |
| Grandfathered 1990 | 465 | 522 | 465 | 362 | 465 | 511 | | | |
| Grandfathered 1999 | 474 | 529 | 541 | 422 | 379 | 444 | | | |
| Shortfall gf 1990 | 208 | 51 | 438 | 541 | -56 | -102 | | | |
| Shortfall GF 1999 | 199 | 44 | 362 | 482 | 30 | -35 | | | |

Assumptions

- Company A 1999 reduction is 20 units p.a. in 2000. Reduction occurs at existing facilities. Subsequent increases at new sources. Company C reductions are one percent p.a. starting 1990.
- Allocation: All budget not used for crediting is allocated through grandfathering using reconstructed baseline approach.
- Crediting: All absolute reductions at existing facilities credited. (same as Chafee Bill). Companies able to choose 1999 base period. For company A, post 1999 increases accommodated by upward “new source” adjustments to baseline.

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