CHAPTER 9

Protecting the Environment

Economic growth and environmental improvements go hand-in-hand. Economic growth can lead to increased demand for environmental improvements and can provide the resources that make it possible to address environmental problems. Some policies aimed at promoting environmental improvements can entail substantial economic costs. Misguided policies might actually achieve less environmental progress than alternative policies for the same economic cost. It is therefore important to weigh the direct benefits of environmental regulations against their economic costs.

While the free-market system typically promotes efficiency and thus enhances economic growth, the absence of property rights for environmental "goods" such as clean air and water can lead to negative externalities that reduce societal well-being. This can be addressed by establishing and enforcing property rights that will lead the affected parties to negotiate mutually-beneficial outcomes in a market setting. If such negotiations are expensive, however, the government can design regulations that consider both the benefits of reducing the environmental externality as well as the costs the regulations impose on society. Regulations should be designed to achieve environmental goals at the lowest cost possible, thus helping to achieve environmental protection and continued economic growth.

The key points in this chapter are:

- Establishing and enforcing property rights for the environment can address environmentally-related market failures. Any needed regulations should consider both the benefits and the costs.
- Environmental risks should be evaluated using sound scientific methods to avoid possible distortions of regulatory priorities.
- Market-based regulations, such as the cap-and-trade programs promoted by the Administration to reduce common air pollutants, can achieve environmental goals at lower cost than inflexible command-and-control regulations.

The Free Market and the Environment

In a free-market system, only trades that benefit both parties will take place. Market prices coordinate the activities of buyers and sellers and convey information about the strength of consumer demand for a good, as well as how costly it is to supply. In the context of the environment, a market failure may occur if a voluntary transaction between parties imposes involuntary costs on a third party. These involuntary third-party costs are known as *negative externalities* (or *spillovers*), and their existence in a free market can lead to inefficient outcomes; that is, outcomes that fail to maximize the net benefits to society. For example, a plant might produce and sell a good to a consumer to both their advantage, but the production process may result in emissions of air pollutants that negatively affect others not involved in the transaction. The root of the market failure is that there are no clear property rights for the surrounding air. The interests of the third party—the people affected by the plant's emissions—are not represented in the market transaction.

If those affected by the plant's emissions had a right to demand compensation for the costs imposed on them by the pollution, then the firm would take these costs into account when making its production decisions. The plant would produce only up to the point where the benefit of another unit of production equals the additional cost of producing the good plus the cost to the people negatively affected by the pollution. Any additional emissions due to producing more goods would require compensation that is greater than the monetary gain the plant gets from selling the additional goods. Likewise, if the property right belonged to the plant, the people negatively affected by the emissions could compensate the plant for reduced emissions. Either way, all three parties (consumers, the firm, and those affected by the emissions) would transact voluntarily to everyone's benefit, resulting in an efficient outcome. If the government were to assign and enforce the property right, and if it were costless for parties to collectively agree on compensation, then an efficient use of resources would result from private bargaining, regardless of which party was assigned the property right. This insight is known as the *Coase theorem*.

The Role of Government in Regulating the Environment

The existence of property rights does not always guarantee an efficient outcome. If there are many sources of pollution or there are many parties affected by the emissions, then it might be difficult for the parties collectively to agree on the compensation, and an efficient outcome might therefore not be achieved. This presents an economic justification for government involvement and regulation. Government regulation might also be justified in order to address distributional concerns associated with environmental problems.

Regulations that address negative externalities can therefore improve societal welfare. To improve the environment while still promoting economic growth, sound policies must consider both the benefits and the costs of regulations. Economic growth itself can contribute to environmental improvements

(Box 9-1). As the economy grows, the demand for environmental improvements increases and the greater wealth provides more resources to better address environmental concerns. It is therefore important to weigh the direct environmental benefits of regulations against their economic costs.

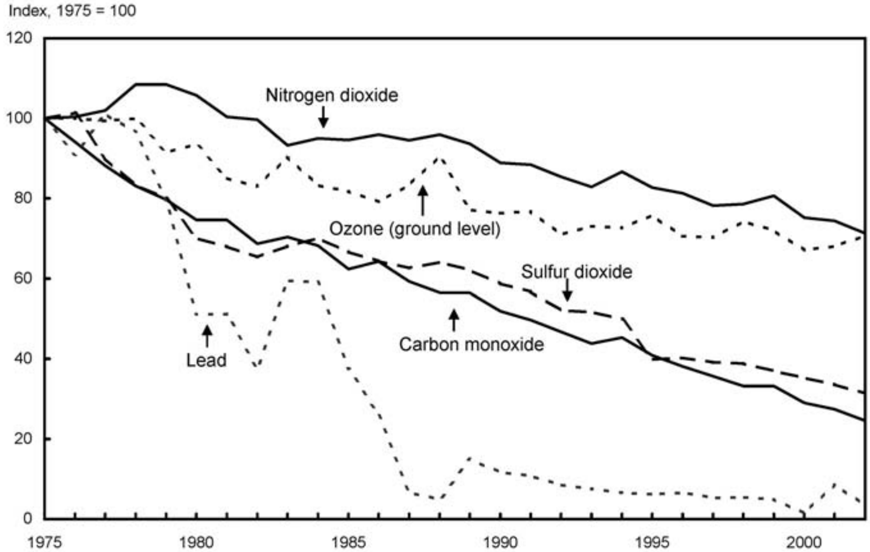
Box 9-1: Economic Growth Can Improve the Environment

Much research has shown that economic growth contributes to environmental gains. In the early stages of economic development, environmental degradation may occur because nations place higher priority on basic needs such as food and shelter. As wealth increases, however, so does demand for a cleaner environment, and greater wealth provides more resources to better address these environmental concerns. After a certain level of national income is attained, the balance shifts and environmental degradation is arrested and then reversed. For several decades in the United States, many environmental indicators have been improving as the economy has also grown.

From 1975 to 2002, concentrations of five of the six common air pollutants (the pollutants for which there are reliable data) decreased by an average of 60 percent (Chart 9-1), as real gross domestic product (GDP) increased by about 130 percent, energy consumption increased by 35 percent, and the population increased by 34 percent. While the Nation's air quality has improved substantially since passage of the Clean Air Act of 1970, air quality was improving prior to 1970, perhaps due to market-induced technological advancements (such as improvements in energy efficiency) that accompany economic growth. The limited air-quality monitoring data available before 1970 indicate that average annual concentrations of particulate matter in urban air dropped 16 percent from 1957 to 1970 and these total suspended particulates (liquid or solid particles in the air) across the country fell by about six percent from 1958 to 1970 (Chart 9-2).

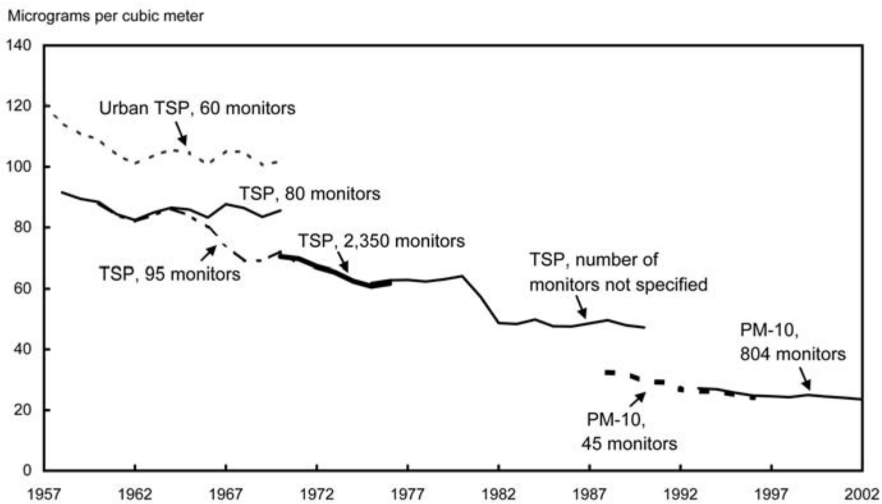
As the Nation's productive output has increased and environmental quality has improved, so too has the health and well-being of Americans. In the last century, life expectancy at birth increased from 48 to 80 years for women and from 46 to 74 years for men. Infant mortality dropped to the lowest level ever recorded in the United States. The death rates for heart disease, cancer, and stroke are also decreasing. This well-documented correlation between wealth and health extends across time and nations. More-developed countries have higher life expectancy, and globally, life expectancy has increased as per capita wealth has increased.

Chart 9-1 **National Concentrations of Air Pollutants**
Concentrations of five major air pollutants have been declining since 1975.



Note: The number of air monitors varies across pollutants and time.
Source: Environmental Protection Agency.

Chart 9-2 **Particulate Matter Concentrations**
While the data for monitoring airborne particulate matter have not been uniform, limited data indicate that particulate matter began declining steadily prior to passage of the Clean Air Act in 1970.



Note: TSP refers to total suspended particulates and PM-10 refers to particulates with diameter of 10 micrometers or less. The figures for monitors are the number that collected data for a particular series.
Sources: Environmental Protection Agency and Council on Environmental Quality.

Misplaced Reasons for Government Intervention

In making environmental policies, it must be recognized that government measures themselves might create further inefficiencies. When it is difficult to determine the extent of an environmental externality, an attempt to rectify it might end up making matters worse by imposing unintended costs on third parties without achieving an efficient outcome.

This inefficiency can arise even from well-intentioned environmental regulations. Two fallacious arguments are frequently used to justify inefficient regulations. One such misplaced rationale is that regulations improve the economy and spur job growth. The reasoning goes as follows: environmental regulations lead firms to install pollution-control technologies, which they must purchase from other firms. These technologies are built, delivered, installed, and operated by workers who otherwise would not be doing this work. Similarly, the regulations may promote environmentally-friendly industries that hire people who would not be hired otherwise. For these reasons, the regulations are said to "spur" the economy and job growth. By this reasoning, throwing a rock through a window also improves the economy, because it necessitates the hiring of someone to repair the window. What this ignores is that the resources spent to comply with an unnecessary or inefficient regulation are diverted from other uses. The money and people involved could have been used instead to produce more goods for consumers or to build new factories or machinery. The jobs associated with complying with environmental regulations are a cost of regulation, not a benefit.

Another misplaced view of environmental regulation is that the goal of regulations should be to eliminate or substantially reduce risks without considering costs. This approach is embodied in some well-intentioned laws. The 1970 Clean Air Act, for example, directs the Environmental Protection Agency (EPA) Administrator to set national ambient air quality standards (NAAQS) that achieve "an adequate margin of safety," and the Supreme Court has ruled that "the Clean Air Act…unambiguously bars cost considerations in the NAAQS setting process." Similarly, the stated goal of the Occupational Safety and Health Act of 1970 is "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions," without considering the costs of doing so. While the goals of these laws are noble, they do not recognize the inevitable trade-offs involved. Not all environmental laws preclude cost considerations. For example, the Safe Drinking Water Act Amendments of 1996 explicitly acknowledge the importance of benefit-cost analysis when considering the appropriate level of regulation for contaminants in drinking water.

Regulations Impose Benefits and Costs

The failure to consider costs inhibits the goal of making regulations that maximize the difference between benefits and costs. Furthermore, the failure to consider costs can lead to a misallocation of resources, because a regulation that is made without considering costs might receive more resources than other regulations that warrant greater attention. While the benefits of many regulations include both health and non-health related benefits, many regulations primarily address fatality risks, and there is a wide range of cost per expected life saved across such regulations. For example, one survey of cost per life saved across regulations found that the regulation for childproof cigarette lighters costs approximately $100,000 per life saved (in 2003 dollars) whereas the formaldehyde regulation costs approximately $80 billion per life saved (in 2003 dollars). Shifting resources from regulations where the cost per expected life saved is high (for example, formaldehyde regulation) to regulations where it is low (for example, childproof lighter regulation) would result in more lives saved for the same cost to society. Many of the differences in cost per life saved occur because legislative mandates only sometimes allow agencies to consider costs when crafting regulations.

Stringent regulations may appear to be good for society because they save lives. However, because the Nation's ability to bear costs is limited, the wide range of costs per life saved across regulations implies that more lives could be saved at the same cost by shifting resources to the regulations with lower costs per expected life saved. One study found that society could save twice as many lives with the same budget if it designed regulations in a way that maximized lives saved. Some of the more costly health-based regulations might actually lead to a net increase in fatality risk because their high costs diminish the resources available for improving other health and environmental outcomes.

Using Science to Help Set Regulatory Priorities

Sound regulatory policy must be based on scientific assessments of environmental and health risks. Scientific assessments involve a careful examination of the risks involved and of the expected health outcomes for the people exposed to the risk at hand. This allows for an unbiased evaluation of environmental and health threats in which to target regulatory actions. Unfortunately, regulatory risk assessments at times overestimate some threats, or overemphasize risks to "hypothetical" (rather than real) people. These practices can lead to a distortion of regulatory priorities.

Overestimating the Risks: The Problem with "Cascading Conservatism"

In a well-intentioned attempt to be prudent, regulatory agencies sometimes rely on scientific assessments of environmental and health risks based on assumptions that overstate actual risks. When estimating chemical toxicity, for example, risk assessors have at times relied on high-end default assumptions that are likely to overestimate the actual risk of a chemical. Toxicity testing is evolving to use information that permits assessors to move away from assumptions that lead to overstated risks. When more data are available, regulatory risk assessors do not need to rely on high-end default assumptions and can instead attempt to estimate more accurately the expected level of risk. Because the EPA's primary goal is public health protection, however, it still relies on high-end default assumptions when there is uncertainty about scientific data.

Similarly, regulatory agencies sometimes use high-end estimates of the likelihood of people being exposed to a certain risk. These exposure estimates are then combined with toxicity estimates that are themselves likely to overstate risk. The multiplicative impact of combining several high-end component estimates is known as *cascading conservatism*. This practice can lead to risk estimates that greatly overstate the threat of environmental problems and thus overstate the benefits of regulating those risks. One study found that in a sample of hazardous waste sites, over 40 percent of the sites requiring cleanup under the Superfund program would shift into the discretionary cleanup range if not for the overestimation of risks resulting from cascading conservatism.

Such high-end risk estimates can lead to several types of problems. First, the practice overstates the risk of all environmental health problems relative to other types of hazards. This overstatement can cause too many resources to be allocated to addressing low-priority concerns. An example of such a distortion is the commonly-held view that synthetic chemical pollutants such as insecticides are a leading contributor to cancer. In reality, the evidence suggests that such chemicals account for a low percentage of human cancers. The main contributors to human cancer appear to be smoking and poor diet—each of which accounts for about one-third of cancers. The result is that regulatory efforts are directed at addressing the risks of synthetic chemicals that may well pose lower risks of causing cancer than many common natural chemicals.

A second problem with the high-end risk estimates caused by cascading conservatism is that they can distort the allocation of resources among different environmental health concerns. If each uncertain component that goes into a risk assessment overstates the risk, then the multiplicative impact of cascading conservatism will result in higher risk estimates for threats that have more uncertain components. For example, if there are two equally effective pesticides, with one posing a higher threat to the population than the other, the safer pesticide might be assessed as more of a threat if there are more uncertain components involved in its risk assessment. This assessment could result in the safer pesticide receiving stronger regulatory emphasis by the government. It is better to target regulatory dollars to the risks expected to be higher in a reasonable scenario or range of scenarios than to the risks that might be higher in a worst-case scenario.

Population-Weighted Risk Assessments

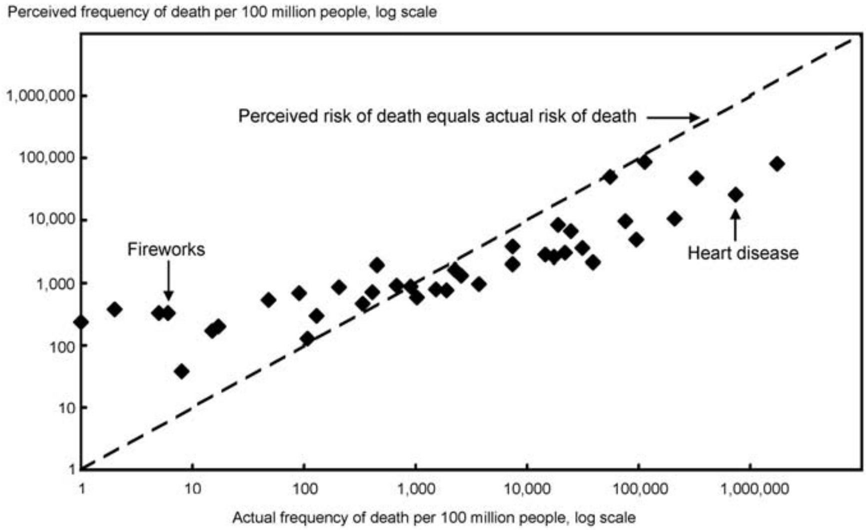
Regulatory efforts can also be distorted when risk assessments ignore the number of real people potentially exposed to an environmental risk. For example, an environmental hazard at one location might pose a greater risk to any person exposed to the hazard than an environmental hazard at a second location. However, if no one lives near the first location and many people live near the second location, the expected risk to society is higher at the second location.

The case of *United States* v. *Ottati & Goss* offers one example of such misplaced regulatory priorities. In this case, a company litigated for relief of an EPA-required cleanup that would have cost the company $9.3 million to remove small amounts of contaminants from a site that was already mostly decontaminated. The company had already spent $2.6 million to clean the site so that small children playing on the site could eat small amounts of dirt daily for 70 days each year for three and a half years without significant harm. The additional $9.3 million would be used to burn the soil, which would allow children to eat a small amount of dirt each day for 245 days per year without significant harm. However, there was little chance that children would ever be exposed to this site because it was located in a swamp. The courts ruled in favor of the private party and refused to enforce the proposed remediation goal.

Objective Versus Perceived Risk

Regulatory decisions should be based on scientific assessments of risks rather than perceived risks. This approach would help properly order priorities for regulatory decisions. Perceived risks often differ from expert assessments of risk because laypeople have difficulty assessing the frequency of low-probability events. Chart 9-3 compares survey respondents' perceived risks of dying from various hazards to the objectively measured risks of dying. In this chart, the dashed line represents where the perceived risk equals the actual risk; if all the points on the chart fell on this line, it would indicate that survey participants precisely estimated the risk of dying from various hazards. All points to the left of the dashed line represent hazards for which the

Chart 9-3 **Relationship Between Actual and Perceived Risk of Dying**
People tend to overestimate the risk of dying from low-fatality events and underestimate the risk of dying from high-fatality events.



Source: Sarah Lichtenstein, Paul Slovic, Baruch Fischhoff, Mark Layman, and Barbara Combs, "Judged Frequency of Lethal Events," *Journal of Experimental Psychology: Human Learning and Memory*, November 1978.

perceived risk of dying is higher than the actual risk, and all points to the right of the line indicate hazards for which people thought the risk of dying is lower than it actually is. The chart suggests that it is common to overestimate fatalities associated with low-probability events and to underestimate fatalities associated with high-probability events. These systematic misperceptions may lead to misplaced pressures to overregulate small environmental risks at the expense of addressing larger ones.

Achieving Goals Through Cost-Effective Regulations

As discussed in Chapter 7, *Government Regulation in a Free-Market Society*, when the assignment of property rights is insufficient to achieve an efficient outcome, government intervention may help achieve efficiency. Chapter 7 discusses government actions that can, in principle, achieve an efficient outcome by incorporating the costs of externalities into the market's price mechanism. It is important that any regulatory mechanism that addresses externalities do so in the least costly (that is, the most cost-effective) way so that society's scarce resources are not wasted. This section focuses on how to achieve air-quality goals cost effectively, but many of the lessons can be applied toward achieving other environmental goals, such as clean water protection and energy-efficiency standards.

Command-and-Control Regulations

Air-quality command-and-control regulations prescribe specific technologies that individual firms must use to control emissions, or they set specific emission rates for individual firms. The United States currently has many such environmental regulations. These regulations are inherently inflexible and are ill-suited to achieving emissions reductions in the least costly manner. While some command-and-control air-quality regulations may be just slightly more costly than cost-effective regulations, studies show that others are up to 22 times more expensive than the most cost-effective set of controls.

The reason command-and-control regulations are more expensive is straightforward: suppose the regulatory goal is to halve the emissions emanating from two firms. A command-and-control regulation might require each firm to cut its emissions by half. However, if it is less costly for one firm to reduce emissions, then—so long as the health effects of the emissions depend only on the total from the two emission sources—shifting the burden to the firm with lower abatement costs would result in the same environmental improvement at a lower cost. In general, the greater the differences across firms in their emissions before the regulation, and the greater the differences across firms in the rate at which each firm's costs rise with additional reductions, then the more costly a command-and-control approach is compared to more flexible approaches. Cost-effective emissions reduction is achieved when the cost of reducing an additional unit of emissions (the *marginal abatement cost*) is equal across all firms.

An example of an inflexible command-and-control regulation is the mechanism by which the Clean Air Act Amendments of 1990 address hazardous air pollutants (HAPs). The Act specifies that the emissions reduction standards for categories of existing HAP polluters must be set at "the average emission limitation achieved by the best performing 12 percent of the existing sources." While some flexibility is allowed in establishing the emission limitations, the command-and-control standard for regulating HAPs has frequently been interpreted in a way that ignores the differential costs of reducing emissions across existing sources within a category. This likely results in higher costs than would a more flexible regulation.

Command-and-control regulations also fail to provide market incentives for firms to explore less expensive means of reducing emissions. More flexible, incentive-based regulations would provide signals to the market of the increased demand for emissions reductions. With proper incentives in place, markets can respond to such an increase in demand with technological innovation and efficient reallocation of their scarce resources to achieve the goal.

Command-and-control regulations can also unintentionally lead to outcomes that are contrary to their environmental goals. An example of this is the New Source Review component of the 1977 Clean Air Act Amendments. This legislation required a strict control technology for most new industrial facilities and for facilities that undertook significant modifications, but it exempted existing facilities that did not make major modifications from the same standards. It was thought at the time to be more efficient to add new pollution control technology when plants were upgrading or when building new plants. This situation is known as *new source bias* because it provides an incentive for existing sources of emissions to continue their business operations for longer than would have been the case under normal market conditions without the regulation. It also provides an incentive for existing plants to forgo modifications.

New pollution-causing production sources tend to be cleaner than old ones even in the absence of regulations, so extending the business operations of older plants without making modifications could result in higher emissions. Applying different regulations for "routine" versus "major" modifications also leads to ambiguity, litigation delays, and uncertainty in business planning, all of which can harm the economy and may impede environmental improvements. The Administration recently addressed this problem by establishing clear rules that remove disincentives for facilities to modify and undertake routine maintenance, repair, and replacement activities that could improve the safety, reliability, and efficiency of the plants.

Market-Based Price Regulations: Emission Fees

Environmental regulations that provide firms with market-based incentives for emissions reduction avoid the complications of command-and-control regulations and achieve the same goals at lower costs. In particular, emission fees and cap-and-trade programs are usually less expensive than command-and-control approaches at achieving regulatory goals. An emission fee involves a charge to polluting sources for each unit of pollution emitted. Because each successive unit of emissions reduction typically involves increased costs, each source will reduce emissions until it would cost more to reduce the next unit of emissions than it would to pay the emissions fee. This results in equal marginal abatement costs across all affected firms.

With an emission fee, the total level of emissions reduction will depend on the per unit fee: a higher rate will achieve more emissions reduction. The emission fee also provides incentives to reduce emissions, because the better a firm is at reducing emissions, the lower the total fee the firm must pay. This sends a market signal that pollution has a price (equal to the emission fee), and any innovative means of reducing emissions will save firms from paying the fee. This market signal is likely more adept than the government at spurring technological innovation, adapting to changes in the economy, and shifting resources to reflect the increased demand for emissions reduction.

Market-Based Quantity Regulations: Cap-and-Trade

The main problem with an emission fee is that it is difficult to know beforehand what fee level will achieve the desired amount of pollution reduction. A cap-and-trade regulation addresses this issue and provides market incentives to reduce emissions in a cost-effective way. Such regulations "cap" the amount of allowable emissions and require that a firm own a permit for each unit of pollution emitted in a given period (for example, a year). This permit effectively establishes a legal property right for the air affected by the pollution, so that any emissions must be paid for by the firm. The government allocates the pollution permits to the emission sources and then allows the sources to buy and sell permits from each other.

Under a cap-and-trade system, a source with a high cost of reducing an additional unit of emissions would be willing to purchase a permit from a source with a lower marginal abatement cost. With a well-functioning market for the permits, sources will trade permits until the price for the permits equals the marginal abatement cost. As with the emission fee, the marginal abatement costs will be equal across sources, leading to a cost-effective result. The cap-and-trade system also provides an incentive to reduce emissions because each unit of emissions reduction saves the source the price of another permit. This regulation sends a market signal that there is a price for emissions and any innovative means of reducing emissions will save firms from paying the price. The cap-and-trade system therefore achieves the target level of pollution reduction at the lowest cost.

One consideration for a cap-and-trade system is how to allocate the permits initially. A cap-and-trade system that allocates the permits based on historic emissions or other firm characteristics, known as *grandfathering*, in essence gives away a valuable asset—the permits. A grandfathering system could establish a barrier to entry for new firms because any new entrant would have to purchase permits from existing firms.

One way to avoid these problems is to auction the permits at some regular interval to the highest bidders. Firms with higher marginal abatement costs would bid more for permits than those that can achieve less-costly emissions reductions. While auctioning the permits would result in lower profits for the regulated firms (compared to giving away the permits), it would not affect the firms' output decisions. Grandfathering versus auctioning the permits is primarily a question of distribution, not efficiency—it is a question of whether a public asset should be given to firms for free or sold as a means of generating public revenues.

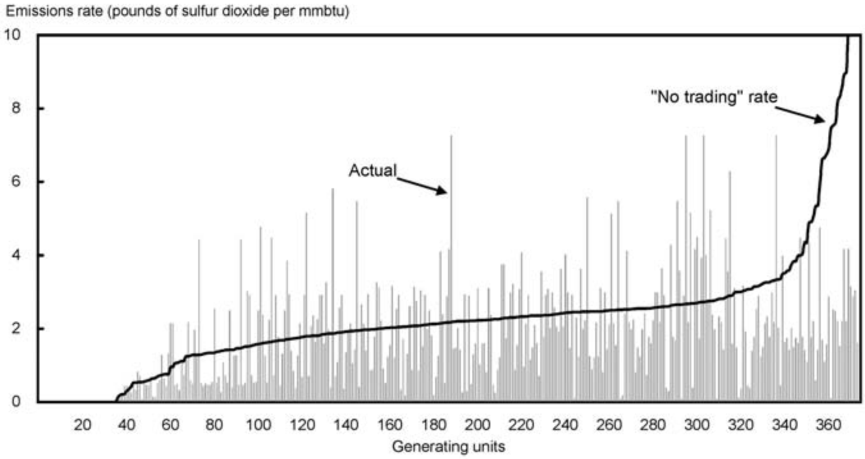
A notable example of a cap-and-trade system is the sulfur dioxide (SO_2) trading program created under Title IV of the Clean Air Act Amendments of 1990. The program set a goal of reducing emissions by 10 million tons from the 1980 level by 2010. This was to be accomplished in two phases. The first phase, which began in 1995, initially capped the SO_2 emissions at 263 individual units which were owned by 110 electric utility power plants in 21 eastern and midwestern states. These plants, which were primarily coal-fired, emitted the greatest amounts of pollution among power plants in these regions. From 1995 to 2000, an additional 182 units were allowed into the program. The second phase, which began in 2000, further decreased the annual emissions of SO_2 and required all large fossil fuel-fired power plants in the contiguous 48 states and the District of Columbia to hold permits to cover their emissions.

In both phases, power plants could purchase permits from other power plants in order to meet their emissions coverage. The program also allowed plants to carry over (or *bank*) unused permits to use in later years, which gives firms even greater flexibility in achieving long-term pollution reduction. In contrast to a command-and-control system, this cap-and-trade system allows plants that find it costly to reduce their SO_2 emissions to purchase credits from plants that can reduce SO_2 at lower cost.

Evidence indicates that such cost-saving trades did indeed take place as firms took advantage of the system's inherent flexibility (Chart 9-4). Each bar in the following chart represents the emissions rate each plant achieved after trading permits in 1997. The superimposed line in the figure shows the level of emissions each plant would have had to achieve in the absence of trading. Bars below the line indicate plants that reduced their emissions by more than the required amount and sold their excess permits or banked them. Bars above the line indicate plants that purchased permits or used previously banked permits to avoid costly abatement. The figure shows that almost every plant took advantage of the flexibility of the system, suggesting that plant-level costs of reducing SO_2 emissions vary greatly.

The trading program has achieved its pollution-reduction goals at great cost savings. By the end of the first phase, emission reductions were almost 30 percent below the required level. The flexibility of this approach has been estimated to provide cost savings of approximately $0.9 billion to $1.8 billion a year compared to costs under a command-and-control regulatory alternative; other tradable-permit markets have had significant cost savings as well (Table 9-1).

Chart 9-4 **Unit-Level Sulfur Dioxide Emissions Trading in 1997**
Variation in actual plant-level emissions for units in the Acid Rain Program indicates that firms took advantage of the flexibility and cost-savings inherent in the cap-and-trade system.



Note: Corresponding graphs for other years of the program show similar patterns.
Sources: Richard Schmalensee, Paul L. Joskow, A. Denny Ellerman, Juan Pablo Montero, and Elizabeth M. Bailey, "An Interim Evaluation of Sulfur Dioxide Emissions Trading," *Journal of Economic Perspectives*, Summer 1998. Update from personal communication between A. Denny Ellerman, Massachusetts Institute of Technology, and the Council of Economic Advisers.

TABLE 9-1.— *Cost Savings of Tradable-Permit Systems*

Program	Traded commodity	Years of operation	Cost savings (2003 dollars[1])
Emissions trading program	Criteria air pollutants	1974-present	Total, \$1-\$12 billion
Lead phasedown	Rights for lead in gasoline	1985-1987	Total, \$400 million
Acid rain reduction	SO_2 emission reduction credits	1995-present	Annual, \$0.9-\$1.8 billion

[1] Base year for values for emissions trading program not specified.

Sources: Robert W. Hahn, "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders," *Journal of Economic Perspectives*, Spring 2000; Curtis Carlson, Dallas Burtraw, Maureen Cropper, and Karen L. Palmer, "Sulfur Dioxide Control by Electric Utilities: What Are the Gains from Trade?" *Journal of Political Economy*, December 2000; and Environmental Protection Agency.

Emission Fees Versus Cap-and-Trade

As mentioned previously, one problem with emission fees is that it is difficult to know beforehand at what level to set the fee to achieve the desired pollution reduction. This might require periodic adjustments of the fee level, and such adjustments would introduce uncertainty that could interfere with firms' planning decisions. The emissions fee does, however, allow the government to set with certainty the marginal cost of emissions reduction. For each emission fee there is a corresponding allocation of permits that would achieve the same results; however, it is difficult to know beforehand what the market price for permits will be once trading actually takes place.

One way to reconcile these issues is to offer a cap-and-trade system with a *safety valve*. The safety valve sets a maximum price for a permit, which guarantees that the price of reducing emissions does not exceed the expected benefits. The regulatory agency issues and sells extra permits on request from any firm at this fixed safety valve price, thus guaranteeing that the market permit price does not exceed this level. A cap-and-trade program with a safety valve achieves the target level of emission reductions in a cost-effective manner, while protecting the regulated firms against unexpected short-term price increases in emissions reduction.

The President's Cap-and-Trade Program

An example of a well-designed incentive-based regulatory approach is the President's Clear Skies proposal for reducing emissions of sulfur dioxide, nitrogen oxides, and mercury from electric utility generators by approximately 70 percent by 2018. Clear Skies would cost-effectively reduce emissions by establishing a cap-and-trade system for each of the three pollutants. The EPA has estimated the benefits of the Clear Skies Act at $113 billion annually by 2020, compared with $6 billion in projected annual costs. These include $110 billion in annual health benefits (including the prevention of 14,100 premature deaths and 30,000 hospitalizations and emergency room visits) and $3 billion in annual benefits from increased visibility at national parks. Under the existing Clean Air Act, the EPA issues national air-quality standards for certain pollutants, including particulate matter and ozone. The EPA projects that compared with existing programs, the Clear Skies Act would lead 35 additional eastern U.S. counties to meet the particulate matter standard by 2020, leaving only eight counties not meeting the standard. The EPA expects that the remaining counties not meeting the standards would move closer to achieving them due to the Clear Skies Act.

To mitigate the effects of market shocks that potentially affect the costs of emissions reduction, Clear Skies would establish a safety valve price for permits of each pollutant. It would also provide regulatory certainty by achieving the reductions of all three pollutants in two phases. Firms would therefore plan their reductions of the three pollutants together and over the long term. Indeed, because the Clear Skies plan allows the banking of permits for future use, it provides an incentive for firms to achieve reductions quickly. Additionally, Clear Skies would provide revenue for the government because it phases in an auction system for the permits.

Clear Skies demonstrates the lessons learned from past regulatory experiences: instead of imposing an inflexible, command-and-control regulation to achieve emissions reduction, it offers a market-based, cost-effective, cap-and-trade program to achieve large reductions in emissions from electric utility generators.

Conclusion

Economic growth and environmental improvements are at times incorrectly seen as competing aims. Increased economic production can indeed lead to greater environmental degradation. However, an increase in economic resources provides more options (most notably, technological advancements) for addressing environmental problems. Moreover, a growing economy can also lead to increased demand for environmental improvements. It is therefore important to weigh the direct environmental benefits of a regulation against its economic costs. The goal should be to maximize the net benefits to society, while also giving due consideration to distributional issues. Maximizing net benefits is best achieved in a free-market setting unless there are spillover costs to third parties.

Spillover costs are best addressed by establishing property rights that will lead the affected parties to negotiate a mutually-beneficial outcome. If the costs of such negotiations are prohibitive, however, government should respond carefully and always keep in mind the possible government spillover costs. To make effective regulations, the government must first assess the environmental problems using sound, unbiased estimates of the hazards and then craft incentive-based regulations to address them. Such regulations can address the spillover costs of environmental problems at lower costs to society than the traditional command-and-control regulatory methods. These principles, and the lessons learned from our past regulatory experiences, as described throughout this chapter, should guide our future regulatory endeavors to achieve environmental improvements coupled with economic growth and efficiency.