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**Streams of Environmental Innovation:
Four Decades of EPA Policy Reform**

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Streams of Environmental Innovation: Four Decades of EPA Policy Reform

The idea of innovation has become almost a mantra for all organizations, public and private. The world is changing rapidly, and organizations must adapt. For the private sector, economic relationships change, customers demand new products and services, technologies become outdated, and pressure from competitors is relentless. For public agencies, demands for efficiency and quality increase, budgets become more constrained, political executives want measurable results, and citizens want to be more engaged. Doing things a certain way because that was how they were done in the past no longer is acceptable. The white water conditions of modern society demand innovation.

This innovation imperative would seem to be as or more relevant to organizations in the field of environmental policy as any other. Indeed, the concept of the environment raises some of the most dynamic and rapidly-changing issues faced by government. Forty years ago, air and water pollution from large industrial sources were defined as the main environmental problem. Then abandoned hazardous waste sites, residential radon, and ozone-depleting chemicals were added to the list. More recently, climate change, energy and water security, deforestation, and habitat loss have figured more prominently on policy agendas.¹ Along with a growing list of problems has come a reconceptualization of the policy field more generally. Concerns about environmental *protection* have largely been replaced with a greater focus on environmental *sustainability*, in recognition of the complex interrelationships that exist among economic, political, and social choices.²

The institutional and social aspects of environmental policy also have changed. Reflecting in part the ideas of the “new” public management, problem-solving is viewed

¹ For discussions, see the chapters in Daniel C. Esty and Marian R. Chertow, *Thinking Ecologically: The Next Generation of Environmental Policy* (1997).

² Robert F. Durant, Daniel J. Fiorino, and Rosemary O’Leary, eds., *Environmental Governance Reconsidered: Challenges, Choices, and Opportunities*. (2004), 1-27; Daniel A. Mazmanian and Michael E. Kraft, eds. *Toward Sustainable Communities: Transition and Transformation in Environmental Policy*, 2d ed. (2009); Daniel J. Fiorino, “Sustainability as a Conceptual Focus for Public Administration, 70 *Public Administration Review* (2010); National Research Council, *Sustainability at the U.S. EPA* (2011).

in most developed countries not just as the responsibility of government but of a range of institutions in society.³ Leading firms have moved from a culture of resisting regulation to internalizing it and moving beyond compliance in their environmental performance.⁴ Non-profit organizations and collaborative institutions play an increasingly prominent role in finding and promoting solutions. From an initial focus on hierarchical, expert-based regulation, environmental policy in most countries increasingly incorporates economic incentives, information-based approaches, public-private partnerships, and other tools.⁵ At the same time, the resources available to government agencies compared the number of environmental problems they confront are falling. In sum, the innovation imperative common to all organizations is alive and well in environmental policy.

Despite this imperative, innovation as an area of systematic study has drawn only scattered attention from environmental policy practitioners and researchers. To be sure, many studies of specific innovations exist, and several are discussed below. The task of defining and categorizing policy innovation generally, however, has drawn less attention. What types of innovation have been attempted? What have been their objectives? How have they evolved? What explains their success or failure? What are their assumptions and conceptual foundations? What lessons for policy design and implementation may be drawn from them? The purpose of this article is to begin to answer such questions by setting out basics of a framework for describing and studying environmental innovation.

³ On the new public management and the related concept of government reinvention, see Andrew Stark, "What Is the New Public Management?" 12 *Journal of Public Administration Research and Theory* (2002), 137-151; John Kamensky, "Role of the 'Reinventing Government' Movement in Federal Management Reform," 56 *Public Administration Review* (1996), 247-255. For a social and legal theory perspective, see Jan Kooiman, ed., *Modern Governance: New Government-Society Interactions* (1993); Gunther Teubner, "Substantive and Reflexive Elements in Modern Law," 17 *Law and Society Review* (1983), 239-285; and Gunther Teubner, Lindsay Farmer, and Declan Murphy, eds., *Environmental Law and Ecological Responsibility: The Concept and Practice of Ecological Responsibility* (1994).

⁴ Forest Reinhardt, *Down to Earth: Applying Business Principles to Environmental Management* (2000); Daniel C. Esty and Andrew S. Winston, *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage* (2006).

⁵ For discussions, see: Theo de Bruijn and Vicky Norberg-Bohm, eds., *Industrial Transformation: Environmental Policy Innovation in the United States and Europe* (2005); Thomas Dietz and Paul C. Stern, eds., *New Tools for Environmental Protection: Education, Information, and Voluntary Measures* (2002).

This article is organized around the concept of “streams” of environmental innovation. This refers not to specific innovations but to categories of innovations that share characteristics. Among these characteristics are the goals, design, application, and theoretical underpinnings of the innovations. Table 1 lists several identifiable streams of environmental innovation. Within each stream, one may identify specific actions or policies as innovations. Within the emissions trading stream, for example, are the bubble policy, sulfur dioxide allowance trading, and point/non-point water pollution trades. Among the voluntary programs are such specific innovations as the 33/50 program, Energy Star, and WasteWise. Different goals are more or less important among the various streams. Some, such as citizen participation or alternative conflict resolution, are designed mainly to promote policy and agency legitimacy; others—economic incentives or voluntary programs—are justified more on the basis of improved efficiency and effectiveness. For each stream, it is possible to identify a deficiency or need that led to the consideration and adoption of the specific innovations falling within it. In the case of risk-based planning, for example, the need was for a more rational way of setting priorities in the face of a rapidly-expanding policy agenda. By defining these streams of innovations, this article aims to impose some degree of analytical order on the diverse range of activities viewed as environmental innovations and undertaken since the 1970s.

The next section provides a definition of environmental policy innovation and the basis for placing the innovations into streams. After that is a discussion of five of several innovation streams that may be identified since the existing mold for environmental protection was cast in the 1960s and 1970s. The final part draws several conclusions and then discusses the implications for designing, implementing, and evaluating innovations.

Table 1: Illustrative Streams of Environmental Innovation

1. Environmental conflict resolution

Policy dialogues, negotiated rulemaking, site-specific mediation

2. Emissions trading

Offsets, NOx trading, acid rain allowance trade, GHG cap and trade

3. Risk-based planning

Unfinished Business, regional and state comparative risk, budget planning

4. Citizen participation

Superfund community relations, electronic rulemaking, citizen advisory panels

5. Program integration

Integrated analyses, cluster projects, integrated permitting

6. Regulatory and permit flexibility

Project XL, flexible air permits, integrated pulp and paper rules

7. Voluntary programs

Climate Leaders, Performance Track, Energy Star, 33/50

8. Collaborative planning

National Estuaries Program, watershed planning, civic environmentalism

9. Information tools

Toxics Release Inventory, drinking water advisories, risk communication

10. Analytical Tools (which could be broken down into even more specific streams)

Risk assessment, cost-benefit analysis, strategic planning and budgeting

The Concept of Environmental Innovation

The concept of innovation is often studied but not always well-understood. Critical to the concept is that an innovation is seen as something new. In his work on the diffusion of innovations, Everett Rogers describes an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption.”⁶ In a recent book on environmental innovation, Toddi Steelman defines it as “a new program or process for those adopting it.”⁷ Laurence O’Toole takes a process perspective in defining innovation as “patterns of activities to achieve a new goal or improve the pursuit of an existing one.”⁸ In these terms, an innovation is not only perceived as being new but is motivated by the intent to achieve new goals or realize existing ones more effectively. In his excellent study of policies for supporting environmental innovation by business in six countries, David Wallace defines innovation broadly as “any change in technology, production processes or organizational and managerial structure and techniques.”⁹ In this brief sampling, innovation is a combination of perceived newness, the “thing” that is innovative (a process, program, technique, structure, and so on), and an intent to come up with something that is perceived as being new and improves results or performance.

Defining innovation is far less complicated than explaining when and why it occurs and, more importantly, why some innovations persist over time and others fail. In *Implementing Innovation*, Toddi Steelman provides a useful typology of explanations from the social science and public policy literature on the success and durability of innovation. For innovations to succeed over time, there should be a combination of motivated *individuals* in a culture that supports change; of *structures* that promote

⁶ Everett Rogers, *Diffusion of Innovations*, 5th ed. (2003), at 12.

⁷ Toddi A. Steelman, *Implementing Innovation: Fostering Enduring Change in Environmental and Natural Resource Governance* (2010), at 5.

⁸ Laurence O’Toole, Jr., “Implementing Public Innovations in Network Settings,” 29 *Administration and Society* (1997), at 116. Quoted in Steelman, *Implementing Innovation*, at 5.

⁹ David Wallace, *Environmental Policy and Industrial Innovation: Strategies in Europe, the US and Japan* (1995), at 11.

communication, provide incentives, and define a political environment that is amenable to change; and *strategies* that frame problems, draw upon shocks in the system that open windows for change, and use innovation to enhance legitimacy.¹⁰ A key part of her argument is that innovation occurs in the context of larger institutional processes; those processes determine the success and durability of innovation more than the actions of dedicated entrepreneurs, whatever catalytic significance individual change agents may have. Wallace adopts an institutional perspective as well. His argument is that the characteristics of the larger political and regulatory system determine the likelihood that firms will seek out and adopt innovative practices and technologies. In particular, much of the environmental policy literature suggests, the potential for continuous and long-term innovation in the private sector depends on government policies that provide incentives, allow flexibility, build trust with accountability, and reduce uncertainty for firms.¹¹ Innovation in government and public policies thus may affect the potential for innovation in the private sector and throughout the broader policy system.

Innovation is defined here as *institutionalized change in government's policies or practices that is designed to improve outcomes and/or processes or to implement and achieve outcomes more cost-effectively*. The focus is on innovations undertaken since the 1970s, when the current model for environmental protection was established. To be sure, the late 1960s and 1970s were a period of sweeping innovation and change in U.S. environmental policy, and for that matter in most affluent democracies.¹² National

¹⁰ Steelman, at 4.

¹¹ This is a central argument in Daniel J. Fiorino, *The New Environmental Regulation* (2006). Also see Michael Porter and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship" 9 *Journal of Economic Perspectives* (1995), 119-132; Neil Gunningham and Peter Grabosky, *Smart Regulation: Designing Environmental Policy* (1998); Daniel Press and Daniel A. Mazmanian, "Toward Sustainable Production: Finding Workable Strategies for Government and Industry," in Norman J. Vig and Michael E. Kraft, eds., *Environmental Policy: New Directions for the Twenty-First Century*, 7th ed. (2010), 220-243; and Daniel J. Fiorino, "Rethinking Environmental Regulation: Perspectives on Law and Governance," 23 *Harvard Environmental Law Review* (1999), 441-469.

¹² For comparisons, see Miranda Schreurs, *Environmental Politics in Germany, Japan, and the United States* (2002); Martin Janicke and Helmut Weidner, eds., *National Environmental Policies: A Comparative*

Ambient Air Quality Standards (NAAQS) and Environmental Impact Statements (EIS) are two such innovations that were noteworthy in the basic design. For purposes of this article, however, the model created in such laws as the National Environmental Policy Act (1969); Clean Air Act (1970); Federal Water Pollution Control Act (1972); Toxic Substances Control Act (1976) and others of that era are the foundation on which the changes discussed here were built.¹³ In the terms used in the policy literature, these laws were a manifestation of a “punctuated equilibrium” in U.S. environmental policy, while the policy innovations discussed here were an expression of more incremental change.¹⁴

Note that there are several elements to this definition of innovation. The condition of “institutionalized” change requires that a policy or practice go beyond being considered or proposed to being incorporated into government policy. In the language of studies of innovation, it must be adopted. The definition also specifies that there be intent behind the change. The conditions of the definition are that the innovation represents an effort to improve policy outcomes (cleaner air, less waste, safer drinking water) or processes (better data, more participation, more sensible priority-setting) or lead to a desired level of policy outcomes or process quality at less cost. Given that some of the innovations discussed here were adopted for reasons of economic efficiency, it is necessary to include some element of cost-effectiveness in the definition. The concept of “streams” of innovation makes it possible to group related policies or practices that meet the above definition of innovation into discernible categories for study and analysis.

Devising an analytical framework also means having criteria and terminology for describing, comparing, and evaluating environmental innovations. How may one stream

Study of Capacity-Building (1996); Uday Desai, ed., *Environmental Politics and Policy in Industrialized Countries* (2002).

¹³ On environmental laws, see Richard J. Lazarus, *The Making of Environmental Law* (2004). On policy see Mary Graham, *The Morning After Earth Day: Practical Environmental Politics* (1999); J. Clarence Davies, *The Politics of Pollution Control* (1970); Alfred A. Marcus, *Promise and Performance: Choosing and Implementing an Environmental Policy* (1980); Daniel J. Fiorino, *Making Environmental Policy* (1995).

¹⁴ Frank Baumgartner and Bryan Jones, *Agendas and Instability in American Politics* (1993).

of innovations, such as risk-based planning, be distinguished from or compared to others, such as partnerships and voluntary programs or alternative conflict resolution?

One way is by the intended goals. Some kinds of innovations are adopted to improve effectiveness, in the sense of achieving a higher level of a desired outcome. Others focus on efficiency; they are designed to achieve outcomes or implement processes at less cost. In other cases, an innovation is designed to enhance the legitimacy of an agency or process by making them more acceptable to the targets of the policy or others affected by it. Still others are defined by the goal of creating or enhancing capacities for future problem-solving. The description and analysis of the several streams of environmental innovation in this article is based on these four goals: effectiveness, efficiency, legitimacy, and capacity. Many researchers give attention to the first two but neglect the latter two, which are difficult to measure or not viewed as important evaluation criteria. Table 2 defines the four goals.

Table 2: The Goals of Environmental Policy Innovations

<i>Effectiveness</i>	Achieving a higher level of environmental outcomes
<i>Efficiency</i>	Achieving desired environmental outcomes at less cost
<i>Legitimacy</i>	Achieving outcomes in more politically acceptable ways
<i>Capacity</i>	Improving the ability to achieve future environmental outcomes

Each of these innovation streams may be seen as attempts to meet all of the goals to some degree. In most cases, however, it is possible to distinguish one or two primary goals for a given stream, with others being secondary. For example, economic efficiency is almost always cited as the primary goal of using emissions trading. Few observers would associate efficiency with efforts to enhance citizen participation, which often reduces efficiency, at least in the near term. Participation is justified more on the basis of

enhancing the legitimacy of institutions, processes, and outcomes.¹⁵ Secondly, participation also may be justified a way to build capacity for future problem-solving.¹⁶ A potential, often ignored benefit of voluntary programs is that they build a capacity for future problem-solving, especially for issues less amenable to conventional regulation. In this article, the streams are described according to the relative importance of each goal.¹⁷

Streams of Environmental Innovation

This section proposes a way of imposing some order on the array of EPA innovations that have been undertaken over the last four decades. As one would expect, the range of attempted or successful innovations has been large. They reflect all the goals listed above; were aimed at many stages of policy making, from agenda setting to implementation; and grew from many conceptual origins and sources of dissatisfaction with what existed. Their durability and long-term effects have varied, as the comparisons below suggest. The argument here is that grouping specific activities into streams of innovation is useful for comparing and analyzing specific initiatives. The five streams examined in this article are: (1) emissions trading; (2) program integration; (3) risk-based planning; (4) regulatory and permitting flexibility; and (5) voluntary programs. Although most involve actors in addition to EPA, such as state agencies or regulated firms, all five of these innovations focus on actions by EPA and the federal government.¹⁸

¹⁵ Daniel J. Fiorino, "Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms," 15 *Science, Technology, and Human Values* (1990), 226-243.

¹⁶ The concept of institutional capacity at a national level is defined and examined in Helmut Weidner, "Capacity-Building for Ecological Modernization: Lessons from Cross-National Research," 45 *American Behavioral Scientist* (2002), 1340-1368 and Martin Janicke and Helmut Weidner, eds., *Capacity-Building in National Environmental Policy: A Comparative Study of 17 Countries* (2002)..

¹⁷ On the social benefits of innovation see Tomas M. Koontz and Craig W. Thomas, "What Do We Know and Need to Know about the Environmental Outcomes of Collaborative Management?" 66 *Public Administration Review* (2006), 111-121, especially 117.

¹⁸ On state environmental innovations, see Alka Sapat, "Devolution and Innovation: The Adoption of State Environmental Policy Innovations by Administrative Agencies," 64 *Public Administration Review* (2004); 141-151; Barry G. Rabe, "Racing to the Top, Bottom, or the Middle of the Pack: The Evolving State Government Role in Environmental Protection," in Norman J. Vig and Michael Kraft, eds., *Environmental*

Other such streams of innovation could be identified from the past thirty years, as suggested in Table 1.¹⁹ Among these are citizen participation; such analytical methods as cost-benefit and risk analysis; environmental conflict resolution; collaborative planning; and information tools, such as the Toxics Release Inventory. For our purposes, however, the five listed above provide a place to start in defining related categories of innovations, drawing conclusions about the adoption and durability of innovations, and conducting a preliminary assessment of innovation capacities at federal and state levels. Although only five of these many streams are considered in this article, the framework is suggested as a way to describe and assess environmental innovation more generally. Each innovation stream is examined according to its theoretical basis; its definition and evolution; perceived strengths and weaknesses; and its impact on environmental policy.

1. Emissions Trading

The conceptual basis for environmental regulation lies in bureaucratic theory. In an approach John Dryzek terms “administrative rationalism,” government regulators use technical expertise to develop standards, usually based on definitions of “best available technology” or a similar standard, and apply them to sources of pollution.²⁰ Agencies monitor compliance and assign legal penalties to sources that fail to meet the standards and administrative provisions (e.g., reporting and monitoring) associated with them. Typically, the same technology standards typically apply to sources in a defined category, with limited allowances for variations in costs or circumstances. Compliance is defined in either-or terms; that is, the incentive is to meet the standards but not to exceed them.

Policy: New Directions for the Twenty-First Century (2010), 27-50; Mark Stephan and Denise Scheberle, eds., “Innovations in Environmental Policy Regulation and Management,” 44 *American Behavioral Scientist* (2000), 536-711.

¹⁹ A stream is commonly defined as “a steady current of a fluid” or “a trend, course, or drift of opinion, thought, or history.” It suggests that there are identifiable boundaries around the fluids, ideas, or thoughts in the stream and they persist over time and space. Of course, streams dry up, and innovations end. They also may disappear for a time and reemerge when conditions again become favorable.

²⁰ John Dryzek, *The Politics of the Earth: Environmental Discourses*, 2d ed. (1997), 75-98.

In contrast, the foundation for market incentives comes from economic theory.²¹ The goal is to maximize economic efficiency by allowing regulated sources the discretion to determine the least costly methods for meeting the policy objectives. These incentives are provided in many forms: pollution fees, input fees (such as a carbon tax), emissions trading (cap and trade), and deposit-refund, among others. By far, the most significant innovation in U.S. environmental policy has been emissions trading, which is the focus here. It has become firmly established in air quality, is used to some degree in water quality, and has become the centerpiece of a possible U.S. response to climate change. Indeed, after initially being skeptical about emissions trading in the 1970s and 1980s, many environmentalists now embrace cap-and-trade as the best and most politically feasible way of putting a price on carbon. Of all the innovations discussed in this paper, trading has been the most fully implemented and has had the greatest long-term effect.²²

Like most innovations, trading moved from theory to practice as a matter of perceived necessity. In the 1970s, air quality on Southern California exceeded the health-based National Ambient Air Quality Standard for ozone. Under the Clean Air Act, the state could not grant more air permits that would allow emissions to increase. In effect, this would have frozen industrial development. The solution was to allow new emissions only if the source asking for a permit could offset them with at least equivalent reductions from existing sources. (The new source would also have to meet the most stringent technology standards available.) From these relatively simple origins, a variety of trading systems began to emerge in the late 1970s and 1980s.²³ The “bubble” policy

²¹ The classic is Allen V. Kneese and Charles L. Schultze, *Pollution, Prices, and Public Policy* (1975). For a summary of economic incentives, including trading, see Tom H. Tietenberg, “Economic Instruments for Environmental Regulation,” 6 *Oxford Review of Economic Policy* (1990), 17-33; Robert W. Hahn and Gordon L. Hester, “Marketable Permits: Lessons for Theory and Practice,” 16 *Ecology Law Quarterly* (1989) 361-406; and Tom H. Tietenberg, *Emissions Trading: Principles and Practice*, 2d ed. (2006).

²² An excellent overview of trading is Robert N. Stavins, “Market-Based Environmental Policies,” in Paul R. Portney and Robert N. Stavins, eds., *Public Policies for Environmental Protection*, 2d ed. (2000).

²³ For early analyses, see Brian J. Cook, *Bureaucratic Politics and Regulatory Reform: The EPA and Emissions Trading* (1988); Richard A. Liroff, *Reforming Air Pollution Regulation: The Toil and Trouble of*

gave facilities the flexibility to modify controls in specific release points so long as overall emissions met permitted levels. Gradually, markets emerged for brokering trades among different sources. To justify this flexibility environmentally, the rules built in trading ratios, meaning that some emissions had to be retired as part of the trades. The outcome could be justified as more effective, as well as less costly, than a conventional approach.

Applied administratively in the 1980s, trading was codified in the Clean Air Act Amendments of 1990.²⁴ Congress directed that sulfur dioxide (SO₂) emissions be cut in half (some ten million tons) from a 1980 baseline by 2000. The targets of the cuts were large utilities, which had several options, including meeting new emission standards, exceeding them and selling excess emission allowances to other utilities, or not meeting them and buying allowances from someone else. The premise was that sources with high marginal costs would purchase allowances, and those with low costs would be able to create a surplus to sell to others. This would minimize marginal control costs by redistributing them to all sources and reduce the overall costs to society.²⁵ Using trading rather than technology standards is estimated to have saved in the range of a billion dollars.²⁶ The programs' success made trading more credible to groups that previously had been skeptical of trading as granting sources little more than a "license to pollute."²⁷

EPA's Bubble (1986); and Robert Hahn, "Economic Prescriptions for Environmental Policy Instruments: Lessons from the United States and Continental Europe," in Robyn Eckersley, ed., *Markets, the State, and the Environment: Towards Integration* (1995), 129-156.

²⁴ Discussions of acid rain allowance trading are Judith A. Layzer, "Market-Based Solutions: Acid Rain and the Clean Air Act Amendments of 1990," in Layzer, ed., *The Environmental Case: Translating Values into Policy*, 2d ed. (2006), 375-403; Robert N. Stavins, "What Can We Learn from the Grand Policy Experiment? Lessons from SO₂ Allowance Trading," 12 *Journal of Economic Perspectives* (1998), 60-88; Dallas Butrow and Byron Swift, "A New Standard of Performance: An Analysis of the Clean Air Act's Acid Rain Program," 28 *Environmental Law Reporter News and Analysis* (1996), 10411-10423.

²⁵ On differences on marginal control costs associated with trading, see Paul R. Portney and Robert N. Stavins, eds., *Public Policies for Environmental Protection*, 2d ed. (2000), 112-115.

²⁶ Dallas Butrow, Alan Krupnick, Erin Mansur, David Austin, and Deidre Farrell, "The Costs and Benefits of Reducing Acid Rain," Discussion Paper 97-31-REV (Washington, DC: Resources for the Future, 1997).

²⁷ On this argument, see Michael J. Sandel, "It's Immoral to Buy the Right to Pollute (with replies)," in Robert N. Stavins, ed., *Economics of the Environment: Selected Readings*, 5th ed. (2005), 355-358.

As a sign of its durability, a “cap and trade” system became the leading policy option for cutting greenhouse gases in the U.S. The American Clean Energy and Security Act (ACES or Waxman-Markey), passed by the House in June 2009, created a system in which 85% of emission allowances would be allocated and the remainder auctioned. The proportion available by auction would have increased over time. Using 2005 as a baseline, ACES established increasingly tighter targets for cuts in greenhouse gases: 17% by 2020; 42% by 2030; and over 80% by 2050. The value of a permit to emit one ton of carbon was expected to rise as the emissions targets were tightened. The revenue from permit auctions would be used to offset higher energy costs for low-income households, fund climate adaptation, support clean energy research, and other activities. The bill also set national renewable electricity standard and authorized other climate actions, but cap and trade was the centerpiece and the most contested part of the legislation.²⁸ The bill was passed by the House by a seven-vote margin, but did not make it through the Senate.²⁹ Greenhouse gas trading has been adopted regionally in the United States, such as in the Regional Greenhouse Gas Initiative in the several northeast states and in California, as well as in the European Union and other countries.³⁰

Although not as widespread as in the air program, trading also has been applied to water pollution. A promising application is point/non-point trading. The advantage in this case, as with air quality, is minimizing the marginal costs of control across sources. Large, point sources of pollution, such as industrial facilities and sewage treatment plants, have had to meet stringent standards over the last few decades, to the extent that

²⁸ On ACES, see The Pew Center on Global Climate Change (www.pewclimate.org/acesa) Accessed June 3, 2010. On climate politics generally, see Anthony Giddens, *The Politics of Climate Change* (2009).

²⁹ “The Cap and Trade Bill: Waiting for the Other Shoe to Drop,” *The Economist*, September 10, 2009 (available at www.economist.com/node/14419375).

³⁰ Christian Egenhofer, “The Making of the European Emissions Trading Scheme: Status, Prospects, and Implications for Business,” 25 *European Management Journal* (2007), 453-463. On regional trading programs in the U.S. see Michele M. Betsil and Barry G. Rabe, “Climate Change and Multilevel Governance: The Evolving State and Local Roles,” in Daniel A. Mazmanian and Michael E. Kraft, eds. *Toward Sustainable Communities*, 2d ed. (2009), 201-225; Barry G. Rabe, “States on Steroids: The Intergovernmental Odyssey of American Climate Policy,” 25 *Review of Policy Research* (2008), 105-128.

the marginal costs of additional units of pollution reduction are high. The marginal costs are much lower for non-point sources, including agriculture and storm water, which are less amenable to regulation through technology controls.³¹ By focusing reductions on non-point sources, whose actions are funded and facilitated by point sources through trading effluent programs, more reductions are achieved at less cost.³² Effluent trading has drawn attention as a strategy for reducing nutrients in such areas as the Chesapeake Bay, driven by Clean Water Act provisions on Total Daily Maximum Loads (TMDLs).³³

Emission trading has been successful and durable, with an influence that extends beyond the U.S. With an evolution extending over more than three decades, it has illustrated the capacity within the U.S. environmental policy system to learn from experience and the apply lessons learned to the next iteration of policies. A record of results, lower costs, and increasing political acceptability brought trading into the mainstream of U.S. environmental policy. As discussed later, it also rests on a sound theoretical foundation. Of the five innovation streams discussed in this article, trading has proven to be the most durable and has sustained the most current policy relevance. Indeed, the failure to adopt a national cap and trade program in the U.S. in 2009 was attributable more to political opposition to imposing any limits on greenhouse gases than to trading itself. The reality of American politics was such that no policy strategy would likely have drawn enough legislative support to be enacted in the midst of the greatest economic crisis in eight decades.

³¹ On water trading, see Mindy Selman, Suzie Greenhalgh, Evan Branosky, Cy Jones, and Jenny Guiling, *Water Quality Trading Programs: An International Overview* (Washington, DC: World Resources Institute, 2009). This review identified 57 water trading programs, of which 51 were in the U.S.

³² For an assessment, see the *EPA Water Quality Trading Evaluation: Final Report U.S. Environmental Protection Agency* (2008). Available at epa.gov/watershed/trading.htm.

³³ Cy Jones, Evan Bronosky, Mindy Selman, and Michelle Perez, *How Nutrient Trading Could Help Restore Chesapeake Bay*, WRI Working Paper (Washington, DC: World Resources Institute, 2010). On TMDLs, see James Boyd, *The New Face of the Clean Water Act: A Critical Review of the EPA's Proposed TMDL Rules*, Washington, DC: Resources for the Future, Discussion Paper 00-12, 2000).

2. Program Integration

The issue of program integration may be traced to aspects of bureaucratic theory and organization as well as to the incremental features of the U.S. policy system. Complex organizations rely on specialization and division of labor to understand issues, organize expertise, assign responsibility, and complete tasks.³⁴ This is a source of strength as well as weakness in bureaucratic organization. Given the complexity of environmental issues, breaking problems and strategies into manageable pieces was a logical strategy. Reinforcing this tendency to simplify complex problems was the nature of policy change in the U.S. Although the “environmental decade” of the 1970s represented a period of rapid change, it did not emerge in the form of an overall strategy for addressing issues comprehensively. As issues emerged on the policy agenda (i.e., first air and water pollution, then toxic chemicals, hazardous wastes and others) and political coalitions formed in response, legislative and bureaucratic strategies emerged piecemeal. The result was a highly fragmented environmental policy system that persists to this day.

This fragmentation has been a recurring source of dissatisfaction. When it was passed in 1969, the National Environmental Policy Act (NEPA) was seen by many observers as an integrating statute. It established the “environment” holistically as a subject of national concern and a responsibility of the federal government.³⁵ Similarly, creating the EPA in the 1970s was viewed a major step toward program integration.³⁶ Established by executive order, the EPA reorganization consolidated functions from the Departments of Health, Education, and Welfare (air), and Interior (water), and Agriculture (pesticides), and the Atomic Energy Commission (radiation), among others.

³⁴ H.H. Gerth and C. Wright Mills, eds. *From Max Weber, Essays in Sociology* (1946), 196-244. Also see Herbert A. Simon, *Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations*, 4th ed. (1997).

³⁵ The case for making the environment a focus for public policy was set out in Lynton Caldwell, “Environment: A New Focus for Public Policy?” 23 *Public Administration Review* (1963), 132. ON NEPA, see Lynton Keith Caldwell, *The National Environmental Policy Act: An Agenda for the Future* (1998).

³⁶ Lakshman Guruswamy, “Integrated Thoughtways: Reopening of the Environmental Mind?” 1989 *Wisconsin Law Review* (1989), 463-527.

William Ruckelshaus, EPA's first administrator, decided early on to follow the medium-based organization reflected in the statutes rather than a functionally-based approach.³⁷ He decided that it was more important at the time to demonstrate a capacity for action, especially in enforcement, than to devote time and resources to a major reorganization.³⁸

Three laws once seen as paths to integration—NEPA, the Toxic Substances Control Act (TSCA), and the Pollution Prevention Act (PPA)—have not fulfilled that role. NEPA encourages federal agencies to look holistically at the environment and establishes requirements for Environmental Impact Statements, but it lacks a direct connection with the regulatory decisions that drive the pollution control system. TSCA has hardly been used as a gap-filler, let alone an integrating statute, largely because of its limitations, especially with respect to existing chemicals issues.³⁹ More a set of principles and goals than a source of regulatory authority, the PPA of 1990 has not been able to compete with the mainstream regulatory laws. In contrast to other developed countries, the U.S. lacks an integrated environmental statute.⁴⁰ For example, comprehensive environmental planning in the Netherlands and integrated pollution control in Sweden and the United Kingdom are cited in the literature for their higher capacities for program integration.⁴¹

³⁷ Alfred A. Marcus, *Promise and Performance: Choosing and Implementing an Environmental Policy* (1980). On government organization and policy before 1970, see J. Clarence Davies, III, *The Politics of Pollution* (1970), 98-144. On the early issues associated with fragmented policy making, see J. Clarence Davies and Barbara S. Davies, *The Politics of Pollution*, 2d ed. (1975). The concept of a "medium-based" statute refers to the environmental medium or pathway in which problems are defined, such as air, water, waste and chemicals.

³⁸ For an analysis of EPA's structure, see Alfred A. Marcus, "EPA's Organizational Structure," 54 *Law and Contemporary Problems*, 5-40.

³⁹ On the limitations in TSCA, see J. Clarence Davies, "Some Thoughts on Implementing Integration," *Environmental Law*, 22 (1992), 139-147, at 140.

⁴⁰ The feasibility of using existing statutes as an integrating strategy is discussed in J. Clarence Davies, "Some Thoughts on Implementing Integration," 22 *Environmental Law* (1992), 139-147. On states, see Barry G. Rabe, *Fragmentation and Integration in State Environmental Management* (1986).

⁴¹ See the country studies in Nigel Haigh and Frances Irwin, *Integrated Pollution Control in Europe and North America* (1990), especially Don Hinrichsen, "Integrated Permitting and Inspection in Sweden," 151-168; Susan Owens "The Unified Pollution Inspectorate and Best Practicable Environmental Option in the United Kingdom," 169-108; and Graham Bennett, "Policy Planning in the Netherlands," 212-241; On policy integration as it relates to sustainability, see Andrew J. Jordan and Andrea Lenschow, eds. *Innovation in Environmental Policy? Integrating the Environment for Sustainability* (2008).

Several specific innovations have been attempted over the years to overcome this fragmentation. All have come from within EPA; Congress has rarely been interested in addressing an issue that is so firmly rooted in the legal framework. These efforts reached a peak in the late 1980s and 1990s; as with many innovations, interest fell off after 2000. At times, EPA has attempted to overcome the statutory constraints by integrating on the basis of chemicals, industry sectors, and geography.⁴² Probably the most successful effort at integrating by chemical was the multi-media lead strategy adopted in 1991.⁴³ It set out explicit goals for reducing lead risks and drew upon several laws and programs in addressing a complex issue. With EPA support, the Conservation Foundation developed two versions of a model integrated environmental statute in the late 1980s and early 1990s.⁴⁴ At about the same time, the agency experimented with a series of regulatory “clusters” that were aimed at integrating (or at a minimum, coordinating) actions that could be linked on the basis of chemical, affected resource, industry sector, or other principle. The goal was to establish shared definitions of the problems associated with each cluster and draw upon the available resources more systematically in solving them. In the mid-1990s, the Common Sense Initiative (CSI) was created in part to reorient policies and actions on the basis of industry sector more than environmental medium.⁴⁵

⁴² Jurgen Schmandt, “Managing Comprehensive Rule Making: EPA’s Plan for Integrated Environmental Management,” 45 *Public Administration Review* (1985), 309-318.

⁴³ U.S. Environmental Protection Agency, *Strategy for Reducing Lead Exposures* (Washington, D.C., February 21, 1991). Odelia Funke, “Struggling with Integrated Environmental Policy: The EPA Experience,” 12 *Review of Policy Research* (1993), 137-161.

⁴⁴ Discussed in Frances H. Irwin, “An Integrated Framework for Preventing Pollution and Protecting the Environment,” 22 *Environmental Law* (1992)1-76, at 25. On the U.S. experience in particular, see Terry Davies, “The United States: Experimentation and Fragmentation,” in Haigh and Irwin, *Integrated Pollution Control*, 51-66. The two model statutes were the Environmental Protection Act and the Environmental Information and Integration Act, both drafted at the Conservation Foundation in the late 1980s.

⁴⁵ On the Common Sense Initiative (CSI) see Cary Coglianese and Laurie K. Allen, “Building Sector-Based Consensus: A Review of the US EPA’s Common Sense Initiative,” in de Bruijn and Norberg Bohm, *Industrial Transformation*, 65-92. The six industry sectors were metal finishing, iron and steel, computers and electronics, auto manufacturing, printing, and petroleum refining. EPA also created a Sectors Strategies Division to continue work on sector approaches. This was cancelled by the new administration in 2009.

Although these programs encouraged issue and time-specific progress toward integration, none overcame the constraints of the fragmented legal framework. Nor could they offset the existing bureaucratic implementation and congressional oversight systems. Program integration at EPA has been an ad hoc response to perceived needs for coordination at specific points in time for particular set of issues; it has not achieved long-term, structural change or displayed entrenched legal and institutional frameworks.

In contrast to the record with emissions trading, the program integration stream has shown little staying power. Advocates were never able to make a convincing case to the congressional oversight committees that the deficiencies of the existing, medium-based statutory framework were serious enough to justify change. Once established, legislative and bureaucratic arrangements have proven difficult to change. The EPA “stovepipes” became entrenched in agency operations and culture and in relationships with state agencies. Although integration efforts on such specific issues as groundwater and lead yielded modest, short-term success, they were not institutionalized. At this point, there is little interest in addressing integration, from EPA or Congress.⁴⁶ In recent years, a constituency for achieving more integration across programs is lacking, and such issues are rarely reflected in the EPA’s internal agenda, especially in the atmosphere of highly-charged conflicts that have characterized recent American environmental politics.

3. Risk-Based Planning

The origins of risk-based planning lie with the emergence of a tool—quantitative risk assessment—and the perceived need to rationalize a rapidly-growing environmental policy agenda in the 1980s. Risk assessment emerged in the late 1970s and the 1980s as

⁴⁶ Although perhaps one possible sign of an interest in program integration may be found in a report that the EPA commissioned from the National Academies of Sciences. Although integration is not a major theme in the report, sustainability is an inherently integrating discourse. See National Research Council, *Sustainability and the U.S. EPA* (2011). This topic also is explored in Shari K. Gossarth and Alan D. Hecht, “Sustainability at the U.S. EPA,” 30 *Ecological Engineering* (2007), 1-8.

a powerful tool for improving the factual bases of environmental policy. Its most obvious and important application is in making regulatory decisions.⁴⁷ Having quantitative estimates of risk allows policy makers to determine the likely level of harm presented by problems and whether government should intervene. It defines a quantitative metric for decisions that is based in an empirical understanding of threats to health and ecology.

The innovation stream in this case is the use of risk information to set priorities. Risk-based planning, also termed comparative risk analysis, was part of a second environmental policy “epoch” in which policy makers wanted to rationalize processes for setting priorities and allocating resources among them.⁴⁸ In effect, agencies wanted to gain more control over their policy agendas in the face of a growing list of problems. As always, political factors prepared the ground for and created the demand for innovation. The resignations of the initial Reagan administration appointees at EPA in 1983 led to the return of William Ruckelshaus, the agency’s first and now fourth administrator, whose goal was to restore EPA’s credibility and effectiveness. A centerpiece of the second Ruckelshaus term was bringing the concept of risk into policy making. In particular, he drew upon the risk assessment/risk management model set out by the National Academy of Sciences in an influential 1983 report.⁴⁹ It distinguished the more neutral, science-based process of quantitatively describing risk (assessment) from the arguably more value-based, political process of deciding what to do about risk (the management phase).

The application of risk as a metric for making regulatory decisions evolved in the 1980s into a means of setting priorities. The list of environmental problems to which

⁴⁷ Richard N.L. Andrews, “Risk-Based Decision Making: Policy, Science, and Politics,” in Norman J. Vig and Michael E. Kraft, eds., *Environmental Policy in the Twenty-first Century*, 6th ed. (2005), 215-238.

⁴⁸ Discussed as an example of conceptual learning in Daniel J. Fiorino, “Environmental Policy as Learning: A New View of an Old Landscape,” 61 *Public Administration Review* (2001), 322-334. The concept of environmental policy epochs comes from Daniel A. Mazmanian and Michael E. Kraft, *Toward Sustainable Communities: Transition and Transformations in Environmental Policy*, 2d ed. (2009), 3-32.

⁴⁹ National Academy of Sciences, *Risk Assessment in the Federal Government: Managing the Process* (1983). Also see William D. Ruckelshaus, “Risk, Science, and Democracy,” 1 *Issues in Science and Technology* (1985), at 19.

government was expected to give attention had grown rapidly since 1970. From an initial focus on large air and water pollution sources and chemicals, the agenda now included such problems as abandoned hazardous waste sites, stratospheric ozone depletion, habitat loss, residential radon, household chemicals, and global warming. In particular, many regulators thought that hazardous waste issues were drawing more resources and attention than problems that empirically were posing higher health and ecological risk.⁵⁰ Later in the 1980s, EPA Administrator William Reilly compared environmental agenda setting to a video game of “Space Invaders,” in which, “whenever you see an enemy ship on the screen, you blast at it with both barrels—typically missing the target at least as often as you hit it...The last two decades of environmental policy in this country have been similar in some ways to that video game...”⁵¹ Political institutions typically react to problems piecemeal without an overall sense of priority. Risk-based planning responded to the perceived need for better priority-setting and more efficient use of resources.⁵²

The innovations that made up this stream came in stages. The pace-setter was a national comparative risk ranking issued as the *Unfinished Business* report of 1987. EPA commissioned agency and outside experts, in four groups, to rank thirty-one problems on the basis of cancer health, non-cancer health, ecological, and welfare risks.⁵³ That was followed by a series of regional, state, and local comparative risk projects in the late 1980s and early 1990s. At the same time, the EPA and other agencies were incorporating the concept and metrics of risk into internal planning and budgeting. The explicit goal was to direct more resources to problems that, empirically, posed higher risks. The obverse, of course, is that problems seen as posing less risk then receive fewer resources.

⁵⁰ On regulatory priorities at this stage (the 1980s) in EPA’s history, see Marc K. Landy, Marc J. Roberts, and Stephen R. Thomas, *The Environmental Protection Agency: Asking the Wrong Questions* (1990).

⁵¹ William K. Reilly, “Aiming Before We Shoot: the Quiet Revolution: in Environmental Policy.” Address to the National Press Club, September 26, 1990. Available at www.epa.gov/history/topics/risk/.02htm.

⁵² Daniel J. Fiorino, “Can Problems Shape Priorities? The Case of Risk-based Environmental Planning,” 50 *Public Administration Review* (1990), 82-90.

⁵³ U.S. Environmental Protection Agency, *Unfinished Business: A Comparative Assessment of Environmental Problems* (1987).

The national and regional risk projects suggested that existing agency priorities did not always match the evidence regarding relative risk. Highly-ranked health risks included radon and indoor air pollution, household chemicals, pesticides, conventional air pollution, and drinking water contaminants. Highly-ranked among ecological risks were stratospheric ozone depletion, global warming, alteration of aquatic habitat (e.g., wetlands), non-point source water pollution, and effects of mining, oil, and gas wastes. Risk-based planning received a boost from EPA's Science Advisory Board in 1990; it not only endorsed the concept but the logic underlying the various risk ranking projects.⁵⁴

A further round of projects, conducted at the state and local levels, applied the overall methodology but added an element of citizen participation and engagement. The state projects in particular incorporated a large degree of public participation, including citizen advisory boards, public meetings and hearings, and media outreach. The state and regional projects also went beyond priority-setting by proposing management strategies for highly-ranked risks. They based the strategies on evaluations of EPA's legal authority, the feasibility and costs of controls, and public perceptions of problems.⁵⁵

If asked, sponsors of risk-based planning would probably name capacity and efficiency as their primary goals. The capacity goal is reflected in the desire to bring risk analysis into planning as a basis for more rational decisions. The efficiency goal is promoted by targeting resources on problems that pose more health and ecological threat, leading to more risk reduction for the resources expended. There also is a case to be made for the goal of legitimacy, given that citizen participation was incorporated into the state and local projects, and that having an empirical basis for allocating scarce resources would earn greater public confidence. These state and local projects aimed not only to integrate risk analysis into priority setting but to involve communities. To this

⁵⁴ U.S. Environmental Protection Agency, Science Advisory Board, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990).

⁵⁵ See Daniel J. Fiorino, *Making Environmental Policy* (1995), 160-165.

day, the state and local projects constitute one of the more thoughtful efforts by the EPA or any federal agency to engage the public in upstream (i.e., earlier in decision making) policy making.⁵⁶

On the surface, risk-based planning did not face as much political opposition as some of the other innovation streams discussed here. Yet there were reservations from some quarters, and these probably helped to undermine support for the concept after the presidential transition of 1993.⁵⁷ To its critics, risk analysis was seen as justification for not taking or delaying action when there was empirical uncertainty about levels of risk. One concern was the prospect of “paralysis by analysis” in making regulatory decisions.⁵⁸ Another was that risk-based planning would substitute elite, technocratic preferences for priorities that had been defined through the political process. Among environmentalists, there was suspicion that risk assessment increased the factual burdens of regulatory “proof” and this would spill over into processes for priority setting. The worry generally has been that injecting risk estimates into priority setting imposes too high a regulatory burden of proof on agencies, in opposition to the “precautionary principle” favored by many environmental advocates, which urges action in the face of scientific uncertainty.⁵⁹

The long-term effects of risk-based planning did not match the high expectations that emerged around the national, regional, and state/local projects. Interest declined in the transition from William Reilly to his successor in Bill Clinton’s term, Carol Browner.

⁵⁶ An excellent resource on comparative risk and its application in government is J. Clarence Davies, ed., *Comparing Environmental Risks: Tools for Setting Government Priorities* (1996).

⁵⁷ For a skeptical note on risk-based planning, see James E. Krier and Mark Brownstein, “On Integrated Pollution Control,” 22 *Environmental Law* (1992), 119-138 and Robert V. Percival, Risk Assessment and the Mission of the Environmental Protection Agency,” Testimony before the Joint Hearing of the Subcommittee on Environment, Energy, and Natural Resources and Subcommittee on Legislation and National Security of the Committee on Government Operations (February 1, 1994).

⁵⁸ A tactic employed by critics of regulation is to use requirements for risk assessments to tie up the regulatory process and curtail rulemaking, most notably in the “Contract with America” in the mid-1990s. See Michael E. Kraft, “Environmental Policy in Congress,” in Norman J. Vig and Michael E. Kraft, eds., *Environmental Policy: New Directions for the Twenty-First Century*, 7th ed. (2010), 110-111.

⁵⁹ Robert F. Durant, “The Precautionary Principle,” in Robert F. Durant, Daniel J. Fiorino, and Rosemary O’Leary, eds., *Environmental Governance Reconsidered: Challenges, Choices, and Opportunities* (2004), 105-143.

The most serious attempt to infuse risk-based thinking into EPA priority-setting after that came in the late 1990s, when the planning and analysis staff within the budget office required risk justifications from program offices and matched risk data against funding for various programs.⁶⁰ This exercise, however, has had limited effects on funding decisions. By 2011, it is fair to say that risk-based planning has had, at best, a marginal and ad hoc effect on planning and decisions, except perhaps at the margins of choice.

4. Regulatory Flexibility

This stream of innovations emerged as a response to the design and operation of the national system for environmental regulation in the U.S. It reflected several trends in the 1990s. One was dissatisfaction with the costs, adversarialism, and lack of adaptability of the system that had been adopted in the 1970s. Unlike most of the earlier critics, who challenged the existence or stringency of regulation, these “revisionist” critics were concerned that the regulatory system was not keeping pace with changes in environmental problems and economic conditions.⁶¹ A second trend was a political climate that had become skeptical of regulation. The 1994 congressional elections yielded a Republican majority that led, especially in the House of Representatives, to a conservative backlash against the environment.⁶² Third was the increasing interest, as a result of the 1992 Earth Summit in Rio de Janeiro, in environmental sustainability. In the Rio’s wake, for example, the Clinton administration created a President’s Council for Sustainable Development, many firms launched sustainability programs, and non-

⁶⁰ See, for example, the statement of Al McGartland, from EPA’s Office of Policy, Economics, and Innovation, before the Senate Committee on Environment and Public Works, October 3, 2000, for a nuanced discussion of the role of comparative risk analysis in budgeting and priority-setting.

⁶¹ The revisionist critics—supporters of environmental values and programs but favoring new approaches—are discussed in Fiorino, *The New Environmental Regulation*, 121-155. The best policy-level expression of this perspective is William D. Ruckelshaus, “Stepping Stones,” 15 *Environmental Forum* (1998), 30-36.

⁶² Michael E. Kraft, “Environmental Policy in Congress,” in Norman J. Vig and Michael E. Kraft, eds., *Environmental Policy: New Directions for the Twenty-First Century*, 7th ed. (2010), 99-124, at 109.

government organizations stressed a sustainability theme.⁶³ A fourth trend was a “Reinventing Government” initiative launched by the administration in the mid-1990s.⁶⁴

Regulatory flexibility probably is the most politically charged of the innovation streams discussed in this article. To many environmentalists, it poses direct challenges to the stringency and effectiveness of the regulatory system that had been built up over the preceding decades.⁶⁵ For them, *flexibility* was a cover word for *rollback*, and reinvention was little more than an attempt to capitalize on anti-regulatory sentiment that had been brewing for decades. That this innovation stream was so contested politically made it vulnerable to the swings from the Clinton, to the Bush, to the Obama administrations from 1993 to 2009.⁶⁶ What began as a “third-way” group of innovations under President Bill Clinton in the mid-1990s had, by the end of the polarized Bush years, become a symbol to many environmentalists of the decline of the environmental regulatory state.

By far the most visible and revealing of the innovations within this stream was Project XL. Shorthand for *Project Excellence and Leadership*, this initiative directly confronted the long-standing criticism that rigidity and fragmentation in regulation were, at times, impeding progress. The premise for XL was not that regulation was unnecessary or even too stringent, but that it was poorly designed and applied. XL’s conceptual foundations could be found not in conservative or anti-regulatory think tanks but among politically moderate environmental officials and reformers. Among the

⁶³ President’s Council for Sustainable Development, *Sustainable American: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future* (1996).

⁶⁴ Several environmental initiatives were announced by the White House in March 1996. See Bill Clinton and Al Gore, *Reinventing Environmental Regulation* (1996). For an assessment, see U.S. Government Accountability Office, *Challenges Facing EPA’s Efforts to Reinvent Environmental Regulation* (July 1997). A list of EPA reinvention initiatives may be found in Appendix I of this report. Also see Walter A. Rosenbaum, “Escaping the Battered Agency Syndrome: EPA’s Gamble with Regulatory Reinvention,” in Norman J. Vig and Michael E. Kraft, eds. *Environmental Policy: New Directions for the Twenty-First Century*, 4th ed. (2000), 165-189.

⁶⁵ A critique is Rena Steinzor, “Reinventing Environmental Regulation: The Dangerous Journey from Command to Self-Control,” 22 *Harvard Environmental Law Review* (1998), 103-.

⁶⁶ Daniel J. Fiorino, “Regulating for the Future: A New Approach for Environmental Governance,” in Daniel A. Mazmanian and Michael E. Kraft, eds. *Toward Sustainable Communities: Transition and Transformations in Environmental Policy*, 2d ed. (2009), 63-86.

advocates of more flexible regulation were the President's Council for Sustainable Development; Progressive Policy Institute (the policy arm of the Democratic Leadership Council); National Academy of Public Administration; and Aspen Institute.⁶⁷ Among the high-profile supporters of a third way for environmental regulation were Vice-President Al Gore, Administrator Carol Browner, and former Administrator William Ruckelshaus, all of whom held strong, pro-environmental records.⁶⁸ As former EPA official Karl Hausker has written, "it would be supremely ironic if the hundreds of participants in the next generation policy forums had come up with a recipe for environmental disaster, despite their commitments to, and credentials in, environmental protection."⁶⁹ Despite such support, reinvention initiatives such as Project XL aroused suspicions among some environmentalists as a source of the unraveling of the environmental regulatory state.

Project XL invited regulated facilities to propose changes in the rules that would allow them to achieve better environmental results. It was a simple quid pro quo, in which flexibility would be exchanged for measurably better performance. The XL story has been recounted many times.⁷⁰ The topics of interest here are its conceptual

⁶⁷ An excellent resource on the case for innovation in the 1990s is the three reports of the National Academy of Sciences: *Setting priorities, Getting Results: A New Direction for the Environmental Protection Agency* (1995); *Resolving the Paradox of Environmental Protection: An Agenda for Congress, EPA, and the States* (1997); and *environment.gov: Transforming Environmental Protection in the 21st Century* (2000). For an example of the Progressive Policy Institute's point of view, see the "Statement by Debra Knopman to the Democratic Platform Committee" (St. Louis, MO, July 6, 2000; available at <http://www.dlc.org/ppi> (accessed February 6, 2010)). The Aspen Institute report is *A Call to Action: Building a Performance-Based Environmental Protection System* (2007). Also see Donald F. Kettle, ed., *Environmental Governance: A Report on Next Generation Environmental Policy* (2002) and Marc A. Eisner, *Governing the Environment: The Transformation of Environmental Regulation* (2006).

⁶⁸ An example is William D. Ruckelshaus, "Stepping Stones," 15 *The Environmental Forum* (1998), 30-36.

⁶⁹ Karl Hausker, *The Convergence of Ideas on Improving the Environmental Protection System* (Washington, D.C.: Center for Strategic and International Studies, 1999), n. 4.

⁷⁰ For discussions and assessments of Project XL, see Alfred A. Marcus, Donald A. Geffen, and Ken Sexton, *Reinventing Environmental Regulation: Lessons from Project XL*; Bradford C. Mank, "The Environmental Protection Agency's Project XL and Other Regulatory Reform Initiatives: The Need for Legislative Authorization," 25 *Ecology Law Quarterly* (1998), 1-88; Dennis D. Hirsch, "Bill and Al's XL-ent Adventure: An Analysis of the EPA's Legal Authority to Implement the Clinton Administration's Project XL," *University of Illinois Law Review* (1998), 129-172; and, more generally, Magali Delmas and Ann Terlak, "Voluntary Agreements for the Environment: Institutional Constraints and Potential for Innovation," in Kurt Deketelaere and Eric Orts, eds., *Environmental Contracts: Approaches to*

foundations, the assumptions behind it, and the reasons for its success or failure. To a large degree, its origins may be traced to the core ideas of reinvention, which assert that characteristics of bureaucracy as it evolved over the years are responsible for many of the failures that have been associated with government. The reinvention critique was that agencies were more focused on rules, standardization, constraints, and procedures than on missions and results.⁷¹ A precept of reinvention was that regulatory agencies and the organizations they regulate should be given more discretion in adapting to situations as they exist on the ground. Project XL fit this mindset perfectly. It invited companies and other organizations to propose modifications in regulations that would lead to improved environmental performance at less cost, based on their “on-the-ground” knowledge.

The program continued through the remainder of the Clinton term. Eventually 51 specific projects were authorized. Some served as demonstrations for regulatory changes that were adopted more widely. Many were one-time changes that were not extended or replicated beyond the specific project. EPA found that it was difficult, from a political and legal perspective, to justify deviations from its own rules or to allow flexibility within the context of its often highly-specific statutes. Some environmental groups challenged the intent and justification for the idea of regulation by exception, especially when they were perceived as a threat to the stringency of the existing regulatory system and to their leverage. The Bush administration demonstrated little interest in Project XL, and the program eventually was terminated as the projects came to a conclusion in 2003.⁷²

Another innovation that may be associated with the regulatory flexibility stream, and that may have staying power, is flexible air permits. Permitting is a core process in

Environmental Innovation in the United States and Europe (2000), 349-367; and Daniel J. Fiorino, “Toward a New System of Environmental Regulation,” 26 *Environmental Law* (1996), 249-265.

⁷¹ For an analysis, see Eugene Bardach and Robert Kagan, *Going by the Book: The Problem of Regulatory Unreasonableness*, 2d ed. (2002)

⁷² *Project XL Comprehensive Report* (Washington, D.C.: Office of Policy, Economics, and Innovation, 2002).

environmental regulation, yet it has been remarkably resistant to reform.⁷³ Permits are vehicles for translating standards into practical, enforceable limits and applying them to individual or groups of sources. They also are among the most resource-intensive of the regulatory functions assigned to state agencies, which issue over ninety-percent of all environmental permits.⁷⁴ A major issue is the time and uncertainty involved in permitting, especially when facilities need approval for new processes in response to customer demands and must implement changes on tight production schedules.⁷⁵ For conventional permits, process changes typically require permit modifications and regulatory approvals. Flexible permits differ by allowing sources to operate within limits that are more stringent but also more flexible; permitted sources may make limited operational changes, as defined in the permit, without having to obtain prior approval from regulatory agencies.

Starting in the late 1990s, EPA developed several such permits on a pilot basis. It found that they encouraged emission reductions and pollution prevention that exceeded the provisions of the existing permits. They also helped sources operate more efficiently by reducing the time and uncertainty in changing processes. A third benefit was reducing administrative burdens on regulators by not requiring so many permit modifications.⁷⁶ After several pilots and an evaluation of flexible air permits in 2001-2002, EPA began an effort to codify flexible air permitting in regulations. The final rule was signed on

⁷³ Terry Davies, *Reforming Permitting* (2001).

⁷⁴ Barry G. Rabe, "Racing to the Top. Bottom, or the Middle of the Pack? The Evolving State Government Role in Environmental Protection," in Norman J. Vig and Michael E. Kraft, eds., *Environmental Policy: New Directions for the Twenty-First Century* (2010), 29. States also complete more than 90% of enforcement actions and collect almost 95% of environmental data used by the federal government. *Ibid.*

⁷⁵ For a discussion of this issue in the semiconductor industry, see Jan Mazurek, *Making Microchips: Policy, Globalization, and Economic Restructuring in the Semiconductor Industry* (2003). The need for more rapid permits approvals was the factor behind some of the Project XL initiatives discussed above. A Prime example is the project with the Intel Corporation. See "Excellence, Leadership, and the Intel Corporation: A Study of EPA's Project XL," in the National Academy of Public Administration, *Resolving the Paradox of Environmental Protection* (1997), 75-97.

⁷⁶ U.S. Environmental Protection Agency, *Evaluation of Implementation Experiences with Innovative Air Permits* (Offices of Air Quality Planning and Standards and Policy, Economics, and Innovation (2004).

January 13, 2009. After a review by the incoming administration in early 2009, this rule was released unchanged in September 25 2009;⁷⁷ the number of flexible permits was expected to increase as more staff become experienced in developing them. Flexible permits thus illustrate a successful innovation that is currently being implemented. It may be that the more specific boundaries around flexible air permitting as an innovation made it more politically acceptable than the broader, more generic scope of Project XL.

The highly contested innovations in this stream are the most obvious casualties of the polarization that has characterized environmental politics in the last decade. Although there were critics of this innovation stream in the 1990s, even while the EPA was in Democratic hands, the core idea of flexibility applied selectively was endorsed by many strong supporters of the environment. In Congress, members of both parties had proposed “second generation” legislation granting discretion to the EPA to use more flexible, performance-based tools.⁷⁸ By the 2000s, interest in such approaches was gone, overshadowed by the more fundamental political conflicts over environmental policy, especially after the 2010 elections, when the House switched to a Republican majority.

5. Partnerships and Voluntary Initiatives

The greater use of partnerships and voluntary initiatives in environmental policy since the early 1990s shares many characteristics with the preceding innovation stream. The political climate for regulation was generally hostile or wrapped up in congressional gridlock; supporters of environmental values were frustrated with limits in conventional regulation; business wanted to be able to make or claim progress without new regulation.

These factors, however, do not fully explain the interest in voluntary initiatives and partnerships. What was apparent by the late 1990s was that many countries and

⁷⁷ The final rule is available at www.epa.gov/NSR/documents/FinalRule2009.pdf.

⁷⁸ For example, see Richard Stewart, “A New Generation of Environmental Protection?” 29 *Capital University Law Review* (2001), 21.

levels of government were pursuing non-regulatory, collaborative action as a means of complementing, preparing for, or even displacing regulation.⁷⁹ Japanese environmental policy, for example, was built largely on the basis of local agreements adopted in the context of national policy.⁸⁰ European countries moved toward greater use of voluntary action and negotiated agreements through the 1990s.⁸¹ At local and state levels in the U.S., collaborations focused on watersheds and habitat have drawn attention in recent decades.⁸² Dewitt John's concept of "civic environmentalism" aimed to capture the increasing uses of bottom-up, improvised, place-based approaches.⁸³ Voluntary programs respond to the recognized deficiencies in conventional regulatory approaches.

Of the streams of innovation discussed in this paper, the conceptual foundations of voluntary initiatives and partnerships are probably the least developed and coherent. These innovations have proven to be difficult to define by researchers and practitioners alike. To be sure, shared characteristics come to mind. The *voluntary* aspect means that participation in these innovations is not legally required and occurs at the discretion of the participants. The *collaborative* aspect suggests the opportunity for diverse interests to cooperate in achieving shared goals. The idea of *partnerships* is that there is a formal

⁷⁹ Richard D. Morgenstern and William A. Pizer, *Reality Check: The Nature and Performance of Voluntary Environmental Programs in the United States, Europe, and Japan* (2007); Dinah H. Koehler, "The Effectiveness of Voluntary Environmental Programs—A Policy at the Crossroads?" 35 *Policy Studies Journal* (2007), 689-722; Peter deLeon and Jorge Rivera, eds., *Voluntary Environmental Programs: A Policy Perspective* (2009).

⁸⁰ Eric Welch and Akiri Hibiki, "An Institutional Framework for Analysis of Voluntary Policy: The Case of Voluntary Pollution Prevention Agreements in Kita, Kyushu, Japan," 46 *Journal of Environmental Planning and Management* (2003), 523-543; Welch and Hibiki, "Japanese Voluntary Agreements: Bargaining Power and Reciprocity as Contributors to Effectiveness," 35 *Policy Sciences* (2002), 401-424.

⁸¹ There is a substantial literature on voluntary environmental initiatives in Europe. See, for example, Edoardo Croce, ed., *The Handbook of Voluntary Environmental Agreements: Design, Implementation and Evaluation Issues* (2005); de Bruijn and Norberg-Bohm, *Industrial Transformation*; and David E. Grimeand, "Convergence or Divergence in the Use of Negotiated Environmental Agreements in U.S. and European Environmental Policy," in Norman J. Vig and Michael G. Faure, eds., *Green Giants: Environmental Policies of the United States and European Union* (2001), 159-181.

⁸² Tomas M. Koontz, Toddi A. Steelman, JoAnn Carmin, Katrina Smith Korfmacher, Cassandra Moseley, and Craig W. Thomas, *Collaborative Environmental Management: What Roles for Government?* (2004).

⁸³ Dewitt John, *Civic Environmentalism: Alternatives to Regulation in States and Communities* (1994); Dewitt John, "Civic Environmentalism," In Durant, Fiorino, and O'Leary, *Environmental Governance Reconsidered*, 219-254.

agreement to act in specified ways and to meet expectations that are mutually defined.⁸⁴ These terms, however, provide a listing of shared characteristics rather than a useful conceptual foundation.

Reflecting this disjointed foundation, voluntary programs take many forms. Potoski and Prakash have set out a theoretical basis for one type, known as “green clubs.” These induce members “to produce positive social externalities beyond what government regulations require them to produce.”⁸⁵ Green clubs accomplish this by providing benefits to members that are unavailable to non-members. These excludable benefits usually consist of recognition, access to information, and preferential treatment. Benefits also are non-rival; making them available to one member of the club does not make them unavailable to others. Many clubs, such as certification for environmental management systems (ISO 14001) or business-NGO codes of conduct (the Forest Stewardship Council) do not involve government directly. Others do.⁸⁶ Examples of EPA-sponsored green clubs created in recent decades include 33/50, Wastewise, Climate Leaders, the National Environmental Performance Track, Energy Star, and WaterSense.⁸⁷

Two issues affect the credibility of green clubs: (1) Do they limit free-riding? (2) Do they avoid or minimize shirking? Sponsors of green clubs limit shirking and minimize free-riding by requiring third-party auditing of qualifications and performance, public disclosure of member conformance with program criteria, and sanctioning mechanisms, such as removal. What Potoski and Prakash term *weak sword* clubs include just the first;

⁸⁴ These features are discussed in more detail in Daniel J. Fiorino, *Voluntary Initiatives, Regulation, and Nanotechnology Oversight: Charting a Path* (Woodrow Wilson International Center for Scholars, 2010).

⁸⁵ Matthew Potoski and Aseem Prakash, eds., *Voluntary Programs: A Club Theory Perspective* (2009), 20.

⁸⁶ See Potoski and Prakash, *Voluntary Programs: A Club Theory Perspective*, 17-39. On use by EPA and states, see Daniel J. Fiorino, “Green Clubs: A New Tool for Government?” in the same volume, 209-229.

⁸⁷ For information on current EPA voluntary programs, see www.epa.gov/partners. On Performance Track specifically, see www.epa.gov/performancetrack. For an analysis of EPA’s 33/50 program see Madhu. Khanna and Lisa Ann Damon, “EPA’s Voluntary 33/50 Program: Impact on Toxic Releases and Environmental Performance of Firms,” 37 *Journal of Environmental Economics and Management* (1999), 1-25.

medium sword clubs require the first two; and *strong* sword clubs involve all three.⁸⁸ Club theory provides a conceptual underpinning for a subset of voluntary programs. It may apply to government-sponsored as well as those in which agencies are not involved.

Voluntary programs also take other forms, with less of a theoretical foundation. In the chemicals area, they may expand access to data. The High Production Volume Chemicals and Nanomaterials Stewardship Programs are examples.⁸⁹ These encourage but do not compel firms to submit data needed for regulatory decisions. Other programs, such as Design for the Environment, build partnerships with industry for developing environmentally-preferable technologies. The Green Suppliers Network provides data and other resources, such as technical reviews, to leverage supply chains for economic and environmental gains.⁹⁰ The Sustainable Futures Initiative complements the new chemical reviews EPA conducts under Section 5 of the Toxic Substances Control Act.⁹¹ It enables firms to conduct their own screening process, with training and an approved methodology, to qualify for expedited reviews for their new chemical submissions. Such programs are justified as a means of acquiring data that would otherwise be unavailable to agencies, prepare the ground for mandatory reporting or testing, or determine what data are available from industry as a basis for making regulatory decisions on chemicals.

The goals of voluntary programs are not always clear, to supporters or critics. To many advocates, the primary goal is to enhance capacities for future problem-solving. By demonstrating the value of collaboration toward mutual goals, building trust through recurring relationships, and improving the ability to measure results, these programs are designed to enhance institutional capacity, not only for the issue at hand but future ones.

⁸⁸ Matthew Potoski and Aseem Prakash, “Covenant with Weak Swords: ISO 14001 and Firms’ Environmental Performance,” 24 *Journal of Policy Analysis and Management* (2005), 745-769.

⁸⁹ See U.S. EPA, *Status and Future Directions of the High Production Volume Challenge Program* (Office of Pollution Prevention and Toxic Substances, 2004); *Nanoscale Materials Stewardship Program: Interim Report* (Office of Pollution Prevention and Toxic Substances, 2009).

⁹⁰ www.greensuppliers.gov.

⁹¹ www.epa.gov/oppts/sf.

For other advocates, voluntary programs are all about delivering environmental results; they exist to obtain reductions in greenhouse gases, solid waste generation, water use, and so on. Of course, for many supporters, voluntary programs may achieve both kinds of goals. Yet most evaluations of such programs have focused almost entirely on whether or not they may be proven to deliver results beyond what would have been achieved under “business as usual.” Although the capacity-building (often termed social) benefits of voluntary programs often are recognized, they are difficult to define and measure.

Voluntary programs occupy a tenuous political, administrative, and legal space in the overall policy scheme. They are rarely authorized specifically in statutes; EPA has relied on general language in the 1990 Pollution Prevention Act to justify most of them.⁹² Although many business firms support these initiatives, they also argue that the benefits of joining are few and the attention drawn to participants creates political risks.⁹³ Among environmentalists, these programs often are seen as an excuse not to regulate, a way for business to claim credit without necessarily delivering verifiable results, and a diversion of resources from the “core” functions of regulation and enforcement. Environmental agencies have not been able, theoretically or practically, to articulate the relationship of voluntary to existing regulatory, grant, and enforcement programs. As a result, voluntary programs operate at the margins of agency policy. One reliable estimate is that voluntary programs draw about 1.6% of EPA’s budget.⁹⁴ Despite the attention given to voluntary programs in recent years, and in contrast to experiences elsewhere, they have not been systematically incorporated into national policy in the U.S. and operate at the margins of current policy. This does not mean that they could not contribute effectively to national policy capacities, but that they have not been integrated effectively into what now exists.

⁹² Section 6604.

⁹³ Terry Davies and Jan Mazurek, *Industry Incentives for Environmental Improvement: An Evaluation of U.S. Federal Incentives* (1996). See also GAO, *Challenges Facing EPA’s Efforts to Reinvent Environmental Regulation*, 49-53.

⁹⁴ Morgenstern and Pizer, *Reality Check*, at 2.

Patterns in Environmental Innovation

Given that the innovation streams profiled here are only a portion of the EPA innovations over the last forty years, one should be careful about drawing general conclusions. Because these innovations as a whole, rather than specific initiatives, have received scattered attention in the policy literature, however, it is worth considering the implications of this discussion and conclusions that may be drawn from it. Table 4 gives a summary of the characteristics of each of the five innovation streams discussed here.

Table 3: Summary of Characteristics of the Five Innovation Streams

	Perceived Need/Deficiency	Theoretical Basis	Examples	History/ Status
Emissions Trading	Accommodating health-based goals with growth & efficiency	Economic theory	Offsets Bubble policy Water trading Acid rain Cap and trade	Gradual expansion and incorporation into mainstream policy, especially air
Program Integration	Accounting for cross-media effects & need for more holistic strategies	Administrative theory	Toxics integration IEMP Clusters initiative	Ad hoc adjustments but no systematic incorporation in regulatory policy
Risk-Based Planning	Lack of means to set priorities with growing list of problems; need to restore agency credibility	Rational policy model	Unfinished Business Regional/state projects	Adopted in late 1980s/early 1990s, but limited long-term effects
Regulatory Flexibility	Evidence of barriers to more effective solutions	Reinvention movement Second generation critique	Project XL Flexible air permits	Highly contested and limited use, except flexible air permitting
Voluntary Programs	New problems for which regulatory solutions unavailable or no authority	Club theory; otherwise weak theoretical foundation	33/50 Program Climate Leaders Performance Track	Many existing programs; not incorporated systematically in mainstream policy

One issue raised by these cases is the importance of having an underlying theory to explain and justify innovation. As the discussion above suggests, varying levels of theoretical justification exist for each of these streams of innovation. It is most developed

for emissions trading, which is grounded in economic theory. It is probably least developed for voluntary initiatives, although the recent applications of club theory may remedy that to some degree. Both program integration and risk-based planning draw, more implicitly than explicitly, on the public administration literature on rational and incremental models. The flexibility theme has a shallow but identifiable theoretical foundation coming out of the self-reflective tendencies in U.S. environmental policy in the 1980s and 1990s, which in turn drew upon the reinvention concept within government. The shallowness of that foundation is apparent in the ease with which critics of flexibility have been able to portray such efforts as rollback or deregulation rather than as a source of legitimate policy reforms.

It arguably helped for the emissions trading stream to be based on an underlying theory. On the other hand, the same economic theory could be applied to emission fees, which are rarely used in U.S. policy. Indeed, despite strong support from economists and others, the carbon tax has gone nowhere as an option for reducing CO₂.⁹⁵ The lesson is that a theoretical foundation may help, but practical and symbolic politics are more important. Having a theoretical foundation allied with practical politics, the right goals, and a demonstrable set of benefits may be necessary to provide a winning combination from an innovation perspective. It also may help to provide a clear solution to a pressing problem, as was the case with SO₂ trading and the 1990 Clean Air Act Amendments, where the reduced costs achieved through trading probably cleared the legislative path.

Viewing the program integration and risk-based planning streams as steps towards more rational policy making sheds light on their strengths and limitations. In this sense, these streams are conceptually similar to such rationality-based reform initiatives as Programming, Planning Budgeting Systems (PPBS), Zero-Based Budgeting

⁹⁵ On the feasibility of a carbon tax, see Thomas Sterner and Henrik Hammar, “Designing Instruments for Climate Policy,” in Bernd Hansjurgens, ed., *Emissions Trading for Climate Policy* (2005), 17-36.

(ZBB), and the Government Performance and Results Act (GPRA).⁹⁶ The program integration stream stresses the need for more comprehensive, synoptic approaches as an antidote to the fragmentation of U.S. environmental policy. The risk-based planning stream reflects an interest in defining more objective and evidence-based methods for setting priorities and countering the “problem of the day” syndrome. Like their cousins PPBS, ZBB, and GPRA, they impose high cognitive and information demands. Also like these reforms, they challenge the existing constituency and politics-based methods for decision making. All of these innovation streams illustrate the limits of rationality when faced with the realities of practical politics, limited time and information, and interest group pressure.

Having an underlying theory provides more coherence to groups of innovations and probably also helps in defining sources of intellectual support for them. On its own, however, theoretical foundations do not determine success, as emission fees illustrate. One could argue, based on the regulatory flexibility and voluntary initiatives experience, that the lack of an underlying theory to justify a change is at least a potential weakness.

What may we observe about the practical origins of innovations? From where did the interest in change arise in the first place? Each of these innovation streams began with a perceived deficiency in the status quo and recognition of the need for change.⁹⁷ In the case of emission trading, it was the need to reconcile the demands of the air quality standards with the political imperative for economic growth, and later to demonstrate more efficient ways of achieving air quality goals. The initial offsets program was a pragmatic adjustment to accommodate the decision made by Congress in the 1970s

⁹⁶ The conceptual distinctions between incremental and rational-comprehensive models of decision making were articulated in Charles Lindblom, “The Science of Muddling Through,” 19 *Public Administration Review* (1959), 79-88. On the GPRA, see Beryl Radin, “The Government Performance and Results Act (GPRA): Hydra-Headed Monster or Flexible Management Tool,” 58 *Public Administration Review* (1998), 307-316; on zero-based budgeting, see Matthew Andrews and Herbert Hill, “The Impact of Traditional Budgeting Systems on the Effectiveness of Performance-Based Budgeting: A Different Viewpoint on Recent Findings,” 26 *International Journal of Public Administration* (2003), 135-155.

⁹⁷ Richard Rose, *Lesson-Drawing in Public Policy: A Guide to Learning Across Time and Space* (1993).

Clean Air Act to establish health-based air quality standards. With the offsets, the health standards were maintained while the means of implementing them was modified. The evolution through the various trading programs in the 1980s to acid rain allowance trading to proposals for capping and trading greenhouse gases enabled policy makers to maintain air quality goals while enabling sources to reduce emissions cost-effectively.

For risk-based planning, the perceived deficiencies were a lack of control over a policy agenda that had grown rapidly, an agency whose credibility had suffered greatly, and the lack of any apparent basis for determining priorities. Once William Ruckelshaus returned to EPA for his second tour as administrator in 1983, he saw a need to take EPA away from the political arena and move it to a more fact-based, scientific ground.⁹⁸ The origins of the program integration stream may be traced back to the founding of the EPA. In relative terms, even creating a national environmental agency was a step toward integration; what had been scattered among many agencies was consolidated into one. The importance of the next step, of connecting better across environmental media (air, water, waste, and chemicals) has been asserted at various points throughout the EPA's history, but it never achieved enough political support to lead to a long-term solution.

The flexibility stream responded to the perception that a fragmented, rigid, and legalistic regulatory system was not only costly but could stifle innovation and results. This was the narrative put forth by advocates of a second generation of environmental policy in the 1990s, most of whom strongly supported environmental progress. The competing narrative was that regulatory flexibility would lead to less stringent standards, not simply more flexible and efficient ways of meeting the same standards. Voluntary programs were viewed as a way to solve problems without having to get new laws passed by a gridlocked Congress, while using a more flexible, collaborative model. The Bush

⁹⁸ William D. Ruckelshaus, "Science, Risk, and Public Policy," 221 *Science* (1983), 1026-1028.

administration's efforts to undermine regulation in the early 2000s reinforced critics of both innovation streams and pushed EPA back into full regulatory mode in 2009.⁹⁹

What about goals? Are some more politically appealing than others? This article proposed four goals that underlie most innovations: effectiveness, efficiency, capacity, and legitimacy. The cases suggest that effectiveness and efficiency are more marketable politically than capacity and legitimacy. This is not surprising, given that effectiveness and efficiency are easier to define, explain, and measure than the more abstract concepts of capacity and legitimacy. The political demand that innovations pay relatively quick returns also could reduce the success rate of innovations aimed at the latter two goals. The emissions trading stream was suspect in many quarters for some time, but it became more acceptable as experience demonstrated that trading could achieve at least the same result as technology-based regulation, although at less cost. Although issues remain with respect to emissions trading, such as environmental justice implications of redistributing pollution locally or regionally, the effectiveness/efficiency case largely has been made.¹⁰⁰ A national cap and trade program, after all, was the centerpiece of the 2009 legislation that would have created a national carbon dioxide reduction program, and nutrient trading is considered to be an option for improving water quality in the Chesapeake Bay.

The goals of the other streams are less clear; as a result, their effects are more difficult to measure and justify. The importance of institutional capacity is recognized in the environmental policy literature. Advocates of voluntary programs view them as a way to transform relationships, establish trust, improve measurement techniques, and adapt to new issues. All of these specific objectives relate to the general goal of building future problem-solving capacities. A primary goal of regulatory flexibility is to remove barriers to problem-solving and allow organizations to focus more on environmental results.

⁹⁹ Margaret Kriz Hobson, "The Greenest White House in History," *National Journal* (September 26, 2009), 20-29.

¹⁰⁰ Lily N. Chinn, "Can the Market Be Fair and Efficient—An Environmental Justice Critique of Emissions Trading," 26 *Ecology Law Review* (1990), 80-125.

Such innovation benefits not only are difficult to define and measure, they often accrue well into the future. Especially with the emphasis on achieving results under initiatives like the GPRA, these long-term, qualitative benefits are less-than-compelling politically.

Given the dynamism that characterizes environmental issues, and the transition to sustainability occurring in much of the world, it is surprising that environmental innovation has received limited systematic analysis. This article has focused on a subset of policy innovations, all of which were undertaken nationally by the EPA. Some have been more successful than others. All arose from a sense of dissatisfaction with the status quo and reflected a perceived need for change. One innovation stream had a well-defined theoretical foundation; others did not. Some exhibited more clarity in goals than others, with readily documented benefits. Each specific innovation is part of a group of actions. These streams offer a useful way of describing, comparing, and evaluating policy change.

This article concludes with brief mention of three issues. One is the value of the “streams” concept in studying environmental innovation. The notion of streams provides a mid-level conceptual framework for thinking about innovation, falling between the specific actions, practices, or policies that constitute the innovations and the abstract concept. It allows us to organize related sets of innovations that share characteristics. This makes it possible to identify the characteristics of different initiatives, track them over time, and determine the common factors that led to change. Although specific innovations come and go, factors leading to a search for and adoption of a stream of innovations typically do not. For example, although program integration has not been a priority issue within EPA in recent years, it almost certainly will return at some point as a concern and stimulate additional policy change. Specific innovations come and go, but the ideas themselves, the goals they are meant to achieve, and the needs they are aimed at meeting remain.

A second issue is the relationship between policy innovations undertaken within government and the prospects for innovation in society. At its core, government policy aims to change behavior. Much behavioral change consists of innovations in technology and management that lead to environmental progress. The innovation streams discussed here were focused in part on making the EPA and state agencies more effective, efficient, capable, and legitimate. To the extent that they promote these goals, they may be seen as successful. Even more critical, however, are the effects of government policy on private sector innovation. Although effective in forcing changes in the near-term, there is evidence that technology-based regulation may not be the best way to induce long-term, continuous innovation.¹⁰¹ Stringent strategies that also are flexible and predictable may be effective in inducing long-term innovation. Of the five innovation streams discussed here, regulatory flexibility and voluntary programs were aimed in part at this objective.

A third issue is the link between federal and state innovation. Environmental policy making occurs in the context of close and complex interdependence among federal and state agencies.¹⁰² EPA depends on states to implement innovative approaches; states depend on EPA for policy discretion, intellectual capital, lesson-sharing, and funding. In a study of federal-state/provincial relationships, Barry Rabe compared environmental innovation in the U.S. and Canada. This study assessed the notion that a decentralized regulatory federalism such as Canada's is more conducive to innovation than is a more centralized one like that of the U.S. This is based on the assumption that the more

¹⁰¹ N. Johnstone, I. Hascic, and M. Kalamova, "Environmental Policy Design Characteristics and Technological Innovation: Evidence from Patent Data," *OECD Environment Working Papers*, No. 16 (2010) and, by the same authors, "Environmental Policy Design Characteristics and Technology Innovation," 27 *Journal of Analytical and Institutional Economics* (2010), 275-299. Similar, more conceptual arguments may be found in Michael Porter and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship," 9 *Journal of Economic Perspectives* (1995), 119-132; Environmental Law Institute, *Barriers to Environmental Technology and Use* (1998); and Wallace, *Environmental Policy and Industrial Innovation*.

¹⁰² For discussions, see Denise Scheberle, *Federalism and Environmental Policy: Trust and the Politics of Implementation* (2004); Michael E. Kraft and Denise Scheberle, "Environmental Federalism at Decade's End: New Approaches and Strategies," 28, *Publius: The Journal of Federalism*, (1998), 131-146.

autonomous Canadian provinces would be freer to explore innovative ideas than the states, which are subject to closer federal oversight. The study concluded, however, that in four areas of innovation—pollution prevention, cross-media integration, information disclosure, and outcome-based performance measures—states have been more successful innovators than the Canadian provinces.¹⁰³ It appears from this analysis that federal-state interdependence may encourage more diffusion of innovation in the U.S.¹⁰⁴ Indeed, facilitating and supporting innovation and lesson-sharing among the states in the U.S. was a primary function of the EPA’s National Center for Environmental Innovation before it was and reorganized early in the Obama administration.¹⁰⁵

The capacity for organizational innovation and change is critical to success in dealing with environmental problems in the coming decades. Environmental issues and the contexts in which they are addressed are dynamic and complex. This article has examined a number of past EPA innovations and proposed an approach to studying and evaluating them. By looking at related groups of innovations, it is possible to identify factors that promote or impede organizational change and determine how best to design innovations for long-term success. Specific innovations may come and go, but the reasons they are adopted, the factors affecting their success, and the goals they are meant to achieve continue. The concept of streams of innovation offers a way to compare, study, and evaluate the four decades of EPA environmental policy innovations.

¹⁰³ Barry G. Rabe, “Federalism and Entrepreneurship: Explaining American and Canadian Innovation in Pollution Prevention and Regulatory Innovation,” *27 Policy Studies Journal* (1999), 209-220.

¹⁰⁴ There have been several signs of the Obama EPA’s reduced support for state innovation. It has eliminated the National Center for Environmental Innovation, cancelled a long-standing state innovation grants program, and terminated or scaled back work on such projects as integrated permitting and sector-based innovation projects. The EPA web site, for example, notes that information on sector-based innovation projects was last updated in March 2010. For useful resources on integrated permitting, see “Integrated Permitting: An International Collaboration Effort” at www.epa.gov/osem/integrated/index.htm.

¹⁰⁵ The former National Center for Environmental Innovation became the Office of Strategic Environmental Management early in the Obama administration. See www.epa.gov/osem/historical.htm.