



Climate Change & Sustainability

Cap and trade programs for greenhouse gas



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The messages from scientific and business organizations, such as the Intergovernmental Panel on Climate Change (IPCC) and the World Economic Forum, are clear; action is required in order to address climate change.

“...large reductions in the emissions of greenhouse gases, principally CO₂, are needed soon to slow the increase of atmospheric concentrations, and avoid reaching unacceptable levels.”¹

“...one thing is crystal clear: to ensure our future prosperity, we need a high-growth and low carbon economy. To that end, a set of practical policies and incentives is urgently required to help remove the obstacles to more low-carbon finance and technology.”²

Concern for the potential implications of climate change is leading governments to consider policies and programs designed to reduce greenhouse gas (GHG) emissions. A number of possible policy options exist including:

- Performance standards
 - Building codes
 - Energy efficiency standards
 - Renewable energy standards
 - Transportation fuel economy standards
- Tax and other incentives
 - Incentives for accelerated deployment of low carbon technologies
 - Investment in research and development of low carbon technologies
 - Consumer rebates for energy efficiency improvements
 - Feed in tariffs
- Public education and awareness
- Market based mechanisms
 - Cap and Trade
 - Baseline and credit
 - Carbon Tax

There is no single policy approach that can achieve all emission reduction goals, so governments are implementing a range of approaches. Cap and trade programs are one option that is considered to be effective in creating a financial incentive for emissions reductions for large emitters in industrial sectors.

The European Emissions Trading Scheme (EU ETS) has been in place since January 2005. Cap and trade programs are under consideration in a number of jurisdictions, including the United States.

The purpose of this paper is to present the key characteristics of greenhouse gas emissions cap and trade programs.

¹ G8+5 Academies' Joint Statement: Climate change and the transformation of energy technologies for a low carbon future, May 2009. <http://www.nationalacademies.org/includes/G8+5energy-climate09.pdf>

² World Economic Forum, August 2009, <http://www.weforum.org/en/initiatives/ghg/index.htm>

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Cap and trade programs are designed to bring economic efficiency to emissions reductions, by rewarding over compliance and thereby encouraging reductions to occur where abatement can be achieved at lowest cost. A cap and trade program is created when a government, or other enforcing agency, establishes a cap on emissions for a defined set of industries or entities, referred to as the “covered sectors”. This cap, which is measured in tonnes of greenhouse gas (GHG) emissions per year, may become increasingly stringent over time. The government creates “allowances” where each allowance gives the holder the right to emit one tonne of CO₂equivalent, (CO₂e),³ in a given year. Facilities that are part of a covered sector have a compliance obligation, which requires them to report their actual emissions on an annual basis, and to surrender allowances equal to their actual emissions.

Allowances are either freely allocated to some or all participants often based on some historic emissions level, or sold via an auction. If the cap on GHG emissions decreases over time or emissions levels rise allowances are a scarce resource. Allowances therefore have value and define the “price of carbon”. This price is intended to reflect at least in part the cost to the environment of the emissions. The current and forecast value of allowances is used by businesses in making investment and operating decisions that impact the amount of GHG they emit. The policy intention of a price on carbon is to encourage investment in lower emission technologies and change consumption patterns to less carbon intense products.

Allowances are sold by companies that have low cost options for reducing their own emissions. They are purchased by companies who only have high cost emissions reduction options, in order to meet their compliance obligation. This buying and selling of allowances is referred to as “trading”. The purpose of trading is to allow discovery of the lowest cost emission abatement options and hence minimize the overall economic cost of the transition.

Many cap and trade programs also permit the surrender of offset credits as a means for facilities to meet their compliance obligation. Offset projects reduce GHG emissions below the otherwise “business as usual” level at a facility which is not covered by the cap and trade program. The government, or some other authority, awards an offset credit for each tonne of emissions reduction, (measured in tonnes CO₂e/year) and these credits can be used by a covered sector facility in lieu of an allowance to meet its compliance obligation. Kyoto credits–Certified Emission Reduction units under the Clean Development Mechanism or Emission Reduction Units under the Joint Implementation mechanism–are examples of offset units.

A cap and trade program is created when a government, or other enforcing agency, establishes a cap on emissions for a defined set of industries or entities

³ See text box “Greenhouse gases, CO₂e, and Global Warming Potential” for a definition of carbon dioxide equivalent.

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The scope of a cap and trade program defines the covered sectors and the gases that are regulated. When many sectors are included the scope is considered to be “economy wide”. Other programs apply only to specific sectors. The sectors included are generally those that emit a significant proportion of total anthropogenic emissions and can include:

- electricity generation
- producers and importers of fossil fuels
- petroleum refining
- producers and importers of GHG gases for sale or distribution
- industrial emitters (examples include mining, metal smelting, iron and steel production, aluminium, chemical, ceramics, cement, glass, food production)
- fossil fired combustion devices
- natural gas distribution.

In some proposed cap and trade programs covered sectors include agriculture and forestry (e.g. New Zealand).

When cap and trade programs are restricted to fewer sectors they typically include high emitting sectors such as electricity production.

Cap and trade programs may include all, or only a subset, of the greenhouse gases.

Greenhouse gases, CO₂e, and Global Warming Potential (GWP)

Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). These six are the gasses subject to the Kyoto protocol. When programs include only a subset of these GHGs they typically include carbon dioxide, which is the major greenhouse gas.

The amounts and effect of greenhouse gases are compared using the metric “CO₂equivalent” (CO₂e). “It is determined by multiplying the emissions of a gas (by mass) by the gas’ “global warming potential” (GWP), an index representing the combined effect of the length of time a given greenhouse gas remains in the atmosphere and its relative effectiveness in absorbing outgoing infrared radiation.” (insert footnote, Pew Center on Global Climate Change, Climate Change 101, Cap and Trade, January 2009, p.8).

The GWPs of some of the more common greenhouse gases are shown in the table below.

Greenhouse gas	GWP
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous Oxide (N ₂ O)	298
HFC 23	14,800
SF ₆	22,800

IPCC Working Group 1, Technical Summary, 2007)

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Compliance with cap and trade programs is normally at a facility level, (or installation, as they are called in Europe), where a facility can be defined as all buildings, plants, structures, installations, and equipment that:

- (a) emit or may emit GHG(s);
- (b) are located on one or more contiguous or adjacent properties;
- (c) are under common control of the same owner(s) or operator(s); and
- (d) form a producing unit, function as a single integrated site, or have the same first two digits of the Standard Industrial Classification or same first three digits of the North American Industry Classification System⁴

Programs establish a “threshold” which determines which facilities are large enough to be included in the program. The optimal level for the threshold has been the subject of considerable study. Lower thresholds capture more emissions; however including large numbers of low emitting facilities increases the administrative complexity of the program. A balance is sought that includes a high percentage of emissions, without creating an excessive number of reporting entities. If a program is limited to electricity generators the threshold is often defined in terms of generator capacity (e.g. 20 MW). In economy wide schemes the threshold is defined in terms of annual emissions. 25,000 T CO₂e/yr is a typical threshold.

It is important to note that the threshold often applies at a facility level. Facilities which emit above the threshold must report emissions from all sources and all GHG’s included in the program. Some programs have “de minimus” levels below which specific sources need not be measured, or below which estimation approaches can be applied. Facilities that emit less than the threshold are not required to surrender allowances, but may still be required to report emissions.

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⁴ Western Climate Initiative, Essential Requirements of Mandatory Reporting, July 15, 2009, page WCI.9-4

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The entity that is required to surrender allowances to the regulator is referred to as the “point of regulation” (PoR) or point of obligation. The PoR can either be the:

- direct emitter (e.g. electricity generator) or
- an upstream entity.

In most cases the covered entity is the direct emitter that emits GHG by burning fossil fuels, venting, flaring or fugitive emissions of methane, or via process emissions (as in cement production), for example.

Upstream entities are designated as the point of regulation when there are a large number of emitting sources that are below the compliance threshold, in order to capture emissions that otherwise would not be included in the cap and trade program. Examples include refineries and natural gas distributors. Refineries can be the point of regulation for emissions that result when gasoline is burned in cars and trucks. Natural gas distributors can be the point of regulation for emissions from homes heated with natural gas. In addition to their own direct emissions, upstream point of regulation entities must surrender allowances for the “attributed emissions” which result when the products they sell or distribute are combusted by their end use customers.

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Allowances are issued by the government and authorize the emissions of an amount of GHG, typically one tonne of CO₂e per year. The total number of allowances issued by the government in any year establishes the cap on emissions by the covered sectors.

The government regulator is responsible for the initial distribution of allowances. Allowances can be allocated free of charge or can be auctioned to market participants. The allocation of allowances impacts the distribution of program costs, although it does not impact the program effectiveness in reducing emissions. After the initial allocation, allowances trade in secondary markets, via brokers, in over-the-counter transactions, or on exchanges.

Allowances can be freely allocated to covered sector companies (e.g. electricity generators) or to entities that will be impacted by the cap and trade program, but that might not be directly covered by the program (e.g. electricity distribution companies). Free allocation achieves a number of goals including:

- Easing the transition into a cap and trade program. Allocating allowances can mitigate the financial impact on covered entities in the early years of a cap and trade program, when technologies to reduce emissions are not broadly available. Impacts can be particularly significant for industries that are not able to pass costs on to customers.
- Mitigating the impact on consumers, particularly low income households. Allowances can be allocated to energy distribution companies, who would sell the allowances, with the resulting revenue used to mitigate energy rate impacts on consumers. Increases in energy cost, which would result from cap and trade programs, have a disproportionate impact on low income consumers. This can be mitigated through the means of applying the allowance revenue to the energy ratepayers.
- Protect trade exposed sectors. Creation of a cap and trade program can disadvantage industries that compete with foreign companies that are not subject to a comparable carbon costs or performance standards. Freely allocating allowances to participants in trade exposed sectors can protect against a competitive disadvantage.

Allowances can also be distributed through an auction, with the resulting revenue used for:

- Funding low carbon technologies. Revenue from auctions can be used to fund the research, development and demonstration of low carbon technologies.
- Government programs. Revenues from auctions can be used to fund government programs, including programs to mitigate the impact of cap and trade schemes on low income consumers.
- Reduce taxes. Revenue from auctions can be used to reduce taxes.

Programs typically use a combination of free allocation and auctioning, with an intention to increase the percentage of allowances auctioned over time.

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The compliance period defines the frequency with which covered entities must surrender allowances to the government. Compliance periods typically are often on a calendar year basis, with a requirement to report emissions and surrender allowance the following year (typically in April). Sometimes allowances and obligations relate to a longer period for example the first period where a cap is established and closed at the same time as the first Kyoto commitment period.

Allowances generally have a “vintage” that defines the period in which the allowance was created. Banking provisions permit the use of prior year allowances for compliance in a later period. This effectively allows a compliance entity to over-comply in early periods, in anticipation of higher carbon prices in subsequent years. This over-compliance has positive environmental impacts.

Cap and trade programs may also have provisions which allow a covered entity to borrow allowances from the future to meet current period compliance. These provisions often limit the volume that can be borrowed, and may require repayment of a larger number of allowances, effectively creating an interest rate.

Banking and borrowing have the effect of reducing the volatility of carbon prices as they create intertemporal flexibility.

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Many cap and trade programs permit the surrender of offset credits, in lieu of allowances, as an additional compliance mechanism. Offset credits are awarded to offset projects in recognition of emission reductions resulting from the project operations. There are a number of criteria for offset project eligibility which typically include that the:

- Project is at a facility that is not subject to a mandatory cap and trade program
- Project must reduce emissions below its “business as usual” (BAU) level
- Reductions must not be required by regulation
- Emission reduction must be verified by an independent 3rd party verifier.

Regulators may accept domestic and/or international credits. International credits are typically created under the Kyoto protocol’s Clean Development Mechanism and Joint Implementation (CDM and JI). Offset project types may include, among other methodologies:

- Afforestation and reforestation
- Agricultural projects (soil sequestration, anaerobic digesters, etc.)
- Landfill methane capture
- Coal mine methane capture
- Renewable energy
- Energy efficiency programs

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While no single approach is sufficient to drive the necessary reductions in GHG emissions, many governments are including a cap and trade program in their climate change mitigation plans. A knowledge of cap and trade mechanisms is essential to understanding the impact on business, including carbon management, accounting and tax implications. While this paper has introduced the fundamental concepts, significant differences exist between the various regional and national programs. These differences must be thoroughly understood as they can significantly affect the business implications.

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