Cap-and-Trade Systems: The Basics

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1 Introduction

A cap-and-trade scheme (also referred to as an emissions trading scheme) is where a regulatory body sets an absolute aggregate cap (e.g. tonnes of CO_2 or CO_2 equivalent) on the allowable emissions for certain industrial sectors in certain geographies for a given period of time (compliance period).

Regulators then allocate emissions allowances (also referred to as permits) equal to the cap set to the entities bound by the regulation. At the end of the compliance period the regulated emitters then report their emissions levels and surrender/retire allowances equal to their reported emission level. Allowances typically have a 'vintage' which defines when they were allocated and by when they must be retired.

If an entity is able to reduce emissions to levels below their permitted levels (e.g. through investment in improved energy efficiency, production changes or internal abatement) it is then able to sell surplus allowances to other regulated entities that cannot reduce emissions to levels below which they are permitted.

In a cap-and-trade scheme, regulated entities are allowed to buy and sell emissions permits from each other but because the aggregate emissions cap is typically set below the historical aggregate emissions level of the regulated entities, allowance/permit scarcity creates a market price for the allowances/permits.

Regulated entities whose emissions reduction costs per tonne (marginal cost of abatement) are lower than the prevailing market price for allowances will benefit from investing in emissions abatement and selling their excess emissions allowances to those entities whose marginal cost of abatement exceeds the market price for allowances.

As a result, one of the key benefits of a cap-and-trade scheme is that this flexibility lowers overall compliance costs and delivers the most expedient and cost effective emissions reductions when compared to taxes or other policy options.

There are now regulated greenhouse gas cap-and-trade schemes operating in the European Union (EU Emissions Trading Scheme - ETS); New South Wales, Australia (NSW) (the Greenhouse Gas Reduction Scheme - GGAS); Alberta, Canada (Specified Gas Emitters Regulation - SGER); and the North Eastern and Mid-Atlantic states US (Regional Greenhouse Gas Initiative).

An effective, fair and functional cap-and-trade scheme relies on the careful consideration of a number of key design factors. These factors are:

1) Scope
2) Sectors
3) The cap
4) Allowance provisions
5) Offsets and offsetting

2 Scope

The scope of a cap-and-trade scheme determines which gases are to be regulated and the geographic boundaries (jurisdiction) of the scheme. Although there are cap-and-trade schemes for NOx and SO_2 (such as Ontario's NOx and SOx Emission Trading Scheme) and the long-running US EPA Acid Rain Program; this paper discusses only cap-and-trade schemes that cover greenhouse gases (GHGs) in North America.

While some cap-and-trade schemes only cover CO_2 (such as the EU ETS and RGGI) other schemes such as Alberta's SGER scheme and NSW, Australia (and all of the impending schemes in North America) cover at least all six GHGs covered by the Kyoto Protocol. These 'Kyoto gases' are carbon dioxide (CO_2); methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

The geographic boundaries of a cap-and-trade scheme are typically the jurisdictional boundaries of the regulatory body establishing the scheme.

3 Setting the Cap

For a cap-and-trade scheme to be successful at reducing GHG emissions, the cap set must be lower than the historical aggregate emissions of the emitters regulated by the scheme. In some cases, a cap is initially set at or even above the historical aggregate emission levels of those regulated. Such an approach is often used to increase buy-in for a scheme and to provide regulated emitters a 'dry run' period to develop the systems and means for managing and reducing GHG emissions.

Most emissions trading schemes have phases (typically 3 or 4 years) for which the cap is predetermined and transparent to all. Over time, the cap is typically reduced or 'ratcheted' down from one phase to the next. This decreases overall GHG emissions and stimulates abatement innovation and investment moving forward.

When setting a cap, regulators can choose either an absolute cap or an intensity-based cap. An absolute cap is one where the cap is fixed and the sum of the allowances granted equals that absolute cap. An intensity-based system is one where the cap – or target emission level - is a target ratio of emissions per unit of economic activity (e.g. per unit of production)[1]. Given that there are no simple metrics that can be used to normalize production across multiple sectors and more importantly because intensity-based targets (like carbon taxes) don't actually define an absolute upper limit on emissions, intensity-based targets are not an environmentally defensible solution to climate change and thus not the norm in emissions trading systems. These two approaches can also be combined where an absolute cap applies overall and to individual sectors, but allowances within a sector are divided among emitters on an intensity basis. Canada's 2007 Turning the Corner scheme and Alberta's Specified Gas Emitters Regulation are intensity-based schemes.

4 Sectors

Cap-and-trade schemes typically include emitters based on both the quantity of GHGs emitted and by sector. As such, a cap-and-trade scheme will typically only apply to large final emitters (LFE's) in sectors that are responsible (at an aggregate) level for emitting the most GHGs in a jurisdiction.

With the exception of Alberta where emitters are regulated if they emit more than 100,000 tonnes of CO_2 per year regardless of sector[2], all existing cap-and-trade schemes regulate LFEs by sector and a minimum emission threshold.

5 Allowance Provisions: allocation

When distributing emissions allowances, regulators generally have three options – grandfathering, auctioning or a combination of the two.

Grandfathering (sometimes referred to as 'gratis') is the process of allocating, free-of-charge, emission allowances on the basis of historical emissions. Grandfathering is often used:

1) when a regulator (e.g. a public utilities commission), rather than the market, sets the maximum price that consumers can be charged for a good and thus the regulated entity (e.g. a utility) is not able to pass through the additional cost of allowances to consumers;
2) when a sector is energy-intensive and exports to markets that are not bound by the cap-and-trade scheme and are consequently placed at a competitive disadvantage; and,
3) when regulators are trying to win buy-in and acceptance for the introduction and early 'pilot' phases of a cap-and-trade scheme.

Although the first (2005 – 2007) and second (2008 – 2012) phases of the EU ETS saw a vast majority of allowances granted free-of-charge, the general tendency now – as is the case with the third phase (2013 - 2020) of the EU ETS - is to mandate the increasing use of auctioning[3].

In auctioning, interested parties (e.g. emitters) must bid on allowances, with supply and demand dictating the resulting prices paid.

If auctions are fair, efficient, and transparent to all involved, the benefits of auctioning are:

1) grandfathering can lead to windfall profits for those entities – particularly energy and utility companies – that can pass on the cost (market price) of carbon to end consumers irrespective of the fact that they have not incurred those costs for their allowances. This acts to merely redistribute wealth from consumers to regulated entities;
2) it is argued that grandfathering is less efficient than auctioning;
3) auction proceeds can be used to serve public interests (i.e. offset increased prices, support climate change initiatives, fund research, innovation and the development of green and low carbon technologies, etc.); and,
4) grandfathering provides little incentive for innovation and investment in low carbon technologies.

6 Allowance Provisions: banking and borrowing

Cap-and-trade schemes typically include considerations for 'banking' and 'borrowing' of allowances. Banking is when a regulated entity has surplus allowances for a given compliance period and holds or 'banks' them for use (or sale) in a future compliance period. Banking is common in trading schemes and: allows emitters flexibility in managing their business needs; helps plan for future investments; encourages early action to reduce emissions; and encourages over-compliance.

On the contrary, borrowing is when a regulated entity lacks sufficient allowances for a given compliance period and borrows allowances from a future compliance period to meet its present needs. Borrowing is

not common in cap-and-trade schemes as it defers total emissions reductions and thus compromises the primary goal of expedient emissions reductions within the cap.

7 Allowance Provisions: performance credits

While most cap-and-trade schemes allocate emission allowances (equal to the desired aggregate cap) in advance of a compliance period, performance credit schemes – as in Alberta – award credits retrospectively to emitters for lowering their emissions below their set cap or baseline in a previous compliance period. These schemes are often referred to as baseline-and-credit schemes[4] as a regulated entity is granted the right to emit a certain base level of emissions typically measured as a ratio of emissions to output or production.

Similar to intensity-based emissions targets (as in Alberta and the 2007 Canadian federal Turning the Corner plan), in a baseline-and-credit scheme, the target is a prescribed ratio of emissions to output rather than an absolute cap. As a result, one of the key criticisms of baseline-and-credit (and intensity-based) schemes is that they are not guaranteed to meet the primary environmental objective of capping emissions below an absolute limit or threshold.

8 Offsets and Offsetting

An effective cap-and-trade scheme is one where the aggregate allowable emissions cap is lower than the historic emissions levels of the sectors bound by the cap. However, unless emission can be reduced through internal abatement technologies or increased production efficiency, the only means of reducing emissions is by reducing production. In such cases, (all things being equal) the cap would by definition reduce gross domestic product and limit economic growth.

However, CO_2 (and the other greenhouse gases) are what are referred to as uniformly mixed pollutants. Unlike other air pollutants whose impacts are local to where they are emitted, the global warming impact of greenhouse gases is the same regardless of where on earth they are emitted. Similarly, reducing a tonne[5] of CO_2 from a project in Costa Rica has the same mitigating effect as a tonne reduced in Canada, Kazakhstan or Croatia.

As a result, GHG cap-and-trade schemes allow regulated emitters to use a stipulated amount 'offsets' in meeting their compliance obligations. Offsets (sometimes referred to as carbon credits) are generated by approved carbon reduction/avoidance projects (e.g. reforestation and landfill methane capture) that take place outside of, and are external to, reductions required within the cap. For instance, Canadian federal proposals have referred to excluding fixed process emissions, such as CO_2 emissions from lime calcination in cement production, from the regulated targets, which would make reduction of these types of emissions potentially eligible for offset creation. Offsets enable regulated entities to meet their compliance obligations by purchasing the credits that reduction projects generate.

Clean Development Mechanism and Joint Implementation projects, for example, are the mechanisms to generate offsets under the Kyoto Protocol and whose credits (certified emission reductions – CERs and emission reduction units – ERU respectively) are eligible for use in the EU ETS.

The reasons for including offsets in a cap-and-trade scheme are as follows:

1) Offsets ensure that emissions reductions are generated at least cost to society. Regulated entities whose internal emissions reduction costs per tonne of CO_2e (marginal cost of abatement) are higher than the prevailing market price for offsets will benefit from purchasing offsets rather than investing

internally to reduce emissions. Conversely, businesses not bound by the cap that can reduce emissions more cost effectively (and have a lower marginal cost of abatement) will be able to sell their offset credits to those with higher marginal abatement costs with compliance costs tending toward the lowest marginal cost of abatement in the economy.

2) Offsets provide compliance flexibility and lower overall compliance costs for those bound by the cap. According to the US EPA, allowing unlimited domestic and international offset credits in the 2008 Lieberman-Warner bill would have caused allowance prices in 2020 to fall by 71%, from $51 per tonne to $15 which would have translated into GDP savings of $333 billion in 2020[6].

3) Offsets allow businesses to stay competitive by keeping compliance costs down and prevent the premature retirement of less efficient capital assets. This similarly improves competitiveness and helps prevent jobs and economic activity from relocating outside the capped jurisdictions.

4) Offsets allow businesses, communities, investors and entrepreneurs outside the cap to create marketable carbon credits through carbon reduction/avoidance projects. This encourages investment, innovation and wider societal participation in the scheme and thus ensures that a broader range of sectors in the economy benefit from the scheme.

5) Where internal abatement costs are higher than the market price for credits, offsets are the most cost-effective means to reduce emissions and thus allowing for offsets is the most expedient way to reduce the greatest quantity of emissions. As a result, offsets provide an efficient means of reducing GHGs in the short term while new reduction technologies are developed and deployed.

Entities that develop, purchase and/or use offsets to meet regulated compliance obligations operate in a 'regulated carbon market'. Entities that develop, purchase and use offsets for reasons other than regulatory compliance (e.g. voluntary carbon reduction targets and 'carbon neutral' initiatives) operate in what is referred to as the 'voluntary carbon market'.

While there are a number of similarities between the regulated and voluntary markets (i.e. purchase and sale of emission reduction credits) there are a number of key differences.

Regulated cap-and-trade schemes stipulate (typically by project types and geographic origin) exactly which offsets are eligible and how they can be used for compliance purposes while offsets developed for and used in the voluntary market do not by necessity have to conform to any prescribed regulations, standards or protocols.

Acronyms and Abbreviations

CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
ERU	Emission reduction units
EU ETS	European Union Emission Trading Scheme
GGAS	Greenhouse Gas Reduction Scheme (New South Wales, Australia)
GHG	Greenhouse gas
HFC	Hydrofluorocarbons
LFE	Large final emitter
LNG	Liquefied natural gas
MT	Metric tonne (also metric ton)
N_2O	Nitrous oxide
NOx	Nitrous oxides
SOx	Sulphur oxides
SGER	Specified Gas Emitters Regulation (Alberta, Canada)
PFCs	Perfluorocarbons
RGGI	Regional Greenhouse Gas Initiative (US Northeast)
SF_6	Sulphur hexafluoride
US EPA	United States Environmental Protection Agency

References

[1] www.davidsuzuki.org/files/climate/Intensity_Targets_Not_The_Solution.pdf
[2] www.carbon-financeonline.com/index.cfm?section=americas&action=view&id=10466&return=search
[3] The Greenhouse Gas Market 2008: Piecing Together a Comprehensive International Agreement for a Truly Global Carbon Market. IETA 2008. www.ieta.org/ieta/www/pages/download.php?docID=3118
[4] http://socserv2.socsci.mcmaster.ca/~econ/faculty/mullera/papers/varcap.pdf
[5] Tonne and ton refer to metric tonne and are equal to 1,000 kilograms or 2,204.6 pounds
[6] www.ieta.org/ieta/www/pages/download.php?docID=2968