Chapter 5

Applied Transaction Cost Economics: Emission Permit Trading

If factors of production are thought of as rights, it becomes easier to understand that the right to do something which has a harmful effect (such as the creation of smoke, noise, smells, etc.) is also a factor of production.... The cost of exercising a right (of using a factor of production) is always the loss which is suffered elsewhere in consequence of the exercise of that right—the inability to cross land, to park a car, to build a house, to enjoy a view, to have peace and quiet or to breathe clean air.

—Coase (1960), p. 44

Together, three of Coase's most influential works, "The Nature of the Firm," "The Federal Communications Commission," and "The Problem of Social Cost," create a coherent theory about the relationship between property rights and transaction costs and the institutional implications of those relationships. Transaction costs, that is, the costs of defining property rights, shape incentives and how we organize the use of resources. As the example in the previous chapter of spectrum license auctions shows, these ideas have significant policy implications, even if their implementation takes decades. The use of emission permit trading in the United States to reduce air pollution is another example; it too, has long-lasting and great beneficial effects. The design of the emission permit trading program has several Coasean features, particularly the emphasis on institutional design to reduce transaction costs.

In 1970 the US Congress passed the Clean Air Act (CAA), enacting regulatory standards for a specific set of emissions. Geographic areas were required to meet specific National Ambient Air Quality Standards (NAAQS), and companies that were the sources of emissions faced limits on their emission rates and regulation of the particular technologies that could be used in production processes. One of the "criteria pollutants" regulated under the CAA was sulphur dioxide (SO_2), produced primarily from burning coal to generate electricity. When airborne SO_2 combines with water, sulfuric acid is the result; it falls as acid rain and harms aquatic life, trees, and the carved faces of sculptures on buildings. Airborne SO_2 also causes respiratory illness and consequent health costs. The CAA regulations led power plant owners to build tall smokestacks to reduce local SO_2 emissions, but that SO_2 entered the jet stream and was transported to other regions where the resulting acid rain caused harm. The CAA regulations had not reduced the harms associated with SO_2 emissions, but had relocated them, and many areas were still not meeting the CAA's air quality standards. Economists working on environmental policy suggested a different approach.

Emission permit trading

This different approach was emission permit trading. Emission permit trading built on a "netting" program that the Environmental Protection Agency (EPA) had established in the mid-1970s to allow new sources of SO_2 in a region if they purchased emission credits from an existing source in the region. However, that program had substantial bureaucratic requirements that created high transaction costs (Tietenberg, 2010: 362). The EPA worked with economists to design a market for SO_2 emission permits, or allowances. The design of this new market was also part of the process of negotiating the Clean Air Act Amendments (CAAA), which Congress passed in 1990 and authorized the EPA to design and administer. Title IV of the CAAA aimed to reduce SO_2 levels by 10 million tons from their 1980 levels in a decade, implemented in two five-year phases. (In 1985 electricity generation accounted for around 70 percent of SO_2 emissions in the US and coal-fired power plants accounted for 96 percent of that amount.)

The design of this program, called the EPA Acid Rain Program, involved considerable bargaining and its implementation was extremely detailed.

Focusing on the most essential design details indicates how important Coase's ideas were for the design and the ultimate success of the program. The Acid Rain Program included several innovative features (see Stavins, 1998; Ellerman et. al., 2000; and Sandor, 2012). The CAAA targeted a total national quantity of SO_2 emissions rather than individual source emission rates or technologies. It laid out an emissions reduction timeframe to meet the target in 2000. The total quantity, or cap, declined over time to deliver more emissions reductions. In Phase I (1990-1995), the 263 largest SO_2-emitting coal-fired power plants were required to reduce their annual emissions every year. In Phase II almost all fossil fuel-fired power plants were subject to the national emissions cap. The EPA used a formula to determine each plant's allowable emissions, and each plant received emission allowances based on its historic emission rates (so that it could not manipulate its current emissions to affect its allowance allocation).

The mechanism for meeting the Phase I and II requirements was trading emission allowances. Utilities would be required to have emission allowances, each of which permitted the owner of the allowance to emit one ton of SO_2 in the year it was issued or in any subsequent year. If annual emissions exceeded allowable emissions, the utility had three choices: use an allowance it already owned, abate (i.e., reduce emissions), or purchase an allowance. If emissions were below allowable emissions, the utility could sell the difference. The number of annual allowances decreased over time, tightening the cap and ensuring emission reductions. This "cap-and-trade" system created incentives for utilities to find the least-cost ways to reduce SO_2 emissions.

Parties could trade the allowances through the annual auction market the EPA established at the Chicago Board of Trade, as well as through private market transactions. Electricity generators were not the only parties allowed to participate in the allowance market; brokers speculating on a future price increase could purchase allowances and sell them later, and environmental groups could purchase them and retain them, which would ensure that that ton of SO_2 was never emitted. The program also had a voluntary participation option. In addition, some allowances were auctioned to utilities in every year in a "revenue-neutral" auction.

One aspect of better-defined property rights and lower transaction costs is using technology to do so. The EPA developed a continuous emission monitoring system and implemented it in the Acid Rain Program, enabling it to verify the amounts utilities entered into the allowance tracking system. Using technology to reduce monitoring costs (and backed up by a $2,000/ton penalty on any emissions that exceed allowances) facilitated exchange in ways consistent with the examples Coase used in "The Problem of Social Cost."

Seeing the emission allowance as an asset

The predominance of the market in the program design is the feature that reflects Coase's ideas, particularly his argument for spectrum license auctions. Making property rights clear and transferable in markets makes it possible to discover what the allowances are really worth, rather than having a bureaucratic process establish some estimate of the value. It created a decentralized process by which the allowances find their highest-valued uses and users.

> There were two policy options to reduce acid rain: command and control (CAC) or flexible mechanisms.… Flexible mechanisms consisted of taxes and/or subsidies, or something more dynamic like emissions trading, that is, cap-and-trade. The concept of emissions trading… had its roots in Ronald Coase's theory of social cost (fully articulated by J. H. Dales). (Sandor, 2012: 206)

In this case, as with the spectrum license, the emission permit is more of a use right than a property right, but the essential feature for value discovery and creation is that the right is transferable, which turned the regulation from a requirement into an asset.

Thinking of the emission allowance as an asset highlights another important feature of the Acid Rain Program. Allowances could be banked for use in future years, which had a considerable effect on the incentives of allowance holders. In any given year a utility had three choices for an allowance: use it, sell it, or bank it. Facing this explicit choice made the utility confront the opportunity cost of the allowance because it had to evaluate what it thought the allowance was worth in each of those three options, and then choose what it saw as the most valuable option. Different utilities viewed those options differently; in other words, their opportunity costs were subjective, and that diversity combined with good market institutions enabled a mutually beneficial exchange of emission allowances. In the SO_2 emission reduction context, this evaluation amounted to each utility figuring out if it could abate the pollution more cheaply than the market price of the allowance, which would mean it could make money from selling the allowance and instead abating the pollution. An emission permit market created incentives for firms to figure out cheaper and more effective abatement technologies. Similarly, if they could abate more cheaply than they expected the future price of the allowance to be, they could bank the allowance to sell later, or to use later if necessary. The emission permit market made the opportunity cost of emitting a ton of SO_2 economically salient in a way that prior command-and-control regulations had never been able to do.

What are some ways to abate SO_2 pollution? It turned out that buying lower-sulphur coal from the Powder River Basin in Wyoming was a relatively low-cost way to reduce emissions and sell allowances to others, and utilities profited from doing exactly that. Coal substitution was cheaper than new generation technology (made even cheaper by railroad rate deregulation in the late 1970s) and delivered emission reductions without having to use allowances. Creating more cost-effective smokestack scrubbers also abated emissions without using allowances. As Coase had argued for spectrum licenses and in "The Problem of Social Cost," property rights and markets created incentives to innovate that economized on resource use.

The Acid Rain Program succeeded beyond the expectations of its designers. Utilities achieved emissions reduction targets ahead of schedule, and most of the areas that had SO_2 concentrations above the NAAQS saw reductions that brought them into compliance with the regulation. Some regional pollution "hotspots" occurred occasionally, but overall, between 1990 and 2004, SO_2 emissions fell by 36 percent—despite an increase in coal-fired electricity generation of 25 percent during the same period (Schmalensee and Stavins, 2013: 106).

As SO_2 concentrations fell—and even fell below increasingly tight standards—the market value of the allowances dropped and trading volume dwindled. Early banking of so many allowances provided a cushion for future technological and commercial changes and the tightening of the cap that brought down SO_2 emissions. Most recently, the shift from coal to natural gas generation since the mid-2000s has reduced emissions further, a result of hydraulic fracturing innovations that have increased natural gas supplies. More significant, though, has been the subsequent government regulation of individual sources at the federal and state levels that has essentially closed down the SO_2 allowance market.

> Through a series of new Clean Air Act regulations, court rulings, and regulatory responses, the courts affirmed that EPA could not set up a new interstate trading system or modify the Title IV system in the absence of new legislation from Congress. In response, state-level and source-level constraints were put in place that ultimately rendered the SO_2 cap-and-trade system itself nonbinding and effectively closed down the allowance market. (Schmalenseee and Stavins, 2013: 113)

Despite the Congressional demise of the Acid Rain Program, it remains the most successful market-based pollution control initiative ever developed. Its most valuable features are Coasean: defining use rights in a shared resource, reducing transaction costs, and using markets to enable parties to discover value, create value, and innovate.

Over the past 15 years as environmental policy attention has turned to greenhouse gas emissions, the cap-and-trade design has been applied in several places (e.g., the European Emissions Trading Scheme, California's Cap and Trade program, and the Regional Greenhouse Gas Initiative in the US northeast), with mixed results. One economist involved in the Acid Rain Program, Richard Sandor, created the Chicago Climate Exchange (CCX) in 2003. Inspired by Coase, Sandor designed the CCX as a voluntary, legally binding, greenhouse gas emission reduction and trading exchange (Sandor, 2012: chps. 11 and 18). The CCX ceased trading in 2010 due to inactivity in US carbon trading.

Applying the successful Acid Rain Program emission permit market design to greenhouse gases faces significant physical, economic, and political challenges. Greenhouse gases behave differently from SO_2, and the effects are not felt locally or on a short timeframe. They are also embedded in widespread economic activity, unlike the concentration of SO_2 emissions, which was centred in fossil fuel electricity generation. The challenges of designing and implementing carbon markets reinforce the lesson from Coase that institutions matter and are highly context-specific.