

Emissions Trading

[Encyclopedia of Public Health](#): Emissions Trading

Emissions' trading is a means of achieving environmental objectives at potentially lower cost than the more traditional use of uniform standards on emissions sources. Properly designed emissions trading systems can also encourage innovation.

A number of different types of emissions trading approaches have been used in the United States and elsewhere. The least structured, termed emission "offsets," involves a reduction of emissions at one place to compensate for increased emissions somewhere else. Such offsets can be between different plants or different sources within the same plant. Offsets can be particularly useful in allowing new or expanded sources of pollution to exist in a region already failing to meet its environmental objectives.

A more ambitious approach, which requires additional governmental infrastructure, is the open-market trading system. This approach allows a pollution source to earn marketable emission rights by reducing its emissions to levels below a regulatory standard or by making reductions in advance of a prescribed deadline. The credits earned may be sold to other sources and used to offset an equal amount of excess emissions. The credits may also be resold or (where allowed) banked for future use. Open-market trading has not been formally implemented in the United States.

Still more ambitious, flexible, and demanding in terms of government infrastructure is a cap-and-trade system, where sources in an area may trade pollution reduction responsibilities among themselves to meet an aggregate emissions cap for a given region. Under this system, the regulatory authorities decide on the aggregate level of allowable emissions for all the parties participating in the program (the "cap") and then it allocates to each party a portion of this amount in the form of "allowances," which are tradable rights to pollute. Once allowances are allocated, parties are prohibited from emitting more pollution than their allocation, unless they purchase additional allowances from another party.


The Environmental Protection Agency's (EPA) acid rain program, widely hailed a success from both environmental and economic perspectives, is the most prominent example of the cap-and-trade type of emissions trading. Emission reductions are ahead of schedule and the costs are considerably lower than anticipated.

Emissions' trading has several potential advantages compared to traditional regulatory approaches. Firms are free to use the options they believe to be most cost-effective, and they do not need to seek approval from government authorities or engage in lengthy negotiations about the "appropriateness" of their actions. At the same time, some remain skeptical of emissions trading, on both ethical and technical grounds. One thing that is widely agreed upon is that credible monitoring systems are essential to ensure the environmental integrity of emissions trading regimes.

(SEE ALSO: [Acid Rain](#); [Ambient Air Quality \[Air Pollution\]](#); [Environmental Protection Agency](#); [Hazardous Air Pollutants](#); [Pollution](#); [Sulfur-Containing Air Pollutants \[Particulates\]](#))

— RICHARD D. MORGENSTERN



 A coal power plant in Germany. Due to emissions trading, [coal](#) may become less competitive as a fuel.

Emissions trading (also known as **cap and trade**) is an [administrative](#) approach used to control [pollution](#) by providing [economic incentives](#) for achieving reductions in the emissions of [pollutants](#).

A central authority (usually a [governmental](#) body) sets a limit or *cap* on the amount of a pollutant that can be emitted. Companies or other groups are issued emission permits and are required to hold an equivalent number of *allowances* (or *credits*) which represent the right to emit a specific amount. The total amount of allowances and credits cannot exceed the cap, limiting total emissions to that level. Companies that need to increase their emission allowance must buy credits from those who pollute less. The transfer of allowances is referred to as a [trade](#). In effect, the buyer is paying a charge for polluting, while the seller is being rewarded for having reduced emissions by more than was needed. Thus, in theory, those who can reduce emissions most cheaply will do so, achieving the pollution reduction at the lowest cost to society.^[1]

There are active trading programs in several [air pollutants](#). For [greenhouse gases](#) the largest is the [European Union Emission Trading Scheme](#).^[2] In the United States there is a national market to reduce [acid rain](#) and several regional markets in nitrogen oxides.^[3] Markets for other pollutants tend to be smaller and more localized.

Overview

The overall goal of an emissions trading plan is to minimize the cost of meeting a set emissions target.^[4] The *cap* is an enforceable limit on emissions that is usually lowered over time — aiming towards a national emissions reduction target.^[4] In other systems a portion of all traded credits must be retired, causing a net reduction in emissions each time a trade occurs. In many cap-and-trade systems, organizations which do not pollute may also participate, thus [environmental groups](#) can purchase and retire allowances or credits and hence drive up the price of the remainder according to the [law of demand](#).^[5] Corporations can also prematurely retire allowances by donating them to a nonprofit entity and then be eligible for a tax deduction.

Because emissions trading uses [markets](#) to address pollution, it is often touted as an example of [free market environmentalism](#). However, emissions' trading requires a cap to effectively reduce emissions, and the cap is a government regulatory mechanism. After a cap has been set by a government political process, individual companies are free to choose how or if they will reduce their emissions. Failure to reduce emissions is often punishable by a further government regulatory mechanism, a fine that increases costs of production. In theory, firms will choose the least-costly way to comply with the pollution regulation, which will lead to reductions where the least expensive solutions exist, while allowing emissions that are more expensive to reduce.

History

The efficiency of what later was to be called the "cap-and-trade" approach to [air pollution](#) abatement was first demonstrated in a series of micro-economic computer simulation studies between 1967 and 1970 for the National Air Pollution Control Administration (predecessor to the [United States Environmental Protection Agency](#)'s Office of Air and Radiation) by Ellison Burton and William Sanjour. These studies used mathematical models of several cities and their emission sources in order to compare the cost and effectiveness of various control strategies.^{[6][7][8][9][10]} Each abatement strategy was compared with the "least cost solution" produced by a computer optimization program to identify the least costly combination of source reductions in order to achieve a given abatement goal.^[11] In each case it was found that the least cost solution was dramatically less costly than the same amount of pollution reduction produced by any conventional abatement strategy.^[12] This led to the concept of "cap and trade" as a means of achieving the "least cost solution" for a given level of abatement.

The development of emissions trading over the course of its history can be divided into four phases:^[13]

1. Gestation: Theoretical articulation of the instrument (by [Coase](#),^[14] [Crocker](#),^[15] [Dales](#),^[16] [Montgomery](#)^[17] etc.) and, independent of the former, tinkering with "flexible regulation" at the US Environmental Protection Agency.
2. Proof of Principle: First developments towards trading of emission certificates based on the "offset-mechanism" taken up in Clean Air Act in 1977.
3. Prototype: Launching of a first "cap-and-trade" system as part of the US [Acid Rain Program](#), officially announced as a paradigm shift in environmental policy, as prepared

by "Project 88", a network-building effort to bring together environmental and industrial interests in the US.

4. Regime formation: branching out from the US clean air policy to global climate policy, and from there to the European Union, along with the expectation of an emerging global carbon market and the formation of the "carbon industry".

Cap and trade versus offsets created through a baseline and credit approach

The textbook emissions trading program can be called a "cap-and-trade" approach in which an aggregate cap on all sources is established and these sources are then allowed to trade amongst themselves to determine which sources actually emit the total pollution load. An alternative approach with important differences is a baseline and credit program.^[18] In a baseline and credit program polluters that are not under an aggregate cap can create credits, usually called offsets, by reducing their emissions below a baseline level of emissions. Such credits can be purchased by polluters that do have a regulatory limit.^[19]

Economics of international emissions trading

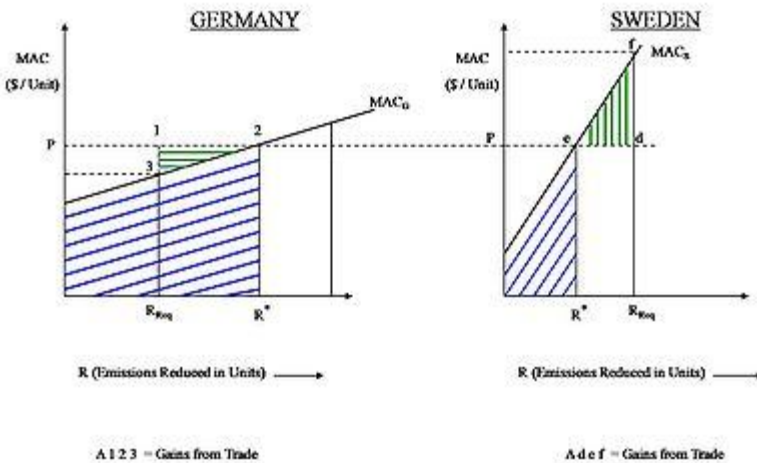
It is possible for a country to reduce emissions using a [Command-Control](#) approach, such as regulation, [direct](#) and [indirect taxes](#). The cost of that approach differs between countries because the *Marginal Abatement Cost* (MAC) — the cost of eliminating an additional unit of pollution — differs by country. It might cost China \$2 to eliminate a ton of [CO₂](#), but it would probably cost Sweden or the U.S. much more. International emissions-trading markets were created precisely to exploit differing MACs.

Example

Emissions trading through *Gains from Trade* can be more beneficial for both the buyer and the seller than a simple emissions capping scheme.

Consider two European countries, such as [Germany](#) and [Sweden](#). Each can either reduce all the required amount of emissions by itself or it can choose to buy or sell in the market.

Emissions Trading



Example MACs for two different countries

For this example let us assume that Germany can abate its CO₂ at a much cheaper cost than Sweden, e.g. $MAC_S > MAC_G$ where the MAC curve of Sweden is steeper (higher slope) than that of Germany, and R_{Req} is the total amount of emissions that need to be reduced by a country.

On the left side of the graph is the MAC curve for Germany. R_{Req} is the amount of required reductions for Germany, but at R_{Req} the MAC_G curve has not intersected the market allowance price of CO₂ (market allowance price = $P = \lambda$). Thus, given the market price of CO₂ allowances, Germany has potential to profit if it abates more emissions than required.

On the right side is the MAC curve for Sweden. R_{Req} is the amount of required reductions for Sweden, but the MAC_S curve already intersects the market price of CO₂ allowances before R_{Req} has been reached. Thus, given the market allowance price of CO₂, Sweden has potential to make a cost saving if it abates fewer emissions than required internally, and instead abates them elsewhere.

In this example, Sweden would abate emissions until its MAC_S intersects with P (at R^*), but this would only reduce a fraction of Sweden's total required abatement. After that it could buy emissions credits from Germany for the price P (per unit). The internal cost of Sweden's own abatement, combined with the credits it buys in the market from Germany, adds up to the total required reductions (R_{Req}) for Sweden. Thus Sweden can make a saving from buying credits in the market ($\Delta d-e-f$). This represents the "Gains from Trade", the amount of additional expense that Sweden would otherwise have to spend if it abated all of its required emissions by itself without trading.

Germany made a profit on its additional emissions abatement, above what was required: it met the regulations by abating all of the emissions that was required of it (R_{Req}). Additionally, Germany sold its surplus to Sweden as credits, and was paid P for every unit it abated, while spending less than P . Its total revenue is the area of the graph (R_{Req} 1 2 R^*), its total abatement

cost is area ($R_{Req} - R^*$), and so its net benefit from selling emission credits is the area ($\Delta 1-2-3$) i.e. Gains from Trade

The two R^* (on both graphs) represent the efficient allocations that arise from trading.

- Germany: sold ($R^* - R_{Req}$) emission credits to Sweden at a unit price P .
- Sweden bought emission credits from Germany at a unit price P .

If the total cost for reducing a particular amount of emissions in the *Command Control* scenario is called X , then to reduce the same amount of combined pollution in Sweden and Germany, the total abatement cost would be less in the *Emissions Trading* scenario i.e. ($X - \Delta 123 - \Delta def$).

The example above applies not just at the national level: it applies just as well between two companies in different countries, or between two subsidiaries within the same company.

Applying the economic theory

The nature of the pollutant plays a very important role when policy-makers decide which framework should be used to control pollution.

CO₂ acts globally, thus its impact on the environment is generally similar wherever in the globe it is released. So the location of the originator of the emissions does not really matter from an environmental standpoint.

The policy framework should be different for regional pollutants^[20] (e.g. SO₂ and NO_x, and also mercury) because the impact exerted by these pollutants may not be the same in all locations. The same amount of a regional pollutant can exert a very high impact in some locations and a low impact in other locations, so it does actually matter where the pollutant is released. This is known as the *Hot Spot* problem.

A [Lagrange framework](#) is commonly used to determine the least cost of achieving an objective, in this case the total reduction in emissions required in a year. In some cases it is possible to use the Lagrange optimization framework to determine the required reductions for each country (based on their MAC) so that the total cost of reduction is minimized. In such a scenario, the [Lagrange multiplier](#) represents the market allowance price (P) of a pollutant, such as the current market allowance price of emissions in Europe^[21] and the USA.^[22]

All countries face the market allowance price that exists in the market that day, so they are able to make individual decisions that would minimize their costs while at the same time achieving regulatory compliance. This is also another version of the [Equi-Marginal Principle](#), commonly used in economics to choose the most economically efficient decision.

Prices versus quantities, and the safety valve

There has been longstanding debate on the relative merits of *price* versus *quantity* instruments to achieve emission reductions.^[23]

An emission cap and permit trading system is a *quantity* instrument because it fixes the overall emission level (quantity) and allows the price to vary. Uncertainty in future supply and demand conditions (market volatility) coupled with a fixed number of pollution credits creates an uncertainty in the future price of pollution credits, and the industry must accordingly bear the cost of adapting to these volatile market conditions. The burden of a volatile market thus lies with the industry rather than the controlling agency, which is generally more efficient. However, under volatile market conditions, the ability of the controlling agency to alter the caps will translate into an ability to pick "winners and losers" and thus presents an opportunity for corruption.

In contrast, an [emission tax](#) is a *price* instrument because it fixes the price while the emission level is allowed to vary according to economic activity. A major drawback of an emission tax is that the environmental outcome (e.g. a limit on the amount of emissions) is not guaranteed. On one hand, a tax will remove capital from the industry, suppressing possibly useful economic activity, but conversely, the polluter will not need to hedge as much against future uncertainty since the amount of tax will track with profits. The burden of a volatile market will be borne by the controlling (taxing) agency rather than the industry itself, which is generally less efficient. An advantage is that, given a uniform tax rate and a volatile market, the taxing entity will not be in a position to pick "winners and losers" and the opportunity for corruption will be less.

Assuming no corruption and assuming that the controlling agency and the industry are equally efficient at adapting to volatile market conditions, the best choice depends on the sensitivity of the costs of emission reduction, compared to the sensitivity of the benefits (i.e., climate damages avoided by a reduction) when the level of emission control is varied.

Because there is high uncertainty in the compliance costs of firms, some argue that the optimum choice is the price mechanism. However, the burden of uncertainty cannot be eliminated, and in this case it is shifted to the taxing agency itself.

Some scientists have warned of a threshold in atmospheric concentrations of carbon dioxide beyond which a run-away [warming](#) effect could take place, with a large possibility of causing irreversible damages. If this is a conceivable risk then a quantity instrument could be a better choice because the quantity of emissions may be capped with a higher degree of certainty. However, this may not be true if this risk exists but cannot be attached to a known level of GHG concentration or a known emission pathway.^[24]

A third option, known as a *safety valve*, is a hybrid of the price and quantity instruments. The system is essentially an emission cap and permit trading system but the maximum (or minimum) permit price is capped. Emitters have the choice of either obtaining permits in the marketplace or purchasing them from the government at a specified trigger price (which could be adjusted over time). The system is sometimes recommended as a way of overcoming the fundamental disadvantages of both systems by giving governments the flexibility to adjust the system as new information comes to light. It can be shown that by setting the trigger price high enough, or the number of permits low enough, the safety valve can be used to mimic either a pure quantity or pure price mechanism.^[25]

All three methods are being used as policy instruments to control greenhouse gas emissions: the EU-ETS is a *quantity* system using the cap and trading system to meet targets set by [National Allocation Plans](#), the UK's [Climate Change Levy](#) is a *price* system using a direct [carbon tax](#), while China uses the CO₂ market price for funding of its [Clean Development Mechanism](#) projects, but imposes a *safety valve* of a minimum price per tonne of CO₂.

Incomplete country cooperation and border adjustments

Most economic studies of the costs of reducing carbon emissions assume global participation,^{[26][27][28][29]} but since the [Kyoto Protocol](#) has limited country participation, which is likely to continue in any post-Kyoto agreement, [carbon leakage](#) will arise. Direct leakage effects occur when production of a good is shifted to a country not bound to reduce its carbon emissions. Indirect leakage results from the lower world price of petrochemicals, especially oil and coal. Non-participating countries will import more oil and coal, both to fuel the production of energy-intensive exports and goods produced for domestic consumption.^[30] Economic considerations of free riding, expectations, and general equilibrium studies suggest that these effects can be substantial.^[31] One of the controversies about carbon mitigation policy thus arises about how to "level the playing field" with border adjustments.^[32] One component of the [American Clean Energy and Security Act](#), for example, calls for carbon surcharges on goods imported from countries without cap-and-trade programs. Even aside from issues of compliance with the [General Agreement on Tariffs and Trade](#), such border adjustments presume that the producing countries bear responsibility for the carbon emissions. As Wang and Watson^[33] note, however, one quarter of China's carbon emissions are generated in the production of exports, mostly for consumers in developed countries, and a consumption-based cap-and-trade system may be more in accordance with the principles of benefit taxation (see [Knut Wicksell](#)).

Trading systems

Kyoto Protocol

The [Kyoto Protocol](#) is a 1997 international treaty which came into force in 2005, which binds most developed nations to a cap-and-trade system for the six major [greenhouse gases](#).^[34] (The United States is the only industrialized nation under [Annex I](#) which has not ratified and therefore is not bound by it.) Emission quotas were agreed by each participating country, with the intention of reducing their overall emissions by 5.2% of their 1990 levels by the end of 2012. Under the treaty, for the 5-year compliance period from 2008 until 2012,^[35] nations that emit less than their quota will be able to sell [emissions credits](#) to nations that exceed their quota.^[36]

It is also possible for developed countries within the trading scheme to sponsor [carbon projects](#) that provide a reduction in greenhouse gas emissions in other countries, as a way of generating tradeable [carbon credits](#). The Protocol allows this through [Clean Development Mechanism](#) (CDM) and [Joint Implementation](#) (JI) projects, in order to provide flexible mechanisms to aid regulated entities in meeting their compliance with their caps. The UNFCCC validates all CDM projects to ensure they create genuine additional savings and that there is no [carbon leakage](#).

The [Intergovernmental Panel on Climate Change](#) has projected that the financial effect of compliance through trading within the Kyoto commitment period will be *limited* at between 0.1-1.1 percent of [GDP](#) among trading countries.^[37] By comparison the [Stern report](#) placed the costs of doing nothing at five to 20 times higher.^[38]

Australia

Garnaut Draft Report

Main articles: [Garnaut Climate Change Review](#) and [Carbon Pollution Reduction Scheme](#)

In 2003 the New South Wales (NSW) state government unilaterally established the [NSW Greenhouse Gas Abatement Scheme](#) to reduce emissions by requiring electricity generators and large consumers to purchase NSW Greenhouse Abatement Certificates (NGACs). This has prompted the rollout of free energy-efficient compact fluorescent light bulbs and other energy-efficiency measures, funded by the credits. This scheme has been criticized by the Centre for Energy and Environmental Markets (CEEM) of the UNSW because of its reliance upon offsets.^[39]

On 4 June 2007, former Prime Minister [John Howard](#) announced an [Australian Carbon Trading Scheme](#) to be introduced by 2012, but opposition parties called the plan "too little, too late".^[40] On 24 November 2007 Howard's coalition government lost a general election and was succeeded by the Labor Party, with [Kevin Rudd](#) taking over as prime minister. Prime Minister Rudd announced that a cap-and-trade emissions trading scheme would be introduced in 2010,^[41] however this scheme was delayed by a year until mid-2011.^[42]

Australia's Commonwealth, State and Territory Governments commissioned the [Garnaut Climate Change Review](#), a study by Professor [Ross Garnaut](#) on the mechanism of a potential emissions trading scheme. Its interim report was released on 21 February 2008.^[43] It recommended an emissions trading scheme that includes transportation but not agriculture, and that emissions permits should be sold competitively and not allocated free to carbon polluters. It recognized that energy prices will increase and that low income families will need to be compensated. It recommended more support for research into low emissions technologies and a new body to oversee such research. It also recognized the need for transition assistance for coal mining areas.^[44]

In response to Garnaut's draft report, the [Rudd Labor](#) government issued a Green Paper^[45] on 16 July that described the intended design of the actual trading scheme.

European Union

Main article: [European Union Emission Trading Scheme](#)

The European Union Emission Trading Scheme (or EU ETS) is the largest multi-national, greenhouse gas emissions trading scheme in the world and was created in conjunction with the [Kyoto Protocol](#).

After voluntary [trials in the UK](#) and Denmark, Phase I commenced operation in January 2005 with all 15 (now 25 of the 27) member states of the [European Union](#) participating.^[46] The program caps the amount of carbon dioxide that can be emitted from large installations with a net heat supply in excess of 20 MW, such as power plants and carbon intensive factories and covers almost half (46 %) of the EU's Carbon Dioxide emissions.^{[47][48]} Phase I permits participants to trade amongst themselves and in validated credits from the developing world through Kyoto's [Clean Development Mechanism](#).

Whilst the first phase (2005 - 2007) has received much criticism due to oversupply of allowances and the distribution method of allowances (via grandfathering rather than auctioning), Phase II links the ETS to other countries participating in the Kyoto trading system. The European Commission claims that it has been tougher on Member States' Plans for Phase II, dismissing many of them as being too loose again.^[49] However, the use of carbon offsets means that the entirety of the emissions reductions required by the cap in phase 2 could be met outside of the EU itself.^[50]

All EU member states have ratified the [Kyoto Protocol](#), and so the second phase of the EU ETS has been designed to support the Kyoto mechanisms and compliance period. Thus any organization trading through the ETS should also meet the international trading obligations under Kyoto.

New Zealand

On 4 December 2007, the Labour-led Government introduced the Climate Change (Emissions Trading and Renewable Preference) Bill which set out a greenhouse gas Emissions Trading Scheme for New Zealand.^[51] In May 2008, the Government released some economic analyses which supported the scheme, although there were some differences in opinion on the detail.^[52] An interesting feature of the New Zealand Emissions Trading Scheme is that it includes forest carbon and creates deforestation liabilities for landowners.^[53]

The emissions trading bill passed into law on 10 September 2008.^[54] On November 16, 2008, the newly formed National-led government announced that it would delay implementation of the ETS to allow a review by a Parliamentary Select Committee.^[55]

See also: [New Zealand Emissions Trading Scheme](#)

United States

An early example of an emission trading system has been the SO₂ trading system under the framework of the [Acid Rain Program](#) of the 1990 [Clean Air Act](#) in the U.S. Under the program, which is essentially a cap-and-trade emissions trading system, SO₂ emissions were reduced by 50% from 1980 levels by 2007.^[56] Some experts argue that the cap-and-trade system of SO₂ emissions reduction has reduced the cost of controlling acid rain by as much as 80% versus source-by-source reduction.^{[57][58]}

In 1997, the State of [Illinois](#) adopted a trading program for [volatile organic compounds](#) in most of the Chicago area, called the Emissions Reduction Market System.^[59] Beginning in 2000, over 100 major sources of pollution in eight Illinois counties began trading pollution credits.

In 2003, [New York State](#) proposed and attained commitments from nine [Northeast](#) states to form a cap-and-trade [carbon dioxide](#) emissions program for power generators, called the [Regional Greenhouse Gas Initiative](#) (RGGI). This program launched on January 1, 2009 with the aim to reduce the carbon "budget" of each state's electricity generation sector to 10% below their 2009 allowances by 2018.^[60]

Also in 2003, U.S. corporations were able to trade CO₂ emission allowances on the [Chicago Climate Exchange](#) under a voluntary scheme. In August 2007, the Exchange announced a mechanism to create emission [offsets](#) for projects within the United States that cleanly destroy [ozone](#)-depleting substances.^[61]

In 2007, the [California Legislature](#) passed the California Global Warming Solutions Act, [AB-32](#), which was signed into law by Governor [Arnold Schwarzenegger](#). Thus far, flexible mechanisms in the form of project based offsets have been suggested for five main project types. A [carbon project](#) would create offsets by showing that it has reduced carbon dioxide and equivalent gases. The project types include: manure management, forestry, building energy, SF₆, and landfill gas capture.

Since February 2007, seven U.S. states and four Canadian provinces have joined together to create the [Western Climate Initiative](#) (WCI), a regional greenhouse gas emissions trading system.^[62]

On November 17, 2008 President-elect [Barack Obama](#) clarified, in a talk recorded for [YouTube](#), that the US will enter a cap-and-trade system to limit [global warming](#).^[63]

The [2010 United States federal budget](#) proposes to support clean energy development with a 10-year investment of US \$15 billion per year, generated from the sale of greenhouse gas (GHG) emissions credits. Under the proposed cap-and-trade program, all GHG emissions credits would be auctioned off, generating an estimated \$78.7 billion in additional revenue in FY 2012, steadily increasing to \$83 billion by FY 2019.^[64]

The [American Clean Energy and Security Act](#), a cap-and-trade bill, was passed on June 26, 2009, in the House of Representatives.

See also: [Climate change in the United States](#)

Renewable energy certificates

Main article: [Renewable Energy Certificates](#)

[Renewable Energy Certificates](#), or "green tags", are transferable rights for renewable energy within some American states. A [renewable energy](#) provider gets issued one green tag for each

1,000 [kWh](#) of energy it produces. The energy is sold into the electrical grid, and the certificates can be sold on the open market for profit. They are purchased by firms or individuals in order to identify a portion of their energy with renewable sources and are voluntary.

They are typically used like an [offsetting scheme](#) or to show [corporate responsibility](#), although their issuance is unregulated, with no national registry to ensure there is no double-counting. However, it is one way that an organization could purchase its energy from a local provider who uses fossil fuels, but back it with a certificate that supports a specific wind or hydro power project.

Carbon market

Main article: [Carbon emission trading](#)

Carbon emissions trading is emissions trading specifically for [carbon dioxide](#) (calculated in tonnes of [carbon dioxide equivalent](#) or tCO₂e) and currently makes up the bulk of emissions trading. It is one of the ways countries can meet their obligations under the [Kyoto Protocol](#) to reduce carbon emissions and thereby [mitigate global warming](#).

See also: [personal carbon trading](#) and [carbon offset](#)

Market trend

Carbon emissions' trading has been steadily increasing in recent years. According to the [World Bank](#)'s Carbon Finance Unit, 374 million metric tonnes of carbon dioxide equivalent (tCO₂e) were exchanged through projects in 2005, a 240% increase relative to 2004 (110 mtCO₂e)^[65] which was itself a 41% increase relative to 2003 (78 mtCO₂e).^[66]

In terms of dollars, the World Bank has estimated that the size of the carbon market was 11 billion USD in 2005, 30 billion USD in 2006,^[65] and 64 billion in 2007.^[67]

The Marrakesh Accords of the Kyoto protocol defined the international trading mechanisms and registries needed to support trading between countries, with allowance trading now occurring between European countries and Asian countries. However, while the USA as a nation did not ratify the Protocol, many of its states are now developing cap-and-trade systems and are looking at ways to link their emissions trading systems together, nationally and internationally, to seek out the lowest costs and improve liquidity of the market.^[68] However, these states also wish to preserve their individual integrity and unique features. For example, in contrast to the other Kyoto-compliant systems, some states propose other types of greenhouse gas sources, different measurement methods, setting a maximum on the price of allowances, or restricting access to CDM projects. Creating instruments that are not truly [fungible](#) would introduce instability and make pricing difficult. Various proposals are being investigated to see how these systems might be linked across markets, with the [International Carbon Action Partnership](#) (ICAP) as an international body to help co-ordinate this.^{[69][70]}

Business reaction

With the creation of a [market](#) for mandatory trading of carbon dioxide emissions within the Kyoto Protocol, the [London financial marketplace](#) has established itself as the center of the carbon finance market, and is expected to have grown into a market valued at \$60 billion in 2007.^[71] The voluntary offset market, by comparison, is projected to grow to about \$4bn by 2010.^[72]

23 [multinational corporations](#) came together in the [G8 Climate Change Roundtable](#), a business group formed at the January 2005 [World Economic Forum](#). The group included [Ford](#), [Toyota](#), [British Airways](#), [BP](#) and [Unilever](#). On June 9, 2005 the Group published a statement stating that there was a need to act on climate change and stressing the importance of market-based solutions. It called on governments to establish "clear, transparent, and consistent price signals" through "creation of a long-term policy framework" that would include all major producers of greenhouse gases.^[73] By December 2007 this had grown to encompass 150 global businesses.^[74]

Business in the UK have come out strongly in support of emissions trading as a key tool to mitigate climate change, supported by NGOs.^[75] However, not all businesses favor a trading approach. On December 11, 2008, [Rex Tillerson](#), the CEO of [Exxonmobil](#), said a [carbon tax](#) is "a more direct, more transparent and more effective approach" than a cap-and-trade program, which he said, "inevitably introduces unnecessary cost and complexity". He also said that he hoped that the revenues from a carbon tax would be used to lower other taxes so as to be revenue neutral.^[76]

The [International Air Transport Association](#), whose 230 member airlines comprise 93% of all international traffic, position is that trading should be based on "benchmarking," setting emissions levels based on industry averages, rather than "grandfathering," which would use individual companies' previous emissions levels to set their future permit allowances. They argue grandfathering "would penalise airlines that took early action to modernise their fleets, while a benchmarking approach, if designed properly, would reward more efficient operations".^[77]

Measuring, reporting, verification (MRV)

Meaningful emission reductions within a trading system can only occur if they can be measured at the level of operator or installation and reported to a regulator. There is an [open-source tool](#) for helping operators accurately measure and plan their emissions. For greenhouse gases all trading countries maintain an inventory of emissions at national and installation level; in addition, the trading groups within North America maintain inventories at the state level through [The Climate Registry](#). For trading between regions these inventories must be consistent, with equivalent units and measurement techniques.

In some industrial processes emissions can be physically measured by inserting sensors and flow meters in chimneys and stacks, but many types of activity rely on theoretical calculations for measurement. Depending on local legislation, these measurements may require additional checks and verification by government or third party [auditors](#), prior or post submission to the local regulator.

Enforcement


Another significant, yet troublesome aspect is [enforcement](#).^[78] Without effective MRV and enforcement the value of allowances are diminished. Enforcement can be done using several means, including [fines](#) or [sanctioning](#) those that have exceeded their allowances. Concerns include the cost of MRV and enforcement and the risk that facilities may be tempted to mislead rather than make real reductions or make up their shortfall by purchasing allowances or offsets from another entity. The net effect of a corrupt reporting system or poorly managed or financed regulator may be a discount on emission costs, and a (hidden) increase in actual emissions.

Strengthening the ETS

An ETS has one distinct advantage in its ability to make deep cuts in carbon emissions - individual participation. Individuals and organizations can strengthen the carbon emission reduction impact of an ETS by voluntarily buying and cancelling carbon credits.^[79] This removes the credits from the carbon market so that they can never be used to emit carbon. Because the number of carbon credits is limited, this means fewer carbon credits remain. That makes the price of the remaining credits higher which helps make low-carbon solutions more economically attractive and helps achieve a [Low-carbon economy](#).

Criticism



 Chicago Climate Justice activists protesting cap and trade legislation in front of [Chicago Climate Exchange](#) building in Chicago Loop

There are a large number of critics of carbon trading as a control mechanism. Critics include environmental justice nongovernmental organizations,^[80] economists, labor organizations and those concerned about energy supply and excessive taxation. Some see carbon trading as a government takeover of the free market.^[81] They argue that trading pollution allowances should be avoided because they result in failures in accounting, dubious science and the destructive impacts of projects upon local peoples and environments.^[82] Instead, they advocate making reductions at the source of pollution and energy policies that are justice-based and community-driven.^[83] Many argue that that emissions trading schemes based upon *cap and trade* will necessarily reduce jobs and incomes.^[84] Most of the criticisms have focused on the carbon market created through investment in Kyoto Mechanisms. Criticism of cap-and-trade emissions trading has generally been more limited to lack of credibility in the first phase of the EU ETS.^[85]

Critics argue that emissions trading does little to solve pollution problems overall, since groups that do not pollute sell their conservation to the highest bidder. Overall reductions would need to come from a sufficient reduction of allowances available in the system.

Regulatory agencies run the risk of issuing too many emission credits, diluting the effectiveness of regulation, and practically removing the cap. In this case, instead of a net reduction in carbon dioxide emissions, beneficiaries of emissions trading simply pollute more. ^[citation needed] The National Allocation Plans by member governments of the European Union Emission Trading Scheme were criticized for this when it became apparent that actual emissions would be less than the government-issued carbon allowances at the end of Phase I of the scheme. Certain emissions trading schemes have been criticized for the practice of [grandfathering](#), where polluters are given free allowances by governments, instead of being made to pay for them. ^[86] Critics instead advocate for auctioning the credits. The proceeds could be used for research and development of sustainable technology. ^[87]

Critics of carbon trading, such as [Carbon Trade Watch](#), argue that it places disproportionate emphasis on individual lifestyles and carbon footprints, distracting attention from the wider, systemic changes and collective political action that needs to be taken to tackle climate change. ^[81] Groups such as [the Corner House](#) have argued that the market will choose the easiest means to save a given quantity of carbon in the short term, which may be different to the pathway required to obtain sustained and sizable reductions over a longer period, and so a market-led approach is likely to reinforce technological lock-in. For instance, small cuts may often be achieved cheaply through investment in making a technology more efficient, where larger cuts would require scrapping the technology and using a different one. They also argue that emissions trading is undermining alternative approaches to pollution control with which it does not combine well, and so the overall effect it is having is to actually stall significant change to less polluting technologies.

The corresponding uncertainty under a tax is the level of emissions reductions achieved. ^[citation needed]

The [Financial Times](#) published an article about cap-and-trade systems which argued that "Carbon markets create a muddle" and "...leave much room for unverifiable manipulation". ^[88]

More recent criticism of emissions trading regarding implementation is that old growth forests, which have slow carbon absorption rates, are being cleared and replaced with fast-growing vegetation, to the detriment of the local communities. ^[89]

Recent proposals for alternative schemes to avoid the problems of cap-and-trade schemes include [Cap and Share](#), which was being actively considered by the Irish Parliament in May 2008, and the *Sky Trust* schemes. ^[80] These schemes state that cap-and-trade or *cap-and-tax* schemes inherently impact the poor and those in rural areas, who have less choice in energy consumption options.

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- [International Emissions Trading Association](#)

- [The Stern Review on the economics of climate change](#) - Chapters 14 and 15 have extensive discussions on emission trading schemes and carbon taxes
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