Transitioning an Emissions Trading System from Intensity Allocations to a Binding Cap

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Executive Summary

This report discusses the issues involved in transitioning an intensity-based emissions trading system to one with a binding absolute cap, specifically:

- The relationship of the absolute cap to the national emissions target;
- The change in the method of distributing allowances; and
- How participants manage their compliance before and after the transition.

An intensity-based system distributes allowances free to each participant annually based on its actual production during the year and a specified intensity factor. Total allowable emissions fluctuate annually due to changes in the output of the participants. With an absolute cap, the government specifies the allowable emissions for each year in advance. Allowances equal to the cap are distributed by auction or free based on historic data ("grandfathering") or recent data ("updating").

In terms of the total allowable emissions, a transition in 2026 from a limit that fluctuates annually to one that is specified in advance poses no problems. The main issue is setting the cap at a "reasonable" share of the national target with a "reasonable" reduction from the allowable emissions in 2025. The information needed to ensure that the proposed cap is reasonable from both perspectives will not be available until 2022 to 2024.

For allowance distribution, the simplest transition from an intensity-based free allocation is to a free distribution based on updating. An abrupt transition to auctioning would have a major financial impact on participants and probably would be resisted. A transition to grandfathering would use very old data or create a strong perverse incentive to increase emissions. Unfortunately, the cost of meeting a given cap is higher with an updating formula than for auctioning or grandfathering.

An intensity-based allocation also could be implemented with a declining share of the allowances distributed free over time with the balance of the allocation being auctioned. Then continuing the phase out of free allowances using the intensity-based allocation and auctioning the balance of the cap would be the simplest transition.

Certainty relating to the rules of the emissions trading system, knowledge of the allowance allocations several years into the future, allowance banking, and liquid markets for current and future allowances help participants to minimize their compliance costs. A liquid market for future allowances requires advance distribution of at least some allowances, which means an auction or a grandfathering formula.

Ultimately, the cost of the emission reductions implemented by the participants in the emissions trading system is borne by individuals in their capacities as consumers, shareholders, employees, taxpayers, and recipients of government services. Free distribution of allowances benefits the shareholders of the participating firms and employees in trade-exposed industries. If the allowances are auctioned, who benefits depends on how the revenue is used.

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1. Background and Scope

The Government of Canada has asked the National Round Table on the Environment and the Economy (NRTEE) to provide advice on, *inter alia*, medium-term (2020–2025) targets for greenhouse gas emission reductions by industrial sources, recognizing the outlook for Canadian economic growth and the Government's intention to build upon the emissions intensity approach with targets that are ambitious enough to translate effectively into a fixed cap on absolute emissions.

This report discusses the issues involved in transitioning an intensity-based emissions trading system to one with a binding absolute cap. Such a transition involves three groups of issues:

- The change from a limit on total allowable emissions that fluctuates annually under an intensity-based system to an absolute cap on allowable emissions established by the government and the relationship of the absolute cap to the national emissions target;

- The change in the method of distributing allowances from free distribution to participants based on their current output in the intensity-based system to free distribution, based on some other formula, or an auction in the system with an absolute cap; and

- How participants manage their compliance given the rules of the emissions trading system before and after the transition.

Allowances have a market value, so allowance distribution involves a distribution of wealth. Thus the issues relating to the distribution of allowances involve the largest economic stakes and are the most complex.

An intensity-based emissions trading system is assumed to be implemented for two eight year periods – 2010 through 2017 and 2018 through 2025 – with the transition to an absolute cap taking place on January 1, 2026. The participants are assumed to be fossil-fired electricity generating units and large industrial facilities, which collectively account for approximately half of Canada's total greenhouse gas emissions.

The next section outlines the relevant features of intensity-based and absolute cap emissions trading systems. Section 3 discusses the issues related to setting the absolute cap and the transition to such a cap. Issues related to changes to the method of distributing allowances are discussed in Section 4. How the transition affects the behaviour of participants is analyzed in Section 5. Section 6 provides a summary.

2. An Emissions Trading System

An emissions trading system regulates specified emissions by a defined set of sources. It is assumed that Canada implements a system to regulate the greenhouse gas emissions due to fuel combustion and industrial processes by electricity generators and industrial plants that exceed specified size thresholds. Allowances – each of which permits the owner to discharge 1 tonne of CO_2 equivalent[1] are assumed to be distributed annually.[2] At the end of each year, every regulated source (participant) must remit to the government enough allowances to cover its actual emissions during the year or incur a non-compliance penalty.

With full compliance, the actual emissions of all participants can not exceed the allowable emissions as indicated by the allowances distributed. In an intensity-based system, total allowable emissions are determined by the output of the participants and hence fluctuate from year to year. With an absolute cap, total allowable emissions are determined in advance by the government. In all systems allowances are tradable, so sources that reduce their emissions can sell surplus allowances to participants with high emission reduction costs.[3]

This report focuses on the transition from an intensity-based system to one with an absolute cap. This affects both the total allowable emissions and the distribution of allowances. Allowance banking – permission to save (bank) surplus allowances for use during a future year – is assumed to be a feature of the trading system throughout.[4] Other features of the emissions trading system – monitoring and reporting requirements, the non-compliance penalty, ability to use credits from approved offsets,[5] the ability to use allowances from linked trading systems,[6] treatment of new entrants, etc. – are not specified but are assumed to remain unchanged.

2.1 An Intensity-based Emissions Trading System[7]

In its simplest form, an intensity-based emissions trading system distributes allowances to each participant annually based on its actual production (such as KWh generated or tonnes of steel produced) during the year and a specified intensity factor (such as tonnes of CO_2 per kWh, or tonnes of CO_2 per tonne of steel).[8] The intensity factor differs by industry and usually declines over time, either annually or at specified intervals, such as the end of each of the proposed eight years periods. The intensity factor for a new participant may be lower than that for existing sources in the same industry since a new source has the opportunity to adopt more modern technology.

Key features of this design are that:

- Total allowable emissions fluctuate from year to year due to changes in the output of the participants as well as the establishment of new sources required to participate in the system.[9]

- All allowances are distributed to participants free.

The greenhouse gas emissions intensity of Canadian industry has been declining since the early 1990s. Over the period 1990 through 2004 the emissions intensity of Canadian industry declined by more than one-third – over 3% per year – due to improved emissions efficiency of industry and a shift toward less emissions-intense products.[10] Unless the intensity factors decline at a corresponding rate, the emission reduction targets for participants become less stringent.

An intensity-based distribution of free allowances acts as a production subsidy.[11] This reduces the output decline due to imposition of the emissions trading system and so helps reduce the adverse impacts on trade-exposed industries.[12] But this protection for trade-exposed industries comes at a cost. Higher output means higher emissions, higher marginal emission control costs and lower profits than under an allowance distribution not based on current production.[13]

2.2 An Emissions Trading System with an Absolute Cap

With an absolute cap, the total allowable emissions (the cap) for each year is specified in advance by the government. The cap usually declines annually or at specified intervals. Allowances equal to the cap are distributed using some combination of auction and free distribution based on a specified formula. Due to their effects on behaviour, formulae are divided between those based solely on historic data ("grandfathering") and those based on data after the system is implemented ("updating").

With an auction, the government sells the available allowances.[14] An auction, rather than sale at a specified price, is used because the government is not able to determine the price at which all of the available allowances will be purchased.[15] The government can use the auction revenue for various purposes, including reduction of existing taxes,[16] measures to benefit the environment, incentives to develop emission reduction technologies, or assistance to adversely affected firms, employees and consumers.

Grandfathering distributes allowances free to participants based on historic – prior to the start of the emissions trading system – data. The allocation to each participant is usually based on its emissions, output, or energy input during a specified period shortly before implementation of the emissions trading system is announced. The calculated allocations are scaled to match the overall cap.[17] Rules are needed for participants that cease operation and new sources required to join the system.[18]

Updating distributes allowances free to participants based on current or recent data that are updated over time. For example, the allocation for 2015 may be based on data, such as emissions, output or energy input, for 2013. Updating is very similar to intensity-based allocation, but with an absolute cap the calculated allocations need to be scaled to match the cap. The updating formula can be applied to new sources and those that cease operation.

Key features of an emissions trading system with an absolute cap are that:

- The overall cap on allowable emissions is a fixed quantity for each year specified in advance by the government. The cap may decline annually or be adjusted periodically.

- Allowances equal to the cap are distributed some any combination of (1) an auction, (2) free based on historic data (grandfathering), or (3) free based on current/recent data (updating).

Updating, like an intensity-based allocation, acts as a production subsidy. As a result, the economic cost of achieving a given cap is higher with an updating distribution of free allowances than with auctioned allowances or free distribution based on historic data (grandfathering).[19] Since total emissions are capped, updating shifts allowances from less rapidly growing to more rapidly growing participants.[20]

2.3 Distribution of the Compliance Costs

Implementing an emissions trading system imposes costs on the participants.[21] Part of the cost is passed on to customers through higher prices and part of the cost is absorbed by shareholders through a reduction in the value of the firm's assets. The price increases reduce demand, so output falls and employment may be reduced. The magnitude of the price increases and output reductions will differ by participant depending upon factors such as the emissions-intensity of the product, competition from firms in other jurisdictions, the elasticity of demand for the product,[22] and how the allowances are distributed.

Participants that produce products whose demand is not price sensitive can raise prices and, if allowances are distributed free, earn higher profits. This has been the case for electricity generators under the European Union emissions trading scheme.[23] Participants that face competition from foreign firms not subject to comparable emissions control regulations may not be able to raise their prices. The result can be a transfer of production to foreign competitors with perhaps no reduction of global emissions and economic losses to the shareholders of the Canadian firms.[24]

Participants raise their prices if they can. Their output may decline, profits may be lower and asset values may be reduced. Other firms are affected by the higher prices and lower output, which in turn affects more firms.[25] Employment may be reduced at firms where output falls. Output, employment, and possibly profits, rise at firms that supply emission reduction technologies. Government revenue may be affected by the changes in profits and employment. Ultimately, the net cost is borne by individuals in their capacities as consumers, shareholders, employees, taxpayers, and recipients of government services.[26]

How the allowances are distributed affects how the cost is distributed. Free distribution of allowances can compensate for the loss of asset value, which benefits shareholders. Free distribution can help protect the output of trade-exposed industries, which benefits employees and shareholders of firms in those industries. If the allowances are auctioned, who benefits depends on how the government uses the revenue; how it spends the revenue or which taxes is reduces.

3. Total Allowable Emissions

Under the intensity-based system, total allowable emissions fluctuate from year to year due to changes in the output of the participants. With an absolute cap, the limit on allowable emissions each year is specified in advance by the government. The transition to an absolute cap raises issues of:

- The relationship of the cap to the national target; and
- The magnitude of the emission reductions imposed on participants.

3.1 Relationship of the Cap to the National Target

Canada is expected to adopt short-, medium- and long-term emissions targets. Participants in the emissions trading system will account for approximately half of Canada's greenhouse gas emissions. Since the emissions trading system represents a large fraction of total emissions, the absolute cap will need to be consistent with the national emissions target at the time.

To meet the national emissions target, Canada will need to implement policies to limit emissions by sources not covered by the emissions trading system. A number of different policies are likely to be needed to limit emissions by sources, such as agriculture, buildings, forestry, transport and waste. Policies to promote increased sequestration by carbon sinks and implementation of CO_2 capture and storage may also be adopted.

The absolute cap for the emissions trading system will need to reflect the national emissions target at the time. But the relationship between the national target and the cap for the emissions trading system is not precise. If participants in the emissions trading system account for exactly half of Canada's greenhouse gas emissions the cap need not be 50% of the national target, but it almost certainly will be between 40% and 60% of the target.

Whether the cap is higher or lower than the participants' share of national emissions will depend on how the government chooses to distribute the emissions reduction burden. This will be influenced by considerations such as the marginal costs of emissions reductions for other sources relative to the market price for allowances, the effectiveness of the policies to limit the emissions by other sources, and the economic impacts of the policies adopted for different sources.[27]

The participants in the emissions trading system, their emissions and the costs of reducing emissions will change significantly over the next 20 years due to new entrants, firms that cease operation, changes in production technology, implementation of emission reduction measures, and other factors. Even if the national target for 2026 is known now, other variables that affect the cap for 2026 will not be known until a few years before the transition.

To develop efficient compliance plans participants need information on the level of the cap and, ideally, allowance prices at least five years into the future. Thus, the initial caps should cover at least the years 2026 through 2030. But the information needed to set those caps probably will not be available until between 2022 and 2024. However, participants will have a sense of the likely range for the caps before this, since they are unlikely to differ significantly from the trading system's share of national emissions.

3.2 The Magnitude of the Reduction in Total Emissions

The transition in the nature of the limit on allowable emissions – from one that fluctuates annually with actual output to one that is specified in advance – does not create any problems. This transition is comparable to a reduction in the allowable emissions due to lower intensity factors or a reduction of the absolute cap. With a few years' forewarning, participants can develop strategies, including emission reductions and allowance banking, to cope with the change.

Since the intent is to reduce total greenhouse gas emissions over time, the cap for 2026 is assumed to be lower than the forecast allowable emissions for 2025. How large a reduction is "reasonable" for participants in the emissions trading system? The size of a "reasonable" adjustment depends on whether the intensity factors have been constant or declining for previous eight years. If the intensity factors have been constant for eight years, a reduction of 25% to 35% from 2025 to 2026 is probably reasonable.[28] If the intensity factors have been declining by about 3% per year, a reduction of 2% to 10% from 2025 to 2026 is probably reasonable.[29]

The larger the bank of accumulated allowances, the more easily participants can cope with a given reduction as part of the transition to an absolute cap. Thus, the size of the accumulated allowance bank provides another yardstick for the size of a "reasonable" reduction. A reduction equal to 20% to 30% of the forecast allowance bank at the end of 2025 is probably reasonable.[30] The emissions and accumulated allowance bank through the end of 2025 probably can not be projected accurately until a few years earlier. Thus it will be difficult to assess the size of the emission reduction implied by a proposed cap and whether it is "reasonable" until a few years beforehand.

3.3 Summary

The transition from a limit on allowable emissions that fluctuates annually with actual output to one that is specified in advance does not create any problems. The issue is the level of the cap for 2026 and subsequent years. The cap should be a "reasonable" share of the national target and be a "reasonable" reduction from the allowable emissions in 2025.

What constitutes a "reasonable" share of the national target depends on the emissions and marginal costs of emissions reductions for the participants in the emissions trading system and the other sources of greenhouse gases. What constitutes a "reasonable" reduction from 2025 emissions depends on the history of previous reductions, the size of the allowance bank, and the costs of other compliance options available to participants.

The information needed to ensure that proposed caps are reasonable from both perspectives will not be available until a few years beforehand, probably 2022 to 2024. However, participants will have a sense of the likely range for the caps before this, since the caps are unlikely to differ significantly from the trading system's share of national emissions.

4. Distribution of Allowances

The transition from an intensity-based system to one with an absolute cap requires a change in the method of distributing allowances. The intensity-based system distributes allowances free to participants based on their output during the current year. A system with an absolute cap distributes the allowances using an auction or free distribution based on a grandfathering or updating formula. This section discusses the transition to each of these three methods. First the rationales for distributing allowances free are reviewed.

4.1 Rationales for Free Distribution of Allowances

Allowances are financial assets, so participants want to receive them free. The way allowances are distributed affects the behaviour of participants. Free intensity-based or updating allocations act as a production subsidy that encourages higher output and hence higher emissions or, with a fixed cap, higher compliance costs. In contrast, distribution by auctioning or grandfathering does not distort the behaviour of participants.

Free distribution of allowances is widely accepted as justified as:

- Compensation for the loss in value of existing assets due to introduction of the emissions trading system; and
- Protection for firms in trade-exposed industries.[31]

Typically, not all of the available allowances would be needed for these purposes.[32] The balance could be auctioned.[33]

Introduction of an emissions trading system can reduce the profits and hence the value of existing assets of some participants. Free allowances can compensate for that loss of value. To maintain an incentive to minimize emissions, the size of the free distribution should be determined before the system begins operation and not vary with subsequent output or emission levels. A free intensity-based or updating allocation is not an efficient method of providing compensation for the loss in value of existing assets.

In trade-exposed industries introduction of an emissions trading system could lead to transfer of output to competitors in jurisdictions not subject to comparable emissions control obligations. A free allocation to firms in such industries based on each firm's production helps protect against such transfers of output. A free intensity-based or updating allocation can provide such protection, although the quantity allocated usually is not determined by the level of protection needed.

4.2 Transition to auction

Operationally a transition from an intensity-based free distribution to an auction of allowances is simple; allowances for 2025 are distributed free based on actual output during 2025 and allowances for 2026 are auctioned. Some trade-exposed firms might still need protection in 2026. Those firms could receive free allowances and the remaining allowances could be auctioned.

But the transition from a free distribution to an auction involves a major financial change for participants. For 2025 each participant would receive a large fraction of the allowances it needs for compliance at no cost. The next year each participant would have to buy all of the allowances it needs. This abrupt transition from getting free allowances to having to buy all of the allowances needed for compliance would be very unpopular with participants. Thus a transition to auctioning the allowances probably would need to be implemented gradually.

The transition to an auction removes the production subsidy effect of the intensity-based distribution, which should make compliance with the new absolute cap less costly to Canadian society.[34] The auction raises revenue that the government can use to reduce existing taxes, or spend on measures to benefit the environment, develop emission reduction technologies, or assist adversely affected firms, employees and consumers.

4.3 Transition to grandfathering

A transition from an intensity-based distribution to a free distribution based on "historic" data (grandfathering) does not impose a financial burden on participants since all allowances continue to be distributed free. If some trade-exposed firms still need protection in 2026, they can be given the allowances allocated by the grandfathering formula or the allowances needed for protection, whichever is higher.[35]

But grandfathering is difficult to implement for a transition that occurs on January 1, 2026. A grandfathering formula that takes effect in 2026 typically would be based on data relating to one or more years between 2020 and 2024. Using that period as the basis for the grandfathering formula would create a very strong perverse incentive to raise output, and hence emissions, during those years. This because the participant will be awarded more allowances for the year in question due to the intensity-based allocation and more allowances every year from 2026 on due to the grandfathering formula.

The perverse incentive created by using future years as the "historic" period for the grandfathering formula can be avoided. One option is to use a historic period that ends prior to 2007 for the formula that takes effect in 2026. Given the changes to the participant population during the intervening 20 years, the resulting allocation might be considered unfair. Another option is to announce that post-2025 allocation will be based on updating and to switch to grandfathering based on 2020 to 2024 data in 2026. To succeed, this strategy must be kept secret until after the end of the "historic" period.

The transition to a grandfathering distribution removes the production subsidy effect of the intensity-based distribution. Compliance with the new absolute cap should be easier and less costly as a result. But, grandfathering does not raise revenue.

4.4 Transition to updating

A transition from an intensity-based free distribution to a free distribution based on current data (updating) is very simple. In principle the same intensity-factors can continue to be used.[36] The only change needed is to scale the calculated allocation to each participant so that the total number of allowances distributed is equal to the emissions cap for the year. If some trade-exposed firms still need protection in 2026, they can be given the allowances allocated by the updating formula or the allowances needed for protection, whichever is higher.[37]

The transition to an updating formula does not impose a financial burden on participants since all allowances continue to be distributed free. However, an updating formula acts as a production subsidy, so the compliance cost for a given absolute cap will be higher than with grandfathering or an auction. And updating does not raise revenue.

4.5 Transition if Free Intensity-based Allocations Decline Over Time

The above discussion assumed the intensity-based allocation involved free distribution of all of the allowances indefinitely, as is usually the case. Instead, the share of the intensity-based allocation distributed free could decline over time with the balance of the allocation being auctioned.[38] For example, the fraction of allowances distributed free could start to decline when sources in the United States are subject to comparable regulations governing their greenhouse gas emissions.[39] This intensity-based allocation reduces the strength of the production subsidy over time and generates revenue for the government.

Assuming that an increasing share of the intensity-based allocation is auctioned, the transition issues discussed above are modified as follows:

- The transition to all allowances being auctioned in 2026 is a much smaller financial shock for the participants because only a fraction of the allowances are distributed free in 2025. To provide a more gradual transition, the phase out of the free allowances could continue until it reaches zero.

- The transition to grandfathering still faces the same problem of the perverse incentive created by using future years as the "historic" period for the allocation formula. After reducing the share of the allowances distributed free for many years, increasing the share to 100% again in 2026 is unlikely. If the phase out of the free distribution is sustained, the incentive to increase output during the

"historic" period is much smaller because the grandfathering formula covers only a small and declining share of the allowances after 2026. Rather than implementing a grandfathering formula for a small share of the allowances for a few years, the free intensity-based allocation could continue until it reaches zero with the remaining allowances being auctioned.

- The transition to updating is still simple, but the share of the allowances distributed free would rise to 100% again in 2026, which is unlikely. Instead, the phase out of the free distribution could continue until it reaches zero when all allowances would be auctioned.

In summary, if the share of the intensity-based allocation distributed free declines over time, reverting to 100% free distribution with the transition to the absolute cap is unlikely. A continued phase out of the free distribution is more likely. An abrupt shift to an auction of all allowances is equally unlikely. Rather, continuing the phase out of the free distribution with an intensity-based allocation is simplest solution.

4.6 Summary

Free distribution of allowances is widely accepted as compensation for the loss in value of existing assets due to introduction of the emissions trading system and protection for firms in trade-exposed industries. An intensity-based allocation is not an efficient method of providing compensation for the loss in value of existing assets. An intensity-based can provide protection for trade-exposed industries, although the quantity allocated usually is not determined by the level of protection needed.

The simplest transition from an intensity-based free distribution of allowances is to a free distribution based on current data (updating). An abrupt transition to auctioning has a major financial impact on participants and probably would be resisted. A transition to grandfathering must rely on very old data or create a strong perverse incentive to increase emissions. But an updating formula acts as a production subsidy, so the cost of meeting the cap is higher than for auctioning or grandfathering.

An intensity-based allocation also could be implemented so that the share of allowances distributed free declines over time with the balance of the allocation being auctioned to raise revenue. Then continuing the phase out of free allowances using the intensity-based allocation would be the simplest approach.

5. How Participants Manage the Transition

Participants must manage their compliance before and after the transition. They will use the mechanisms available – banking, purchases/sales of allowances for future years, investment in emission reduction measures – to minimize the cost of compliance. Managing compliance is easier if each participant knows what its free allowance allocation will be and what allowance prices will be several years into the future.

An intensity-based emissions trading system distributes allowances to each participant annually based on its actual production during the year. Allowances are distributed when the actual output is known, which is usually only a few months before the compliance deadline. This reduces the liquidity of the allowance market, which increases costs.[40] Liquidity can be improved by basing the current year's allocation on the previous year's output, or by distributing a share, say 80%, of the previous year's allocation at the beginning of the year. Such changes make allowances available to the market earlier.

The best way to generate allowance prices for future years is to distribute some of the allowances in advance. This enables allowances for future years to be traded, generating prices that participants can use to evaluate emission reduction investments.[41] Advance distribution requires that some of the allowances be distributed by auction or a grandfathering formula. Distributing all allowances free on the basis of current output in an intensity-based system or by an updating formula means allowances can not be distributed in advance.

A bank of allowances, access to credits from approved offsets, and links to other trading systems give participants more flexibility in planning their compliance.[42] These provisions increase the quantity of allowances and credits participants can use to achieve compliance. They can also improve the liquidity of the markets for current and future year allowances.

In principle an emissions trading system may allow borrowing – use of allowances issued for a future year for compliance during the current year – to increase liquidity. Only the New South Wales Greenhouse Gas Abatement Scheme allows borrowing and the amount of borrowing is limited.[43] Other systems allow the market to structure such transactions and so place the risk of default on the participant rather than the environment.[44]

Participants must manage their compliance before and after the transition. They will use the mechanisms available – banking, purchases/sales of allowances for future years, investment in emission reduction measures – to minimize the cost of compliance. Certainty relating to the rules of the emissions trading system, knowledge of the allowance allocations several years into the future, and liquid markets for current and future allowances help participants to minimize their compliance costs. This requires distribution of at least some allowances several years in advance, which means an auction of at least some of the allowances or a grandfathering formula.

6. Summary

This report discusses the issues involved in transitioning an intensity-based emissions trading system to one with a binding absolute cap, specifically:

- The change from no explicit limit on allowable emissions to an absolute cap on emissions and the relationship of the absolute cap to the national emissions target;
- The change in the method of distributing allowances; and
- How participants manage their compliance before and after the transition.

An intensity-based system distributes allowances free to each participant annually based on its actual production during the year and a specified intensity factor. Total allowable emissions fluctuate from year to year due to changes in the output of the participants.

With an absolute cap, the total allowable emissions for each year are specified in advance by the government. Allowances equal to the cap are distributed using some combination of auction and free distribution based on historic data ("grandfathering") or recent data ("updating").

An intensity-based distribution of allowances acts as a production subsidy. It is not an efficient method of providing compensation for the loss in value of existing assets due to imposition of the emissions trading system. While it can provide protection for trade-exposed industries, the intensity-based allocation usually is not determined by the level of protection needed. An intensity-based allocation means higher emissions, higher marginal emission control costs and lower profits than for an auction or grandfathering.

With respect to the limit on total emissions, a transition from a limit on allowable emissions that fluctuates annually with actual output to one that is specified in advance does not create any problems. The main issue is setting the cap at a "reasonable" share of the national target and with a "reasonable" reduction from the allowable emissions in 2025.

What constitutes a "reasonable" share of the national target depends on the emissions and marginal costs of emissions reductions for the participants in the emissions trading system and the other sources of greenhouse gases. What constitutes a "reasonable" reduction from 2025 emissions depends on the history of previous reductions, the size of the allowance bank, and the costs of other compliance options available to participants.

The information needed to ensure that proposed caps are reasonable from both perspectives will not be available until a few years beforehand, probably 2022 to 2024. However, participants will have a sense of the likely range for the caps before this, since the caps are unlikely to differ significantly from the trading system's share of national emissions.

For the allowance distribution, the simplest transition from an intensity-based distribution is to a free distribution based on updating. An abrupt transition to auctioning has a major financial impact on participants and probably would be resisted. A transition to grandfathering must rely on very old data or create a strong perverse incentive to increase emissions. But an updating formula acts as a production subsidy, so the cost of meeting the cap is higher than for auctioning or grandfathering.

An intensity-based allocation also could be implemented so that the share of allowances distributed free declines over time with the balance of the allocation being auctioned. Then continuing the phase out of free allowances using the intensity-based allocation would be the simplest approach.

Participants will use the mechanisms available – banking, purchases/sales of allowances for future years, investment in emission reduction measures – to minimize the cost of compliance. Certainty relating to the rules of the emissions trading system, knowledge of the allowance allocations several years into the future, and liquid markets for current and future allowances help participants to minimize their compliance costs. This requires distribution of at least some allowances several years in advance, which means an auction of at least some of the allowances or a grandfathering formula.

Ultimately, the net cost of the emission reductions implemented by the participants in the emissions trading system is borne by individuals in their capacities as consumers, shareholders, employees, taxpayers, and recipients of government services. How the allowances are distributed affects how the cost is distributed across individuals. Free distribution of allowances benefits the shareholders of the participating firms and employees in trade-exposed industries. If the allowances are auctioned, how the revenue is used – lower taxes or spending to benefit the environment, incentives to develop emission reduction technologies, or assistance to adversely affected firms, employees and consumers – determines who benefits.

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Notes

[1] Carbon dioxide (CO_2) is the most abundant of the greenhouse gases. Others emitted by human activity and controlled by the Kyoto Protocol are methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Emissions of the other gases are often expressed as CO_2 equivalents by multiplying the quantity emitted by the global warming potential (GWP) of the gas over 100 years. The GWP is a measure of the radiative effect of 1 kg of a gas relative to that of 1 kg of CO_2 over a specified time period.

[2] Allowances are also called permits, credits, quotas and names unique to the trading system. As discussed in Section 3 allowances can be distributed free based using a specified formula, by auction, or by any combination of the two.

[3] A source whose emission reduction cost is higher than the market price of an allowance can reduce its compliance cost by buying allowances rather than reducing its own emissions.

[4] Existing emissions trading systems have rules that range from no banking to unrestricted banking, with less restrictive rules being environmentally compatible with and more common for greenhouse gases. Most existing trading systems have accumulated a relatively large bank of surplus allowances during the initial years (Haites, 2005). Although banking is assumed it could be restricted, for example by a limited life (e.g., 2 to 5 years) for allowances.

[5] Actions by specified non-participants that reduce emissions can earn "credits" in many emissions trading systems. Such offset credits are equivalent to allowances for compliance purposes, but where they are used they typically constitute a small share (less than 5%) of the allowances.

[6] An emissions trading system may agree to accept allowances from another system for compliance (and possibly vice versa) thus linking the systems. Most existing and proposed trading systems for greenhouse gases have absolute caps. Fischer, 2003 reviews the issues that arise when linking an intensity-based system and a system with an absolute cap.

[7] For more on intensity-based systems see Ellerman and Wing, 2003 and Herzog, et al., 2006. These papers and others discuss intensity-based limits mainly in terms of country commitments under an international agreement. Haites (2003) discusses intensity-based limits for participants in a domestic emissions trading system.

[8] Mathematically, the allocation ($a_{i,t}$) to a participant (i) in industry (j) for year (t) is: $a_{i,t} = f_{j,t} * o_{i,t}$ where $f_{j,t}$ is the intensity factor for industry (j) in year (t), such as tonnes of CO_2e per tonne of finished steel; and $o_{i,t}$ is the actual output of firm (i) during year (t), such as tonnes of finished steel. The total allowable emissions (A_t) is the sum of the allocations: $A_t = \Sigma_i a_{i,t}$. The actual emissions of participant (i) for year (t) are $e_{i,t}$ measured in tonnes of CO_2 equivalent. If $e_{i,t} < a_{i,t}$ participant (i) has surplus allowances to sell or bank for use in future years. If $e_{i,t} > a_{i,t}$ participant (i) needs to buy allowances or use allowances banked from previous years to achieve compliance.

[9] The allocation to a source that ceases operation is zero because its output is zero.

[10] Nyboer, et al., 2006, pp. 12-13.

[11] The strength of the subsidy depends on the allocation per unit of output relative to the actual emissions per unit of output as well as the basis for the free distribution, for example current output or a moving average of the output during the past few years.

[12] An intensity-based distribution of free allowances might be challenged as a production subsidy under World Trade Organization (WTO) or North American Free Trade Agreement (NAFTA) rules. The risk of a challenge is relatively low as long as competitors in the United States and developing country parties to the Kyoto Protocol are not subject to comparable emissions control regulations. To reduce the risk of a successful challenge, the National Emissions Trading Taskforce in Australia proposes that the free allocation to firms in trade-exposed, energy-intensive industries be equal to the impact of the emissions trading system on energy prices (NETT, 2006, p. 131).

[13] Haites, 2003.

[14] Auction design can affect the behaviour of the bidders, so an appropriate design must be chosen. The auction should be designed to sell a relatively large quantity of homogeneous items (allowances) to multiple successful bidders at a uniform price. Government auctions of Treasury Bills are a possible model. A growing number of emissions trading systems are gaining experience with allowance auctions.

[15] If the government set a price that is too high, some of the available allowances would not be sold, making the compliance burden more onerous for participants. If the government set the price too low, the demand for allowances would exceed the quantity available so quantities would need to be rationed.
[16] Reducing existing taxes lowers the cost of the emissions trading system to the economy.
[17] For example, if the allocations are based on actual emissions during 2005 and the cap during a given year is equal to 90% of 2005 emissions, each participant would receive an allocation equal to 90% of its actual 2005 emissions.
[18] Some systems continue to give allowances to participants that cease operation, while others discontinue allocations to such participants immediately or with some delay. Some systems give allowances to new participants, while others do not give them any.
[19] An auction imposes higher financial costs on participants than free distribution of allowances, whether based on an updating or grandfathering formula. However, the cost to the economy is higher with a free distribution based on an updating formula, than with auctioned allowances.
[20] If the participants as a group are growing and the cap is fixed, only those that grow faster than average get a larger allocation. Participants that grow at less than the average rate get a smaller allocation.
[21] NCEP, 2007.
[22] Elasticity is a measure of the sensitivity of the change in demand for a product to a change in its price.
[23] Sijm, et al., 2006.
[24] If the price does not change, demand for the product does not change. Since the emissions trading system raises the costs of the Canadian firm, its output is likely to be reduced. This means more of the demand is supplied by foreign competitors not subject to comparable emissions control regulations. If the emissions intensity of the foreign competitors is the same as that of the Canadian firm, global emissions do not change.
[25] The effects will be felt by firms that are not participants in the emissions trading system.
[26] While most of these individuals will be residents of Canada, some of the consumers and shareholders will be foreigners.
[27] An economically efficient set of policies would impose the same marginal cost on all emissions sources. Thus policies to limit the emissions of other sources could be designed to have a marginal emission reduction cost comparable to the market price for allowances.
[28] In the US SO_2 acid rain program the allocations to Phase 1 participants were constant from 1995 through 1999 and then dropped by about 50% for 2000 and subsequent years. The Clean Air Interstate Rule (CAIR) currently being implemented will reduce the allowable SO_2 emissions by participants in the eastern US by a further 50% in 2010.
[29] In the RECLAIM NOx and SOx programs in the greater Los Angeles area the annual cap dropped by between 5% and 15% from 1994 through 2003 and has been constant since. Allowance banking is prohibited in the RECLAIM program.
[30] In the US SO_2 acid rain program the allowance bank at the end of Phase 1 was about 115% of the allowable Phase 2 emissions. The reduction in the allocation to Phase 1 sources in 2000 was roughly 50%, representing between 20 and 25% of the allowance bank.
[31] NETT, 2006, pp. 124-138. The trade-exposed industries might not be participants in the emissions trading system, but they could still be awarded free allowances as protection.
[32] The quantity needed to protect trade-exposed industries in Canada could be large in the near term. A large fraction of the Canadian economy is open to international trade. Canada's main trading partner, the United States, and developing countries currently do not impose greenhouse gas emissions control obligations on their firms. Over time, those jurisdictions are expected to introduce such obligations, which would reduce the need to protect Canadian firms.
[33] NCEP, 2007.
[34] Auctioning the allowances raises the financial cost to system participants, but removing the production subsidy effect reduces the cost of meeting the specified emissions cap and hence reduces the cost to Canadian society.
[35] The allocations to all participants would still be adjusted to match the overall emissions cap.
[36] A new updating formula could be used after the transition, but such a change might be resisted by the participants whose allowance allocations would be reduced.
[37] The allocations to all participants would still be adjusted to match the overall emissions cap.

[38] Mathematically, the allocation ($a_{i,t}$) to a participant (i) in industry (j) for year (t) is: $a_{i,t} = g_t * f_{j,t} * o_{i,t}$ where g_t is the fraction of the allocation distributed free in year (t); $f_{j,t}$ is the intensity factor for industry (j) in year (t); and $o_{i,t}$ is the actual output of firm (i) during year (t). The total allowable emissions (A_t) is still be $A_t = \Sigma_i f_{j,t} * o_{i,t}$. Then $g_t * A_t$ allowances would be distributed free and $(1 - g_t) * A_t$ allowances would be auctioned for year (t).

[39] For example, if sources in the United States are subject to comparable regulations governing their greenhouse gas emissions starting in 2012, the free allocation could decline by 5% per year from 100% in 2011 to 30% in 2025

[40] Liquidity is the ease with which a good can be bought or sold. A liquid market is one where a buyer (seller) can purchase (sell) the desired quantity of the good quickly at the market price. If liquidity is limited participants do not know how many allowances will be available and/or what the price will be. They then tend to implement emissions reduction measures internally to achieve compliance. The cost of the internal measures may be higher than the market price.

[41] Forward contracts and options can provide such information, but their transaction costs are much higher than those for the sale of issued allowances. A forward contract or option involves a promise by a firm to deliver allowances at a specified price at a future date. The credit ratings of the parties are critical to such contracts. Thus the contract negotiation is much more complex than a purchase of allowances for a future that have already been issued.

[42] See Ellerman, 2003 for an analysis of the use of the banking provision of the SO_2 acid rain program to manage the transition from Phase 1 to Phase 2.

[43] Borrowing is limited to 10% of the amount needed for compliance and the quantity borrowed must be repaid the following year.

[44] A participant that expects to have surplus allowances for future years but needs allowances for the current year can purchase the latter to achieve compliance and sell, directly or via a forward contract, surplus allowances for the future year(s). The participants bear the risks of default. If borrowing is allowed and the participant ceases operation before repaying the borrowed allowances, the environment suffers.