Carbon Cap

Cap and Trade: Emissions Trading Explained

Erfana Hossein

Pricing Carbon

Carbon emissions and the climate change they cause are a very good example of what economists term a market failure due to the unpriced externality that they contribute to society. These emissions have grown exponentially since the industrial revolution (figure 1). A market failure exists when the free market is not functioning to maximize social welfare and this is the case with carbon dioxide emissions. The full cost of emitting carbon dioxide is not factored into the cost of production by the emitting companies. Instead, the cost is external to the company since both the cost and impact of the CO2 emissions are borne by all humans and not by the polluting entity. Another example would be a factory situated on a river that pollutes the water, causing health problems for people who live downstream.

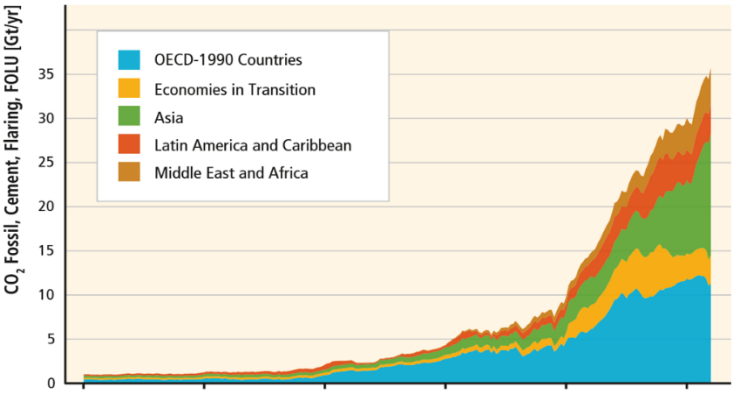


Figure 1: Annual Release of CO2 into the Atmosphere (IPCC, 2014)

It is generally accepted that one of the most efficient ways to correct a market failure is to place a price on the externality that reflects its true cost.

In the case of climate change we need to put a price on emitting carbon dioxide into the atmosphere to reflect the cost and damage it is doing to the planet and the people who live on the planet. Normally, carbon emissions are expressed in tonnes of carbon dioxide released into the atmosphere and the amount of CO2 released for a given activity is referred to as the carbon footprint. Whilst activities related to generating carbon emissions provide benefits to humans, they also come with costs in terms of the damages caused by termperature rises and climate change. Some examples of the amount of CO2 emitted from activities are:

A passenger's emissions for a flight from London to New York: 2 tonnes of CO2.

The heating/electricity for the average home in Europe for one year: 5-7 tonnes of CO2.

The total average annual emissions for a middle-aged adult in Europe: 10-20 tonnes of CO2.

Tax or Cap and Trade?

Since it is generally accepted that we must put a price on carbon that reflects its true cost to society, the decision then becomes how to price carbon. There are two ways to implement a price on carbon emissions; a tax or a cap and trade system. Both policies can achieve the goal of pricing carbon emissions in order to provide a strong financial incentive to reduce emissions.

Both methods have been implemented around the world, sometimes together. A carbon tax can be imposed on the production, distribution or use of carbon-based fuels i.e. coal, oil, and gas. A government can set a price per tonne of carbon which would then translate into a tax on electricity, natural gas, or oil. The goal is to set the tax at a level that will create a disincentive to produce energy by carbon-based means and to switch to clean energy technology such as wind or solar power. The tax will cause firms or individuals to internalize the cost of carbon (the externality) when making production and consumption decisions. In the case of firms, the cost of reducing emissions is known as the marginal abatement cost and this can have different values indicating the costs of abating different carbon emitting activities. It is indicates the price of carbon that would induce the firm to switch to a zero carbon equivalent. Figure 2 below indicates the price of carbon per tonne for power utilities.

Year	Carbon-Price Corridor (US$/$tCO_2$)
2020	24-39
2025	30-60
2030	30-100

Figure 2: *The Investment-grade Carbon Pricing Corridors Initiative (2018)*

Cap and trade, often referred to as emissions trading, works by first setting a cap on emissions and then lowering this cap annually over time to meet a climate policy. Carbon allowances equal to the emissions cap are then allocated or auctioned to the emitting entities who are then free to trade these allowances between them. The allocation process is determined by issuing firms allowances that equal their historical emissions. This mechanism to cap and trade greenhouse gas emissions is now one of the most preferred policy instruments in the world.

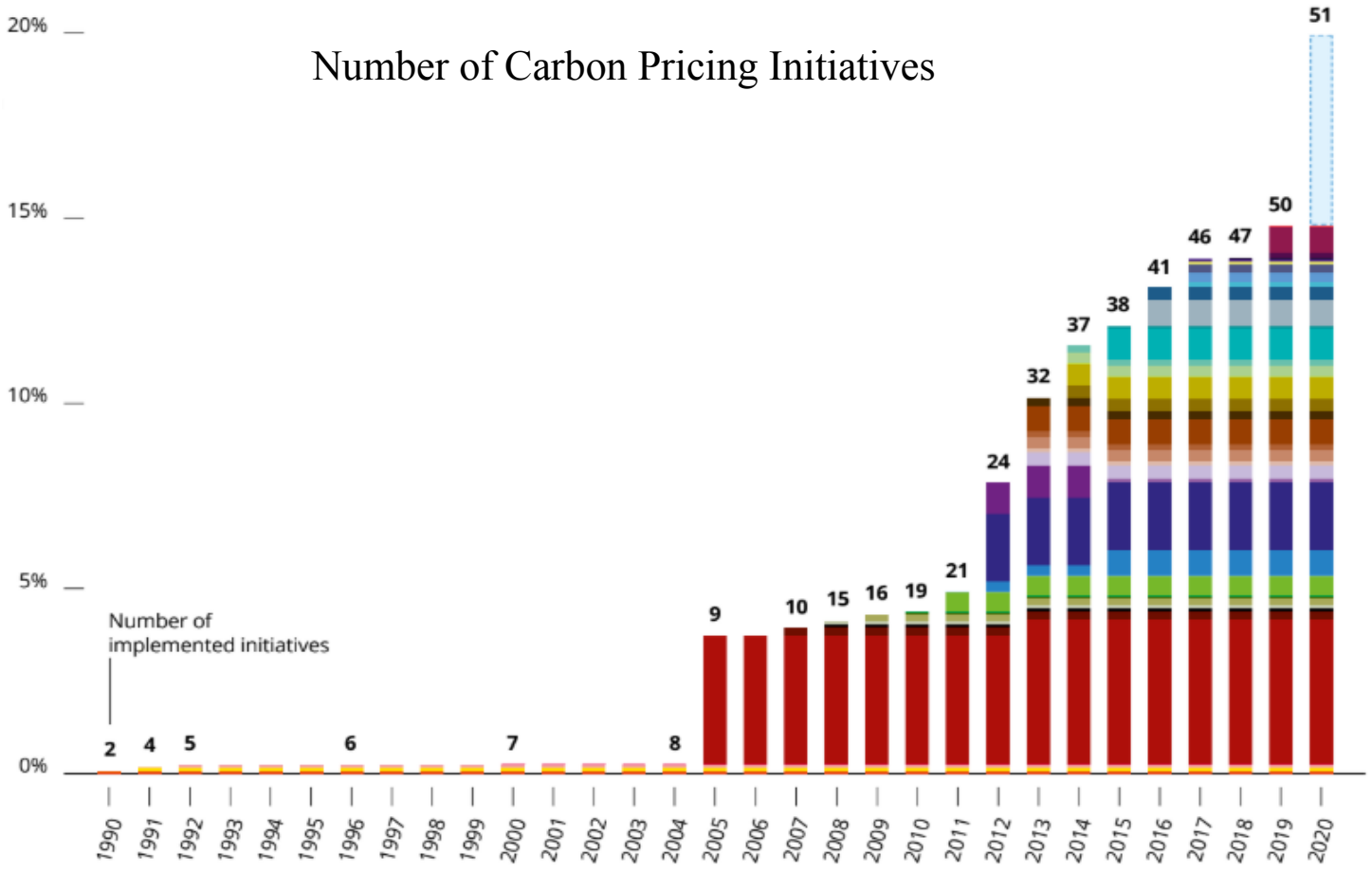
As the scope and usage of emission trading continues to grow and expand (figure 3) it becomes imperative that its capabilities are understood. Emission trading has allowed economies to decouple emissions from economic growth, reducing previous concerns that environmental policies hinder economic prosperity.

Emissions trading systems (ETS) have been established in multiple countries around the world as a proven market-based solution for reducing carbon emissions. An ETS is often referred to as a cap and trade initiative since the program caps the total amount of CO2 emissions while allowing the emitting entities to trade CO2 between them. This market-based solution provides environmental certainty in terms of the amount of emissions produced, whilst allowing the market to set the price. Non-compliant entities are usually given a fine. For example, non-compliance in the EU market costs €100/tCO2. By allowing the trading of allowances it means that the emissions abatement that occurs, will happen at the lowest cost since firms with a low abatement cost will abate and sell their allowances to firms with a higher abatement cost. This is a key benefit of an ETS along with other benefits such as the ability to "bank" allowances and hold them for use in the future. Firms for whom it is more expensive to abate will buy allowances until the carbon allowance price rises to a point where it makes economic sense for those firms to incur the costs of abatement. The key benefit of a cap and trade system is that it provides environmental certainty about reduction in the total quantity of emissions while at the same time reduction emissions at the lowest cost.

In order to evaluate the relative merits of a tax versus a cap and trade emissions trading system, we need to evaluate the efficiency and distributive properties of both.

Under ideal conditions, taxes and cap-and-trade would result in the same cost and quantity of emissions abatement. But being under ideal conditions implies an absence of uncertainty about the benefits and costs of abatement, which is never the case. In the case of a tax, we have a cost certainty (cost of abatement at the tax rate) but no environmental certainty about quantity of emissions reduction. In the case of cap and trade, we have uncertainty of the cost but a environmental certainty about the quantity of emissions reductions. Since a tax must be paid annually, in the short run it may be inefficient compared to a cap and trade system since firms will not have the time or flexibility to determine how to cut emissions. In terms of the long run, the efficiency loss from a tax is much greater than a permit scheme because it hinders the flexibility of firms to find solutions.

Politically, cap and trade is often noted to have a more positive connotation among citizens than a carbon tax. A tax forces firms to reduces emissions on the government's terms. However, as well as flexibility on the method of abatement, a cap and trade system allows firms to borrow and bank allowances into future compliance periods. Reducing carbon emissions then becomes a multiyear decision. A cap and trade system allows the market to determine the price of carbon emissions and this means that it can be self-adjusting to market forces. As an example, the carbon price will generally be higher when the economy is doing well and lower during economic contractions.



Regarding the concern of market complexities and failures, a tax is vulnerable to becoming more complex than cap and trade. Taxes can be changed in the future, revenues can be redirected to other purposes due to exemptions, deductions, and subsidies and the double-dividend hypothesis, where carbon tax revenues are used to reduce taxes elsewhere, may not be used. A carbon tax was discussed by the Clinton Administration in 1992 but quickly became reduced to a negligible tax on gasoline.

Cap and trade systems have launched within the United States, as states have taken control of reducing their emissions. The oldest is the Regional Greenhouse Gas Initiative covering 9 states on the east coast of the United States and the second is the Western Climate Initiative consisting of California nd the province of Quebec in Canada. Many othe countries have launched emissions trading systems or are planning to launch them shortly including the European Union, South Korea, Kazakhstan, New Zealand, China and other notable markets.

How Cap and Trade Works

To illustrate how an ETS results in physical emissions reductions (abatement) a generic example follows.

If an electric utility is regulated under an ETS, it will need to demonstrate compliance with the rules of the system at the end of each compliance period, typically annually. The company will be required to deliver carbon allowances to the regulator equal to the amount of CO2 tonnes emitted in the compliance period. The company will typically receive or purchase carbon allowances to ensure that they comply. Failure to comply incurs costly penalties and the entire system is tightly monitored and regulated.

If the utility needs to add more electricity capacity, they will have to decide between using fossil-fuel based electricity generation or renewable energy technology such as wind or solar power generation. Since the fossil fuel-based solution will also generate CO2 emissions, the company will need to factor the price of carbon allowances into its decision. This creates a financial incentive that favours low carbon solutions.

If the company were to replace fossil-fuel based electricity production with renewable electricity production, this would result in lower emissions leaving the company with unused allowances at the end of the compliance period. These unused allowances could be sold into the market or held and used in next year's compliance period. Again, this switch from fossil fuel generation to clean energy has a direct financial incentive to reduce emissions. On the other hand, if the company wants to emit more CO2 via fossil-fuels, then it will need to purchase additional allowances in the market. The combination of dynamic supply and demand drivers, combined with the annual reduction in the supply of carbon allowances, is incorporated into the market price for a tonne of carbon dioxide.

As the price of carbon increases, it provides a larger financial incentive for emitting entities to find ways to reduce their carbon emissions. The reduction of emissions is commonly referred to as abatement and each company will have a range of actions they can take to abate emissions, from low cost activities to higher cost activities. For firms and the economy in general, this is known as the marginal abatement cost curve.

The key determinant of how much physical abatement takes place is therefore dependent upon two main factors: the physical cost of abatement and the price of a carbon allowance.

Cap and Trade Success Stories

One of the earliest success stories for Cap and Trade was the system implemented in the USA in 1990 to curb Sulphur Dioxide (SO2) emissions that were causing acid rain. Flue gas emissions from coal-fired power plants were the primary source of these emissions in the US. The Clean Air Act Amendments of 1990 aimed to slash annual SO2 emissions by 10 million tonnes out of the total 26 million tonnes being emitting - mainly by 3,200 coal plants. The Clean Air Act itself mandated an allowance trading system to accomplish this goal, in the process making it the world's first large scale pollutant cap-and-trade-system. Through two phases, the government freely allocated emission allowances and then let firms decide how to trade them to meet the requirements under the new cap on emissions. Phase I lasted through 1995-1999 and required reductions from the 263 most polluting coal-fired generating units. Phase II began in 2000 and placed an aggregate national emissions cap of 8.95 million tonnes per year on approximately 3,200 electric generating units. Between 1990 and 2004, SO2 emissions from the power sector fell 36% even though total energy output from coal-fired power plants increased by 25% over the same period. By 2010 total emissions had fallen to only 5.1 million tons, a reduction of 81%. The cap itself represented an approximately 50% reduction from 1980 levels. The actual costs of running this very effective system has been proven to be more cost effective comparably to traditional regulatory approaches and lower than the predicted costs. Many of the features of this system would become integral to all cap and trade systems.

Accordingly, the schemes success has led to Harvard University producing a full report highlighting the successes and what was learned (See the full report here). Similar cap and trade schemes now exist across the world and are advocated by organizations such as the World Bank and the UN.

Carbon Cap Limited has a mission statement to raise awareness about climate change and provide solutions directly related to the capping and reduction of carbon dioxide emissions. It provides research and advisory services to family offices related to investing in carbon and offsetting their carbon footprint.