

Reducing Greenhouse

Gas Emissions

Carbon Cap and Trade and the Carbon Tax



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As states deal with climate change, many seek economically efficient ways to reduce greenhouse gas emissions. The most popular market-based approach, cap and trade—which limits greenhouse gas emissions and allows emitters to trade allowances—now is being implemented in more than 10 states. Despite the popularity of cap and trade, many economists think a carbon tax is the least costly and simplest approach. Although few states have considered a carbon tax, San Francisco, Calif., and Boulder, Colo. have created small carbon taxes.

Congress is seriously considering the cap and trade approach, creating concern about how much freedom states have under federal requirements and whether they would be allowed to surpass federal standards. Since states are at the forefront of designing and implementing cap and trade systems and many regional monitoring and trading systems will be operating by the time national legislation is passed, states are urging federal policymakers to expand on existing state efforts instead of creating a completely new system.

States usually see market-based emissions reductions policies as a component of a larger climate change strategy, which also includes policies that reduce emissions through energy efficiency, renewable energy and community design. These other policies are important, since raising the cost of emitting greenhouse gases alone may not access some of the most cost-effective means of reducing greenhouse gas emissions, such as energy efficiency.

Cap and trade and carbon tax policies increase the cost of emitting carbon dioxide gradually over time, allowing industries to adapt and change as new technologies and resources are developed. States with emissions goals are finding that various greenhouse gas reduction sources must be addressed immediately and simultaneously. They can not wait until cap and trade policies take effect if they



wish to reach their targets. California, which is furthest along in implementing its greenhouse gas reduction strategy, has created a multi-faceted program that relies on many policies in addition to cap and trade. The state estimates that its cap and trade policy will meet about 24 percent of its targeted greenhouse gas emissions reductions by 2020. Other policies—including renewable electricity standards (requirement for renewable energy production), low-carbon fuel standards (requirements that fuels for automobiles release less carbon dioxide), vehicle emissions standards (requirements that new vehicles emit less carbon dioxide) and energy efficiency requirements—will provide the remaining emissions reductions.¹

Cap and Trade Policy

Policy makers and economists have shown considerable interest in the cap and trade approach since a federal cap and trade program created in the 1990s successfully in reduced sulfur dioxide emissions at relatively low cost. The policy is best suited to larger multi-state regions that include multiple emissions sources with varying reduction costs.

A cap and trade system functions by placing a ceiling or “cap” on the annual amount of greenhouse gas that can be released in a state or region. Emission allowances then are distributed to emitting industries, which can sell or buy them as needed. Each year, the amount of allowances given or auctioned to emitters is reduced to meet state or regional reduction goals, requiring industries or power plants to either reduce emissions or purchase allowances from other emitters that have surpassed their requirements. Industries that can reduce emissions at low cost will reduce first, then sell excess allowances; those for whom reductions are too expensive will buy them. Trading allows emitters to reduce emissions based on their cost of reductions, as opposed to requiring all industries to meet the same emissions requirements, regardless of cost. The price of emitting greenhouse gases then is passed to consumers, ensuring that energy costs reflect the added environmental damage that may be associated with greenhouse gas emissions.

Each allowance is equal to 1 ton of carbon dioxide (CO₂) emissions. Other greenhouse gases, such as methane or nitrous oxide, are included in the cap. Allowances for these gases are calculated in CO₂ equivalents. For example, methane has 25 times the heat trapping potential of CO₂, so 1/25 of a ton of methane emissions is equivalent to 1 ton of CO₂. Accurate measurement and verification of emissions are essential to accurately setting the cap and assessing compliance.

The First Cap and Trade Experience

The 1990 Clean Air Act Amendments required the U.S. Environmental Protection Agency to establish a cap and trade approach to reduce sulfur dioxide (SO₂) emissions from coal-burning power plants. At the time, acid rain, which is caused by the release of SO₂, was damaging lake and forest ecosystems. By 2006, the program had reduced power sector SO₂ emissions to 40 percent below 1990 emission levels, at just one-fourth of projected costs.^{2,3} In 2010, the annual health benefits from the program are predicted to total more than \$119 billion, not including the value of reduced acid content in lakes and streams.⁴

Distributing Emissions Allowances

Assigning a cost to carbon emissions ensures that the cost of activities that release greenhouse gases are reflected in the cost of energy production. A carbon pricing scheme attempts to incorporate the potential environmental costs related to burning fossil fuel—rising sea levels, agricultural and natural resource damage, increases in severe weather, drought and other damage.

The amount of allowances allocated influences their price and plays a critical role in the success of a cap and trade program. Thus, it is crucial that greenhouse gas emissions registries accurately assess how many allowances are needed. If the registry number is higher than actual emissions, emitters will receive more allowances than they need and can sell them for profit with no emissions reductions. Inaccurate registries in the European Union’s European Trading System, along with free distribution of carbon allowances, resulted in such a scenario. Electric utilities were given more allowances than they needed, sold them for windfall profits, and passed on higher energy prices to consumers. The mistake resulted in substantial analysis and revision of the European program.⁵

As soon as a cap and trade system is established, emissions allowances have substantial value and can result in significant transfer of wealth. Accordingly, equitable and efficient distribution of allowances is paramount. In Europe, utilities passed on the cost of the value of allowances even though they received them for free. Many economists argue that allowances are so valuable that the most efficient method of distribution is auctioning, which offers greater transparency and is more immune to lobbying than free allocation.⁶ Since energy prices increase regardless of whether allowances are given away or auctioned, auctioning provides for reinvestment of money in programs such as energy efficiency or clean energy development, where both consumer and energy costs are reduced.

Although economists tend to agree that auctioning is the most efficient distribution approach, there is pressure to allow free allocation of allowances. Many policies propose a mix of auctioned and freely allocated credits to assuage emitters’ cost concerns.

Price Volatility and Flexible Caps

Price stabilization is a key concern in implementation of a cap and trade system because total CO₂ emissions are held constant while credit prices are allowed to fluctuate, resulting in price volatility.⁷ The cost of emissions allowances depends upon many factors, such as new technology, weather, changes in demand and new buyers. Price volatility can be problematic because it can inhibit long-term investment in measures to reduce emissions. Extreme price volatility has occurred in both the U.S. sulfur dioxide program and the European Trading System.⁸

Many economists suggest implementing different measures to help stabilize prices and improve efficiency.⁹ These mechanisms create a more flexible cap that corresponds

to the price of allowances—if the price becomes too high, the cap adjusts to reduce prices. The three most common policies are described below.

- **Circuit Breaker** – This option allows the government administrator to modify the cap if the price of allowances passes a predetermined amount.
- **Borrowing and Banking** – Borrowing allows emitters to exceed their required emission reductions for the year with the promise that they will repay allowances with reductions in the following year. Banking allows firms to exceed emissions reduction requirements and save allowances for future use or sale. It provides an option for quicker reductions and allows firms to hold allowances if prices are low.
- **Safety Valve** – A safety valve sets a ceiling on the price of allowances in a cap and trade system, which allows emitters to buy additional credits from the government when the credit price reaches a certain level. This keeps a cap on prices when the demand for allowances is high.

Some argue that price caps or safety valves on the price of emissions credits should not be allowed because they could delay the emissions reductions needed to prevent catastrophic global warming scenarios. Since the European program rejected price caps, there is also the chance that allowances from markets with price caps would not

be eligible for sale there. Price caps could hamper U.S. competitiveness in the emerging clean energy sector by limiting the market’s ability to function freely. Carbon prices could then become too low to drive development and adoption of efficiency and clean energy technologies. Table 1 illustrates pros and cons of the cap and trade system.

State and Regional Efforts

The Regional Greenhouse Gas Initiative

Ten northeastern states—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont—developed the first U.S. multi-state greenhouse gas cap and trade, called the Regional Greenhouse Gas Initiative (RGGI). The cap began in 2009, covering CO₂ emissions from power plants in the 10 states. The cap will remain at the same level through 2014, then will be lowered each year thereafter, dropping to 10 percent below the 2009 level by 2018.¹⁵

The first of the quarterly auctions occurred in September 2008. Regulated facilities purchased 80 percent of the allowances, and the remainder were purchased by individuals or companies that had no emissions restrictions under RGGI. The initiative requires states to auction at least 25 percent of allowances and use proceeds to benefit consumers and efforts such as energy efficiency, renewable energy and technology development. RGGI states, after seeing the benefit of auctions, have agreed to auction almost

Table 1. Pros and Cons of Cap and Trade

Pros	Cons
Banking, auctioning and safety valves help stabilize prices. ¹⁰	Large fluctuations and unpredictability in allowance prices to make investment decisions difficult.
	Complexity of a trading regime could foster delay and be difficult to enforce.
Free allocation of allowances can help energy intensive industries remain competitive with companies in regions that have no emissions caps.	Firms operating under cap and trade are at a competitive disadvantage.
Allowance auctioning eliminates windfall profits, provides money for clean energy development, and helps low-income ratepayers.	Free allocation of allowances provides windfall profits for polluters. ¹¹
Allowances can be distributed only to major greenhouse gas emitters and suppliers of fossil fuel, simplifying the system.	A comprehensive program must encompass many sectors, creating complications for trading and enforcement. ¹²
	The initial start-up time will be long.
	Carbon taxation is more efficient than cap and trade. ¹³
The cap, which will shrink over time, guarantees that specific emissions reduction targets will be met.	
Auctioned cap and trade brings in revenues that can be used to ease the burden on those with lower incomes.	Increased energy prices will burden low-income families.

Sources: NCSL and Sightline Institute,¹⁴ 2008.

all their allowances. The first four RGGI auctions—the most recent in June 2009—netted the 10 participating states \$365 million, with credits selling for between \$3.01 and \$3.51 per ton. In the future, RGGI may be extended to include other sources of CO₂ emissions and greenhouse gases.¹⁶

Western Climate Initiative

Partners of the Western Climate Initiative (WCI)—Arizona, British Columbia, California, Manitoba, Montana, New Mexico, Ontario, Oregon, Quebec, Utah and Washington—are designing a system to achieve greenhouse gas emissions reductions of 15 percent below 2005 levels by 2020. The WCI, which was initiated by governors of the member states and provinces, plans to implement a regional cap and trade program to help reach its goal. Many participants still need the support of their state legislatures before cap and trade can become a reality for the entire region. WCI members will begin reporting their emissions in 2011, and the cap and trade program is slated to begin in January 2012.¹⁷

Midwest Greenhouse Gas Accord

Members of the Midwestern Greenhouse Gas Accord include Kansas, Illinois, Iowa, Michigan, Minnesota, Wisconsin and Manitoba. The accord aims to reduce greenhouse gas emissions through a multi-sector cap and trade mechanism. Still in the planning phase, the goal of the accord is to help members establish reductions targets and time frames. It also will develop and implement additional steps to support the cap and trade system, such



as such as low-carbon fuel standards and regional incentives and funding mechanisms.

Carbon Tax

A carbon tax is a direct fee on CO₂ emissions that is raised over time until emissions goals are reached. Most economists feel that taxing greenhouse gases is the most efficient way to reduce carbon dioxide emissions because the tax is easily understood, transparent and relatively simple to implement.¹⁸ To reduce the number of taxable entities, only emitters high in the supply chain would be taxed for each ton of carbon they emit. Emitters will reduce emissions when they find the tax payment is higher than the cost of emissions reductions. A slowly increasing carbon tax would first encourage the lowest cost abatement measures and would allow time for industry to invest in emissions reduction technology and develop low carbon energy sources. Because a carbon tax uses existing tax structures for collection, administering it is likely to be much simpler than managing a cap and trade regime.

Since a carbon tax makes the cost of emissions predictable, it is easier for taxed entities to make long-term investments and budgetary decisions regarding abatement measures. Unlike cap and trade, it is difficult to know what effect the tax will have on actual CO₂ emissions reductions. The tax must be set to increase over time in order to reach a level that matches reduction goals. The cap and trade approach sets the emissions amount and allows the cost of emissions to adjust through auctioning and trading allowances, until they reach a price that induces the targeted reductions. Eight government entities have instituted some form of carbon tax—British Columbia, Finland, Great Britain, New Zealand, Quebec, Sweden, and the cities of Boulder, Colo., and San Francisco, Calif.

Revenue Generation and Uses

Carbon taxation is considered politically unpopular, as most taxes are, because it places an additional tax burden on the economy. The goal of the cap and trade system—to raise the cost of greenhouse gas emissions in order to create reductions—is the same as the carbon tax. As with the carbon tax, governments receive funds to offset potential increases in energy costs and to invest in clean energy. Carbon tax income also could be used to offset or reduce other taxes, such as income tax or sales tax, resulting in no net tax increase. This approach, called tax shifting, can be used to discourage damaging activities, such as polluting, while removing the earning disincentives that may be caused by taxing income. Table 2 discusses the pros and cons of the carbon tax.

Table 2. Pros and Cons of Carbon Taxation

Pros	Cons
A revenue neutral carbon tax shift, one that reduces heavily regressive taxes (such as sales tax), can be politically favorable.	Taxes are politically unfavorable.
A slowly increasing carbon tax will allow low-cost improvements to happen first while the tax is adjusted to reach the desired emissions reductions.	Carbon taxation does not guarantee decreased CO ₂ emissions.
Generated revenue can be invested in research and development and clean energy and efficiency incentives, and can be used to help low-income families pay higher energy costs.	Carbon taxation puts too much money in the hands of the government.
A revenue neutral carbon tax shift (using revenue to reduce sales or other taxes) could reduce regressive taxes.	A carbon tax is regressive and will distort the economy.
Slowly increasing the tax will allow transitional investment, adjustment and technological development.	

Sources: NCSL and Sightline Institute,¹⁴ 2008.

Case Study: Sweden's Carbon Tax

Sweden introduced a carbon tax in 1991. Today, the tax is \$150 per ton of carbon dioxide, but various industries receive exemptions or do not pay the entire tax. No tax is placed on fuels used to generate electricity, fuels from renewable sources, or fuels used for ships, planes and trains. However, individual consumers pay a tax on electricity and motor fuel use.¹⁹ The Swedish Ministry of Environment found the tax has helped change energy consumption patterns.²⁰ Boats at the Port of Goteborg use the local power grid instead of burning diesel oil or sulfurous bunker fuel to power their ships. Sweden's carbon emissions have decreased by an estimated 9 percent since 1990.²¹

Conclusion

As states advance their efforts to reduce greenhouse gas emissions, they are considering policies that help reach their goals while protecting the economy. The appeal of cap and trade—and, more recently carbon taxes—is growing as states look for cost-effective reduction approaches that also support their mandates for clean energy and energy efficiency. Many policymakers are beginning to consider reduction efforts to be compatible with economic growth. Some feel the technologies and

jobs created in the clean energy and energy efficiency sectors will promote growth and provide economic stimulus. As more states create market-based programs, they are considering the potential societal costs of adding greenhouse gases to the atmosphere and attempting to ensure that cost is reflected in the energy prices. These policies increase the value of new clean energy technologies, allowing them to compete with established fossil fuel power generation.

Although concerns about the costs of such programs are common, some consider the cost of not reducing greenhouse gas emissions to be far higher. Assessments by two states found economic benefits from their climate policies. The California Air Resources Board's economy-wide analysis of the state's plan to reduce CO₂ emissions to 1990 levels by 2020 found the plan would increase state productivity by \$27 billion. Some of the benefits from energy inefficiency improvements will save households \$400 per year.²² New Jersey's analysis of its climate reduction plan also found a net benefit to the state.

Since a national cap and trade policy for greenhouse gas emissions is looking more likely, those states with climate policies are likely to be a step ahead when such a program is implemented.

Notes

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