20 CLIMATE-CHANGE POLICIES AT THE NATIONAL LEVEL

Economics brings two central lessons to policies on global warming. The first, discussed in Chapter 19, is that people and firms must face economic incentives to tilt their behavior toward low-carbon activities. Activities that lead to emissions of CO_2 and other greenhouse gases (GHGs) must become more expensive, which primarily requires raising the prices of carbon-based fuels. This is an inconvenient economic truth because people resist paying more for energy.

The second economic truth is that markets alone will not solve this problem. There is no genuine "free-market solution" to global warming. We need new national and international institutions to coordinate and guide decisions about global warming policies. These mechanisms can use the market, but they must be legislated and enforced by governments. This second truth is the focus of this and the following chapter.

THE TWO MECHANISMS FOR CARBON PRICING

Governments can limit emissions and raise the price of CO_2 and other GHGs through two mechanisms: cap-and-trade systems and carbon taxes. The present chapter discusses these systems and their relative merits.

The first approach raises the price of CO_2 emissions by making them scarce and is called "cap and trade." It begins with legislation in which a country caps or limits its CO_2 and other GHG emissions. The country then issues a limited number of allowances that convey the right to

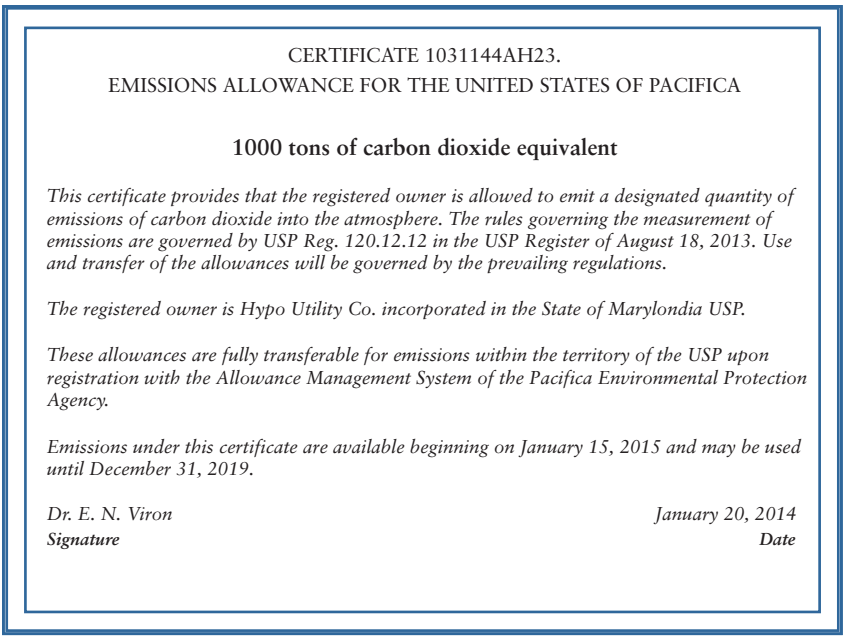

Figure 34. Whimsical certificate for emissions allowance for the United States of Pacifica.

emit a given quantity of CO_2 or other GHG. This kind of regulation has been used by governments around the world to reduce pollution.

Just for fun, Figure 34 shows a hypothetical allowance certificate. In the modern era, certificates are electronic and contain complex regulatory requirements, but this gives the basic idea that emissions allowances are ownership rights that can be bought and sold like cars and houses.

The next stage is a brilliant innovation by environmental economists: the "trade" in cap and trade. In addition to having emissions allowances, firms can buy and sell the allowances. Perhaps firm A owns 1,000 tons of allowances and decides to shut down an obsolete power plant; perhaps firm B desires to open a profitable new computer server farm that will emit 1,000 tons of CO_2. Firm A can sell its valuable allowances to firm B.

How would they set the emissions price? There might be an exchange where allowances are bought and sold; or dealers might link

up buyers and sellers. Firm A would look for the highest bids, and firm B would seek the lowest offers. They might settle on a price of $25 per ton.

The advantage of establishing a market in allowances is to ensure that emissions are used in the most productive manner. In our example, firm A might have stayed in business if it couldn't sell the allowance, but the value might be only $2 per ton. Similarly, purchasing firm B might find that the allowances are actually contributing $202 of net value in the new product. Hence, by allowing the trade, economic welfare is improved by $200 per ton.

These ideas are not just some wild theoretical scheme. They have been used in a wide variety of contexts over the last half century. Permits are auctioned for the rights to drill for oil, to harvest trees, and to use the electromagnetic spectrum. In the environmental area, the most successful example is the use of allowances to limit the emissions of sulfur dioxide (SO_2) since 1990. This program proved very successful in reducing overall emissions and did so much less expensively than many analysts had predicted. The U.S. SO_2 program was so successful that it was used as the basis for the Kyoto Protocol's GHG emissions plan and then for the European Union's CO_2 Emissions Trading Scheme.

In the context of CO_2 emissions, the cap-and-trade plan squeezes the most economic value out of the limited emissions. It accomplishes this through the mechanism of prices and markets, not through governmental micromanaging of businesses. Because emissions are capped below the unregulated or free-market level, they are a scarce resource, like land or oil. The market price of CO_2 allowances rises high enough to reduce emissions to the quantitative limit. Just as a high corn price squeezes corn demand to fit into the available supply, the carbon price induces producers and consumers to reduce their use of carbon-emitting goods to fit within the capped quantity. A binding cap-and-trade regime would indirectly lead to a positive rather than zero price for carbon.

The cap-and-trade idea for CO_2 was implemented by the European Union through its Emissions Trading Scheme. Figure 35 shows the price of CO_2 emissions in the scheme over the period 2006–2012.[1] The

Figure 35. The market price of CO_2 under the European Trading Scheme. This figure shows the history of CO_2 prices under the EU Emissions Trading Scheme from 2006 to 2012. The price declined sharply during the financial crisis and at the end of 2012, when the future of global climate-change agreements was in doubt. Note: The vertical scale uses metric tons rather than American tons (2,205 versus 2,000 pounds). The euro averaged $1.36/€ during this period.

number of allowances from the first phase was greater than actual emissions, and the price fell to zero in 2007. For the second phase, prices started around 20 euros ($27) per ton, but fell by 2012 to around 8 euros ($11) per ton.

In the second approach to raising the carbon price, known as carbon taxation, governments directly tax CO_2 emissions. The basic idea is simple. When a firm burns fossil fuels, the combustion leads to a certain quantity of CO_2 entering the atmosphere. The tax would be levied on the CO_2 content of each fuel. The definitional issues are the same for carbon taxes and emissions caps. The only difference is that one taxes a quantity while the other limits the quantity. The definitions of the quantities are the same.[2]

Let's take an example. Suppose a company generates electricity using coal. A large plant might burn 500 million tons of coal each year. At a tax of $25 per ton of CO_2, the plant would pay almost $400 million per year in carbon taxes. This would be the single most important component of costs and would definitely get the attention of management.

A universal carbon tax would be similar to this example but would apply to all sources of CO_2 (and other GHGs as well). Coal, oil, and petroleum are the major sources of CO_2, but other areas such as cement production and deforestation would also come under a universal tax. As in any tax system, there are many lawyerly details.

Carbon taxes (or more frequently their relatives such as energy taxes) featured in the early discussions of climate-change policy. They were shunted aside in the late 1990s because the political negotiators at international meetings believed that quantitative restrictions were more familiar and more likely to be acceptable to the public and national governments. Since 1997, as a consequence, quantitative restrictions such as cap and trade along with regulations have been the norm in international negotiations.

However, carbon taxes have been used by a few countries to raise revenues. Some western European countries have carbon taxes or mixed energy-carbon taxes on the books. India levied a $1 per ton carbon tax on coal, and China is considering such a tax. Similar proposals have been considered in Korea, Australia, New Zealand, Canada, and the European Union. Up to 2012, no country has introduced a high carbon tax that is applied to the entire economy.

CARBON TAXES AND CAP AND TRADE: THE CENTRAL EQUIVALENCY

How do the two regimes—cap and trade and carbon taxation—compare? Most people will be surprised to learn that they are fundamentally the same. That is, in an idealized situation, they have the same effects on emissions reductions, on carbon prices, on consumers, and on economic efficiency. People may argue strenuously about which is better, but each of them has the effect of reducing CO_2 emissions by

giving strong incentives to consumers and firms to reduce emissions by raising the price of carbon emissions.

The similarity can be seen with the following example. Assume that uncontrolled emissions for the United States are 5 billion tons of CO_2 per year. Then the United States passes cap-and-trade legislation that limits emissions to 4 billion tons. This is done by auctioning off emissions allowances for 4 billion tons. (These are the real-world equivalent of the little cartoon in Figure 34.) Allowances are then traded so that the reductions are undertaken in the most economical manner. Because it is costly to reduce emissions, the price of an allowance would rise to the cost of reducing the last ton. Assume that the cost of the last ton removed is \$25 per ton of CO_2. The price of allowances would then rise to \$25 per ton because that is the price at which emitters are indifferent between incurring the cost of abatement and buying an allowance. From the point of view of a firm doing business, it would cost \$25 to buy the right to emit a ton of CO_2.

Now assume instead that the United States imposed a tax of \$25 per ton of CO_2. At that tax rate, firms would find it economical to reduce emissions by 1 billion tons. From the ground view of individual firms, in both cases the price of adding a ton of CO_2 to the atmosphere is \$25 per ton, so firms will behave identically in both situations. In one case, they pay a tax of \$25 to emit a ton; in the other case, they buy a permit for \$25 a ton. The quantity of emissions and the price of CO_2 are exactly the same for the cap-and-trade regime as for the carbon tax. The only difference is that in the one case government employs a market-based "quantity" regulation, while in the other case government uses a "price" regulation in the form of taxes.

In the end, firms pay \$100 billion (4 billion tons × \$25 per ton) to emit the 4 billion tons of CO_2. In one case it is \$100 billion of taxes; in the other case, it is \$100 billion for allowances. The government gets \$100 billion of revenues in either case. Cap and trade operates just like a tax on pollution.

CARBON TAXES AND CAP AND TRADE: THE IMPORTANT DIFFERENCES

Once we move from an idealized analysis to a realistic situation, significant differences emerge. Generally, economists lean toward carbon taxation as preferable, while negotiators and environmental specialists lean toward the cap-and-trade approach. The following are some of the major considerations.[3]

Carbon tax advocates point out that tax systems are mature and universal institutions of policy. Every country uses taxes. Countries have administrative tax systems, tax collectors, tax lawyers, and tax courts. Countries need revenues, and indeed many countries face large fiscal deficits today. By contrast, there is limited experience with cap-and-trade systems in most countries and virtually no international experience.

A related point is that quantitative limits produce severe volatility in the market price of carbon under an emissions-targeting approach, which can be seen in Figure 35 for the European system. Note how wildly prices fluctuated in 2008, declining by almost 75 percent in a few months. The volatility arises because both supply and demand for permits are insensitive to the permit price. The high level of volatility is economically costly and sends inconsistent signals to private sector decision makers. Clearly, a carbon tax would provide consistent price signals and would not vary so widely from year to year, or even day to day.

One important difference between standard cap-and-trade systems and taxes concerns who pays and who gets the revenues. Historically, the permits or allowances under cap-and-trade plans were allocated free of charge to firms who were regulated. For example, under the U.S. SO_2 program of 1990, virtually all the emissions permits were allocated for free to electric utilities and firms who were historically large emitters and were to be regulated. Allowances were valuable assets, and the free allocation helped reduce the political opposition to the plan by the regulated firms. Similarly, in the early stages of the European CO_2 trading plan, permits were allocated to firms. Economists find the free allocation of emissions allowances objectionable because it

wastes fiscal resources and is not necessary to offset the impacts of the emissions cap on the profits of firms.

Under a carbon tax, the valuable revenues go to the government to be used for recycling to consumers or to buy important collective goods. Some current cap-and-trade proposals require the government to auction the allowances. With auctions, the two systems have equivalent fiscal impacts.

Carbon taxes have two major disadvantages relative to cap-and-trade systems. The first is that the quantity of emissions is uncertain under a carbon tax. If we set a universal carbon tax of $25 per ton, we would not know the actual quantity of emissions. If we have a definite idea of a dangerous level of emissions, this would be a major disadvantage of carbon taxes. So here is a genuine difference. The price of carbon would fluctuate under a cap-and-trade regime while the quantity of CO_2 emitted would remain constant. Under a carbon tax, the quantity emitted would fluctuate while the price would be stable. This suggests that, unless it can be periodically changed, a carbon tax cannot automatically ensure that the globe remains on the safe side of "dangerous anthropogenic interferences" with the climate system.

A further point, emphasized by its advocates, is that cap-and-trade systems have greater political appeal and greater durability. One reason is that political opposition from industry groups who would be disadvantaged by tighter regulation are bought off by allocation of free allowances. Indeed, the value of the free allowances appears to be much greater than the lost profits from the tighter regulations. This source of political glue from cap and trade would disappear if governments moved to auctioning allowances.

A final political argument is that taxes are hard to introduce but easy to cut. Perhaps scientists would persuade the government to introduce a high carbon tax, which would give a strong signal to firms to begin making low-carbon investments. But if the political winds shifted, the next government might reverse that policy and repeal the tax. In a sense, the price volatility in Figure 35 might be replaced by political volatility with a carbon tax if the tax gets caught in partisan political struggles.

The history of regulation suggests that environmental rules tend to have greater durability and have generally been irreversible. Congress introduced a tightening of the rules with respect to SO_2 emissions in 1990. Even with the major political changes in the United States since that time, emissions standards have not changed appreciably. For this reason, many analysts believe that the regulatory route of a cap-and-trade policy would be more durable and have a larger chance of being a credible long-term policy.

How do I come out after weighing the arguments? My first choice is . . . either one! The most important goal is to raise the price of CO_2 and other GHG emissions. If countries find it easier to raise prices with cap and trade, particularly with auctions, that will accomplish the goal. Other countries might find they need a stable and reliable revenue source and lean toward carbon taxes, and I would applaud them. As I will emphasize in Chapter 21's discussion of alternatives, either one is so far superior to other approaches that we must focus on the major goal—raising GHG prices—and not let the differences be obstacles to effective policies.

If I were put on the rack and forced to choose, I would admit that the economic arguments for carbon taxation are compelling, particularly those relating to revenues, volatility, transparency, and predictability. So if a country is genuinely unsure, I would recommend it use the carbon tax approach. However, if a country like the United States has a powerful aversion to new taxes but can swallow a cap-and-trade system, particularly one with the allowances auctioned, then that is definitely better than allowing unchecked climate change or relying on ineffective substitute approaches.

HYBRIDS

There are many competing considerations in weighing carbon taxes versus cap and trade. Is there a compromise, crossing the strengths of the carbon tax regime with cap and trade to produce a hardy hybrid? Perhaps the most promising approach would be to fashion a hybrid mechanism that has quantitative limits with a price floor and a safety valve price at the higher end. For example, a system might have quantitative targets with a minimum CO_2 price as a carbon tax floor. Some

countries might organize their climate-change policies around a cap-and-trade model, as Europe does. They could also incorporate an upper-end safety valve into the system wherein nations could sell carbon emissions permits at a multiple of the tax, perhaps at a 50 percent premium of the base level, to reduce volatility and ensure that the economic costs of the program are contained.

A hybrid system would share the strengths and weaknesses of the two options. It would not have firm quantitative limits of a pure cap-and-trade system. But the soft quantitative limits would guide firms and countries and would generate confidence that the climatic targets were being achieved. The hybrid would have some but not all of the advantages of a carbon tax system. It would have more favorable public finance characteristics, reduce price volatility, mitigate the incentives for corruption, and help alleviate uncertainties. The narrower the difference between the price floor and the safety valve price, the more the program would have the advantages of a carbon tax; the wider the difference, the more it would have the advantages of a cap-and-trade system.

As with systems as complex as the economy and the climate, many design details are just sketches in a brief treatment. The reader can refer to specialized legal or economic analyses for a more detailed analysis.[4] One particularly thorny issue is the treatment of carbon sequestered in forests and soils. In principle, a system would give carbon credits when carbon is accumulated in trees, and the owners would be debited when trees are cut and burned. In practice, keeping an accurate record of these flows is beyond current capabilities, so including forests in an international GHG control system presents real problems.

Another complication is the measurement of flows of GHGs across national borders when the national emissions control systems are not harmonized. Suppose that the United States has a tax of $50 per ton of CO_2 while Canada has a tax of $20 per ton. In an ideal world, imports of CO_2 from Canada to the United States might receive an additional tax of the difference of $30 per ton. The difficulty comes in how to treat indirect or "embodied" CO_2 and other GHGs. Should we include only fossil fuels in the border tax? Or goods that are highly CO_2 intensive, like steel? Or should we include an estimate for all imports? Border tax

treatment will be manageable if the carbon prices are low. But if prices are in the range of $500 or $1,000 per ton of CO_2, as is found in some proposals, then a few percentage points in the CO_2 price can make a substantial difference for the prices and competitiveness of goods in international trade.

These are just two examples of the many realistic details that will need to be ironed out in any global climate policy. They sound tedious for nonspecialists and will make work for lawyers. But working through the details and establishing a price for CO_2 and other GHGs is a critical step on the road to slowing global warming.