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National Round Table on the Environment and the Economy
Table ronde nationale sur l'environnement et l'économie

Design Options in a Domestic Emissions Trading System for the Treatment of Fossil Fuels Used as Feedstocks

Issue 5

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September 1998

DESIGN OPTIONS IN A DOMESTIC EMISSIONS TRADING SYSTEM FOR THE TREATMENT OF FOSSIL FUELS USED AS FEEDSTOCKS

INTRODUCTION

This paper is one of a series of papers on issues that must be addressed in the design of a variety of potential domestic emissions trading systems for greenhouse gases in Canada. The issue considered in this paper is the question of how to treat fossil fuels used as non-energy feedstocks in a domestic emissions trading system.

The paper begins by examining the extent to which fossil fuels are used as non-energy feedstocks in Canada and the implications of this use of fossil fuels for Canada's greenhouse gas emissions. It then goes on to examine why fossil fuels used as feedstocks pose a special challenge in the design of some potential emissions trading systems. Finally, the paper examines a range of options for addressing these issues in emissions trading system design. For further information on this subject, readers may want to examine the paper "Accounting for Non-Fuel Uses of Fossil Fuels in an Upstream Carbon Trading System", published by the Center for Clean Air Policy in March 1998.

TO WHAT EXTENT ARE FOSSIL FUELS USED AS FEEDSTOCKS?

Some fossil fuels are used as a non-energy feedstock or input in the manufacture of a variety of different products (e.g., plastics). These non-energy uses of fossil fuels are not insignificant. According to Statistics Canada, the energy that would have been produced (if combusted) by fossil fuel energy sources used for non-energy purposes in Canada in 1995 was 727 Petajoules.[1] This was equivalent to more than 9%of total demand for fossil fuels in Canada in that year. Table 1 illustrates the various uses of the major fossil fuels in Canada in 1995.[2]

The 9% share is significantly higher than the corresponding figure for the United States where non-energy uses of fossil fuels accounted for only 6% of total fossil fuel energy consumption in 1995.[3] The difference between the two countries is mainly explained by the important role hydroelectricity plays in electricity generation in Canada. With fossil fuels playing a less important role in electricity generation in Canada, the non-energy use of fossil fuels becomes a more important component of total fossil fuel use. This means that issues related to use of fossil fuels as feedstocks in an emissions trading system are going to be more significant in Canada than would be the case in the United States.

[1] The products produced with the use of these fossil fuels as non-energy feedstocks could either ultimately be consumed in Canada or exported.
[2] Statistics Canada. Quarterly Report on Energy Supply-Demand in Canada. 1995-IV. (57-003-XPB).
[3] Centre for Clean Air Policy. Accounting for Non-Fuel Uses of Fossil Fuels in an Upstream Carbon Trading System. March 1998.

TABLE 1 – Fossil Fuel Use in Canada in 1995 (Petajoules)

Use of Fossil Fuel	Coal, Coke, Coke Oven Gas	Natural Gas and Natural Gas Liquids	Crude Petroleum and Petroleum Products	Percentage of Total Use
Transformation (e.g., electricity)	944	205	113	16%
Producer Consumption	6	485	359	11%
Non-Energy Use	**12**	**327**	**388**	**9%**
Industry	171	847	297	17%
Transportation	0	274	1785	26%
Residential/ Agriculture	2	669	283	12%
Commercial / Institutional	0	489	250	9%
TOTAL	1135	3296	3475	100

WHAT ARE THE GREENHOUSE GAS IMPLICATIONS OF FOSSIL FUELS USED AS FEEDSTOCKS?

Because fossil fuels used for non-energy purposes are not combusted, there is no immediate release of greenhouse gases into the atmosphere. Several of the products produced using fossil fuel feedstocks do not release the carbon in the fossil fuel into the atmosphere for many years. Examples of such products include: plastics, rubber, asphalt, and road oil. While this sequestration is significant, it should be noted that these products are not permanent - at least some of the carbon is likely to be ultimately released into the atmosphere.

On other occasions where fossil fuels are used as feedstocks, however, a significant portion of the carbon contained in the feedstock is either:

- released to the atmosphere from the fossil fuel in the production process used to make the product, or
- is temporarily sequestered in the product but is released to the atmosphere in the short-term even though no combustion has taken place.

Examples of fossil fuels that release carbon to the atmosphere when used as non-energy feedstocks include:

- liquid petroleum gases used to make industrial organic chemicals,
- petroleum coke used to make steel, and
- natural gas used to make nitrogenous fertilizers and industrial organic chemicals.

Examples of products produced with fossil fuel feedstocks that sequester carbon for only a short period of time include:

- petrochemical feedstocks,
- napthas, and
- lubricants.

Under the Intergovernmental Panel on Climate Change's (IPCC) guidelines for the construction of national greenhouse gas inventories, the carbon contained in products produced with the use of fossil fuel feedstocks should not be included in national greenhouse gas inventories if the carbon will be sequestered for more than 20 years (e.g., asphalt). For the purposes of greenhouse gas emission accounting, carbon sequestered in these products is assumed to be permanently sequestered.[4] It has been estimated that approximately 43 Mt of carbon dioxide was sequestered in this manner in 1996 and was therefore not included in Canada's national greenhouse gas emissions inventory.[5]

The IPCC requires, however, that estimates be made of the amount of carbon released to the atmosphere from other products produced with fossil fuels as feedstocks. This emitted carbon must be included in the national greenhouse gas inventories of the country that produced the product. According to the IPCC guidelines, the use of fossil fuels as non-energy feedstocks was responsible for approximately 21 Mt of Canada's greenhouse gas emissions in 1996, equivalent to 4.7% of Canada's total carbon dioxide emissions from fossil fuel combustion in that year.[6] Table 2 provides an overview of how the non-energy use of fossil fuels contributed to Canada's greenhouse gas emissions inventory in 1996.

TABLE 2 – Emissions from Non-Energy Uses of Fossil Fuels
in Canada's 1996 Greenhouse Gas Emissions Inventory[7]

Greenhouse Gas Emission Source	**Greenhouse Gas Emissions (Mt)**
Fossil Fuels Used as Non-Energy Feedstocks	
- natural gas	8.83
- coal	0.96
- petroleum coke and secondary coke gas	4.17
- natural gas liquids	1.73
Products Produced with Fossil Fuel Feedstocks	
- petrochemical feedstocks	2.19
- napthas	0.73
- lubricants	1.43
- other products	1.15
TOTAL	**21.2**

WHY ARE FOSSIL FUELS USED AS NON-ENERGY FEEDSTOCKS AN ISSUE IN THE DESIGN OF DOMESTIC EMISSION TRADING SYSTEMS?

The use of fossil fuels as non-energy feedstocks poses an interesting challenge to the design of a domestic emissions trading system for greenhouse gases in Canada. These fuels present a significant measurement, monitoring and verification challenge in any emissions trading system.

[4] This can change when the life of these products ends. For example, the carbon contained in plastics that are incinerated will be released into the atmosphere. These greenhouse gas emissions would be included in the national greenhouse gas inventory of the country where the plastic was incinerated.
[5] Personal communication with Ken Olsen, Environment Canada.
[6] Canada's 1996 greenhouse gas emissions inventory was recently released by Environment Canada. Total emissions in 1996 were 671 Mt, a 12% increase over revised 1990 base year levels of 599 Mt. Carbon dioxide emissions from fossil fuel combustion in 1996 were 454 Mt.
[7] Personal communication with Ken Olsen, Environment Canada.

As demonstrated above, it is possible to distinguish fossil fuels used for energy purposes and fossil fuels used for non-energy purposes. More difficult, however, is estimating the amount of greenhouse gases emitted and sequestered by the use of fossil fuels for non-energy purposes. In Table 2, the non-energy use of fossil fuels was shown to produce four different types of products in Canada. In reality, however, the situation is much more complex.

When fossil fuels are used specifically as petrochemical feedstocks, for example, they are converted into thousands of final products and the residence time of carbon in most of these products has not been carefully assessed.[8] Moreover, the production process may involve the creation of several intermediate products, each of which sequesters carbon at a different rate.[9] As a result, developing an accurate estimate of the greenhouse gases that will be emitted or sequestered from the products produced from non-energy feedstocks based on the fossil fuel used is virtually impossible.

These measurement problems can produce difficulties for all sorts of domestic emission trading systems. Within a credit trading system (NRTEE Options 1 and 8), users of fossil fuels as non-energy feedstocks will have difficulty creating greenhouse gas emission reduction credits because of difficulties in determining a baseline and measuring actual emission levels.

Under some forms of cap and allowance trading systems (NRTEE Options 11, 13 and 14), companies that use fossil fuels as non-energy feedstocks will have a difficult time determining actual emission levels and therefore it will be difficult to assess performance relative to a cap on emissions. It will also be difficult for these firms to use continuous emission monitors to determine their emissions level because a portion of their fossil-fuel related emissions will not be generated through combustion.

While these measurement problems are important, they are not insurmountable. After all, there are many sources and sinks of greenhouse gas emissions where estimates of the amount of greenhouse gases emitted or sequestered are uncertain. The issue can be addressed through the adoption and consistent use of standard rules and methodologies (e.g., emission factors prepared by the IPCC or Environment Canada) to make emission estimates. Such emission factors would have to be applied to products with relatively uniform emission rates, so these products need to be defined and to be measured at the appropriate points.

Fossil fuels used as non-energy feedstocks pose a much more significant problem, however, for allowance trading systems where producers, importers and exporters of fossil fuels must hold allowances equal to the total carbon content of the fossil fuels they produce and import (NRTEE Option 4). In fact, two major problems arise.

First, fossil fuel producers and importers are not able to foresee the ultimate end use of their products. If it turns out that these fossil fuels have been used as non-energy feedstocks to produce products that will sequester the carbon contained in the fossil fuels for more than 20 years, producers and importers will be required to hold more allowances than needed to meet the environmental objective. This "overcontrol" of fossil fuel producers and importers imposes an

[8] Center for Clean Air Policy. Op cit.

[9] The Centre for Clean Air Policy paper indicates that there are 8-12 major intermediate products and about 100 minor ones. An intermediate product is a product produced through the use of fossil fuels as non-energy feedstocks that can then itself be used to produce another product. At least some of the carbon content of the fossil fuel is sequestered in the intermediate product and may be sequestered in a final product or may be released to the atmosphere if, for example, the intermediate product is combusted.

unfair economic burden on these firms and flies in the face of the principle that no region or sector should bear an unfair share of the burden of meeting Canada's emission reduction commitments.

For example, in 1996, Canada's fossil fuel producers and importers would have been required to hold allowances for:

- the carbon content of fossil fuels combusted in Canada (454 Mt),
- the carbon content of fossil fuels released through the use of fossil fuel feedstocks (21 Mt), and
- the carbon content of fossil fuels 'permanently' sequestered through the use of fossil fuel feedstocks (43 Mt).

Out of a total of 518 Mt worth of allowances, 43 Mt (8.3%) would represent allowances that were not required from an environmental perspective because the carbon would not be released to the atmosphere. This then, represents the extent of 'overcontrol'. It is a significant amount. An emissions trading system should control actual emissions as accurately as possible. The use of fossil fuels as non-energy feedstocks means this will not be the case in NRTEE Option 4 unless specific actions are taken to address this issue.

Second, users of fossil fuel feedstocks also have the potential to be discriminated against in this system. After all, fossil fuel producers and importers will increase prices (to the extent possible) to encourage users of fossil fuels to take action to reduce emissions. This price signal would penalize users of fossil fuels as non-energy feedstocks. After all, the fossil fuels used as non-energy feedstocks represent a significant component of the total costs faced by these firms in producing their products. If the use of fossil fuels by these firms does not actually produce emissions, but instead sequesters carbon, these firms are being unfairly penalized. If similar action is not taken in other countries, these firms can also be put at a competitive disadvantage. Once again, the principle that no region or sector should bear an unfair share of the burden of meeting Canada's emission reduction commitments is threatened. This problem can only be addressed through the development of a mechanism that provides some form of fiscal relief to the users of fossil fuels for non-energy purposes.

POSSIBLE OPTIONS TO ADDRESS ISSUES RAISED BY THE USE OF FOSSIL FUELS AS NON-ENERGY FEEDSTOCKS.

The Center for Clean Air Policy paper, "Accounting for Non-Fuel Uses of Fossil Fuels in an Upstream Carbon Trading System" presents a number of options to address the issue of fossil fuels used as non-energy feedstocks. The remainder of this paper builds upon the options presented in the Centre for Clean Air Policy paper and explores their implications for the potential domestic emissions trading systems being examined by the NRTEE.

All of these options have two common characteristics:

- they seek to address the 'overcontrol' issue by introducing more allowances or credits into the emission trading system, and
- they seek to address the issue of financial penalties on users of fossil fuels as non-energy feedstocks by providing these firms with access to these additional allowances or credits for use in meeting their own obligations or for sale to others to help them meet their obligations.

Option 1 – Allocate Additional Allowances to Cover the Carbon That is Ultimately Sequestered in Products Produced with Fossil Fuels Feedstocks

Under NRTEE Option 4, fossil fuel producers and importers would face a cap on the carbon content of their fossil fuels used in Canada. If this cap ends up including the carbon content of fossil fuels that is ultimately sequestered in long-lived products, actual emissions will be below the cap and the system will 'overcontrol' emissions. At the same time, however, fossil fuel producers and importers have no way to trace the end use of their products and will not know if the carbon content of their products have been emitted or sequestered.

One way to address this problem would be to provide additional allowances to producers and importers that would cover the carbon content of fossil fuels that is ultimately sequestered in lon-lived products. In 1996, 8.3% of the potential greenhouse gas emissions associated with the use of fossil fuels in Canada was 'permanently' sequestered. Accordingly, each fossil fuel producer and importer would receive 8.3% more allowances than their emissions cap. This would reflect the fact that, on average, 8.3 tonnes of every 100 tonnes of carbon would be sequestered. Some fossil fuel producers (e.g., coal) that see little of their product go to non-energy uses could be excluded from this arrangement.

This option is simple to administer and implement. It is, however, problematic if in reality different fossil fuel producers and importers see vastly different percentages of their product go to non-energy use in Canada. Companies that actually had more than 8.3% of the carbon content associated with their product sequestered through non-energy uses would be penalized under this system. Moreover, this solution would provide little relief to the users of fossil fuels as non-energy feedstocks under an upstream carbon content trading system. This is because such a minor change in the number of allowances required by fossil fuel producers and importers would have only a minor effect on the price increase passed through the system.

It is possible, however, to adjust this approach to address the second concern. For example, the extra allowances (8.3%) could be distributed to firms that use fossil fuels as non-energy feedstocks in proportion to their purchase of fossil fuel feedstocks. These firms could then sell these allowances to the fossil fuel producers and importers who will need them to remain in compliance under NRTEE Option 4. The revenue generated through the sale of these allowances would help these firms weather the price increases generated by a cap on the carbon content of fossil fuels in an upstream emissions trading system.

While this system sounds relatively straightforward, it would be a challenge to ensure that these allowances were distributed equitably. As noted above, fossil fuel feedstocks are used to produce thousands of products, each of which sequester carbon at different rates. Trying to distribute allowances in a manner that reflects the actual sequestration of carbon would require a much more detailed analysis of what happens to fossil fuel feedstocks after they enter the firm that make use of these feedstocks. This level of detail would probably make the allocation of allowances too cumbersome. At the same time, distributing allowances on the basis of the quantity of fossil fuel feedstock used by these firms is unlikely to be equitable because the use of these feedstocks (and the rate of carbon sequestered) will vary from firm to firm.

This approach could also make some sense under NRTEE Options 11, 13 and 14. In this system, caps are imposed on the emissions of individual chemical companies and other non-energy users of fossil fuels. If compliance with these caps is determined by monitoring fossil fuel purchases by these firms (for both energy and non-energy use), the distribution of allowances for fossil fuel pruchases associated with non-energy use would be critical. As noted above, however, some

equity concerns would arise because of the different uses of these fuels for non-energy purposes in different firms. On the other hand, additional allowances would not need to be provided if compliance was determined by monitoring actual emissions from combustion and the use of emission factors (using agreed upon methodologies) to determine greenhouse gas emissions from the non-energy use of fossil fuels.

Option 2 – Provide Credits to Chemical Companies and Other Non-Energy Fossil Fuel Product Users for the Sequestration of Carbon

Under this approach, the federal government would define a standard level of sequestration associated with products produced with the use of non-energy fossil fuel feedstocks. As noted earlier, this would be a challenging task because the amount of carbon sequestered varies in each of the thousands of final products produced through the use of fossil fuels as non-energy feedstocks. Nonetheless, a standard set of general guidelines could probably be agreed to.

Under a credit trading system (NRTEE Options 1 or 8), this approach could be used to allow chemical companies and other non-energy fossil fuel product users to create greenhouse gas emission reduction credits for actions that sequester carbon. In NRTEE Option 1, care would need to be taken to ensure that credits were not awarded for actions that sequester carbon that is not included in Canada's greenhouse gas emissions inventory (e.g., the production of asphalt). If a credit was awarded for asphalt production, and that credit was sold to a greenhouse gas emitter, that emitter would be allowed to increase its own emissions without having made a contribution to reducing the emissions in Canada's greenhouse gas inventory. In NRTEE Option 8, if the regulations or standards applied to chemical companies and other non-energy users of fossil fuels covered their total consumption of fossil fuels (for energy and non-energy purposes), this approach would allow them to create credits through sequestration that could be applied against these regulations or standards.

This approach could also make some sense under NRTEE Options 11, 13 and 14. In this system, caps are imposed on the emissions of individual chemical companies and other non-energy users of fossil fuels. If compliance with these caps is determined by monitoring fossil fuel purchases by these firms (for both energy and non-energy use), these companies could create emission reduction credits for carbon sequestered and apply them against these caps. On the other hand, such credits would not be necessary if compliance was determined by monitoring actual emissions from combustion and the use of emission factors (using agreed upon methodologies) to determine greenhouse gas emissions from the non-energy use of fossil fuels.

Finally, in an upstream carbon content trading system (NRTEE Option 4), chemical companies and other non-energy fossil fuel users could create credits for the carbon they sequester through the use of fossil fuel feedstocks. These credits could then be sold to fossil fuel producers and importers to allow those companies to be in compliance with their caps. As in option 1, the funds obtained would help compensate these companies for the price increases they face under such an emissions trading system.

A potential danger here is the system's complexity. The production of products with fossil fuel feedstocks often goes through several stages. Care would have to be taken in designing the system to ensure that credits could only be created at one stage of the production process for a specific product. If credits are claimed at two different stages of the process, double counting will occur. This can threaten the environmental objective of the trading system because the sale of credits could result in more emissions being produced than had actually been sequestered through creditable activities. Double counting can also produce equity concerns is only some firms

produce credits that do not reflect actual carbon sequestration. While this system is much more complex that Option 1, it could ultimately facilitate the development of better emission and sequestration factors and a more accurate greenhouse gas emissions inventory.

Option 3: Set Aside a Predetermined Number of Credits for Non-Energy Uses of Fossil Fuels and Award These Allowances to Applicants

This option combines elements of Options 1 and 2. Under this approach, a specified additional set of allowances/credits (8.3% more than the emissions cap) is once again created. In Option 1, these additional allowances were either distributed to fossil fuel producers and importers or to the users of fossil fuels for non-energy purposes. Option 3, however, would award these additional credits to firms that could demonstrate that they had taken actions to sequester carbon emissions as outlined in Option 2.

As a result, Option 3 (like Option 2) is less arbitrary than Option 1. Additional allowances are only provided when demonstrable evidence is provided that actions have been taken that will sequester carbon dioxide. As a result, both Option 2 and Option 3 are more equitable than Option 1 because the benefits associated with the allocation of additional allowances or credits into the system are likely to be more accurately matched to firms and activities that actually sequester carbon.

At the same time, Option 3 (like Option 1) is more environmentally effective than Option 2 because there is a limit on the number of allowances/credits associated with carbon sequestration. This eliminates the danger of double counting that was identified in Option 2 and provides more assurance that the environmental objective will be met.

Accordingly, Option 3 appears to be the best of the three options presented. It is not a perfect option. For example, equity concerns do exist in Option 3. Credits are only awarded to a specific limit. If some firms receive credits that represent double counting, it may exclude firms that are actually sequestering carbon from obtaining credits.

Implementation Issues Associated with the Three Options

This discussion of options for addressing the use of fossil fuels as non-energy feedstocks in a domestic emissions trading system raises several issues related to implementation. Three of these issues are briefly discussed below.

First, Options 1 and 3 assume that it is possible to determine how much of the carbon contained in fossil fuels will be 'permanently' sequestered at the time that allowances are distributed or limits are set on the availability of credits associated with carbon sequestration. It is possible to develop an estimate of the quantity of carbon sequestered in long-live products produced with fossil fuel feedstocks on an annual basis. As this number is likely to change over time, the quantity of additional allowances or credits could be adjusted on an annual basis.

Second, Options 2 and 3 require a detailed understanding of the rate at which carbon is sequestered in products produced with fossil fuel feedstocks. Getting an accurate understanding of this is likely to be an enormous task. There will be a need to understand the production process of products, the role of intermediate products in the production process, and a mechanism for tracing the production path of a product from the moment fossil fuels enter a chemical plant until the final product is produced.

Third, Options 2 and 3 both require some mechanism for approval and certification of credits. Given the potential for double counting, and its implications for equity, this process is quite important. One way to address the issue would be to ensure that industry representatives are non-government representatives, particularly from industry, are included in the approval process. In Option 3, with limited availability of credits, all industry representatives will have a clear incentive to ensure that the credits are legitimate.