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Using Market-Based Approaches to Protect the Environment

Pollution Trading, Other Strategies may be More Efficient than Regulatory Mandate

A new paradigm seems to be emerging about the best strategies to prevent pollution and improve water quality.

Traditionally, the federal government and state agencies established performance standards, which set limits on the rate or amount of pollutants that industries could discharge into water resources and the environment. For example, the U.S. Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC), often prescribed numerical criteria for specific pollutants that individual industries and manufacturers would have to meet. In addition, they would often specify the control technology these firms would have to use to meet these limits. If an industry failed to comply with these standards, fines could be imposed.

Recently, many experts (including the EPA, in some cases) have argued that a regulatory approach may not be the best or only way to control pollution. In particular, economists say the use of market-based incentives and cost-driven approaches may be effective strategies to protect the environment.

This issue of Texas Water Resources is the first of a two-part series that will examine innovative strategies to protect the environment and water resources. In this issue, we invited three economists -- Ron Griffin of Texas A&M University (TAMU), John Merrifield of the University of Texas at San Antonio (UTSA), and Pete Emerson of the Environmental Defense Fund (EDF) -- to develop essays about the use of market-based strategies to limit pollution. In the next issue, we'll explore how total maximum daily loads (TMDLs) are being used to improve water quality in Texas and how market-based approaches can be incorporated into the TMDL framework.

Background Information

The amount and type of economic approaches that can be used to improve the environment is virtually limitless, and many strategies have recently been used in Texas. A report published by TWRI suggests that allowing a free market for water rights to develop in the Edwards Aquifer may be more efficient than a highly regulated strategy. Some other examples include efforts by environmental groups to purchase and preserve sensitive lands, and the development and implementation of rate structures that urge water conservation.

One market-based issue that is now generating a lot of interest is the broad topic of pollution trading. The authors of the three essays in this newsletter all touch on this issue.

It needs to be noted that, to date, the concepts of pollution trading and pollution credits have been used to maintain and improve air quality in "airsheds." So far, this concept has not been used to protect water quality in Texas and has only been used on a limited basis, nationally, to maintain stream quality. It also needs to be pointed out that the TNRCC has not yet taken a stand on effluent trading, but agency staff say they are now evaluating its potential use to improve water quality.

Still, there are some lessons that can be learned from the use of the trading of air pollution credits that may be useful in applying these principles to watersheds. A key component of the airshed pollution trading programs is that the maximum quantity of air pollutants that will be allowed is developed. Then, pollution credits are assigned and can be bought or sold as users try to meet improved air quality standards. This same type of scenario will likely be developed for watersheds in the near future as TMDLs are established for many Texas stream segments. The TMDL process will set limits on the total amount of pollutants allowed within a watershed and may set the groundwork for the trading of water pollution credits, similar to the work already being done to improve air quality.

The Case for Tradable Emission Permits

by Ronald C. Griffin, Professor of Natural Resource Economics, Agricultural Economics Department, Texas A&M University

Nearly 30 years ago, when the U.S. became serious about implementing pollution control programs, there were many policy models to choose from. While experts have contributed many refinements since that time, the central models are fundamentally unchanged.

Some pollution policies are quantity-guided (also know as "command and control" regulations). These strategies result in standardized behavioral rules that must be obeyed by pollution dischargers. These rules represent regulations in a full sense. They may be technologically focused. For example, wastewater treatment plants might be obligated to use pollution control technologies that have received government approval. Or the rules can be effluent-focused, as when wastewater treatment plants are required to emit no more than a set amount of a given pollutant per day.

The unifying feature of quantity-guided policy is that some actions or consequences are removed from the decision calculus of polluters. These quantities are governmentally specified. While quantity-guided rules can theoretically distinguish among polluters of differing circumstances, the reality is that they, in general, are uniform within each industry subgroup.

The other major class of pollution policies is price-guided and rely on market incentives. Major types include pollution charges, abatement subsidies, and transferable emission permits. The unifying character of price-guided pollution policies is that they modify the economic environment in which polluters operate, but they do not impose specific rules for behavior. Therefore, these policies are coercive without being absolutely regulatory.

Economics strongly favors price-guided policy. The reason is that price-guided policies achieve any given level of environmental quality at a lower total cost than quantity-guided policy. The argument begins with a recognition that firms in every sector of the economy have many means of achieving an environmental target.

A short list of alternatives follows: 1) firms can treat effluent and alter its character prior to emission; 2) industries can discharge effluent into alternative media (air, land, or water); 3) generators of pollutants can alter production strategies (input mixes) to achieve less emissions; and 4) manufacturers can adopt less polluting technologies. Also, 5) firms can reduce output levels with consequentially reduced emissions; 6) manufacturers can exit the industry or relocate to a less environmentally sensitive place; or 7) industries can manage the receiving media to improve its assimilative capacity (such as aerating water to increase dissolved oxygen or using water rights to smooth streamflow variations).

All these methods are potentially efficient in certain circumstances. Given the array of control alternatives and the great variety among firms, even for enterprises in the same industry, it is an extremely demanding task for an agency to digest all the relevant information and process it so that promulgated regulations can be economically efficient. Such quantity guides must be firm-specific, and there are hundreds of thousands of these industries in the U.S. The task of designing economically efficient regulations is more than demanding - it is impossible.

Price guides, on the other hand, attempt to harness the specialized knowledge of firm managers, so that they make efficient choices on behalf of their businesses and, at the same time, society at large. Let's consider how this might work.

The darling policy of early environmental economics was pollution charges. Charging polluters a "price" for each unit of emitted pollution appeared to utilize the best features of market economics, and, unlike paying firms for abatement, pollution charges align well with the fairness principle of "polluter pays." By setting a charge and letting firm managers decide how much to pollute and how to accomplish this level of pollution, this policy relies on the profit motivations of entrepreneurs to adopt the cheapest approaches. If a control method would cost a business more than it saves in pollution payments, the business rejects it. Because all firms can be expected to act in this way, responsibility for pollution control tends to be distributed optimally across all firms in the economy. Moreover, instead of retarding the pursuit for cleaner technologies as is the case with most quantity guides, pollution charges enlist assistance from companies who search for cleaner technologies so that costs can be controlled.

As U.S. pollution policy evolved during the 1970s, economists spoke with a single voice in favor of economic incentives. However, the adopted legislation of the era was decidedly quantity guided, mostly in the form of technologically oriented regulation. As economists studied these choices and as the U.S. gained experiences with quantity guides, changes began to emerge.

Economists discovered that legislators found pollution charges to be too punishing. The industries to be regulated claimed that these new charges would put them out of business, jobs would be threatened, and these jobs belonged to voters. Decision makers were concerned about competitiveness relative to other countries not yet applying pollution policies. Economists learned again that legislators are sensitive to the status quo and are wary not to directly induce losses to industry, even when economic efficiency would be served. Thus, pollution regulation during the 1970s gave rise to terms like "best practical technology," for which harm to industry could be curbed.

In the late 1970s and afterwards, growing U.S. experience with quantity guides found these policies to be very expensive. Environmental data clearly indicated that accomplishments were occurring, but the capital investments in new equipment were very sizable. There appeared to be considerable room for improving pollution control policy.

These developments opened the door for transferable emission permits. Like pollution charges and abatement subsidies, transferable permits are price-guided and do not mandate specific action by firms. Firms must limit their emissions to the level of permits they have acquired, but the means of doing so is at their discretion. They can always purchase additional permits from other firms in the pollutionshed for which the permits have been defined. The permit price is not set by government authority, but is negotiated between permit buyers and sellers.

A number of benefits result when systems are developed that utilize transferable permits. These include the following: 1) firms that generate pollutants have an incentive to employ the cheapest available means of meeting their permit limits; 2) manufacturers and industries are encouraged to pursue technological advance that offers cost-effective pollution reductions; 3) firms will buy permits when purchase costs are exceeded by pollution control costs; and 4) firms will sell permits when sales value exceeds pollution control costs.

The process of buying and selling permits tends to distribute pollution control across a region in such a way that the total costs of achieving pollution reductions are minimized. Transferable emission permits share these qualities with the other price-guided strategies, whereas quantity-guided policies lack them.

In relation to pollution charges, transferable emission permits are not as economically burdensome for industries unless they are first distributed by auction. Auctioning, though efficiency-enhancing, sets aside a potential advantage of transferable permits. When permits are initially allocated without cost to firms, they are endowed with a valuable property right. This softens the financial burden of pollution control to existing industries, perhaps benefiting particular firms. This enhances global competitiveness and political attractiveness.

Transferable emission permits achieve cost-efficiency while offering a program that can be politically supported.

Implementing Emission Allowance Markets

by John Merrifield, Associate Professor of Economics, University of TexasÐSan Antonio

During the 1970s, it became evident that emission allowance markets were more than just theoretically elegant pollution reduction mechanisms.

Some type of an allowance market is a virtual necessity for some regions. Without some kind of allowance market, regions with excess emissions of the Clean Air Act's six criteria pollutants (known as non-attainment areas) are denied major avenues of economic development. When allowances cannot be purchased, many types of new businesses are prohibited because they would violate air quality standards.

Allowance markets allow non-attainment areas to use regulator-certified "excess" reductions (more than already required) from existing sources to offset the emissions of new businesses. Trading ratios (known as environmental bonuses or environmental premium requirements) of 1.1-to-1 to 1.2-to-1 are often required. These trading ratios are the equivalent of an emission reduction tax. Purchasing or trading for allowance credits lets pollutant generators exceed the new source's emissions. The environment improves with the arrival of each new source.

An emission allowance gives its owner permission to release a unit of a specified pollutant in a defined geographic area during a specified time. As an example, an industry could be allowed to release one ton of sulfur dioxide (SO_2) into an airshed per year.

The establishment of such private property rights requires a capability to monitor each firm's compliance with regulatory limits. Market implementation has two key components. The authorities must define new property rights and select a process to make the change.

An auction produces the most efficient distribution of allowances. The amount of private property in emission allowances and deed restrictions are determined by authorities to reflect air quality goals. Typically, the highest bidders for allowances are firms with the highest incremental emission control costs. This minimizes the cost of reducing emissions to target levels, and trading of allowances lessens expenses.

Allowance markets are illustrated in the figure on page 4. The position of the supply line (S) shows the number of allowances and reflects the air quality goal. With a trading ratio of more than 1.0, the supply line (S) will slide to the left slowly over time. The position of the demand line (D) reflects the cost of alternatives to owning allowances, further reducing emissions. The market determines the price (P) of an allowance.

Property right limits, or deed restrictions, exist to ensure enforceability, to avoid uncompensated third-party effects, and to avoid excessive geographic or temporal concentrations of emissions. Without such limits, a firm might acquire enough allowances to harm their immediate neighbors.

Despite its economic virtues, the auction process is rarely used as a primary means of establishing emission rights. It has a major political liability. Limiting firms' access to the environment's waste disposal services is politically difficult. An auction of a limited number of allowances goes beyond that. In addition to emission control expenses, firms must pay for the remaining limited access to the environment's formerly free, and unlimited, waste disposal services.

When the major environmental laws were debated in the early 1970s, polluters favored a standards-based regulatory approach to limit their expenses to emission controls. Emission allowance markets can begin from the pattern of pollutants permitted by existing regulations. Since polluters are given allowances equal or close to historical emissions (depending upon the overall reduction necessary for compliance with air quality standards), it is a much more politically acceptable initial allocation of allowance rights. If the allowance restrictions are the same, and the amount allocated is the same as what would have been auctioned, such a cap and trade system may be as efficient as an auction-initiated system.

Once established, allowance markets can replace the regulatory, command and control mechanism as the primary basis for future emission allowance allocations. For budgetary and political reasons, including inertia, allowances are usually defined in ways that cause them to fall well short of private property. Most allowances are revocable if emission reduction targets change, and revocations have occurred. Regulatory baselines that determine when emission reductions are "excess," and the basis for a tradable allowance, change. Regulators use such practices to try to achieve reduce emissions without having to spend taxpayer dollars to buy back allowances.

Unfortunately, many critics of pollution trading are often misguided and counterproductive, in my opinion. Still, their arguments can be politically potent. Critics argue pollution trading is paying someone not to pollute, but they don't realize that the net result of implementing these strategies is that the environment benefits.

The resulting uncertainty greatly reduces the incentive to create or buy allowances. Fewer allowance trades mean waste emission reductions cost society more than necessary. With 1-to-1 and 1-to-2 environmental premiums, air quality is less likely to improve.

Tradable emission allowances are underutilized. In addition, the effectiveness of that approach is often hobbled by counterproductive restrictions. In the traditional approach to most environmental issues, command and control approaches dominate, and market approaches such as tradable emission allowances operate at the margin. For many issues, the environment and the economy would benefit from a reversal of that approach, as well as fewer shackles on allowance markets.

EDF Believes Market Forces Can Protect Texas's Environment

by Pete Emerson, Senior Economist, Environmental Defense Fund (EDF), Austin, TX

Whenever too many pollutants are discharged into the environment, too much water is pumped from an aquifer or river, or too many fish are harvested from the sea, we risk a "tragedy of the commons." Consequent environmental and economic problems tell us that we need to regulate (or close) the commons.

To solve the problems of common property, EDF advocates pollution trading to reduce air and water pollution, water marketing to allocate and conserve water, and individual transferable quotas for fisheries.

Pollution trading, water marketing, and individual transferable quotas are examples of "cap-and-trade" regulatory policy. They intervene by changing the incentives that influence resource users' decisions, rather than setting absolute mandates. They benefit the environment and the economy by delivering conservation and environmental quality goals at less cost than other regulatory policies.

Cap-and-trade management tools accomplish two important objectives. They address the carrying (or harvest) capacity of the environment directly. They also promote efficient use of the scarce resource. The key to achieving these objectives is an institutional and legal framework that provides a cap on total resource use, secure and transferable property rights to the resource, accurate and timely monitoring of resource use, and stiff penalties if the property rights are violated.

In passing the Edwards Aquifer Act (Senate Bill 1477) in 1993 and 1995, the Texas Legislature capped pumping from the Edwards Aquifer and provided for a water market. If fully implemented, these provisions will help protect springflows that depend on the aquifer and stretch water supplies to meet the region's rising demands.

The Edwards Aquifer Authority is now allocating pumping permits and developing rules to regulate the buying and selling of water. Still, there are reasons to be concerned. The initial allocation of pumping permits far exceeds the statutory cap and proposals have been put forward that would impede the transfer of water. Without a cap on pumping and the ability to freely transfer water, there will be no water market.

The reasons to have a water market in the Edwards Aquifer region are compelling. With population growth and economic development, we can no longer maintain the fiction that the Edwards contains an unlimited quantity of water. Market prices are needed to signal scarcity, to provide an incentive to conserve water, and to allocate the available water to its highest valued uses. The Texas A&M University Agricultural Program has identified conservation investments that would allow farmers in the region to continue to farm and to sell water to benefit municipal water users and springflow. With conservation investments and a cap-and-trade water market in place, this region would go into the next drought in better shape, reducing the risks and costs of drought management.

The cleanup of sulfur dioxide emissions under the U.S. Clean Air Act of 1990 points to the success of using the cap-and-trade approach. EDF played a lead role in winning the pollution trading program. Under this cap-and-trade policy, EPA distributes annual "pollution allowances" to power plants. Those allowances call on each plant to reduce its emissions of sulfur dioxide by 50% by 2000. With trading of allowances permitted, plant managers have an incentive to concentrate pollution reduction investments where abatement costs are lowest and to continue efforts to reduce emissions. Today, pollution reductions under the sulfur dioxide trading program are running ahead of schedule, and cost savings have been substantial - 50 % or more compared with policies in which no trades are allowed.

Working with the Paso del Norte Air Quality Task Force, EDF advocated a cap-and-trade strategy to reduce pollutants in a common air basin shared by the citizens of El Paso, TX and Juarez, Mexico. Unhealthy levels of ozone, carbon monoxide and other pollutants regularly move across the border and violate national standards in both countries. This transboundary problem is complicated by a huge economic asymmetry and national sovereignty considerations. In May 1996, the U.S. and Mexican governments signed an international agreement recognizing an international air basin and creating a mechanism for local citizens and government regulators to implement a transboundary management strategy. Because the Task Force demonstrated significant cost differentials that favor pollution reduction in Juarez, there is an opportunity for pollution reduction investments to flow from El Paso to Juarez. The benefits are better air quality for everyone and needed cross-border investments and technology flows. Ultimately, as transboundary management continues to evolve, the cities may find it desirable to adopt common air quality targets and greater flexibility to achieve pollution reductions.

There are also concerns air pollution in the Big Bend region. People need to better understand the transport of air pollutants from power plants and other sources in the U.S. and Mexico. The path to cleaner air may lie in negotiating cooperative arrangements to cut emissions over a large region in both countries, and in allowing pollution trading across the border. Experience in the Paso del Norte international air basin and with sulfur dioxide trading will be helpful in designing a transboundary control program to control air pollutants in the Big Bend region.

The cap-and-trade approach is needed to deal with the problems of overfishing. Overfishing has hurt fishermen and marine ecosystems. This problem has been documented for the red snapper fishery in the Gulf of Mexico. EDF has joined Texas fishermen and regulators to recommend that a sustainable harvest quota of red snapper be divided into individual shares and distributed on the basis of historical participation in the fishery. Later, participants could enter and leave the fishery, or adjust their individual harvest by buying and selling shares. The program would let fishermen harvest shares when they decide fishing and market conditions are right, without fear that others will catch their fish and the season will be quickly closed. Fishermen would be able to reduce fishing costs, and minimize wasteful bycatch and ecological damages caused by too many boats chasing too few fish.

In Texas, and many other places, the challenge is to learn from successful incentive-based policies, and to adopt the institutional and legal framework needed to make cap-and-trade regulatory policy a reality. Given an incentive to conserve, innovate and trade, resource users and polluters will apply the basic economic insight that cooperation and efficiency make everyone better off to achieving important environmental goals.

Summary

Obviously, many environmental professionals, policy makers, and individuals agree that a key goal should be to improve water quality and lessen the adverse impacts of water pollution. The question becomes, "What is the best way to achieve these goals?"

Many experts, including those who helped write this article, feel that the best way to protect environmental quality and air and water resources may be to incorporate free market principles like pollution trading into overall control strategies. Indeed, the example of emissions trading to curb air pollution suggests that the skies may be made cleaner in a cost-effective manner by trading pollution credits rather than by implementing and enforcing traditional "command and control" strategies.

It needs to be pointed out that pollution trading to protect and improve water quality is still relatively unproven. There are concerns among some groups that the use of effluent trading, for example, could result in degraded water quality in some streams at the expense of cleaner water in other watersheds. It needs to be remembered that EPA has not yet developed a final strategy for effluent trading (the most recent official documents are a 1996 draft policy). In Texas, the TNRCC is still evaluating whether pollution trading may be a useful tool for protecting the state's water resources.

Pollutant trading within watersheds is a potentially viable concept that needs to be evaluated in more detail to determine if it could protect water quality.

For More Information

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Updates About TWRI Projects

Recently, TWRI has been involved in many research and education projects. For example, TWRI funded work by Robert Coulson of the Texas A&M University Entomology Department to develop a database and geographic information system about rice growing areas of the Lower Colorado River Basin. TWRI recently began administering two research projects, both of which were funded by the U.S. Geological Survey. In one study, a team of Texas A&M University System scientists including John Ellis, Ron Lacewell, Raghavan Srinvasan, and Seiichi Miyamoto are identifying institutional constraints that restrict drought management. In another study, David Eaton and Peter Wilcoxen of the University of Texas at Austin and Al Utton of the University of New Mexico are examining and quantifying "third party" impacts of water transfers.

Two projects directly involve TWRI staff members. TWRI science writer Jan Gerston has been working with a team of Texas A&M University System professionals to increase the amount of education about water conservation issues. As a result, she will publish more issues and additional copies of the Texas Water Savers newsletter. TWRI Information Specialist Ric Jensen is working on a project with researchers from Mississippi State University and other universities along the Gulf Coast. The goal is to collect information on agency policies and programs, regulations, and court decisions that affect coastal management in Texas and other Gulf states.