Streams of Environmental Innovation:

Four Decades of EPA Policy Reform

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Working Paper

December 2010

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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For the private sector, economic relationships change, customers demand new products and services, technologies become outdated, and pressure from competitors is relentless.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. 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 in with a greater focus on environmental *sustainability*, in recognition of the complex interrelationships that exist among economic, political, and social choices.[1]

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] 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).*

in most developed countries not just as the responsibility of government but of a range of institutions in society.[2] Leading firms have moved from a culture of resisting regulation to internalizing it and moving beyond compliance in their environmental performance.[3] 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 new tools.[4] At the same time, the resources available to government relative to the number of environmental problems they confront are shrinking. In sum, the innovation imperative common to all organizations is especially 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

[2] 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).

[3] 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).

[4] 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 EnvironmentalProtection: Education, Information, and Voluntary Measures* (2002).

drawn from them? Beginning to answer these questions by setting out an approach to describing and studying environmental innovations is the purpose of this article.

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, acid rain 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, say economic incentives or voluntary initiatives, are justified more on the basis of improving 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, the paper aims to impose some degree of analytical order on the diverse and wide range of activities that may be viewed as environmental innovations 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 conclusions and offers advice about designing, implementing, and evaluating innovations based on the analysis.

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, 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-understand. 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."[5] In a recent book on environmental innovation, Toddi Steelman defines it as "a new program or process for those adopting it."[6] 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."[7] In these terms, an innovation is not only perceived as being new but is motivated by the intent to achieve new goals or 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."[8] 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

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[5] Everett Rogers, *Diffusion of Innovations*, 5th ed. (2003), at 12.
[6] Toddi A. Steelman, *Implementing Innovation: Fostering Enduring Change in Environmental and Natural Resource Governance* (2010), at 5.
[7] Laurence O'Toole, Jr., "Implementing Public Innovations in Network Settings," 29 *Administration and Society* (1997), at 116. Quoted in Steelman, *Implementing Innovation*, at 5.
[8] David Wallace, *Environmental Policy and Industrial Innovation: Strategies in Europe, the US and Japan* (1995), at 11.

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 communication, provide incentives, and define a political environmental 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.[9] 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.[10] Innovation in government and public policies thus may affect the potential for innovation in the private sector and throughout the 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 here is on innovations undertaken since 1976, when the current model for U.S. environmental protection was largely established. To be sure, the late 1960s and 1970s were a period of sweeping

[9] Steelman, at 4.
[10] 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.

innovation and change in U.S. environmental policy, and for that matter in most affluent democracies.[11] National 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 that was created through such actions as the National Environmental Policy Act (1969); Clean Air Act (1970); Federal Water Pollution Control Act (1972); Toxic Substances Control Act (1976) and other laws of that era are taken as the foundation on which the changes discussed here were built.[12]

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 of innovations, such as risk-based planning, be distinguished from or compared to

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

[12] 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).

others, such as partnerships and voluntary programs or alternative conflict resolution? One way is by goals. Some kinds of innovations are adopted to improve effectiveness, in the sense of achieving a higher level of desired outcomes. 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 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 is based on these four goals: effectiveness, efficiency, legitimacy, and capacity. Many researchers give attention to the first two goals but neglect the latter two, because they are difficult to measure or are not recognized important for evaluating policy actions. Table 2 defines the four goals.

Table 2: The Goals of Environmental Policy Innovations

Effectiveness	Achieving a higher level of environmental outcomes
Efficiency	Achieving desired environmental outcomes at less cost
Legitimacy	Achieving outcomes in more politically acceptable ways
Capacity	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. Secondarily, participation also may be justified a way to build capacity for future problem-solving. A

potential, often ignored benefit of voluntary programs is that they build a capacity for future problem-solving, especially for issues that are less amenable to conventional regulation. In this article, the streams are described according to the relative importance of each goal.[13]

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 three 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 kinds of dissatisfaction with what existed. Their durability and long-term effects have varied, as the comparisons below suggest. The argument underlying this article is that grouping specific activities into streams of innovation is useful for comparing and analyzing them. 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.[14]

[13] 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.

[14] 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 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.

Other such streams of innovation could be identified from the past thirty years, as suggested in Table 1.[15] 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.

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 some definition of best available technology, and apply them to sources of pollution.[16] Agencies monitor compliance and may assign legal penalties to sources that fail to meet the standards and administrative provisions (e.g., reporting and monitoring) that are associated with them. The same technology standards typically apply to all 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.

In contrast, the foundation for market incentives comes from economic theory.[17] The goal is to maximize economic efficiency by allowing regulated sources the discretion

[15] 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.

[16] John Dryzek, *The Politics of the Earth: Environmental Discourses* (1997), at

[17] 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

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.

Like most innovations, trading moved from theory to practice as a matter of perceived necessity in the late 1970s. Air quality on Southern California exceeded the health-based National Ambient Air Quality for 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. The "bubble" policy 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.

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).

Applied administratively in the 1980s, trading was codified in the Clean Air Act Amendments of 1990.[18] Congress directed that sulfur dioxide (SO2) emissions be cut in half (some ten million tons) from a 1980 baseline by 2000. The target of the cuts were large utilities, which had several option of 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. Using trading rather than technology standards is estimated to have saved one to two billion dollars. The program's success made trading more credible politically to groups that previously had been skeptical of trading concepts as granting little more than a "license to pollute."[19]

Cap and trade has become the leading option for cutting greenhouse gases. 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. It was expected that the value of a permit to emit one ton of carbon would rise as the emissions targets were tightened. The revenue from the 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 a national renewable

[18] 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.
[19] 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.

electricity standard and authorized other climate actions, but cap and trade was the centerpiece and the most contested part of the legislation.[20] The Senate never passed it.

Although not as widespread as in the air program, trading also has been applied to water issues. The most common application has been to point/non-point trading. The advantage in this case, as with air quality, is being able to minimize the marginal costs of control across sources. Such point sources of pollution as industrial facilities and sewage treatment plans have had to meet stringent standards over the last few decades, to the extent that the marginal costs of additional units of pollution reduction are high. The marginal costs are much lower for non-point sources, such as agriculture and storm water, which are less amenable to regulation through technology controls.[21] By focusing reductions on non-point sources, whose actions are funded and facilitated by point sources, it is possible to achieve more cuts (through the trading ratio) at less cost.

Emission trading has been successful and durable. With a growth and evolution extending more than three decades, it has illustrated the ability within the environmental policy system to learn from experience and apply lessons to the next iteration of policies. A record of results, lower costs, and increasing political acceptability has brought emission trading to the mainstream of U.S. environmental policy. Another advantage, to be considered more later, is that it is grounded solidly on economic theory.

2. Program Integration

[20] 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).
[21] 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.

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.[22] Given the complexity and dynamism of environmental issues, breaking expertise, problems, and strategies into manageable pieces was logical and probably necessary. Reinforcing this tendency to simplify complex problems was the nature of policy change in the U.S. Although the events of the environmental decade of the 1970s represented relatively rapid change in systems terms, environmental issues were addressed in many pieces as problems were identified and coalitions were formed. It was an era of rapid although piecemeal change.

This fragmentation has been a recurring source of dissatisfaction from the start. When it was enacted in 1969, the National Environmental Policy Act (NEPA) was seen by many as an integrating statute. At a rhetorical level, it established the "environment" holistically as a subject of national concern.[23] Similarly, creating EPA in 1970s was a step toward program integration. Established by executive order, the EPA reorganization consolidated functions from Health, Education, and Welfare (air), the Interior (water), and Agriculture (pesticides) Departments, and Atomic Energy Commission (radiation), among others. 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.[24] Politically, he felt a need to demonstrate a capacity for action, especially in enforcement. Given the history of efforts to integrate across programs, and in light of the

[22] A classic exposition is Herbert A. Simon, *Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations*, 4th ed. (1997).
[23] 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.
[24] 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)

fragmented statutory framework under which EPA operates, it is unlikely that adopting a functionally-based approach at the outset would have made much of a difference later.

Three laws that at some point were seen as potential paths to integration—NEPA, the Toxic Substances Control Act (TSCA), and the Pollution Prevention Act (PPA)—have proved to be ineffective in that role. NEPA encourages federal agencies to look holistically at the environment and establishes the provisions 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 and the relative strengths of the air, water, and waste laws. Because it is more a set of principles and goals than source of regulatory authority, the PPA of 1990 has not been a match for the other laws. Unlike other economically advanced countries, the U.S. lacks an integrated, cross-media environmental statute.[25] In particular, comprehensive planning in the Netherlands and integrated pollution control in Sweden and Great Britain are cited as contrasts.[26]

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 various times, EPA has attempted to overcome statutory constraints by integrating on the basis of chemical, industry sector, and geography.[27] Probably the most successful

[25] 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).
[26] See the country case 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.
[27] Jurgen Schmandt, "Managing Comprehensive Rule Making: EPA's Plan for Integrated Environmental Management," 45 *Public Administration Review* (1985), 309-318.

effort at integrating by chemical was the multi-media lead strategy adopted in 1991.[28] 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.[29] 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.[30]

Although these steps encouraged some incremental integration, none were able to overcome the constraints of the media-specific framework and the bureaucratic implementation and congressional oversight systems that had grown up around it. Policy integration at EPA has largely been an ad hoc response to perceived needs for at least some coordination at some moment. These efforts may have served particular needs effectively at times, but they have not been able to overcome the inherent fragmentation.

In contrast to the record with emissions trading, the policy integration stream has shown little staying power. Advocates were never able to make a convincing case that

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

[29] 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.

[30] 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.

the deficiencies of the existing, medium-based statutory framework were substantial enough to justify a change. Once established, legislative and bureaucratic arrangements have proven difficult if not impossible to change. The EPA "stovepipes" became firmly entrenched in agency operations and culture and in relationships with state agencies. Although integration efforts on specific issues like lead and groundwater yielded some modest, short-term success, they were not institutionalized to any degree. At this point, there is little interest in addressing the integration issue, from EPA or Congress. It is fair to say, by 2010, that there has not been a politically powerful constituency for achieving more program integration, and such issues are rarely reflected in EPA's internal agenda.

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 1980s as a powerful tool for improving the factual premises of environmental policy. Its most obvious and, to this day, most important application was in making regulatory decisions.[31] Having quantitative estimates of risk (toxicity times exposure) allows policy makers to determine the likely level of harm presented by a substance or technology and whether or not government should intervene. It defines a quantitative metric for decision making.

The innovation stream in this case is the use of risk information to set priorities. Risk-based planning, also described as comparative risk analysis, was part of a second environmental policy "epoch" in which policy makers wanted to rationalize processes for

[31] 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.

setting priorities and allocating resources among them.[32] 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 and created the demand for innovation. The collapse of the initial Reagan team at EPA in 1983 led to the return of William Ruckelshaus, the agency's first administrator, whose task 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 proposed by the National Academy of Sciences.[33] It distinguished the more neutral, science-based process of describing risk from the arguably more value-based, political process of deciding what to do about the risks (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 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 posing more health and ecological risk.[34] Later in the 1980s, EPA Administrator William Reilly compared agenda setting 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

[32] 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.
[33] 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.
[34] 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).

decades of environmental policy in this country have been similar in some ways to that video game…"[35] Political institutions typically reacted to problems piecemeal without an overall sense of relative priorities or the most effective way to allocate the available resources. Risk-based planning responded to the perceived need for better priority-setting.[36]

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.[37] 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, EPA and other agencies were incorporating the concept and metrics of risk into internal planning and budgeting processes. The explicit goal was to direct more resources to problems posing higher risks and less to lower risks.

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.[38]

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[35] 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.
[36] Daniel J. Fiorino, "Can Problems Shape Priorities? The Case of Risk-based Environmental Planning," 50 *Public Administration Review* (1990), 82-90.
[37] U.S. Environmental Protection Agency, *Unfinished Business: A Comparative Assessment of Environmental Problems* (1987).
[38] U.S. Environmental Protection Agency, Science Advisory Board, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990).

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.[39]

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. These aimed not only to integrate risk analysis into priority setting but also to involve communities. Indeed, the state and local projects constitute one of the more thoughtful efforts by EPA or any federal agency to engage the public in upstream (that is, earlier in the decision process) policy making.

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.[40] To some critics, risk analysis could provide justification for not taking or delaying action when there was uncertainty. One concern was the prospect of "paralysis by analysis" in making regulatory decisions. Another was that risk-

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

[40] For a skeptical note on risk-based planning and integrated pollution control, 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).

based planning would substitute elite, technocratic preferences for priorities established through the political process. There was also, among some environmentalists and others, a suspicion that risk assessment increased factual the burdens of proof in regulation, and that this would spillover into priority setting. The worry generally is that injecting risk into priority setting imposes too high a burden of proof on agencies before taking regulatory action.

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. 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.[41] This exercise, however, had little effect on funding. By 2010, it is fair to say that risk analysis has a marginal and ad hoc effect on planning and decisions; residual risk data are not systematically used to frame or determine funding priorities.

4. Regulatory Flexibility

This stream of innovations emerged as a response to the design and operation of the system for environmental regulation. It reflected several trends in the 1990s. One was dissatisfaction with the lack of adaptability, the costs, and the adversarial nature of the regulatory system that had been adopted in the 1970s and elaborated upon since. Unlike earlier critics, who challenged the existence or stringency of regulation, "revisionist" critics were concerned that the regulatory system as designed and operated

[41] 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.

was not keeping pace with changes in environmental and economic conditions.[42] A second trend was a political climate that was 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. Third was increasing interest, flowing from the 1992 Earth Summit in Rio de Janeiro, in environmental sustainability. In the wake of Rio, for example, the Clinton administration created a President's Council for Sustainable Development, many private firms launched sustainability initiatives, and non-government organizations stressed sustainability as a theme.[43] A fourth trend promoting interest in regulatory flexibility was the "Reinventing Government" initiatives launched by the administration in the mid-1990s as its most visible reform effort.[44]

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.[45] For them, flexibility was a cover word for rollback, and reinvention was little more an attempt to capitalize on the anti-regulatory sentiment that had been brewing for decades. That this innovation stream was so highly contested politically made it vulnerable to the swings from the Clinton, to the Bush, to the Obama administrations from 1993 to 2009. What began as a "third-way" group of innovations under 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.

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

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

[44] Several environmental initiatives were announced by the White House in March 1996. See Bill Clinton and Al Gore, *Reinventing Environmental Regulation* (1996).

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

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 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. Among the high-profile supporters of a third way were Vice-President Al Gore, EPA Administrator Carol Browner, and former Administrator William Ruckelshaus, all of whom held strong environmental credentials.[46]

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 several times.[47] The issue here is its conceptual foundations, assumptions, 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 failures associated with

[46] An example of this thinking is William D. Ruckelshaus, "Stepping Stones," 15 The Environmental Forum (1998), 30-36.

[47] 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 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.

government. The reinvention critique was that agencies had become more focused on rules, standardization, constraints, and procedures than missions and results.[48] A central precept of reinvention was that agencies should be given and allow for more discretion in adapting to situations as they exist on the ground. Project XL fit this mindset perfectly.

The program continued through the remainder of the Clinton term. Eventually 50 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 when it took office, and the program eventually was terminated as the projects wrapped up by 2003.

Another innovation that may be associated with the regulatory flexibility stream and may have staying power is flexible air permits. Permitting is a core process in environmental regulation, yet it has been remarkably resistant to reform. Permits are vehicles for translating standards into practical, enforceable limits and applying them to sources. They also are among the most resource-intensive of the regulatory functions assigned to state agencies. A major issue is the time and uncertainty involved in permitting, especially when facilities need approval for new processes and respond to customer demands on tight production schedules.[49] For conventional air permits, process changes typically require permit modifications and approval from regulators. Flexible permits differ in allowing sources to operate within limits that may be more

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

[49] 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).

stringent than standard limits but also more flexible, because they allow sources to make operational changes without prior approval from 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.[50] 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 January 13, 2009. After review by the incoming administration in early 2009, this rule was released unchanged in September 25 2009; the number of flexible permits is 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 a policy innovation made it more politically acceptable than the broader scope and implications of an initiative like Project XL.

The highly contested innovations in this stream are the most obvious casualties of the polarization that characterized environmental politics in the early 2000s. Although there were critics of this innovation stream in the 1990s, even with EPA in Democratic hands, the core idea of flexibility applied selectively was endorsed by many supporters of environmental programs. In Congress, members from both parties proposed "second generation" legislation giving EPA discretion to use flexible, performance-based tools. By the early 2000s, interest in such approaches was gone. It was overshadowed by the more fundamental political conflicts over environmental programs, especially air and climate.

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

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 levels of government were pursuing non-regulatory, collaborative action as a means of complementing, preparing for, or even avoiding regulation.[51] Japanese environmental policy, for example, was built largely on the basis of local agreements adopted in the context of national policy.[52] European countries moved toward greater use of voluntary action and negotiated agreements through the 1990s.[53] At local and state levels in the U.S., local collaborations focused on specific watersheds and habitat embody one of the most significant institutional developments of the last two decades.[54] Dewitt John's concept of "civic environmentalism" was designed to capture this spread of bottom-up,

[51] 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).

[52] 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.

[53] 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.

[54] 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).

improvised, and place-based arrangements for environmental problem-solving.[55] These initiatives were responding to widely recognized deficiencies in existing policy systems.

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 *partnership*s is that there is a formal agreement to act in specified ways and to meet expectations that are mutually defined.[56]

Reflecting this somewhat disjointed foundation, voluntary programs take many forms. Scholars have set out a promising theoretical basis for one type, known as "green clubs." These aim to induce members "to produce positive social externalities beyond what government regulations require them to produce."[57] They accomplish this by providing benefits to members that are unavailable to non-members. These excludable benefits typically consist of recognition, access to information, and preferential treatment. Benefits also are non-rival, in that making them available to one member does not make them unavailable to others. Many clubs, such as certification schemes for environmental management systems (ISO 14001) or business-NGO codes of conduct (the Forest Stewardship Council) do not involve government directly. When they do, they

[55] 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. Also see Thomas M. Koontz, JoAnn Carmin, Toddi A. Steelman, and Craig W. Thomas, *Collaborative Environmental Management: What Roles for Government?* (2004).
[56] 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).
[57] Matthew Potoski and Aseem Prakash, eds., *Voluntary Programs: A Club Theory Perspective* (2009), at 20.

are government-sponsored green clubs.[58] EPA-sponsored green clubs created in the last two decades include 33/50, Wastewise, Climate Leaders, the National Environmental Performance Track, Energy Star, and WaterSense.

Two issues affect the credibility of green clubs: Do they limit free riding? Do they avoid or minimize shirking by members? Sponsors of green clubs may limit shirking and minimize free riding in three ways: third-party auditing of member qualifications and performance, public disclosure of conformance with program criteria, and sanctioning mechanisms, such as removal from the club. Weak sword clubs include only the first; medium sword programs require the first two; strong sword mechanisms involve all three mechanisms.[59] The premise is that building these accountability mechanisms into their design makes green clubs more credible and successful.

Voluntary programs also take other forms, where there is less of a theoretical foundation. In chemicals management, they are used to expand EPA's access to data. The High Production Volume Chemicals and Nanomaterials Stewardship Programs are examples. These encourage but do not compel manufacturers, importers, and others to submit data needed for regulatory decisions. Other programs, such as Design for the Environment, involve EPA partnerships with industry to develop and promote environmentally-preferable technologies. The Green Suppliers Network provides information and other resources, such as technical reviews, to help firms leverage supply chains for economic and environmental gains. The Sustainable Futures Initiative complements the new chemical review process (Pre-Manufacture Notification) under Section 5 of the Toxic Substances Control Act. It enables firms to conduct a screening process, with appropriate training and using an approved methodology, in order to qualify for an expedited review for their chemical submission.

[58] 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.
[59] 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.

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. 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, they exist for achieving 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 that exceed what would have been achieved under a business as usual scenario. Although capacity-building (often termed "social") benefits of voluntary programs are acknowledged at times, they are difficult to define and measure.

Voluntary programs occupy tenuous political space in the overall environmental 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.[60] Although many business groups support them, they often have argued that the benefits of joining are few and the attention drawn to participants and their reporting creates political risks. 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 regulation and enforcement. Environmental agencies have not been able, either at a theoretical or practical level, to articulate the relationship of voluntary to existing regulatory, grant, and enforcement activities. As a result, these programs operate at the margins of agency policy. One reliable estimate is that voluntary programs draw about 1.6% of EPA's budget; if the well-funded Energy

[60] Section 6604.

Star is subtracted, this number would be more like half a percent.[61] Despite the attention given to voluntary programs in recent years, and in contrast to experiences elsewhere, they have not been widely or systematically incorporated into national policy in the U.S.

Patterns in Environmental Innovation

Given that the innovation streams profiled here are only a small number of the total that may be identified, one should be careful about drawing conclusions about environmental innovation generally. Because these kinds of policy innovation have received little attention in the policy and legal literature, however, it is worth considering the implications of this discussion and working hypotheses that may be drawn from it. Table 4 provides a summary of the important characteristics of each innovation stream.

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

[61] Morgenstern and Pizer, *Reality Check*, at 2.

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 fully developed for emissions trading, which is grounded in economic theory. It is probably least fully developed for voluntary initiatives, although recent applications of club theory may remedy that to some degree. Both program integration and risk-based planning draw, more implicitly than explicitly, on public administration literature on the rational and incremental models of decision making. 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 was based on the government reinvention movement. The shallowness of that foundation is apparent in the ease with which critics of regulatory flexibility have been able to portray it regulatory rollback or deregulation than as a legitimate set of 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 marshaled in support of emission fees, which have seen almost no application in U.S. policy. Indeed, despite strong support from economists and others, the carbon tax has gone nowhere as an

option for reducing CO2. A theoretical foundation may help, but practical and symbolic politics are more important. Having a theoretical foundation that is allied with practical politics, the right goals, and demonstrable benefits may provide a winning combination from an innovation perspective.

Viewing the program integration and risk-based planning streams as steps toward 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 (ZBB), and the Government Performance and Results Act (GPRA). 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 pressures.

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. 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. The initial offsets program was a pragmatic adjustment to accommodate the decision made by Congress in the 1970s 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 allowing sources to reduce their emissions more 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 more fact-based, scientific ground. The origins of the program integration stream may be traced back to the founding of 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 next step, that of connecting better across environmental media (air, water, waste, and chemicals) has been recognized throughout EPA's history but was never compelling enough 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 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.[62]

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, but 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.

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. Such innovation benefits not only are difficult to define and measure, they accrue often

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

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 has characterized environmental issues in recent decades, and the transition to environmental sustainability that is occurring in much of the world, it is surprising that environmental innovation has received limited attention as an area of systematic study This discussion has focused on a limited subset of policy innovations, all of which were undertaken nationally by EPA. Some have been more successful than others. All arose from a sense of dissatisfaction with the status quo and a perceived need for change. One innovation stream had a well-defined theoretical foundation; some of the others did not. Some innovations exhibit more clarity in their goals than others, with benefits that are more readily documented. 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 concept for thinking about the topic of innovation, falling between the specific actions, practices, or policies that constitute the innovations and the general concept. It allows us to organize related sets of innovations that share characteristics. This makes it possible to identify the core characteristics of different initiatives, study them over time, and determine the common factors that led to change. Although specific innovations may come and go, factors leading to a search for and adoption of a particular stream of innovations typically do not. For example, although program integration has not been a priority issue within EPA for the last few years, it almost certainly will come back at some point as a concern and may stimulate addition attempts at innovation. In brief, although specific innovations come and go, the ideas behind them, the goals they are expected to address, and the needs that they are designed to meet remain with us.

A second issue is the relationship between policy innovations that are undertaken within government and the more general need for environmental innovation in society. At its core, government policy for the environment is designed to change behavior. Much of this 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 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 important, however, are the effects of government policies 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.[63] Strategies that are stringent but also are more flexible and predictable may be the most effective in inducing longer-term innovation. Of the five innovation streams discussed here, regulatory flexibility and voluntary programs were aimed at part at this objective.

A third issue is the link between federal and state innovation. Environmental policy making occurs in the context of a close and complex interdependence among federal and state agencies.[64] EPA depends on states to implement innovative approaches; states depend on EPA for policy discretion, intellectual capital, lesson-sharing, and often funding for innovation. One study of the effects of federal-state/provincial relationships is Barry Rabe's comparison of environmental policy innovation in the U.S. and Canada. This study assessed the notion that a decentralized regulatory federalism like Canada's is more conducive to innovation than a more centralized one like the United States. This is based on the assumption that the more autonomous Canadian provinces would be freer

[63] N. Johnstone, I. Hascic, and M. Kalamove, "Environmental Policy Design Characteristics and Technological Innovation: Evidence from Patent Data," *OECD Environment Working Papers*, No. 16 (2010). Similar arguments may be found in Michael Porter and Claas van der Linde, "Toward New Conception of the Environment-Competitiveness Relationship," 9 *Journal of Economic Perspectives* (1995), 119-132 and Wallace, *Environmental Policy and Industrial Innovation*.

[64] 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.

to explore innovative ideas than 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 Canadian provinces.[65] It appears that federal-state interdependence may encourage more diffusion of innovation in the U.S.[66]

The capacity for organizational innovation and change is critical to success in dealing with environmental problem-solving in the coming decades. Like many other policy areas, environmental issues and the contexts in which they are addressed are dynamic and complex. This article has examined a small number of past EPA innovations and suggested an approach to comparing and studying environmental policy innovation. By looking at related groups of innovations that share characteristics, it may be possible to identify factors which 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 considered and adopted, the factors affecting their success, and the goals they are meant to achieve may carry on. The concept of streams of innovation offers an approach to comparing, studying, and evaluating the institutionalized changes in policies or practices that make up environmental innovation.

[65] Barry G. Rabe, "Federalism and Entrepreneurship: Explaining American and Canadian Innovation in Pollution Prevention and Regulatory Innovation," 27 *Policy Studies Journal* (1999), 209-220.
[66] Although there are signs the current EPA administration reducing its support for state innovation. It has reduced the budget of its National Center for Environmental Innovation, eliminated the state innovation grants program, and terminated or scaled back work on such projects as integrated permitting.