Information Technology

THE UNSUNG HERO OF MARKET-BASED ENVIRONMENTAL POLICIES

Blas Pérez Henríquez

Policymakers around the world are planning international environmental commodities markets intended to forestall climate change, slow biodiversity decline, and tackle other global environmental problems. The European Union, for example, is developing a regional market for carbon dioxide emissions to meet targets set under the Kyoto Protocol. Some U.S. state governments, ignoring the Bush administration's position on climate change agreements, want to integrate their emissions trading systems into a global market for greenhouse gases.

The proposed market strategies would create incentives for producers and consumers to make better use of natural resources. The approach gives producers flexibility to meet regulatory standards that protect human health and ecological systems. But since the road from policy prescription to actual market solution is full of pitfalls, it is useful to analyze the implementation of existing market-based programs and extract lessons for the future.

Although it receives relatively little attention, a crucial factor in the success of the U.S. sulfur dioxide trading program—the mother of all market-based environmental policies—turns out to be information and communication technologies and electronic monitoring systems. Information technology can reduce the operational transaction costs of an emissions trading system. By handling vast amounts of information efficiently, information systems permit accurate tracking of emissions and allowance accounting to ensure compliance. Furthermore, Internet access to regulatory information increases the transparency and accountability of market-based environmental management.

Policy on Paper

Title IV of the 1990 U.S. Clean Air Act Amendments, designed to address the acid rain problem by controlling sulfur dioxide (SO_2) emissions, presented an implementation challenge. The mandate to the U.S. Environmental Protection Agency (EPA) was to create a market-based approach to air quality management, now known as the cap-and-trade system.

The resulting Acid Rain Program set a predetermined cap on overall SO_2 emissions while allowing trading of entitlements among pollution sources and other interested parties to meet this standard in a cost-effective manner. The creation of allowances—quasi-property rights for emissions—promised gains by allowing the free trade of these permits, thus in-

troducing flexibility for electric utilities burning fossil fuels in complying with regulations.

By 1994, a fairly robust environmental commodities market in SO_2 allowances had taken shape. The Chicago Board of Trade runs EPA's annual auction of a small percentage of allowances, which generates valuable price information. However, the vast majority of allowances are traded in an over-the-counter secondary air pollution allowance market. The SO_2 emissions market is regarded as efficient and has been characterized by reasonably good liquidity.

In short, the Acid Rain Program led to the development of a functioning market with low transaction costs, price transparency, and extensive trading activity. When in 1999, EPA Acid Rain Division became the Clean Air Markets Division (CAMD), the new name reflected the extent to which air quality management in the United States was now supported by emissions trading.

Implementation Challenges

Markets depend on information. While designing the Acid Rain Program in 1990, EPA administrators decided to reduce regulatory uncertainty by abandoning such past practices as certification of electric utility compliance plans and requiring detailed facility-specific permits—processes that increased transaction costs and discouraged trading. However, those mechanisms had been used to ensure compliance with environmental standards and new mechanisms would have to be found. The challenge was to maintain the environmental credibility of the emissions trading program while program participants expanded in number and increased demand for market exchanges. The Acid Rain Program forgoes the need to obtain government approval of compliance technologies and strategies and focuses on environmental results through stringent measurement of emissions at each source. It is therefore simpler than its predecessor, reducing transaction costs and encouraging market development.

To function, the Acid Rain Program needed information management systems to track allowance transactions and monitor actual emissions. Fortunately, technological advances in information technology allowed EPA to design a system that would reduce costs both for government regulators and for traders by limiting intervention once Congress had set the environmental goal.

Now, after more than a decade of implementing the Acid Rain Program, EPA administrators say that their main task consists of two activities: processing huge amounts of information and disseminating huge amounts of information. EPA's CAMD has become an emissions and allowance "accountant," in charge of managing information and processing it for compliance purposes. Emissions and allowance information also needs to flow back to producers, to make the allowance market efficient and build credibility in the emissions trading approach. According to Joe Kruger, EPA's chief of the Market Policy Branch, "Without recent advances in information technologies, these activities would be considerably more diffcult, if not impossible."

The Essential Digital Infrastructure

Information technology is what has made the SO_2 emissions trading program work. It reduces paperwork and filing costs, and provides public information online through its database registries, making the system transparent and credible as well as permitting electronic reporting, verification, and processing of emissions data. Furthermore, it stretches administrative resources so that the program can cost-effectively cover a larger universe of sources.

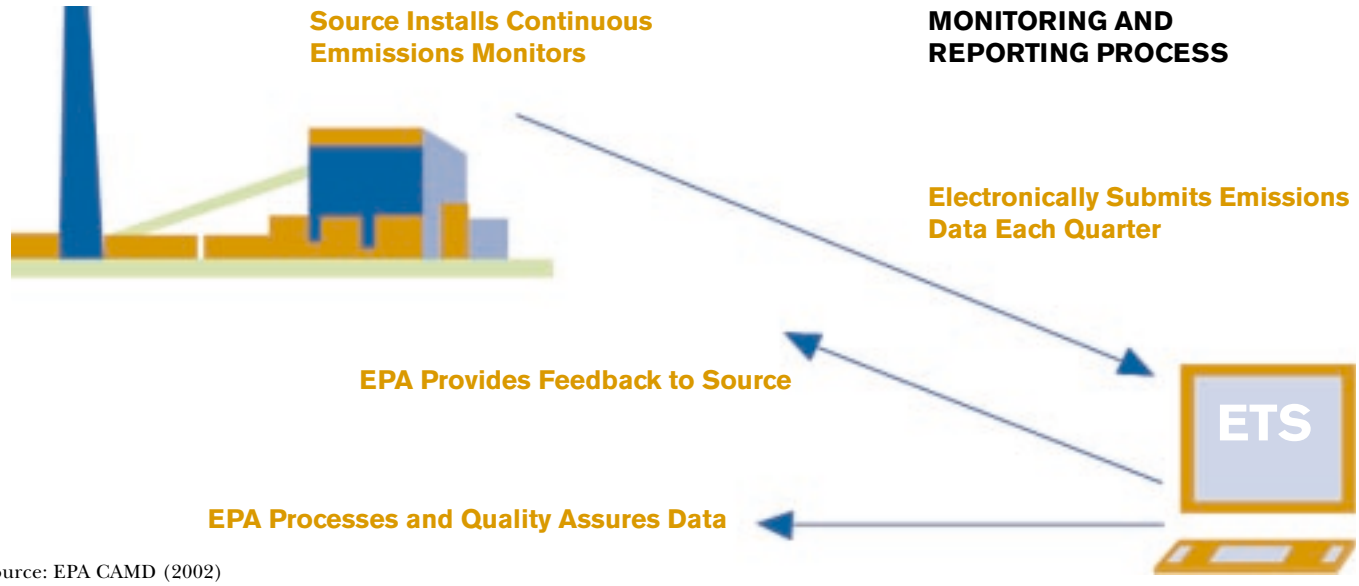
The key elements based on information technology that have been particularly crucial are the allowance tracking system (ATS), the emissions tracking system (ETS), and the continuous emissions monitoring systems (CEMS). These components facilitate regulatory compliance, assist in allowance market development, and allow public access to emissions data.

Allowance Tracking System. ATS was developed as the central registry of allowances used for compliance with the Acid Rain Program.

There are various companies in the private sector that track and disseminate allowance price information for emissions trading markets. In contrast, EPA's ATS tracks transfers of allowances between accounts held by sources and others. Sources that wish to use allowances for compliance must hold them in these accounts.

In addition to its role in compliance, ATS provides a framework for categorizing transactions of SO_2 within the program that is useful in understanding the allowance market. It provides details of all private allowance transfers reported, en-

The concept of a market in emissions allowances was attractive in theory, but information technology made it happen.



Source: EPA CAMD (2002)

abling researchers, market participants, and others to distinguish between "real trades" and those that are only internal administrative transactions between a firm's different emissions sources. There is no regulatory component in this process of categorization; it is conducted to learn more about environmental markets development. Companies are not required to report allowance transfers unless they will use them for compliance.

ATS makes possible more efficient transaction recording processes during the annual reconciliation period in which sources must hold a quantity of allowances equal to or greater than the amount of SO_2 emitted during that year. When the program began in 1995, the rules allowed up to five days to process records because all communications were sent by mail. By 1997, EPA was processing 89% of the transactions in just 24 hours. Today, about 80% of transfers are entered online via the Web by the sources themselves.

Emissions Tracking System (ETS). Although timely allowance transfers are one piece of compliance, the emissions tracking component is probably more important. EPA's Janice Wagner, chief of the Market Operations Branch, which runs the allowance trading mechanism's data systems, calls ETS "the backbone of the program." All quarterly reports are now submitted electronically to ETS, allowing the agency to perform automated data processing to ensure compliance while making the results available to the public. Using the ETS mainframe software, EPA checks utilities' quarterly reports of emissions and automatically sends a score in an "instant feedback" report. If necessary, EPA contacts the utilities to resolve data problems.

Continuous Emissions Monitoring Systems. CEMS are mechanical devices that sample, analyze, measure, and record emissions on a continuous basis. Each emissions unit must install continuous monitoring equipment and report its emissions regularly.

This technology has provided credibility and facilitated the emergence of a relatively effcient market for SO_2 allowances, despite the expense of deploying the monitoring system—an average annual cost of about $124,000 per unit (including operating and capital costs). Capital and operating costs of CEMS amounted to 7% of total observed compliance costs in 1995. The estimated total additional cost is not insignificant—$48 million to $54 million—but the payoff is high-quality data and documentation of early environmental benefits from emissions reductions. According to the EPA, these data are the "gold standard" that backs up the currency of emissions allowances.

Measurement tools are essential for accurately quantifying the pollution commodity being traded and that accuracy in turn promotes smoothly operating markets and environmental integrity. The CEMS requirement thus instills confidence in the market-based approach by verifying the existence and value of the traded allowance.

In 1995, American Electric Power Company submitted its emissions data to EPA via modem. Soon other utilities—Georgia Power, Allegheny Power, and Grain Island Power—followed. CEMS sent emissions data to a utility's computer system, which then compiled it for submission to EPA on a quarterly basis. An EPA software program was developed to assist utilities in preparing, reviewing, and submitting their quarterly reports. This software allows users to check the format and completeness of quarterly reports before submission, and utilities then submit the reports electronically to EPA's computer center. Since virtually all companies in-

cluded in the SO_2 allowance-trading program submit emissions data electronically over the Internet, these processes have been considerably streamlined in contrast to the older dial-up modem data transmission system.

Annual Reconciliation. At the end of each calendar year, EPA compares the number of tons emitted with the allowance holdings of the utility unit to ensure that it is in compliance. Units not in compliance pay a stiff penalty for every ton they emit for which they don't hold an allowance. They are also required to relinquish allowances in the amount of the excess.

Public Access to Data. EPA's data system now serves as an emissions data repository for SO_2, nitrogen oxides (NO_x), and carbon dioxide (CO_2), by source, from the utility industry. The SO_2 and NO_x emissions data may also help states design programs to comply with the National Ambient Air Quality Standards provisions of the Clean Air Act for SO_2, ozone, and particulate matter. While the CO_2 data being collected by ETS only cover the electric power sector, these data will help in the creation of a valuable emissions inventory database for assessing the nation's progress in stabilizing greenhouse gases. Finally, although the ETS and ATS have historically been different systems, they will increasingly be integrated as EPA reengineers its data management systems.

International Implications

The U.S. SO_2 allowance trading program demonstrates that when emissions are capped and accurately measured, an efficient market can develop and the costs of meeting environmental goals can be reduced. Underlying the entire process are electronic monitoring devices, information systems, and Internet communications.

Information technology has become an important tool helping regulators overcome the asymmetry of incentives between themselves and industry: firms have no incentive to provide information to the regulator about the industrial processes being regulated. EPA administrators believe that digital processing changed regulators' role from inspecting compliance choices to measuring results and tracking emissions and allowances—a less costly duty that depends on credible and precise information flows on both pollution emissions and allowance transfers.

Although the extent of the gains from trade derived from the program and its efficiency effects are still debated, to EPA administrators the steady decline in the cost of reducing a ton of SO_2 is proof of the cost savings attributable to the system. From their perspective, the Acid Rain Program is a success: emissions are down by millions of tons, utilities are fully compliant, and trading activity follows an upward trend.

Lessons from implementation of cap-and-trade programs in the United States as well as continued technological progress, such as the possibility of combining remote-sensing technologies in monitoring systems with nanotechnology and global positioning systems, can support the development of more ambitious market-based environmental policy applications.

In the case of developing an international emissions trading mechanism, however, such an arrangement would have to undergo its own process of institutional evolution to become a credible and cost-effective solution to greenhouse gas emissions. In particular, an international greenhouse gas market must provide certainty and transparency in its exchange mechanisms and also address the more challenging economic, technical, social, and political dimensions of the international environmental policymaking context. Information communication technologies and modern monitoring systems will certainly be a critical part of this effort. ■

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Further Readings

www.epa.gov/airmarkets

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