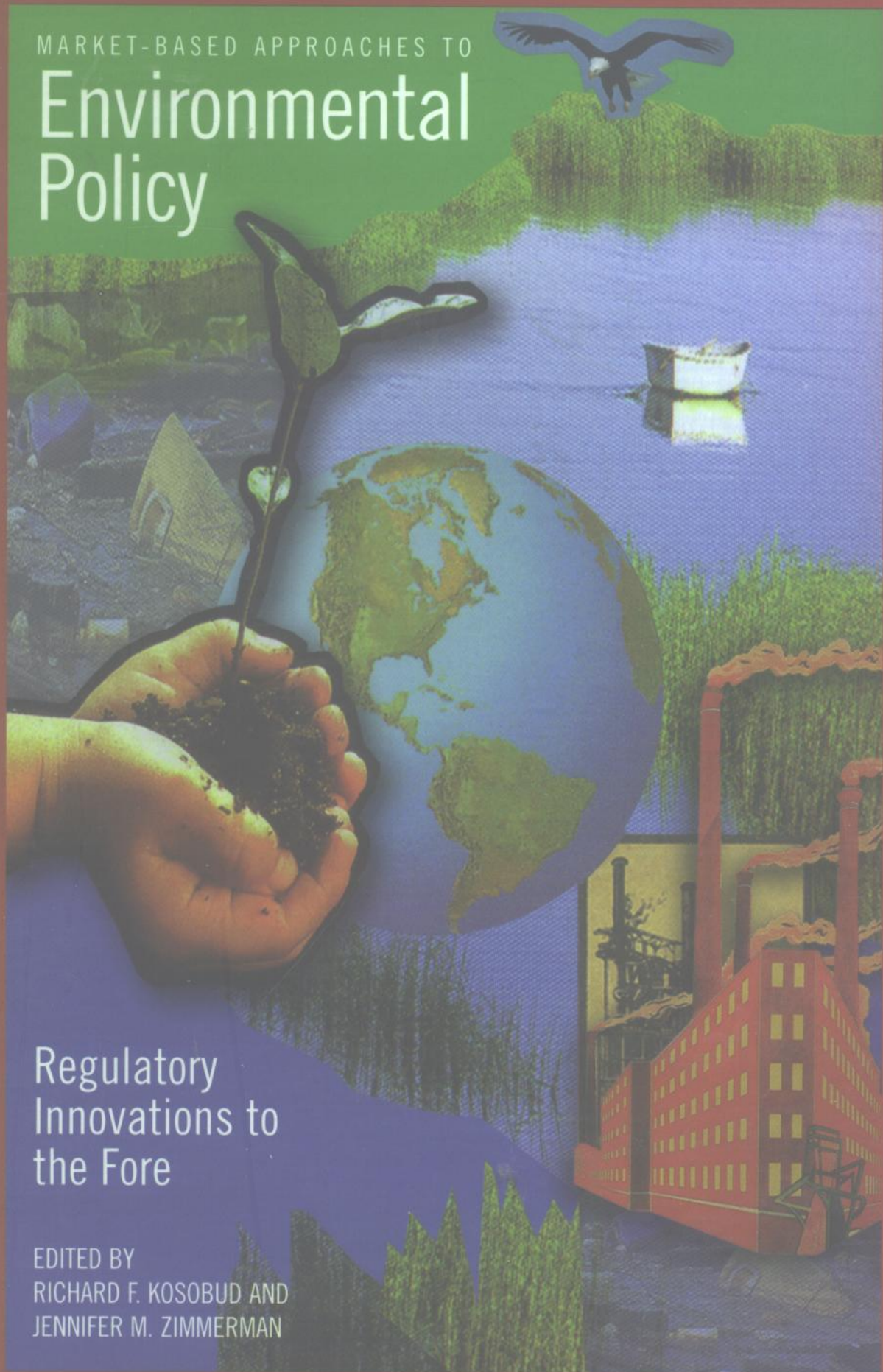


MARKET-BASED APPROACHES TO

Environmental Policy

Regulatory Innovations to the Fore

EDITED BY
RICHARD F. KOSOBUD AND
JENNIFER M. ZIMMERMAN



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PREFACE

□ This volume consists of studies of regulatory innovation that originated as presentations to the Workshop on Market-Based Approaches to Environmental Policy in a series of meetings during the period 1992–1994. The studies were subsequently revised, taking advantage of the exchange of views that was an important feature of the Workshop format. This is not a book about the economic theory of regulatory reform and innovation, though that theory plays an important background role; rather, it is a book about new environmental control measures fresh from the drawing board or being drawn up and readied for consideration. It is also very much a book about the complex setting in which regulatory reform is debated, altered and, on occasion, implemented.

The Workshop was created as one way to explore this complex setting, drawing participants from the regulated, regulating, environmental, public interest, and academic communities. Participants brought separate and often contending viewpoints to the debate but appeared united in their willingness to consider, in a deliberative process, the strengths and limitations of new regulatory tools. At most meetings, formal discussants were chosen to comment on the study of the day. Discussants were chosen for their independent and critical views. Selected discussant comments are included in this volume. In addition, the open exchange of views that occurred in the Workshop was recorded and made available to authors for use in

revisions of their work. This volume, therefore, can be said to be, in many respects, a joint Workshop product.

Regulatory reform has been very much in the air. In the environmental area, it has taken the form of a search for more flexible, cost-effective, and innovation-stimulating methods to achieve environmental goals. Such new methods could include improved direct regulation, reliance on voluntary efforts, or the creation of a wide variety of explicit incentives for households and producers to act in more environmentally benign ways. The major focus of the Workshop was on the latter—application of market-based incentives. These incentive techniques have a long history of mostly favorable academic analysis but a short history of use. The editors have selected studies of a subset of these market-based schemes that deal mainly with air pollution. There are two reasons for this choice: Air pollution ranks among our most serious problems, and air pollution has been the object of recent national legislation with significant implications for regulatory reform.

Market-based approaches are believed to have important strengths, in appropriate applications, compared with conventional regulation. These strengths have been, as yet, insufficiently tried and tested by their deployment, and their limitations have been insufficiently explored. The Workshop was initiated to help in this appraisal by providing a forum for discussing these strengths and limitations, for evaluating the first pieces of evidence on performance of those undergoing trial, and for deliberating on the design of measures under consideration.

During the period of Workshop meetings, environmental markets, or the use of tradable emission permits, moved to the center of the air pollution control stage and captured the attention of participants. A number of meetings were devoted to their design and implementation, especially the most innovative and comprehensive form of environmental market, the cap-and-trade model. So involved, contentious, and interesting did this discussion become that the Workshop organizers decided to try to record the various viewpoints by carrying out a sample survey of participants. Since this came at the close of the series of meetings on the topic, it could properly be termed a deliberative opinion poll of participant views (and not a random sample of the views of the population). The results of this poll are discussed at the close of Part 2.

The book is arranged in four parts. Part 1 provides an introduction and a new comprehensive survey of the current and potential cost savings that are accruing, or may accrue, from increased use of various types of market-based approaches. Part 2 contains studies of

environmental markets under way or soon to be implemented and closes with the results of the deliberative opinion poll.

Part 3 ventures into the uncharted areas of possible future applications of new regulatory systems: one being a market for control of global warming and another exploring joint implementation prospects in this area. The next study in Part 3 examines the extended use of green taxes, and the last study describes a pioneering model for a more voluntary, decentralized environmental management. The incentive for the source of pollution in this instance is the avoidance of direct regulation by demonstrating that voluntary measures can produce, at the very least, an equivalent reduction in pollution. Part 4 contains a conclusion and conveniences for the reader, such as a glossary, index, and biographies of the contributors.

It is a pleasure to acknowledge the Workshop's support by a number of foundations and agencies. Generous financial support for Workshop activities was provided by the John D. and Catherine T. MacArthur Foundation. Further support came from the Chicago Council on Foreign Relations, the Institute of Government and Public Affairs at the University of Illinois, and the Department of Economics at the University of Illinois at Chicago. Facilities for meetings were arranged with the support of the U.S. Environmental Protection Agency, Region 5, Air and Radiation Division; the Commonwealth Edison Company; the Chicago Board of Trade; the Amoco Oil Company; and the Illinois Environmental Protection Agency.

The Workshop is itself the creation of many people of varied backgrounds and interests too numerous to single out; we are very happy to acknowledge their contributions in general. Foremost among this group are the participants: Where they have not clarified an idea during the deliberation, they have helped identify where the bone of contention lies. Others, not directly participating, supported the Workshop with suggestions. A number of people have helped more directly in the preparation of this manuscript. We should like to thank Professor Houston H. Stokes, Pamela Pinnow, Alex Mannella, Phil Nugyen, and Teresa Mieki. Adam Kosobud helped with some computer graphics.

The editors are much indebted to skilled and experienced publishing assistance from Van Nostrand Reinhold and owe a special debt to the cheerful and knowledgeable guidance of Jane Kinney, Senior Editor, Environmental Sciences. The editors retain sole responsibility for editorial viewpoints and for errors and omissions.

Richard F. Kosobud
Jennifer M. Zimmerman



ACRONYMS

ACMA	Alternative Compliance Market Account
AERCO	Area Emissions Reduction Credit Organizations
ALAGC	American Lung Association of Greater Chicago
API	American Petroleum Institute
ATU	Allowance trading unit
BACT	Best available control technology
CAA'70.	Clean Air Act of 1970
CAAA'90	Clean Air Act Amendments of 1990
CAAPP	Clean Air Act Permit Program
CAC	Command-and-control regulation
CARB	California Air Resources Board
CBO	Congressional Budget Office
CBOT	Chicago Board of Trade
CCAP	Climate Change Action Plan
CEMS	Continuous emission monitoring systems
CERCLA.	Comprehensive Environmental Response, Compensation, and Liability Act of 1976
CFCs.	Chlorofluorocarbons
CO	Carbon monoxide
CO ₂ .	Carbon dioxide
EDF.	Environmental Defense Fund
EPRI	Electric Power Research Institute
ERC.	Emission reduction credits
ERMS.	Emissions Reduction Market System
FCCC.	Framework Convention for Climate Change
FERC.	Federal Energy Regulatory Commission

GCC.	Global climate change
GHG.	Greenhouse gas
HAP.	Hazardous air pollutant
ICC.	Illinois Commerce Commission
IEPA.	Illinois Environmental Protection Agency
IPCB.	Illinois Pollution Control Board
IPCC.	Intergovernmental Panel on Climate Change
JI.	Joint implementation
LAER.	Lowest achievable emission rate
LMOS.	Lake Michigan Ozone Study
MAC.	Marginal abatement costs
MACT.	Maximum achievable control technology
MSB.	Marginal social benefit
MSC.	Marginal social cost
MERC.	Mobile source emission credit
NAAQS.	National Ambient Air Quality Standard
NESCAUM.	Northeastern States Coordination Committee for Air
NO _x .	Nitrogen oxides
NPDES.	National Pollution Discharge Elimination System
NRDC.	Natural Resources Defense Council
NRRI.	National Regulatory Research Institute
NSR.	New Source Review
O ₃ .	Ozone
OTAG.	Ozone Transport Assessment Group
OTC.	Ozone Transport Commission
RACT.	Reasonably available control technology
RCRA.	Resource Conservation and Recovery Act
RECLAIM.	Regional Clean Air Incentives Market
SCAQMD.	South Coast Air Quality Management District
SIP.	State implementation plan
SO _x .	Sulfur oxides
TRI.	Toxic Release Inventory
U.S. EPA.	U.S. Environmental Protection Agency
U.S. IJI.	U.S. Initiative for Joint Implementation
ULEV.	Ultra low emitting vehicle
VMT.	Vehicle miles traveled
VOC.	Volatile organic compounds
VOM.	Volatile organic materials
WRI.	World Resources Institute
WWI.	World Wildlife Institute
ZEV.	Zero-emissions vehicle



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■
Part

1



**MARKET TOOLS
FOR GREEN GOALS:
REGULATORY INNOVATIONS
TO THE FORE**



1.1



INTRODUCTION TO PART 1: REGULATORY REFORM AND REINVENTION

The Editors

□ Although the air is cleaner, the water purer, and the land less contaminated in the United States than 25 years ago, we remain, by general agreement, short of our goals of protecting health and reducing economic and ecosystem impacts of pollution to acceptable levels. To reach those goals by further tightening the conventional regulatory or command-and-control measures threatens to increase marginal control costs, to limit control innovations, and to provoke nonproductive confrontation between regulated and regulating communities. Given these negative outcomes, it is easy to see that the decision, when choosing among alternative methods to achieve our environmental goals, is an important and sometimes difficult one.

Among the alternatives to conventional regulation, and the focus of these studies, is the expanded use of market-based approaches which, by reputation, can decentralize control decisions and create appropriate incentives for least-cost environmental management. While more often proposed than installed in the past, these incentive-type systems have received increasing attention by cost-conscious policymakers, have been applied in several instances, and have been considered for many more possible applications. An increasing pool of detailed designs, as well as a small but growing body of evidence on performance, are now available for evaluation. A major aim of this book is to contribute to the evaluation of the

performance and design of deployed and potential incentive schemes.

To further this purpose, we selected studies by front-line researchers, administrators, and observers who are close to the institutional features and transactional processes that ultimately determine whether a market incentive proposal that is attractive in theory is successful in performance. These contributors came from the regulating and regulated communities, from environmental organizations, and from academia. Note that it is not a contention of this volume that the role of any of these essential communities in environmental affairs ought to be downgraded or emasculated. It is not that government ought to refrain from making key decisions in setting environmental goals or in establishing monitoring and enforcement procedures. Rather, it is a question of allocating to each community the subset of environmental decisions that it can best make in furthering our environmental ends.

In the endeavor to sort out these decisions, this volume is concerned mainly with problems of the concrete design and application of alternative environmental policy instruments and does not devote much space to the theoretical modeling of their comparative merits. However, we do not deny—and, in fact, consider as essential—the critical relationship between the two. Theoretical considerations can tell us whether there are worthy destinations in view. Implementation considerations tell us whether we can get there. It is important, and comforting, to know, for example, that the use of tradable pollution permits can be rigorously shown to result in a least-cost solution to control efforts.¹ It is equally important to recognize that wise application procedures or failure to recognize complications or departures from the abstract model can also affect the solution. These procedures and complications are brought to the fore in this volume.

Contributors do not neglect theoretical work; they are well aware of, and make reference to, a number of the findings. Economic theory affords a unifying framework for many of the studies of incentive system applications. Since providing such a framework was not a task assigned to any one study, and since it is likely to be convenient for some readers to have an account, however summary, of key ideas, the editors furnish in this introduction a quick survey of the core analytic arguments about the static and dynamic cost-effectiveness of the major alternative policy instruments.

¹A technical account of the theory of instrument design can be found in the studies included in Part III of Dorfman and Dorfman (1993).

THE SIMPLE ECONOMICS OF LEAST-COST REGULATION

To examine why, in principle, we can expect savings by use of incentives compared with traditional regulatory systems, we set up a very simplified model of two cost-minimizing firms that differ in pollution control or abatement costs. That the firms aspire to minimize control costs and that they are two among many competitive emission sources are among the assumptions that simplify the exposition of this central case. The pollutants are not toxic or localized, and their impacts on households and other enterprises are externalities or social costs of production that have not yet been taken into account. Consequently, the government has set a target for their reduction but has not decided on the specific control measure to use.

To give a concrete feel for the range of these measures, it is useful to list examples of (1) direct, centralized or command-and-control (CAC), and (2) market-based or incentive techniques of control. The former include outright bans on harmful substances, uniform emission standards or specific technologies applied to all polluting sources regardless of individual control costs, content limits, and disposal requirements, among others. The latter include content and safety labeling, emission or product taxes, deposit refunds, disposal taxes, and various tradable permit or allowance schemes.

Figure 1.1.1, a–c graphs the two kinds of decisions important to our model: the government's choice of a target and policy instrument, and the firm's choices of control inputs (level of control). Both axes are scaled to the same spatial dimension for an easy grasp of the relationships.

The marginal abatement-cost curves (MAC) of the two firms, the incremental cleanup cost of emissions, are downward sloping as emissions increase. At the point of 1000 units, emissions are no longer reduced. The downward or negative slope assumes that less expensive control measures exist and are adopted first. The emissions of one firm do not interfere with the output and, hence, do not affect the emissions of the other.

In figure 1.1.1a, two firms, not necessarily of the same employment or output size or in the same industry, each emit 1000 units of pollutant in the no-control policy scenario. Firm 1 is less efficient at reducing emissions, as indicated by its MAC curve being above that of firm 2. Note that we are interpreting abatement costs to be limited to expenditures for control inputs or resources to secure compliance.

A CAC regulation carried out by specification of a particular technology or uniform emissions standard, is imposed by the government. Each firm is limited to the emission of 500 units. Firm 1

Cost-Effectiveness Comparisons

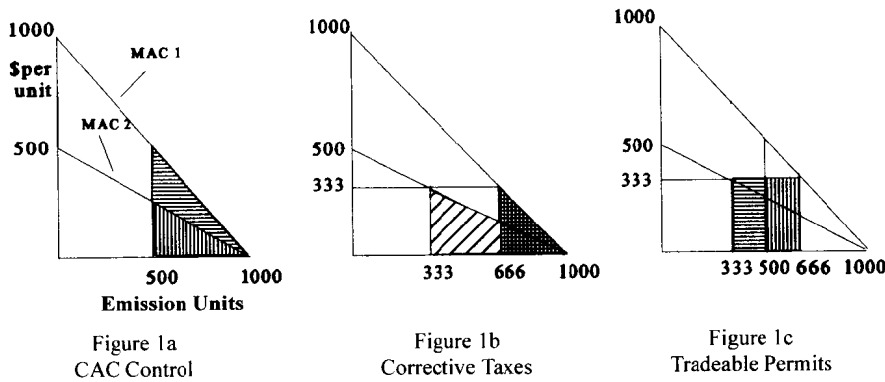


Figure 1.1.1. Cost-effectiveness of three policy instruments compared.

reduces 500 units at a marginal cost of \$500 for the last unit, and firm 2 reduces the same amount at a lower marginal cost of \$250 for the last unit.

Society achieves a 50% reduction in emissions from the two firms—about the reduction in aggregate ozone precursor emissions required in many urban nonattainment areas and not far from aggregate sulfur dioxide emission reductions—at a total resource cost of the shaded triangles; that is, resources are drawn away from other uses to reduce emissions. Marginal control costs for the two firms are not equaled by application of this regulation, as is easily seen.

The government now turns to an incentive system that allows the firms to make specific control decisions in which they draw on their technical and economic knowledge. In figure 1.1.1b, a corrective tax of \$333 per emission unit is levied by the government, which leads firm 1, via cost minimization, to reduce emissions by 333 units and to pay taxes on the 667 emitted units. Firm 2 reduces emissions by 667 units and pays taxes on the 333 emitted units. The corrective tax is set to achieve the same overall reduction in emissions as in the CAC case. No other tax level achieves the desired reduction, given the properties of these cost curves. Note that the government does not need information about the various control practices and techniques adopted, nor does the regulatory staff need to acquire and apply such knowledge. The government does need to obtain infor-